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the LFE meter and the test pressure difference. The recorded measurements shall include the absolute pressure, the temperature, and the relative humidity of the air.

End Result: Verification that the product does or does not meet the performance criteria for Fenestration products. A comprehensive test report will be issued at the end of the conclusion of testing.

Standard: ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference

Scope: This test method describes the determination of the structural performance of exterior windows, doors, skylights, and curtain walls under uniform static air pressure differences, using a test chamber. This test method is applicable to curtain wall assemblies including, but not limited to, metal, glass, masonry, and stone components.

This test method is intended only for evaluating the structural performance associated with the specified test specimen and not the structural performance of adjacent construction.

Applicable Products: All products seeking NAFS-compliant reports for fenestration products. Additionally, widely used in building codes as the method used to confirm/validate perpendicular wind shear capabilities.

Test Procedure: Procedure A - Check the specimen for proper adjustment. For operable specimens, open, close, and lock each ventilator, sash, or door five times after adjustments and prior to testing. Install any required deflection-measuring devices at their specified locations.

Apply the load and hold for 10 s. Release the pressure difference across the specimen and, after a recovery period to allow stabilization of the test specimen, zero-out deflection-measuring devices. The recovery period for stabilization shall not be less than 1 min nor more than 5 min at zero loads.

Unless otherwise specified, apply, and maintain the load for not less than 10 s. Record deflection readings. Reduce the pressure difference to zero and, after a recovery period to allow stabilization of the test specimen, record permanent deformation. The recovery period for stabilization shall not be less than 1 min nor more than 5 min at zero loads.

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Repeat the previous steps for loading in the opposite direction at pre-determined load levels.

Result: Verification that the product does or does not meet the performance criteria for Fenestration products. A comprehensive test report will be issued at the end of the conclusion of testing.

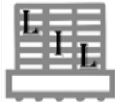
ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

Standard: ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

Scope: This test method addresses water penetration through a manufactured assembly. Water that penetrates the assembly but does not result in failure 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.

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Applicable Products: All products seeking NAFS-compliant reports for fenestration products.

Test Procedure: Adjust the water spray to the specified rate. Apply the air-pressure difference within 15 s and maintain this pressure, along with the specified rate of water spray, for 15 min. Remove the air pressure difference and stop the water spray. Observe and record the points of water penetration, if any.

End Result: Verification that the product does or does not meet the performance criteria for Fenestration products. A comprehensive test report will be issued at the end of the conclusion of testing.

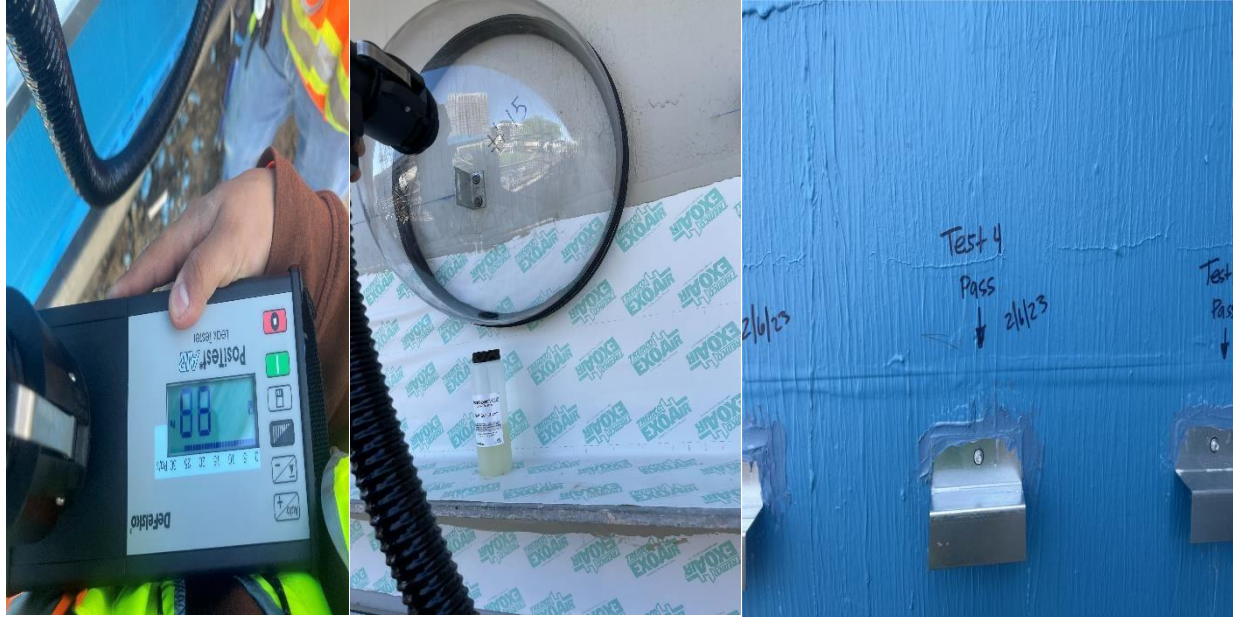
Field Verification of Products:

