

Preparing Concrete to Receive Coatings or Linings

GENERAL OVERVIEW

The performance of coatings or linings applied to concrete is highly dependent on proper surface preparation. Coating integrity and service life will be greatly enhanced with a properly prepared substrate. A well designed and applied coating or repair will most likely fail if the surface is not properly prepared. Selection and implementation of the proper surface preparation method ensures coating adhesion to the substrate and prolongs the service life of the coating or lining system. For simplicity throughout the remainder of the document coating(s) or lining(s) will be referred to as coating(s).

ADDITIONAL RESOURCES

Wolverine Coatings Corporation (WCC) has developed this bulletin along with other technical information to help all interested parties, from specifiers to applicators to owners, have a better understanding of the considerations, materials, and techniques required for proper installation. Consult all recommended information before the use of WCC materials.

WCC Technical Information Bulletins
TIB: N/A

WCC Technical Detail Drawings
TDD: N/A

WCC Technical Data Sheets
TDS: N/A

WCC Safety Data Sheets
SDS: N/A

SAFETY

Prior to commencing work, carefully read and follow all SDS (formerly MSDS), Technical Data Sheets, and any Instruction Manuals for products and equipment used during installation. Following the safety regulations of jobsite, local, state, and federal authorities is the responsibility of the installation company, general contractor, and/or facility owner.

DISCLAIMER

This Document does not purport to address all applicability and safety concerns, if any, associated with its use. It is the responsibility of the user to determine applicability of the information and to establish appropriate safety practices.

ADDITIONAL SURFACE PREPARATION RESOURCES (INDUSTRY STANDARDS)

- AMPP - The Association for Materials Protection and Performance
 - SSPC-SP 13/NACE No. 6 - Surface Preparation of Concrete
 - SSPC TU 2/Nace 6 G197 - Design, Installation, and Maintenance of Coating Systems for Concrete Used in Secondary Containment
 - SSPC-TR5/NACE 02203/ICRI 710.1 - Design, Installation, and Maintenance of Protective Polymer Flooring Systems for Concrete.
- ACI - American Concrete Institute
 - ACI PRC - 302.1-15 Guide to Concrete Floor and Slab Construction
- ICRI – International Concrete Repair Institute (847) 827-0830
 - Includes visual standards to act as a guide in defining acceptable surface profiles for the application of industrial coatings and polymer floor toppings.
 - Technical Guidelines No. 310.2R-2013, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair. Includes visual standards to act as a guide in defining acceptable surface profiles for the application of industrial coatings and polymer floor toppings.
 - Technical Guidelines No.03730, "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion"
- ASTM – American Society for Testing and Materials (610) 832-9585
 - ASTM D4258 "Practice for Surface Cleaning Concrete for Coating"
 - ASTM D4259 "Standard Practice for Preparation of Concrete by Abrasion Prior to Coatings Application"
 - ASTM D4260 "Standard Practice for Acid Etching Concrete"
 - ASTM D4261 "Practice for Surface Cleaning Unit Masonry for Coating"
 - ASTM D4262 "Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces"
 - ASTM D4263 "Standard Test Method for Indicating Moisture in Concrete by the Pastic Sheet Method"
 - ASTM F2420 "Standard Test Method for Determining Relative Humidity on teh Surface of Concrete Floor Slabs Using Relative Humidity Probe Measurement and Insulated Hood"

INSPECTION AND ASSESSMENT OF THE CONCRETE

The information gained from proper assessment of the surface to be coated is critical for long-life and desired aesthetics. Variables such as repair products, procedures, necessary primer, coating thickness, etc. are dependant upon proper assessment. Consult the Technical Data Sheets (TDS) of products to be installed to determine surface requirements. A general assessment will include the following considerations:

- General appearance of the surface including surface irregularities, cracking, deterioration, obvious contamination, etc.
- The existence of curing agents, coatings, or other sealers on the concrete's surface. These will typically require removal for proper primer penetration and bonding.
- Structural stability of the concrete including movement, structural cracking, corroded or exposed reinforcement, etc.
- Because a coating's bond strength can never exceed the pull-off strength of the surface to which it is applied, assessment of the substrate should include determining preparation methods that will maximize pull-off strength. These methods include more aggressive preparation and possibly treatment with a highly penetrating primer to strengthen the surface.
- Moisture vapor transmission (MVT) should not exceed the product's allowable limit as indicated on the TDS. High MVT will most likely cause coating failure if not addressed properly.
- Contamination of the surface can interfere with proper bonding and must be properly assessed. The presence of contaminants such as oil, chemicals, salts, sulfates, etc. must be considered when specifying preparation methods and materials.
- Concrete temperature, humidity, and dew point during installation and curing must be within the limits on the material's TDS. Consider how the weather may affect the project.
- pH must be within limits specified on the material's TDS. Low pH may also be an indicator of contamination.

Further testing may be required when a substrate is in doubt. Core testing, while expensive and time consuming, may be advisable to determine the concrete's strength and contamination. Also, exhaustive moisture and pH testing may greatly reduce the likelihood of failure.

