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PREPARATION IS THE KEY TO SUCCESSFUL FLOOR COATINGS

By Bob Cusumano

Coating new concrete floors can really be tough. Whether you're painting the floor of a large warehouse or the garage in a home, there are several potential pitfalls that the painting contractor must consider. Regardless of whether you are applying latex, alkyd, epoxy or urethane, preparation is critical to insure a long service life.

On-grade slabs should have a 10 mil minimum vapor barrier to prevent moisture vapor transmission. Elevated Slabs should have vented pans to allow moisture to escape.

Before coating concrete floors, it is important that it has been properly cured. As a rule of thumb, concrete should be in place for a period of twenty-eight days at a temperature of 75 degrees Fahrenheit before coating is contemplated. Certain conditions can affect the cure rate including the slab thickness, presence of a moisture barrier, type of concrete, temperature and humidity can all change the cure schedule. pH tests and moisture meter tests can help indicate the degree of cure.

New concrete can hold moisture for a great period of time. It is important, especially when applying a "non- breathable" coating that the concrete is free from moisture as much as possible. Vapor pressures, temperature and humidity differentials and hydrostatic pressure can cause premature coating failure if not detected and corrected. ASTM standard D 4263 describes a test where a plastic sheet is attached to the floor using tape at the perimeter to prevent any moisture from escaping (photo 1). After twenty-four hours, the sheet is examined. If the area of the concrete under the plastic is either darker than the uncovered concrete or if there are drops of water under the plastic, then moisture is emanating from the concrete.

Photo 1

A calcium chloride test is described in ASTM F 1869. This quantifies the volume of water vapor radiating from a concrete slab surface over time. This test is directly specified by many coating manufacturers as the primary measure of moisture acceptability. In this test, a closed canister of dry calcium chloride is weighed. The canister is then opened and placed under a plastic dome which has adhesive at the perimeter to seal the edges. After seventy-two hours, the dome is removed and the canister is closed and re-weighed. Using the amount of weight gain, the amount of moisture that emits from 1,000 square feet of slab surface in 24 hours can be calculated. The result is expressed as "pounds" which is the equivalent weight of water, emitted as vapor, over 1,000 square feet in 24 hours. This result should be compared to the coating manufacturer's parameters for the particular floor coating being used. While the test can measure moisture in a wide range of building climates, the results are only meaningful when conducted in a similar building environment as the finished floor system.

The surface of the concrete should be checked for grease, oil, efflorescence, and dirt that need to be removed. Chemicals and oils are often removed with high-pressure washing. Dirt and grime can be removed with a degreaser worked in with a floor polisher. A "water drop" test can be used to determine if a surface is clean. Water beads on surfaces contaminated with curing compounds, oil, and grease. An acid drop test is also effective to determine the presence of bond breakers or curing compounds that can interfere with adhesion. A drop of muriatic acid is placed on the concrete. If violent fizzing occurs (photo 2) then no film is present. If the acid does not fizz, then there is a barrier present between the concrete and the acid. If a sealer is present, it must be removed prior to coating the concrete.

Photo 2

Laitance is a weak layer that often forms at the surface of concrete slabs as a result of troweling. Troweling brings fine sand from the concrete to the surface. The fine sands create a smooth texture but are weak in strength. Unless the laitance is removed, the coating may adhere well to the surface of the laitance, but the laitance can fracture resulting in delamination. Photo 3 shows an acid stained floor coating that failed because it was applied over laitance. A standard adhesion by tape test was performed, a thin layer of the concrete delaminated with the stain as shown in photo 4.

Photo 4

A tensile pull tester (photo 5) is also effective in determining where laitance is present. Aluminum dollies are affixed to the coated concrete using an epoxy adhesive. A tensile test is then performed. The PSI at failure indicates the strength of the bond. Examination of the dollies also provides valuable information. When a plug of concrete is removed as shown in photo 6, then no laitance is present. However, when the coating delaminates with a thin layer of concrete present (photo 7), then laitance is the culprit.

Photo 5 Photo 6 Photo 7

Laitance may be removed by acid etching or by abrasive blasting. These methods have the additional advantage of creating a surface profile on very smooth concrete. A surface profile is the key to good adhesion.

Acid etching can provide adequate surface preparation for concrete floors, but it will not remove petroleum-based products or oils from the concrete. These and other contaminants must first be removed. ASTM Standard D 4260 describes the process and results that should be achieved. Concrete floors should be wet with clean water prior to applying acid. The etching solution should be 32% muriatic acid diluted in one gallon of water. This two-gallon mixture should cover approximately 150 square feet. A stiff bristled broom can be used to scrub into the surface, where it should foam for 10-15 minutes. After etching, the floor should be neutralized and flushed with clean water. The acid solution should not be allowed to dry on the floor where salts can form. After thorough drying, the pH of the concrete should be tested according to ASTM-D-4262 prior to applying the coating. The roughness of the floor should be similar to medium grit sandpaper. The key is to achieve an even profile. Photo 8 shows a convention floor that failed due to an uneven etch.

Photo 8

Many coating manufacturers recommend abrasive or shot blasting as the preferred method of surface preparation. These methods remove laitance, clean and create a profile all in one step. However, oil or grease must be removed before abrasive or shot blasting to prevent driving it into the concrete. The degree of blast profile should be carefully monitored to prevent creating a greater profile than can be accommodated by the coating to be applied.

Surface preparation is the most important step of any concrete floor coating application. Improper surface preparation will undoubtedly lead to early failure necessitating costly repairs. To ensure that the floor coating provides its full service life, always be sure to comply with the coating manufacturer's specifications for recommended surface preparation techniques, allowable moisture and vapor levels, and coating application requirements.