Bubble gun” testing per ASTM E1186, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems, in progress at LIL. ASTM E1186-17: Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

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Standard: ASTM E1186-17 – Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

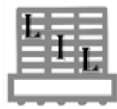
Scope: This test method covers standardized techniques for locating air leakage sites in building envelopes and air barrier systems.

Applicable Products: Applicable to air/vapor barriers, weather-resistant barriers, and air barriers.

Test Procedure: Air leakage detection fluid is applied over the brick tie and seam/lap in the air/vapor barrier (AVB). The chamber is equipped with a centrifugal blower and pressuresensing device to create the specified positive pressure differential inside the chamber. Any sites of air leakage are detected through the visual appearance of bubbles in the detection fluid.

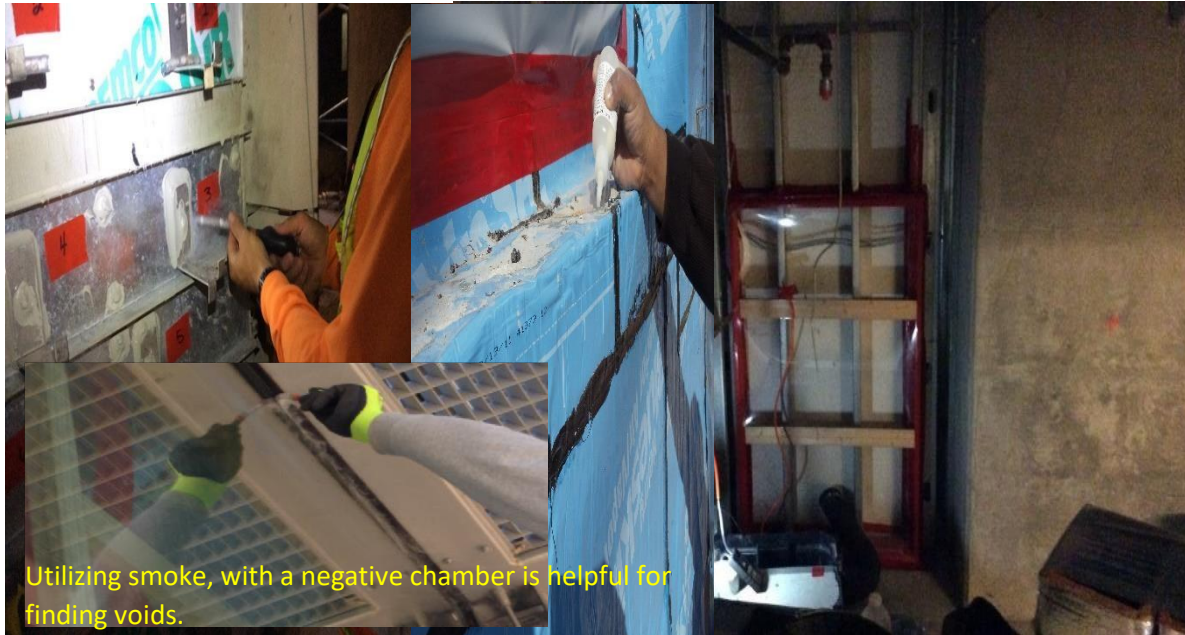
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Result: Upon the completion of a successful test, the product meets the performance criteria for air infiltration resistance or does not meet the criteria, and further remediation may be required to pass.

ASTM E783-02 (2010): Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

Standard: ASTM E783-02 (2010) – Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

Scope: This method provides a field test procedure for determining the air leakage rates of installed exterior windows and doors.

