Spray-Lock®
CONCRETE PROTECTION

Spray-Lock Concrete Protection Products Tested for Water Vapor Transmission Using ASTM E96 Test Method

ASTM E96-10 *Standard Test Methods for Water Vapor Transmission of Materials* is a standard that allows the user to choose the most appropriate method to test a material for water vapor transmission. ASTM E96 is written to allow for multiple products to be covered by a single standard, and appropriate for materials up to 1 ¼ inches (32mm) in thickness. The thickness limit has been set primarily because the time to reach equilibrium of water permeance increases as a square of the thickness. Therefore, thicker materials would potentially take much longer to test. When testing concrete specimens, a laboratory should select test conditions that most closely approach the conditions of use, as set forth in section 5 of the standard, "Significance and Use."

ASTM E96 details two primary methods of testing. The first is the Desiccant Method. The Desiccant Method utilizes a test specimen sealed to the open mouth of a test dish containing a desiccant with the assembly placed in a controlled atmosphere. Periodic weighing of the sample determines the rate of water movement through the specimen into the desiccant.

The second method of testing involves the use of a dish that contains distilled water that is affixed to the specimen. The specimen and dish are exposed to a controlled environment where the water moves through the specimen in vapor form, allowing calculation of water movement. SCP selected this method to try and approximate the conditions in the field where water vapor movement from below a concrete slab to the top of the slab is most critical for flooring manufacturers and installers.

A 1-inch concrete slab thickness was chosen to enable calculations within the normal time frame of the testing regime. Although greater thicknesses could be tested, the time for the test to run would have been increased considerably. The specified relative humidity in the test chamber is 50 +/- 2%. The specified temperature is 100 +/- 1° F (38 +/- 1° C). An air velocity of between 0.066 and 1 ft./sec (0.02 and 0.30 m/s) is specified in the test chamber. E96 allows for extreme humidity, if desired, and temperatures between 73.4° F (23° C) and 80° F (26.7° C). The specified, rather than alternate, test values for temperature and humidity were utilized for the testing under consideration.
SCP decided to use the second test method utilizing a dish and distilled water to approximate field moisture movement through concrete.

The test results presented by SCP for water vapor transmission values are compared to a control specimen that was tested following the same procedure and at the same time as the experimental samples. The calculations used to determine water vapor transmission are also the same and are detailed in section 13 of the standard. When interpreting results, consideration should be given to the statement contained in section 1 of the standard: "Agreement should not be expected between results obtained by different methods." Of additional importance is that the laboratory conditions described above were chosen to best test the efficacy of the treatment to reduce water vapor

transmission, and they likely will not mirror exact performance in the field where environmental conditions, the concrete mix used, and the concrete thickness will all vary considerably from laboratory conditions.

The mix design used for testing was purposefully designed to be a high permeability mix in the untreated state to better demonstrate the ability of SCP products to affect water vapor transmission (WVT). Nine test panels as control concrete with expected high-water vapor transmission were cast and tested to ASTM E-96-10 (water method). Two additional sets of nine panels were cast with the same mix design and then treated with SCP products prior to being tested to ASTM E-96-10. Results of that testing are shown in Figure 1 above. Treatment with SCP products can reduce water vapor transmission significantly. Typical reductions in water vapor transmission are between 70% to 80% compared to untreated controls.

SCP 327 was applied at time of concrete initial set. SCP 578 was applied after concrete was aged in the laboratory for seven (7) days. Average WVT was obtained from direct measurements. Because permeance (perms) is commonly used in the U.S. construction market to describe water vapor transmission, calculated values for perms are provided. The permeance calculations utilized the average WVT and projected values for vapor pressure for the measured relative humidity and temperature of the test chamber.

Table 1: Calculated Permeance Values

Test Group	Average WVT ($lbs/1000ft^2/24$ hr)	Calculated Average Permeance (U.S. Perms)
Control	22.80	0.280
SCP 327 (Applied at Time of Placement)	4.56	0.056
SCP 578 (Applied at 7 days of age)	5.54	0.068

Commentary – Why ASTM E96 was used instead of other methods

SCP technology is different than many moisture mitigation treatments because it penetrates into the concrete matrix, blocking the concrete capillaries and pores instead of sealing the surface. Some flooring and coating companies have had questions about testing SCP-treated substrates. SCP products should be regarded like all other moisture mitigation solutions. Other systems for vapor control that are applied after concrete placement do not require testing because there are not relevant or applicable tests available. All treatments of coatings, reactive penetrants or patching and leveling systems preclude all standard tests for moisture vapor emissions. Flooring and coating companies, owners and contractors alike rely on the warranties of the manufacturers to proceed with application and look to them for solutions if problems arise.

Moisture Vapor Emission Rate (MVER) testing is one of the most commonly requested tests. The following are statements of why the MVER Test (ASTM F1869-16a *Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride*) should not be used for evaluating moisture evaporation rate of treated concrete subfloors.

ASTM F1869-16a states the following in the scope for the test standard:

1.Scope

1.2 This test shall not be used to evaluate the rate of moisture vapor emitted by gypsum concrete or floors containing lightweight aggregate.

1.3 This test shall not be used to evaluate moisture vapor emissions over coatings on concrete or through reactive penetrants or over patching or leveling compounds.

SCP products work by penetrating into the bleed water channels, capillaries, and voids left in the concrete as bleed water exits. Once in the concrete, SCP products react with available alkalis to primarily form Calcium Silicate Hydrate (C-S-H), the same reaction product provided by cement hydration that provides most of concrete's desirable properties.

Based on the most current publication of the ASTM F1869 testing scope and how SCP products work within the concrete reacting with available alkalis, the test method should not be used to determine MVER for SCP treated concrete.

Another common test method requested is the Relative Humidity (RH) Test (ASTM F2710 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In- Situ Probes). This test method determines that relative humidity in the concrete matrix by placement of a probe embedded into the concrete and readings taken once the probe has become acclimated to the surrounding concrete. SCP products trap moisture in the concrete to by blocking off the capillaries and void spaces. The reaction products formed fill the capillaries and voids and shutdown liquid water transmission. This process allows for longer hydration of the concrete. By trapping the moisture in the concrete, the relative humidity will typically remain high for an extended period of time.
Other test methods of obtaining moisture readings can give misleading results as the previous test methods. SCP products are trapping the remaining moisture in the slab to enhance the curing of the concrete structure.

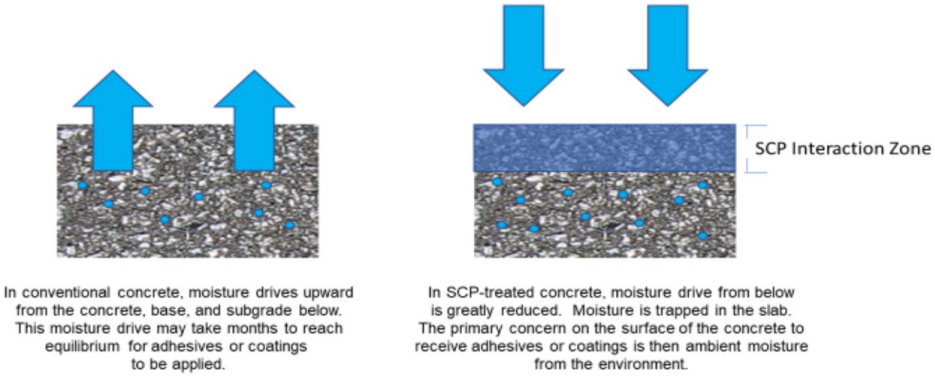

Figure 1: Graphical description of how SCP products work

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