

Water Penetration Testing – Masonry

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Water penetration through the building envelope is the cause of the majority of construction defect litigation in the United States(i). Water entering through roofs and facades damages interior components and causes the growth of mold and other microbes which can render a structure uninhabitable. Field tests are available to measure absorption and penetration of water into the building envelope through materials and assemblies in affected buildings, which is helpful in determining the causes of water penetration problems.



Figure 1. Karsten tube absorption test.

Karsten Tube: The Karsten Tube, also known as the RILEM Tube, is a simple absorption test for masonry surfaces that measures the quantity of water absorbed by a small surface area over time. This test is used as a quality control test and warranty verification test for coatings on masonry walls. It can be used to test coatings, to measure the rate of absorption of masonry units, and to measure the rate of absorption at mortar joints.

Spray and Drip Tests: Spray and drip tests are used to assess the water control features of building assemblies. The American Architectural Manufacturers Association's AAMA 501.2, Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems, describes a spray test conducted at measured pressure with a calibrated nozzle to detect leaks at seams and boundaries in curtain walls and glazings as quality control during installation. This simple procedure is also useful for diagnosing sources of leaks in doors, windows, and flashings in all types of walls. Other more complicated tests involve use of spray racks to apply incident water. Although ASTM E1105, Standard Test Method for Field Determination of water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference is often misused to allege dubious defects, this test and the similar AAMA 502 and AAMA 503 are industry acknowledged field tests for newly installed components and assemblies. Krogstad and Weber (ii) have developed a modified ASTM E1105 spray rack procedure with controlled rate of water flow that is useful in diagnosis of water penetration problems. Krogstad has also developed a test procedure for cavity walls used to evaluate the performance of flashing and weep systems (iii).

Simulated Storm Water Permeance Test: Field-Modified versions of ASTM E 514, Test Method for Water Permeance of Masonry, have been used for many years to measure water permeance of masonry

walls in completed structures. Addressing the interest in this useful modification of its laboratory procedure, ASTM published a new standard in 2008, ASTM C1601, Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces. To measure water penetration, a pressure chamber with an integral spray bar is bolted and sealed to one side of a masonry wall. For four or more hours, the chamber is pressurized with air and a constant spray of water is applied. The volume of water in the closed system is recorded at regular time intervals, and the quantity of water permeating into the masonry surface is expressed as the quantity of water lost to the wall per unit of time during the test.

Infrared Thermography: Infrared Thermographic imaging allows for rapid acquisition of global data of minute temperature differences in the surface of a building. This data can be used to make inferences regarding relative moisture content of materials because of heat transfers related to conductance of water and phase change heat loss or gain (iv). The magnitude of temperature differences observed will be related to the temperature differential between the building exterior and interior, so the season and time of day will affect the imaging results. Interior moisture can be readily detected if there is drying to the interior, as evaporative cooling of surfaces can be measured.

Please feel free to call if you suspect water penetration issues or to read the full technical article on this topic. 303-757-4000.

References

- (i) Feld, Jacob and K.L. Carper, Construction Failure, 2nd Ed., John Wiley & Sons, Inc. N.Y, N.Y., 1997.
- (ii) Krogstad, N. V. and R. A. Weber, "Using Modified ASTM E1105 to Evaluate Resistance of Masonry Barrier, Mass, and Skin Walls to Rain," in Masonry: Design and Construction, Problems and Repair, ASTM Special Technical Publication 1180, American Society for Testing and Materials, Philadelphia, 1993.
- (iii) Krogstad, N. V., "Masonry Wall Drainage Test – A Proposed Method for Field Evaluation of Masonry Cavity Walls for Resistance to Water Leakage," Masonry Components to Assemblages, ASTM STP 1063, John H. Matthys, ed., American Society for Testing and Materials, Philadelphia, 1990.
- (iv) Colantonio, Antonio, "Detection of Moisture and Water Intrusion Within Building Envelopes by Means of Infrared Thermographic Inspections," Journal of Building Enclosure Design, National Institute of Building Sciences, Washington D.C., Summer/Fall 2008.