Applicable Products: Applicable to exterior windows and doors.

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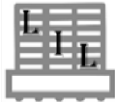
Test Procedure: A polyethylene sheet is sealed over the exterior surface of the test specimen. Air is evacuated/introduced from the chamber to produce the required pressure differential. The amount of airflow (cfm) required to maintain the pressure differential is recorded (extraneous air leakage). Subsequently, the polyethylene sheet is removed from the exterior surface of the specimen. As a result, air infiltrating through the specimen changes the pressure inside the chamber. Adjustments are made to the test equipment to maintain the pressure differential, and the increased airflow is recorded (total airflow). The extraneous air leakage is subtracted from the total airflow resulting in a net airflow amount entering through the specimen. The amount of net airflow is divided by the square footage of the specimen and compared to the maximum allowable air infiltration rate cfm/ft².

Result: Upon the completion of a successful test, the product meets the performance criteria for air infiltration resistance. or does not meet the criteria, and further remediation may be required to pass.

ASTM E1105-15 (2023): Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls

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Standard: ASTM E1105-15 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure

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

Applicable Products: Applicable to curtain walls, windows, skylights, window walls, and doors.

Test Procedure:

ASTM E1105, Procedure A – Water penetration testing is conducted at the specified air pressure differential while simultaneously spraying water onto the exterior face of the assembly at the required rate of 5 gph/sq ft. During testing, the interior face of the test area is inspected for water leakage. Testing continues for 15 minutes.



Custom Field Walk-in Chamber, is helpful for finding issues within curtain wall systems.

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ASTM E1105, Procedure B – Water penetration testing is conducted at the specified air pressure differential. Four cycles are employed during the test unless otherwise requested. Each cycle consists of 5 minutes with the air pressure applied and 1 minute with the air pressure released. Water is applied continuously at the required rate of 5gph/sq ft. During testing, the interior face of the test area is inspected for water leakage.

Result: Upon the completion of a successful test, the product meets the performance criteria for water penetration resistance or does not meet the criteria, and further remediation may be required to pass.

AAMA 501.2-15: Quality Assurance and Water Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems

Standard: AAMA 501.2-15 – Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems

Scope: This test is utilized to provide quality assurance and diagnostic field water penetration check methods for installed storefronts, curtain walls, and sloped glazing systems.

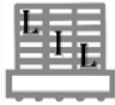
Applicable Products: Applicable to curtain walls, storefronts, window walls, sloped glazing systems, skylights, atriums, transitions, and termination points.



Test Procedure: Water is applied using a hand-held spray assembly employing a type B25 #6.030 nozzle, pressure gauge, control valve, and a 3/4" hose. The water flow is adjusted to produce 30 psi at the nozzle. Water is directed at the joint under test, perpendicular to the face of the specimen.

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The nozzle is moved slowly back and forth above the joint, at a distance of one foot, for a period of five minutes for every five feet of the joinery. An observer on the inside checks for water leakage and documents the results.

End Result: The product tested meets the performance criteria for water penetration resistance or does not meet the criteria, and further remediation may be required to pass.

Standard: ASTM D7877-14 – Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes

Scope: ASTM D7877-14 describes standard procedures for using electrical conductance measurement methods to locate leaks in exposed or covered waterproof membranes. The purpose of the conductance leak location method is to establish an electrical potential between the electrically insulating waterproof membrane and the underlying substrate.

Applicable Products: Applicable for waterproofing membranes installed in roofs, plaza decks, pools, water features, covered reservoirs, and other waterproofing applications.



Test Procedure:

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Low Voltage Electrical Potential – A controlled covering of water on the surface forms the conductive path horizontally across the membrane to any membrane breach. At a breach location, an electrical path to the deck is formed through the water leaking to the deck below. A sensitive receiver detects the leakage current and alerts the operator.

High Voltage Electrical Potential – **An electrode is swept across** the surface of the membrane. The electrode is charged to a high potential relative to the deck below. At a breach location, an electrical arc occurs from the electrode to the deck below. The arc discharge is electronically detected, and the operator is alerted.

Result: Membrane defects (such as design deficiencies, faulty applications of the membrane system, and damage by subsequent trades) are identified and corrected as soon as possible after its installation, thus preventing premature failure of the membrane. If the product does not meet the performance criteria, further remediation may be required to pass.

