Designation: E 331 – 00

Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference[1]

This standard is issued under the fixed designation E 331; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of the resistance of exterior windows, curtain walls, skylights, and doors to water penetration when water is applied to the outdoor face and exposed edges simultaneously with a uniform static air pressure at the outdoor face higher than the pressure at the indoor face.

1.2 This test method is applicable to any curtain-wall area or to windows, skylights, or doors alone.

1.3 This test method addresses water penetration through a manufactured assembly. Water that penetrates the assembly, but does not result in a failure as defined herein, may have adverse effects on the performance of contained materials such as sealants and insulating or laminated glass. This test method does not address these issues.

1.4 The proper use of this test method requires a knowledge of the principles of pressure measurement.

1.5 The values stated in SI units are to be regarded as the standard. The inch-pound equivalents of SI units may be approximate.

1.6 *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.* For specific hazard statements see 7.1.

2. Referenced Documents

2.1 *ASTM Standards:*

E 631 Terminology of Building Constructions[2]

3. Terminology

3.1 *Definitions*—For definitions of general terms relating to building construction used in this test method, see Terminology E 631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *specimen*, *n*—the entire assembled unit submitted for test as described in Section 8.

3.2.2 *test pressure difference*, *n*—the specified difference in static air pressure across the closed and locked or fixed specimen expressed as pascals (lbf/ft^2).

3.2.3 *water penetration*, *n*—penetration of water beyond a plane parallel to the glazing (the vertical plane) intersecting the innermost projection of the test specimen, not including interior trim and hardware, under the specified conditions of air pressure difference across the specimen. For products with non-planer glazing surfaces (domes, vaults, pyramids, etc.) the plane defining water penetration is the plane defined by the innermost edges of the unit frame.

4. Summary of Test Method

4.1 This test method consists of sealing the test specimen into or against one face of a test chamber, supplying air to or exhausting air from the chamber at the rate required to maintain the test pressure difference across the specimen, while spraying water onto the outdoor face of the specimen at the required rate and observing any water penetration.

5. Significance and Use

5.1 This test method is a standard procedure for determining the resistance to water penetration under uniform static air pressure differences. The air-pressure differences acting across a building envelope vary greatly. These factors should be fully considered prior to specifying the test pressure difference to be used.

NOTE 1—In applying the results of tests by this test method, note that the performance of a wall or its components, or both, may be a function of proper installation and adjustment. In service, the performance will also

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[2] *Annual Book of ASTM Standards*, Vol 04.11.

depend on the rigidity of supporting construction and on the resistance of components to deterioration by various causes, vibration, thermal expansion and contraction, etc. It is difficult to simulate the identical complex wetting conditions that can be encountered in service, with large wind-blown water drops, increasing water drop impact pressures with increasing wind velocity, and lateral or upward moving air and water. Some designs are more sensitive than others to this upward moving water.

NOTE 2—This test method does not identify unobservable liquid water which may penetrate into the test specimen.

6. Apparatus

6.1 The description of apparatus in this section is general in nature and any arrangement of equipment capable of performing the test procedure within the allowable tolerances is permitted.

6.2 *Major Components* (Fig. 1):

