Concrete is a durable, inexpensive and common material of construction. At times, it is necessary to apply a coating or topping onto a new or existing concrete surface for purposes of aesthetics, sealing, chemical resistance, or abrasion resistance.

Proper surface inspection and preparation is a very important factor in any successful coating, lining or topping project, and is required for all PolySpec products. The following guideline steps are required for achieving a properly prepared floor for application of polymer coatings.

CURING & MOISTURE

Concrete cures by hydration. The amount of water added to the cement mix (water to cement ratio) is a critical factor in determining slab porosity and suitability for coating. Water to cement ratio should be under 0.50 by weight followed by a full wet curing period and subsequent drying. The object of curing is to keep the concrete as saturated as possible until the fresh cement paste's water-filled spaces have been substantially filled in, and thus reduced, by by-products from the cement's hydration process. The best method of curing is by keeping the surface continuously wet for several days after pouring.

Excess water used in the concrete mix creates permanent space within the slab. This excess water must be evacuated properly before a floor coating can be installed. It is important to consider that, once the water is evacuated, the space remains moist and vapor easily passes through it. If a floor is not properly cured, shrinkage cracks and crazing may be evident, which can add to higher moisture vapor emission levels.

Moisture vapor emission is a dynamic process. ASTM E-1907 calcium chloride testing quantitates a change in weight of moisture-absorbing anhydrous calcium chloride. Expressed in pounds, this measurement is the equivalent weight of water emitted from a 1,000 square foot concrete slab area in a 24 hour period. An alternate test for excess moisture content is the ASTM D-4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method. The test is conducted by taping down a sheet of transparent polyethylene (4 mils thick, approximately 18 in2), to the concrete surface for a period of at least 16 hours. Upon removal, the sheet is visually checked for the presence of moisture. The test should be conducted at 500 square feet intervals.

It is generally accepted that it is safe to install a coating if the slab emission is 3 pounds or less per 1,000 square feet over a 24 hour time period. Quantitative relative humidity (RH) testing, as per ASTM F-2170, should confirm concrete RH results <75%.

Type I Portland Cement Concrete should cure for a minimum of 28 days. The surface should be finished with a light steel trowel when subsequently applying coatings. The bond strength of a coating, lining or topping to the concrete surface can be tested using an Elcometer Adhesion Gauge. This is done in accordance with ASTM D-4541 Standard Test Method for Pull-Off Strength of Concrete Using Portable Adhesion Testers. The method involves bonding a steel dolly to the finished coating and allowing the bonding agent to adequately cure. The dolly is then placed in tension by the gauge and the pull strengths are recorded. Ideally, the concrete should rupture without affecting the bond of the coating to the concrete. This should occur between 300–400 psi, which is the typical tensile strength of concrete.

Any potential problems with the substrate should be noted to the general contractor or owner, and no work should begin until corrective action has been satisfactorily completed.

SURFACE PREPARATION

Concrete surfaces may be contaminated with oils, greases, dirt and chemicals; in addition to removing these contaminants, the surface should also be free of curing membranes and form release agents. This is best accomplished by one of the following methods:

- ***Mechanical Blasting (ITW preferred method) -*** The preferred method of surface preparation of concrete slabs is vacuum-grit blasting, grit blasting or mechanical scarification. These methods are effective in the removal of laitance (the weak alkaline surface residue), curing compounds, dirt and dust. Vertical surfaces must be either grit-blasted or cleaned with hand held mechanical equipment.

  An advantage to vacuum-grit blasting is that a uniform surface texture can be attained. Also, the by-products of blasting are removed from the surface. The profile depth of the surface can be adjusted and controlled depending on the degree of contamination and the type of coating to be applied. For instance, thin mil coatings should be applied over lightly textured surfaces only, with care taken to prevent overlapping of the texture. Thicker toppings can be

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applied over heavier textured surfaces.

- ***Acid Etching -*** Acid etching, although commonly used, is one of the least desirable methods of surface preparation. This is because it introduces water and acid to the substrate, is difficult to recover and is not as effective in obtaining a uniform surface profile. The best acid to use is 15% (by weight) hydrochloric acid (37% solution) in water or 25% (by volume) muriatic acid (28% solution) at a rate of one gallon per 50 square feet. The etching process begins by slowly adding acid to water in plastic buckets. Workers should wear protective clothing including eye wear, rubber gloves, boots and respirator. Acid should be sprinkled onto the surface and spread. For best results, use a plastic sprinkling can to ensure that unspent acid reaches all areas of the concrete.