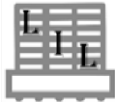
Standard: ASTM E2128 - 12 – Standard Guide for Evaluating Water Leakage in Building Walls

Scope: This guide describes methods for determining and evaluating causes of water leakage of exterior walls.

Applicable Products: Building wall systems employing its exterior and interior finishes, fenestration, structural components, and components for maintaining the building's interior environment. Sealants, masonry, windows and glass/metal curtain walls, exterior insulation and finish systems (EIFS), cement stucco and tile systems, wood and manufactured wood-based siding systems, fiber-cement and cementbonded particle board siding systems, and precast concrete panels.

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Test Procedure: Investigative testing is undergone in order to recreate leaks, trace internal paths of the leaks, correlate test results with observed damage, and verify hypothesis using diagnostic test methods and procedures adapted from standard test methods such as E331, C1601, E547 to meet specific objectives. Diagnostic testing can also be adapted from in-service quality assurance testing procedures such as Test Method E1105 or diagnostic test procedures such as Test Method C1715, AAMA 501.2, and AAMA 511.

Result: Upon the completion of a successful test, the products meet the performance criteria for water penetration resistance or do not meet the criteria, and further remediation may be required to pass.

ASTM D5957-98(2013): Standard Guide for Flood Testing Horizontal Waterproofing Installations

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ASTM D5957-98(2013) illustrates a method for testing the water-tightness of waterproofing installations applied to horizontal surfaces having a slope of no greater than 20 mm/m (2% slope) (1/4" per ft).

Applicable Products: Applies for fully adhered or bonded sheet membranes, liquid or fluid applied membranes, or loose laid sheet membranes of waterproofing installed on parking garages and plaza deck types over habitable spaces or on elevated structures. This standard is not intended for use in building roofing systems.

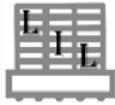
Test Procedure: Waterproofing membrane and flashings should be inspected and deficiencies repaired. Testing should occur prior to the installation of the drainage layer, protection layer, pavers, or overburden. If a protection layer is required for flood testing, the recommended practice is that a temporary protective layer be loose-laid and removed prior to testing the waterproofing system.



A containment assembly is constructed to be nondestructive, non-penetrating of the waterproofing installation, and easily removable. Containment assemblies are composed of a sacrificial sheet or a polyethylene sheet adhered to the surface of the waterproofing membrane using a watertight seal (duct tape). Overflows are provided in the containment assemblies, when needed, at 5 inches above the low point on the test surface so as not to exceed the structural capacity of the substrate. Water loss is monitored via tape marked in 1/8" increments or using other scale instrumentation in at least two locations.

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A test area is flooded with water to achieve a minimum cover of 1 inch but not exceed a maximum depth of 4 inches at the lowest point. Water height is maintained so as not to exceed a minimum level of 2 inches below the edge of flashings. Testing is performed for a minimum of 24 hours and a maximum of 72 hours when rainfall is not forecasted to occur. If leakage is detected during the test period, water is immediately drained from the test area. The location of the leakage is determined and appropriate repairs are made to the system in accordance with the system manufacturer's recommendation for procedures and materials. Following the completion of the repairs and curing of materials, the area is retested under the same conditions as the initial flood test.

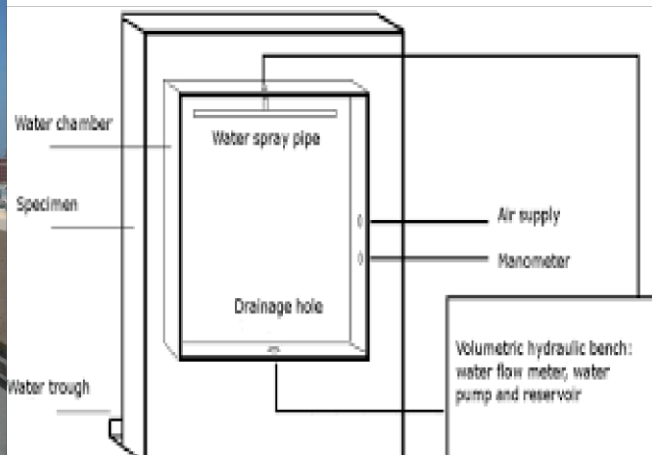
End Result: Flood testing is considered to be completed if no leaks are identified to have occurred during the test period and the membrane and flashings are intact. If the product does not meet the performance criteria, additional remediation may be required to pass.