RESTORATION OF STRUCTURALLY UNSOUND CONCRETE

Concrete to receive coatings must have the strength necessary to maintain its integrity while in service and the stability to have predictable and controllable movement. A slab that is crumbling, rocking back and forth, heaving, or sinking is an unlikely candidate for coating without repair. Have the concrete evaluated by a competent engineer or contractor when in doubt.

Surface deterioration is not necessarily an indicator of structurally unsound concrete. Highly deteriorated concrete may not be structurally unsound throughout. The concrete underneath unsound surface material may be adequate for coating. Localized weak or deteriorated concrete can often be removed and repaired with compatible materials as indicated in the coating's TDS.

If a cementitious repair is necessary, take the cure time of repair material into consideration. Although industry standards state concrete requires a minimum 28 days cure before coating, concrete may take longer before moisture levels drop to allowable levels. There are cementitious repair materials capable of being coated in 8 hours, but at a high cost. Normally, cementitious repair materials require additional surface preparation before a coating is applied. Compatible resinous products, while more expensive, may be more cost effective due to less downtime and/or the possibility of lower labor costs.

CLEANING THE CONCRETE TO REMOVE CONTAMINANTS

Although many preparation methods adequately clean the surface, a clean appearance may not necessarily insure the concrete is uncontaminated or in a condition to receive a coating. A pH test can be a quick indicator of common contaminants.

The pH of concrete is normally alkaline. Many contaminants are more neutral to acidic so often the pH will be lower than normal, indicating contamination.

CLEANING THE CONCRETE TO REMOVE CONTAMINANTS (CONTINUED)

If contamination is suspected or confirmed, it will be necessary to remove the contamination. Depending on the contaminants, there are many cleaners available to handle most types of contamination. Consult Wolverine Coatings Corporation for recommendations.

Contaminants such as soluble salts, sulfates, and nitrates are of particular concern when coating concrete, especially when in the presence of moisture or moisture vapor transmission.

When in doubt, further testing by a qualified person may be necessary.

PREPARING CONCRETE TO RECEIVE THE COATING

For proper bonding, the concrete surface must be open, porous, and textured. Uneven and weak concrete such as bulges, fins, protrusions, and spatter must be removed for maximum bond strength. Also, the tensile (pull-off) strength of finished concrete is actually weakest at the surface. This portion of the concrete is called laitance and must be removed to achieve the highest pull-off strength. Removal of uneven and weak concrete as well as the laitance is generally accomplished through some sort of abrasive or etching operation.

The International Concrete Repair Institute (ICRI) has established objective standards for the degree of concrete preparation required for a given coating thickness. Use the following table as a guideline for surface profile required for various resinous coating thicknesses. Physical samples of the profiles are available for field reference from ICRI and are essential for proper preparation assessment.

Resinous Floor Topping/Overlay Thickness	ICRI Concrete Surface Profile Number
0 - 3 mils	CSP 1 – 3
4 - 10 mils	CSP 1 – 3
10 - 40 mils	CSP 3 – 5
50 mils – 1/8"	CSP 4 – 6
1/8" – 1"	CSP 5 – 9

Typical Concrete Preparation Methods:

- **Diamond Grinding** – Diamond grinding is an option for thinner coatings. Grinding can smooth rough surfaces and discontinuities for more even coating application. Thicker coatings requiring more aggressive surface profiles may require other preparation methods.
- **Shot Blasting** – Shot blasting is the preferred method of preparation for horizontal concrete. It can produce most surface profiles with proper operation. Shot blasting involves peening the floor with steel shot to produce a profile.
- **Scarification** – Scarification is a very aggressive surface preparation method that leaves a rough profile. It can be used to mill down concrete removing deeply contaminated, weak and/or uneven concrete. Because scarification leaves an aggressive surface profile, it is only recommended for thicker coatings.
- **Pressure Washing** – Pressure washing is normally used for cleaning but may be used to achieve light surface profiles for thinner coatings.
- **High pressure water jetting (HPWJ)** may be used to create more aggressive profiles as well as removing unsound concrete. It is especially useful in congested areas and/or areas with irregular surfaces.
- **Abrasive Blasting** – Abrasive blasting may be used to provide most surface profiles, especially in congested areas and/or areas with irregular surfaces. Use clean blast media to avoid surface contamination.
- **Acid Etching** – Acid etching will normally yield a CSP1 profile and is typically only used for very thin coatings. It is inexpensive, but can be corrosive and/or hazardous. Rinse well (do not pressure wash), check pH, and neutralize if necessary. Pressure washing may be used after neutralization if desired. Dry surface to meet requirements on the coating material's TDS.
- **Power Tools** – Mechanical grinders and other abrasive power tools are normally used in areas where larger equipment cannot access.

For your safety, all required personal protection equipment should be used when operating machinery or handling chemicals. Avoid breathing concrete dust.