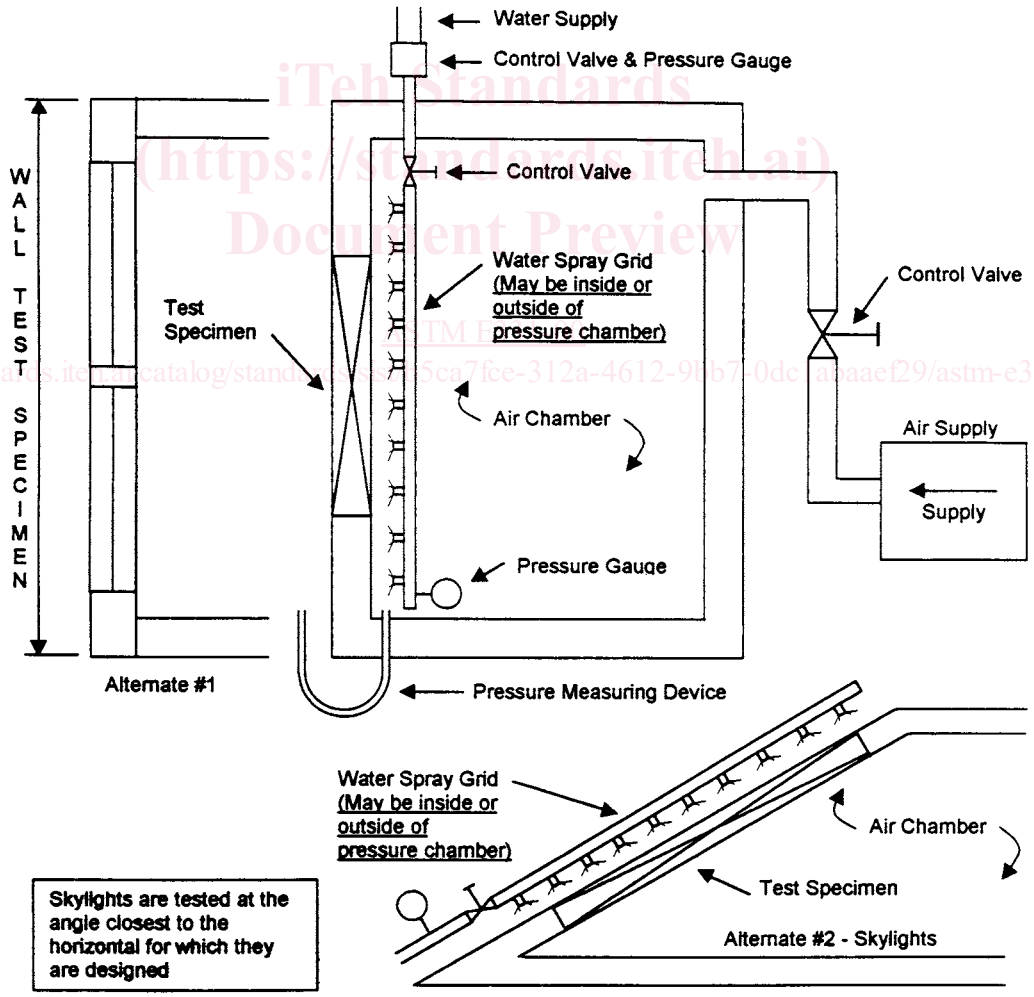
6.2.1 *Test Chamber*—A test chamber or box with an opening, a removable mounting panel, or one open side in which or against which the specimen is installed and sealed. At least one static pressure tap shall be provided to measure the chamber pressure, and shall be so located that the reading is unaffected by the velocity of the air supply to or from the chamber. The air supply opening into the chamber shall be arranged so that the air does not impinge directly on the test specimen with any significant velocity. A means of access into the chamber may be provided to facilitate adjustments and observations after the specimen has been installed.

6.2.2 *Air System*—A controllable blower, compressed air supply, exhaust system, or reversible blower designed to provide the required maximum air-pressure difference across the specimen. The system must provide essentially constant airflow at a fixed pressure for the required test period.

6.2.3 *Pressure-Measuring Apparatus*—A device to measure the test pressure difference within a tolerance of ±2 % or ±2.5 Pa (±0.01 in. of water column), whichever is greater.

6.2.4 *Water-Spray System*—The water-spray system shall deliver water uniformly against the exterior surface of the test specimen at a minimum rate of 3.4 $L/m^2 \cdot min$ (5.0 U.S. $gal/ft^2 \cdot h$).

6.2.4.1 The water-spray system shall have nozzles spaced on a uniform grid, located at a uniform distance from the test specimen, and shall be adjustable to provide the specified



NOTE 1—For a negative pressure system, the water-spray grid would be located outside the chamber and the air supply would be replaced by an air-exhaust system.

FIG. 1 General Arrangement of the Water Leakage Apparatus Positive Chamber System