ASTM C1601-10: Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surface

Standard: ASTM C1601-10 – Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surface

Scope: This test method covers the field determination of water penetration of a masonry wall surface under specific water flow rate and air pressure conditions.

Applicable Products: Applicable to masonry walls.



Test Procedure: The perimeter of a 3' by 4' test chamber is attached and sealed to the exterior wall. The chambers are constructed using an aluminum frame with a 1/4" Lexan face attached and sealed to the wall with anchor bolts/screws and various tapes/sealants.

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The chambers are equipped with a centrifugal blower and a pressure sensing device to maintain the required air pressure differential across the test area, along with a water flow meter. Uniform water spray is applied to the test area at the specified flow rate of 3.4 gal/ft²/hr to create sheet flow on the concrete wall face inside of the chamber. Water is sprayed continuously for 4 hours following a 30-minute pre-conditioning period. Reservoir water level, air pressure, and water flow rate are checked, and water loss is recorded at five-minute intervals throughout the test period.

Result: Upon completion of a successful test, the masonry wall surface meets the performance criteria for water penetration resistance or does not meet the criteria, and further remediation may be required to pass.

Standard ASTM C 1715 Test Method for Evaluation of Water Leakage Performance of Masonry Wall Drainage Systems

This test method describes a standard procedure for determining the ability of masonry wall drainage systems to collect water that penetrates the exterior masonry wythe during rainstorms and to direct this water back to the exterior surface of the wall.

This test method is applicable to wall systems that contain an exterior masonry wythe with a drainage space on the interior face of the exterior wythe. It is not applicable to single-wythe drainage walls.



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This test method is not applicable to masonry barrier walls or other masonry walls that are designed without drainage spaces behind the exterior wythe.

The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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.

Significance and Use

This test method is suitable for use on walls to determine the ability of masonry wall drainage systems to collect water penetrating the exterior wythe and to direct this water back to the exterior surface of the exterior wythe. Removal of a portion of the interior wall finishes is desirable to observe leakage into backup walls. Even with the removal of interior finishes, in many cases, it is not practical to observe surfaces behind spandrel beams, columns, or other obstructions. Potential areas where leakage may occur but that are not visible during the test shall be considered when interpreting the results of the test and shall be recorded in the report.

Standard ASTM E779-19, Methods for Determining Airtightness of Buildings Using an Orifice Blower Door Significance and Use

Airtightness—Building airtightness is one factor that affects building air change rates under normal conditions of weather and building operation. These air change rates account for a significant portion of the space-conditioning load and affect occupant comfort, indoor air quality, and building durability. These test methods produce results that characterize the airtightness of the building envelope. These results can be used to compare the relative airtightness of similar buildings, determine airtightness improvements from retrofit measures applied to an existing building, and predict air leakage. Use of this standard in conjunction with Practices E1186 permits the identification of leakage sources and rates of leakage from different components of the same building envelope. These test methods evolved from Test Method E779 to apply to orifice blower doors.

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Applicability to Natural Conditions—Pressures across building envelopes under normal conditions of weather and building operation vary substantially among various locations on the envelope and are generally much lower than the pressures during the test. Therefore, airtightness measurements using these test methods cannot be interpreted as direct measurements of natural infiltration or air change rates that would occur under natural conditions. However, airtightness measurements can be used to provide air leakage parameters for models of natural infiltration. Such models can estimate average annual ventilation rates and the associated energy costs. Test Method E741 measures natural air exchange rates using tracer gas dilution techniques.

Relation to Test Method E779—These test methods are specific adaptations of Test Method E779 to orifice blower doors. For non-orifice blower doors or for buildings too large to use blower doors, use Test Method E779.

ASTM E779-19

Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
Significance and Use

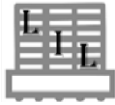
Air leakage accounts for a significant portion of the thermal space conditioning load. In addition, it affects occupant comfort and indoor air quality.

In most commercial or industrial buildings, outdoor air is often introduced by design; however, air leakage is a significant addition to the designed outdoor airflow. In most residential buildings, indooroutdoor air exchange is attributable primarily to air leakage through cracks and construction joints and is induced by pressure differences due to temperature differences, wind, operation of auxiliary fans (for example, kitchen and bathroom exhausts), and the operation of combustion equipment in the building.