SURFACE PREPARATION METHODS

	Preparation Method	When Used	Profile Created	Problems	Solutions
D-VC	Vacuum Cleaning	Removes loose debris	No Change	N/A	N/A
W-LP	Low Pressure Water Cleaning	Cleans surfacing	No Change	Wets concrete	Let concrete dry
W-DS	Detergent Scrubbing	Emulsifies oil and grease	No Change	Detergent and emulsified contaminants	Low pressure water rinse Let concrete dry
W-SC	Steam Cleaning	Cleans surface, removes some oil and grease	No Change	Wets concrete	Let concrete dry
W-AE	Acid Etching	Removes laitance, imparts a profile and cleans surface	CSP 1 to CSP 3	Hazardous, neutralization, inhibited by membranes, curin compounds, grease and oil contamination, wets concrete	Use other acids pH testing, let concrete dry and use other methods
W-WJ	High and Ultra High Pressure Waterjetting	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 3 to CSP 10	Wets concrete Coarse profile	Let concrete dry None
M-GRD	Dry Grinding	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 1 to CSP 2	Dust and debris	Vacuum clean
M-GRW	Wet Grinding	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 1 to CSP 2	Wet sludge, debris Wets concrete	Low pressure water rinse Let concrete dry
A-ABD	Dry abrasive blasting	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 2 to CSP 7	Dust and debris Airborne dust Noise	Vacuum cleaning Vacuum attachments None
M-ABW	Wet abrasive blasting	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 2 to CSP 7	Wets concrete Creates sludge	Let concrete dry Cleaning
M-SB	Shot Blasting	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 3 to CSP 7	Stray shot	Clean surface magnetically
M-SC	Scarifying	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 4 to CSP 7	Dust and debris Bruising, striated pattern on surface	Vacuum cleaning None
N/A	Needle Scaling	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 2 to CSP 4	Dust and debris Striated pattern on surface	Vacuum cleaning None
N/A	Scabbling	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 7 to CSP 10	Dust and debris Bruising, irregular surface pattern	Vacuum cleaning None
N/A	Rotomilling	Removes laitance and some concrete, imparts a profile and cleans surface	CSP 9 to CSP 10	Debris Bruising, grooving of surface and tool marks	Sweeping Vacuum cleaning None

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RESTORATION OF THE CONCRETE SURFACE DEFECTS

In addition to being unsightly, rough and/or uneven concrete will be very difficult or impossible to properly coat. In the case of coating for chemical exposure or waterproofing, it's impossible in many cases to ensure coating thickness or lack of pinholes when coating rough and/or uneven concrete. Thin areas and pinholes are more easily spotted on a smooth surface.

Restoration of concrete's surface defects requires consideration of strength, timetable, cost, and compatibility. Generally, cementitious repairs are less expensive, but have longer cure times and require further surface preparation. Resinous repairs are fast, stronger, and normally compatible, but come at a higher material cost. Consult Wolverine Coatings Corporation for recommendations.

PAY ATTENTION TO THE DETAILS

Coating smooth, wide-open concrete is normally not difficult. But the difference between a good installation and a great, long-lasting installation is the details: joints, cracks, edges, transitions, etc. Refer to the relevant WCC Technical Detail Drawings (TDD) for proper treatment of various scenarios. TDD's for various situations, as well as other technical data, are available on the WCC website. If details of your scenario are not available call Wolverine Coatings Corporation for recommendations.

TIB: Preparing Concrete to Receive Coatings and Linings - Rev 230913

SAFETY

For your safety, all required personal protection equipment should be used when operating machinery or handling chemicals. Concrete dust is a source of silica particles and other hazardous materials that can cause silicosis and other illnesses. Proper safety equipment and methods are the responsibility of the installation company, general contractor, and/or facility owner.

WARRANTY

Wolverine Coatings Corporation warrants its products to be free from defects in material and workmanship. Wolverine Coatings Corporation's sole obligation and Buyer's exclusive remedy in connection with the products shall be limited, at Wolverine Coatings option, to either replacement of products not conforming to this Warranty or credit to the Buyer's account in the invoiced amount of the nonconforming products. Any claim under this warranty must be made by the Buyer to Wolverine Coatings in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or one year from the ship date, whichever is earlier. Buyer's failure to notify Wolverine Coatings of such nonconformance as required herein shall bar Buyer from recovery under this warranty.

Wolverine Coatings makes no other warranties about the product. No other warranties, whether expressed, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply.

Any recommendation or suggestion relating to the use of the products made by Wolverine Coatings, whether in its technical literature, or in response to specific inquiry or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for the Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment, changes in procedure of use, or extrapolation of data may cause unsatisfactory results.

LIMITATION OF LIABILITY

Wolverine Coatings Corporation's liability on any claims based upon Wolverine Coatings Corporation's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allocable to the products or parts thereof which give rise to the claim. In no event shall Wolverine Coatings Corporation be liable for consequential or incidental damages.

LITERATURE REVISION

Published literature is subject to change without notice. Wolverine Coatings Corporation is constantly formulating innovative products, new technologies, and practices. Please check www.wolverinecoatings.com for the latest product data sheets.



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