The acid should be scrubbed into the surface using a stiff bristle broom. Allow the solution to remain on the floor until bubbling action stops (10–15 minutes). If bubbling does not occur, then the acid concentration is too low, or the surface is contaminated and should be prepared by alternate means.

Rinse the floor thoroughly with large amounts of potable water. Do not allow floor to dry prior to rinsing. Check the pH of the wet concrete surface with litmus paper. A pH value below 10 indicates acidic chemical contamination. If an acidic condition persists, rinse with a solution of 1% (by weight) ammonia solution to water followed by a potable water flush. The entire floor surface should then be vacuumed to remove standing water and any residue remaining from the acid etching and wash process. Allow the floor to completely dry out. Fans and space heaters will help speed the drying process.

- ***Solvent Stripping -*** Stripping is the removal of existing coatings by attacking them with an exotic chemical/solvent based mucous type compound, usually containing methylene chloride. Complete protective clothing and respiratory equipment should be worn when working with these compounds. All old paints should be removed in order to attain good adhesion of a new coating to the concrete.
- ***Degreasing -*** Any oil and/or grease contamination on the concrete must be removed prior to coating. Commercial degreasers (such as trisodium phosphate) and removal agents are available that have varying effects on embedded oils or grease. Also, scrubbing with liquid caustic soda will usually attack stubborn greases. For animal fats, use a 50% solution of caustic soda and water. After application, thoroughly flush the surface with potable water. This process should be repeated until the floor is completely free of oils and greases.
- ***Steam Cleaning -*** Cleaning concrete with steam is an effective means of removing heavy deposits of oils and greases. It consists of cleaning the surface with a jet of high-pressure steam sufficient to remove contaminants. Detergents or non-solvent emulsifying agents intended for use with steam cleaning equipment may also be used. If these compounds are used, the surface should be thoroughly and repeatedly washed off with potable water. The surface should be allowed to thoroughly dry.

SURFACE REPAIRS

Oftentimes, concrete contains defects that may affect the performance of an applied coating:

1. ***Form Defects -*** Vertical, formed surfaces usually result in pockets that develop behind the form in the surface of the concrete. Often referred to as honeycombs or bug holes, they become even more evident after grit blasting. These pockets must be filled with a polymer (for epoxy coatings, RezRok® 105 or RezRok® 106; for polyester or vinyl ester coatings, mortar (1:4 b/v mix) of PE-310 primer and F4 powder) or cement patching material prior to coating application. Another common forming defect is fins that develop between forms and must be ground down flush with the surface.
2. ***Poorly Finished Concrete -*** Sometimes concrete is allowed to harden before it has been properly finished. This may result in grooves, rough texture or depressions in the slab surface. These must be ground down prior to coating.
3. ***Spalled Concrete -*** Chemical attack and the effects of freeze/thaw cycles can cause deterioration of the cement matrix of concrete leaving only the aggregate exposed. The depressions must be thoroughly cleaned and, in the case of acid attack, neutralized. Once sound concrete has been attained, the concrete should be brought back up to grade by leveling with a polymeror cement-based repair mortar.
4. ***Cracks -*** Concrete cracks due to shrinkage on curing, expansion & contraction, settlement, mechanical impact, the effects of earthquakes, etc. Cracks must be repaired prior to coating. Cracks that are structural in nature may be injected with a low viscosity epoxy such as RezRok® 105, which fills even hairline size cracks and restores the concrete to its original monolithic integrity. On floors, cracks may be chipped or routed out and then filled with a low modulus epoxy patching compound such as RezRok® 105 or 106. To produce a "bridge effect" that minimizes the chance of a crack occurring in the coating, a preferred method is to fill the routed cracks with Thiokol® 2235M and cover with PermaRez® 345M Flexible Membrane prior to coating; or, in thermally stable environments, bridge the crack with Thiokol® FEC® 2234 and Engineering Fabric.

In addition to the above, it is often necessary to pour new concrete onto or adjacent to the existing slab. For best results, use RezRok® 105, RezRok® 106, or for larger areas RezRok® 150 as an adhesive for joining the two slabs. The new concrete should be placed while the adhesive is wet or tacky. Please refer to PolySpec's product data sheets for installation instructions.

For further information or clarification please consult your PolySpec technical sales representative.

DOC PREP-Concrete Rev 6/18