The fan-pressurization method is simpler than tracer gas measurements and is intended to characterize the air tightness of the building envelope. It is used to compare the relative air tightness of several similar buildings to identify the leakage sources and rates of leakage from different components of the same building envelope, and to determine the air leakage reduction for individual retrofit measures applied incrementally to an existing building, and to determine ventilation rates when combined with weather and leak location information.

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Scope

This test method measures air-leakage rates through a building envelope under controlled pressurization and de-pressurization.

This test method is applicable to small temperature differentials and low-wind pressure differential, therefore strong winds and large indoor-outdoor temperature differentials shall be avoided.

This test method is intended to quantify the air tightness of a building envelope. This test method does not measure air change rate or air leakage rate under normal weather conditions and building operation.

NOTE 1: See Test Method E741 to directly measure air-change rates using the tracer gas dilution method.

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This test method is intended to be used for measuring the air tightness of building envelopes of singlezone buildings. For the purpose of this test method, many multi-zone buildings can be treated as singlezone buildings by opening interior doors or by inducing equal pressures in adjacent zones.

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.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides, and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

ASTM E907-04: Standard Test Method for Field Testing Uplift of Adhered Membrane Roofing Systems

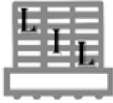
Standard: ASTM E907-04 – Standard Test Method for Field Testing Uplift of Adhered Membrane Roofing Systems

Scope: ASTM E907 covers the determination of the resistance of adhered membrane roofing systems to uplift pressure.



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Applicable Products: Roofing systems with or without rigid board insulation or base ply, which are either adhered or mechanically fastened, and fully adhered membranes.

Test Procedure: A controlled negative pressure is created on top of the roof surface by means of a chamber fitted with a pressure sensing device and vacuum equipment. Loose surfacing such as gravel, slag or granules are removed via sweeping a wide path around the perimeter of the test area. A heavy pouring of hot asphalt is applied over the swept area and allowed to cool. This provides a smooth surface and allows the edges of the chamber to be in complete contact with the roof surface so that a negative pressure is developed inside the chamber. Other methods are not to be used to prepare the test area unless the method used will produce a tight seal and is compatible so as not to damage the roof membrane. Additional approved methods for sealing the chamber are the use of wet sand, duct tape, water or polythene film.

End Result: Upon the completion of a successful test, the roofing system meets the performance criteria for

The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard. re RILEM Tubes an Effective Method of Evaluating the Water Repellent Characteristics of CMU?

The “RILEM” Tube Test was originally developed to provide an indication of the initial absorptive characteristics of stone masonry. These values could be correlated to the deterioration rates of stones in various areas of a stone masonry structure and to evaluate the effectiveness of remediation techniques. Today the RILEM Tube Test is often used (or misused) to assess the water repellent characteristics of a concrete masonry assembly, usually after a report of water penetration. There can be several reasons why a masonry wall leaks, but using the RILEM Tube Test to assess absorptive characteristics of individual units to determine the cause of the water penetration is largely ineffective and the results often misinterpreted.

This misinterpretation can detract from the effort to determine and fix the actual root cause(s) of the masonry wall leaks.

RILEM Tube and Test Method Description:

The RILEM Tube Test was developed in the late 1970’s by RILEM (a European group similar to ASTM) for quantifying the amount water absorbed and forced into the surface of masonry stone.

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The test utilizes a straight or L-shaped hollow tube (see Figures 1 and 2). The straight tube is for horizontal surfaces while the L-shaped tube is for vertical surfaces. The large opening of the tube is adhered to the stone's surface using putty or rope caulk. Water is then added to the tube and monitored over time. As the water drops an absorption rate (volume of water absorbed over time) can be determined.

