CONTROLLING MOISTURE VAPOR FROM CONCRETE SUBFLOORS

Many decorative floor coverings and the bonding materials used to install them are sensitive to excessive moisture. Moisture can cause floor coverings to swell or blister and wood flooring may even buckle. The adhesives used to secure the flooring materials can dissolve and allow it to come loose from the substrate. Continued exposure to moisture allows mold to grow under the flooring material, which can cause discoloration and affect the health of the building occupants.

What is moisture vapor and why does it impact flooring?

Persistent moisture typically comes from the concrete substrate in the form of vapor. Moisture vapor is the gaseous form of water. It surrounds us every day and is measured as relative humidity in the atmosphere. Concrete has a crystalline structure with many capillaries between the cement crystals. These capillaries allow the movement of moisture vapor through the concrete.

Based on the laws of physics, the moisture vapor will move to areas of lower concentration or lower relative humidity. If there is a source of moisture in or below the concrete, the moisture vapor will move to the surface of the concrete through the capillaries where it can affect moisture sensitive floor coverings. This occurs in concrete on ground as well as in suspended concrete slabs. Plumbing leaks can also be a source of moisture in a concrete slab.

Measuring Moisture Vapor

ASTM F710 defines the Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring. In this standard, the first step is to find out how much moisture vapor is emitted from a concrete slab. There are two methods commonly used to measure the moisture vapor transmission rate (MVTR) from a concrete slab. Both methods can be used with on grade or above grade concrete slabs.

ASTM F1869, the Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride, is the older test. It relies on measuring the amount of moisture vapor emitted by the surface of a concrete slab. ASTM F1869 measures MVTR in terms of pounds of water per day per 1,000 sq. ft. of floor area. ASTM F710 recommends an emission rate less than 3 pounds per day per 1,000 sq. ft. for the installation of resilient floor covering.

ASTM F1869 measures the moisture in the top ¼" of a concrete slab but does not measure the moisture deep in the slab that could potentially reach the surface with environmental changes. (This is not an acceptable method for measuring the moisture vapor transmission rate in lightweight concrete slabs.)

ASTM F2170 measures the relative humidity of a concrete slab. This is the Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes. It measures the moisture present deep within a concrete slab. This is the moisture that can escape and affect floor coverings and bonding materials after installation.

ASTM F710 recommends that the relative humidity in a concrete slab be below 75% for installation of most resilient floor covering. With either test method for MVTR, it is important to follow directions for the number and frequency of individual tests in order to achieve accurate readings. In many cases, it is best to run both tests to measure moisture movement from a concrete slab.

Controlling Moisture Vapor

If the MVTR is higher than allowed for the particular floor covering and adhesive to be installed in the project, the concrete slab must be prepared to accept a moisture vapor barrier. A liquid coating is then applied to the bare concrete subfloor, such as TechMVC™ 100% Solids Epoxy Moisture Vapor Control.

TechMVC can be applied to concrete with moisture vapor transmission rates as high as 25 lbs. of moisture emitted per day per 1,000 sq. ft. It can also be installed on concrete slabs with an internal relative humidity of 100%. Properly installed, TechMVC can reduce the moisture transmission rate from a concrete slab to below most floor covering and adhesive manufacturers' recommendations.

Before applying TechMVC, ensure that the concrete slab is structurally sound, clean, dry and free from contaminants that would prevent a good bond. Ambient temperature should be above 50ºF, but not over 90ºF. The concrete slab should be at least 7 days old and should have an ICRI CSP of 3. If necessary, the concrete should be shot blasted

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to this profile. If profiling is required, it must be followed with thorough vacuum cleaning to remove all dust particles.

If the installation is over lightweight concrete (air-entrained or reduced weight aggregate), make sure the ASTM C109 compressive strength of the concrete is greater than 2000 psi and the tensile strength of its surface is greater than 200 psi.

Any stable, non-moving cracks in the concrete slab should be filled with an epoxy, such as TechPrime™ E 100% Solids Epoxy Primer. The epoxy primer must be allowed to cure before applying the moisture vapor control barrier.

It is very important to maintain expansion and control joints throughout the installation. These joints are included in the concrete slab to allow the slab to move with environmental changes, such as temperature fluctuations. The stress generated at these points can damage a moisture vapor barrier and reduce its effectiveness if the barrier is placed directly across an engineered joint. Proper installation of the moisture vapor barrier will isolate the coating to each adjoining concrete slab. The gap between the slabs should be filled with a suitable compression rod and capped with a sealant meeting the requirements of ASTM C920. This sealant will control any moisture movement at these seams between concrete slabs.

When using a moisture vapor barrier, it is important to follow the manufacturer's directions for mixing the components and applying the barrier to the substrate. Do not assume that every manufacturer has the same procedure for mixing and application. The components should be mixed with a low speed power mixer. Using a higher speed will mix air into the epoxy and cause voids in the barrier. Do not mix longer than directed or the components will begin reacting immediately and increase in viscosity. Barriers should not be applied if the ambient temperature is less than the dew point. In these instances, moisture can condense on the floor surface and interfere with the film formation and bond of the barrier.

The mixed product should not be allowed to remain in the mixing container. It must be immediately poured onto the floor and spread uniformly. It is best to spread the material on the floor with a gauged squeegee to the required thickness and then roll it smooth with a lint-free roller. Allow the product to thoroughly cure and then examine the surface for voids, pin holes and air bubbles. Any air bubbles should be shaved off with a sharp blade. A second coat is then applied to fill the craters formed by the bubbles and any voids or pin holes observed. This application should be tight to the surface of the first coat in order to fill the voids.

Completing the Surface Preparation

The newly coated subfloor should be protected from traffic while it cures and until it is covered with any necessary underlayment and the floor covering. A self-leveling underlayment, such as TechLevel™ 150 Premium Self-Leveling Underlayment, can be applied over the moisture vapor control barrier to smooth and level the floor before installation of the decorative flooring.

A suitable primer, such as TechPrime™ A Advanced Acrylic Multi-Surface Primer, must be applied to the fully cured moisture vapor control barrier and allowed to dry before the installation of the self-leveling underlayment. In the rare case where the concrete slab is smooth and level, it may be suitable to bond directly to the moisture vapor barrier. Check with the adhesive manufacturer for proper installation over epoxy coatings.

Careful and complete surface preparation with a moisture vapor control barrier can increase the longevity of decorative resilient or wood floor coverings

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CUSTOM's Technical Services department is available to answer questions about appropriate surface preparation and the application of moisture vapor control barriers to protect floor coverings.

CUSTOMTech Products Available

TechMVC™ 100% Solids Epoxy Moisture Vapor Control
TechPrime™ A Advanced Acrylic Multi-Surface Primer
TechPrime™ E 100% Solids Epoxy Primer
TechLevel™ 150 Premium Calcium Aluminate Based Self-Leveling Underlayment
TechLevel™ XP-1 High Performance Calcium Aluminate Based Self Leveling Underlayment
TechLevel™ 100 Calcium Aluminate Self Leveling Underlayment
Silk™ Calcium Aluminate-Based Patching and Finishing Compound
GenPatch™ General Purpose Calcium Aluminate-Based Patch

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Technical Services 800-282-8786
customtechflooring.com