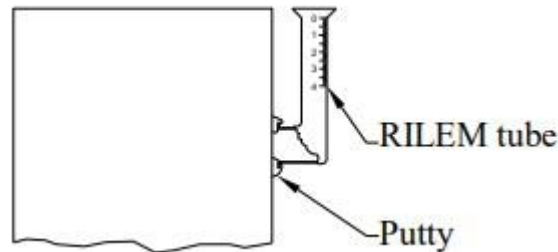


Figure 1 – RILEM Tube on Vertical Surface

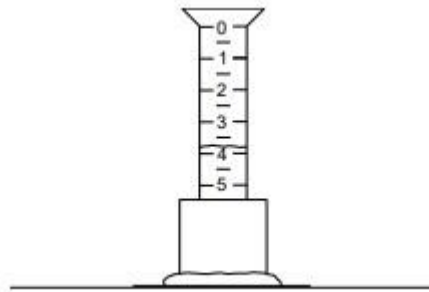


Figure 2 – RILEM Tube on Horizontal Surface

RILEM Tube:

Limitations While the RILEM tube can be visually impactful, the method only quantifies water absorbed and adsorbed by a stone or masonry unit's surface and not the volume of water penetrating through a masonry assembly.

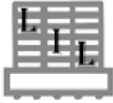
One of the greatest drawbacks to using a RILEM tube is that the area in contact with the surface measures only 0.88 in.² (5.7 cm²), which is quite small. Due to the small area, there is inherent variability in the test. A study conducted at the University of Wyoming concluded that 1,665 tests would need to be conducted for every 12 ft² (1.11 m²) of wall surface being evaluated in order to achieve a sample error of 10% or less [8]. Hence, drawing any conclusions about the water penetration characteristics of an entire wall assembly based on 50, 100, or even 500 tests can be speculative at best.

The RILEM Tube Test can be useful when evaluating the effectiveness of a remediation procedure, such as the application of a surface coating, by measuring the surface absorption characteristics before and after the treatment. However, care and insight must be used when interpreting the results.

Recommended Methods for Evaluating Water Repellency:

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When CMU is specified to have water-repellent characteristics, the industry recommends following NCMA TEK Note 19-7, which contains requirements for this type of CMU [1]. These requirements are based on the use of three test methods, and TEK 19-7 contains performance requirements for each:

Water Droplet or Water Stream Test [2] – This is a quick field method where water beads are placed on a unit in a horizontal position or a stream of water is sprayed onto a constructed wall. If the bead stays on the surface (or if the water stream visibly runs down the wall), the unit is considered to have waterrepellent characteristics. It is important to note that exposure can degrade the repellency characteristics at the surface of the unit, so if the units do not pass this test, they should be taken to the laboratory for further evaluation.

Spray Bar Test [3] – in this test, a unit is subjected to a constant stream of water over the surface of the face shell for four hours. After that time, the inside of the exposed face shell is observed and the amount of dampness is measured. This test is effective in evaluating overall water repellency, as well as detecting the presence of interconnected voids in the concrete matrix.

Water Uptake Test [4] – in this test, a coupon sample is taken from a CMU and partially submerged in water. The amount of water the coupon absorbs over time is measured. This test evaluates the capillary suction of a CMU.

These tests were developed to evaluate the characteristics of the CMU independent of the rest of the concrete masonry assembly. Several laboratory and field methods ([5], [6], [7]) have been developed by ASTM for evaluating the water penetration characteristics of masonry wall assemblies. The NCMA methods are effective in evaluating the water-repellency characteristics of the CMU, and the ASTM methods listed can evaluate either the performance of the assembly overall or the drainage system within a masonry assembly. In many cases, however, these methods may not uncover the underlying problem of why a building is leaking. Such issues many times are tied to causes unrelated to the masonry assembly (such as unprotected masonry during construction, connections at a roof, or improper detailing of flashing).

References

1. TEK 19-7, *Characteristics of Concrete Masonry Units with Integral Water Repellent*, NCMA, 2008.
2. CMU-WR1, *Standard Test Methods for Water Stream and Water Droplet Tests of Concrete Masonry Units*, NCMA, 2009.
3. CMU-WR2, *Standard Test Method for Spray Bar Test of Concrete Masonry Units*, NCMA, 2009.
4. CMU-WR3, *Standard Test Method for Assessing Water Uptake Potential of Concrete Masonry Units*, NCMA, 2009.
5. ASTM C1601-14a, *Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces*, ASTM International, West Conshohocken, PA, 2014, www.astm.org.
6. ASTM C1715-15, *Standard Test Method for Evaluation of Water Leakage Performance of Masonry Wall Drainage Systems*, ASTM International, West Conshohocken, PA, 2015, www.astm.org.

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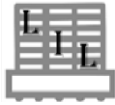
7. ASTM E514/E514M-14a, *Standard Test Method for Water Penetration and Leakage Through Masonry*, ASTM International, West Conshohocken, PA, 2014, www.astm.org.
8. Effects of Pressure on Water Penetration in Brick Masonry, S. Roller, M.S. Thesis, Department of Civil and Architectural Engineering, University of Wyoming, Laramie, WY, 1994.



As required by ANSI/IWCA I-14.1, Section 1.7, all users of this system must provide a clear, concise written Plan of Service to building management on how they will safely mobilize the exterior wall of this facility, including, but not limited to, rigging of all areas, safety line tie-backs and overhead signage and barricades.

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- OSHA CFR 29 - 1910.66, SUBPART F, POWERED PLATFORMS, MAN LIFTS, AND VEHICLEMOUNTED WORK PLATFORMS, AND APPENDIX D OF THE REGULATION.
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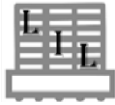
- OSHA CFR 29 - 1910.28, SUBPART D, F, & G SAFETY REQUIREMENTS FOR SCAFFOLDING (FOR “TEMPORARY” INSTALLATIONS).
- OSHA CFR 29 - 1910.29 & OSHA CFR 29-1926.451 SUBPART E, TOWER SCAFFOLDING.
- OSHA CFR 29 - 1910.66, SUBPART F, POWERED PLATFORMS FOR BUILDING MAINTENANCE (FOR “PERMANENT” INSTALLATIONS).
- ANSI/SIA Z359, HARNESSSES, LAYNARDS, LIFELINES.
- ANSI A120.1, SAFETY REQUIREMENTS FOR PERMANENT POWERED PLATFORMS FOR BUILDING MAINTENANCE.
- ANSI/ASME B30-SERIES STANDARDS (FOR LIFTING DEVICES, SLINGS, AND RIGGING HARDWARE).
- ANSI/IWCA I – 14, ROPE DECENT SYSTEM.
- ANSI/IWCA I – 14.1, WINDOW CLEANING SAFETY STANDARDS.
- ANSI/SIA 2359 HARNESSSES, LANYARDS, LIFELINES

Leak Investigation & Testing Services is an on-site inspection company. It was established to provide complete technical support for all types of exterior window walls and various types of wall components. It is capable of providing Quality Control Inspections, Forensic Investigations, Routine Maintenance Surveys, and Power Platform Certification; these typical services offer the clients an enhanced ability to attain quality products and workmanship.

On-site field testing is provided to verify the waterproofing integrity of the actual installation of the cladding on the building.

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Testing to the industry specifications includes; air infiltration and static water penetration; when presented with a problem, a thorough investigation and evaluation will be conducted to determine the causes with a knowledgeable solution being reached.

Additional Services Offered:

- Analyze shop drawings and window perimeter transition details.
- Ensure the correct selection of sealants and waterproofing materials.
- Interphase water-penetration lines for window wall and window perimeter systems.
- Coordinate quality control documentation with window wall and sealant manufacturers' specifications.
- Require quality control documentation by the installation subcontractor for all elevations.
- Field test window walls and building envelopes in accordance with ASTM specifications.
- Develop installer qualification checklists.
- Provide support in litigation.
- Remediate leaks in existing buildings.

Evaluation of Buildings

The most common and costly problems associated with the performance of a building envelope are related primarily with excessive air leakage and water intrusion. In particular, windows, doors, and curtain walls, as well as their interface with the adjacent wall construction, are determining elements in the performance of the building envelope. Improved standards and design principles have contributed in significantly improving the performance of window, doors, and curtain wall systems, whether it is with respect to resistance to water penetration, air leakage resistance, wind load resistance, or condensation resistance. The reality, however, is that many buildings of recent construction are still experiencing problems with the in-service performance of installed window and curtain wall systems. Typically, these problems are often the result of poor installation, fabrication, and lack of adequate quality control.

LI&TS focuses on evaluating the field performance of windows, doors, and curtain walls within the building's envelope.

AERIAL SERVICES:

We provide high-resolution digital photography and infrared thermal imaging services to help maintain, build, or modify water tower structures or any other elevated structure. Complete structure documentation

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includes noting visible deficiencies, the condition of the existing coating, hardware failures, and general overall tower conditions.



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