

Technical Bulletin #1 Surface Preparation Concrete, Wood & Metal Substrates

CONCRETE SUBSTRATES

I. GENERAL INFORMATION

Surface preparation is the most important step of any resinous flooring application. Improper surface preparation could turn what seems to be a simple process into a lengthy, difficult repair. The following conditions will dictate the type of surface preparation:

A. Concrete Placement

1. Slab-on-grade or on the ground
 - a. A 10 mil minimum vapor retarder is necessary to prevent moisture vapor transmission. An efficient reinforced puncture proof barrier is recommended. Do not use vapor retarders made with recycled polyethylene as extended exposure to moisture can lead to degradation.
 - b. Proper jointing will minimize cracking which could transmit through the resinous flooring system. Refer to ACI 302 "Guide for Concrete Floor and Slab Construction" for industry guidelines.
2. Elevated Slabs
 - a. Pan construction should be vented.
 - b. Metal deck construction should be properly jointed to minimize cracking.

B. Curing and Finishing Techniques

1. Curing compounds, if used, must be mechanically removed from the concrete surface prior to all resinous flooring applications.
2. Recommended techniques:
 - a. Wet cure.
 - b. Light steel trowel finish to minimize laitance and provide a hard surface. Do not burnish the surface as it will make surface preparation work more difficult.

C. Age of Concrete

Concrete must be a minimum of 28 days old for resinous flooring applications. Moisture mitigation systems are available which can be used on 5-day old concrete on some installations. Contact **Key Resin Technical Service** for details.

D. Previous Contamination can affect the bond of the resinous flooring and must be removed. Types of contamination are:

1. Oil, grease, or food fats can usually be burned off with a flame gun or removed with a commercial degreasing compound or solvent. Also consider cleaners which utilize oil digesting microbes, contact Key Resin Technical Service for details.
2. Curing compounds, sealers, and concrete laitance are best removed mechanically with:
 - a. vacuum shot blasting
 - b. grinding
 - c. scarifying

E. Present Condition

1. Test for moisture: Coating system bond failures on slabs on grade and elevated/lightweight concrete caused by moisture vapor transmission are the industry's largest single problem and result in extreme frustration from owners, clients, and contractors. **Key Resin Company** recommends testing for moisture vapor transmission. The recognized methods are:
 - a. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride: The maximum allowed water/vapor transmission rate is 3 pounds per 1,000 square feet per 24 hours.
 - b. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes: This test measures the relative humidity in the slab below the surface. If taken over a period of time, it will show the rate of drying in the slab. The maximum relative humidity should be below 80%. This is gaining general industry acceptance as the most reliable and preferred test method.
 - c. ASTM D4263 – Plastic Sheet Test: This test only gives an indication that moisture may be present and should never be used as a primary basis of decision.
2. Moisture related failures can be prevented through:
 - a. Placing new concrete over an efficient vapor barrier.
 - b. Testing for moisture vapor transmission as prescribed above prior to resinous flooring application.
 - c. Applying a moisture vapor transmission reduction system where moisture content is too high for successful resinous flooring applications.
3. A clean surface is necessary to establish a strong bond between the resinous flooring and concrete.
4. Resinous flooring systems are only as sound as the concrete they are applied to. All unsound concrete should be repaired or replaced prior to resinous flooring applications. Consult your **Key Resin Representative** for specific information.
5. Resinous flooring materials should be applied to level concrete substrates. Grind or fill high and low spots prior to application.
6. Repair cracks prior to resinous flooring applications.

F. Mechanical Surface Preparation vs. Acid Etching

Resinous flooring materials ideally bond to concrete with a rough, sandpaper finish free of laitance (weak surface layer of cement fines) with a minimum surface profile of CSP-3 as defined by ICRI guideline 3102R13 "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair". This finish is best achieved by mechanical methods. Other factors which determine the type of surface preparation include:

1. Ecological restrictions involved with waste removal which could prohibit the use of acid etching and other chemical methods.
2. The type of resinous flooring project: It has been common historical practice for residential garage concrete floors to be prepared using acid etching, though concrete grinders are becoming more common.

G. Acid Etching

The following steps are recommended for acid etching:

1. Dilute commercial Muriatic Acid (Hydrochloric Acid) with water using 1 part acid by volume to 3 parts clean water by volume. Add the acid slowly taking care to avoid splashing. Workers should be protected with safety glasses, rubber gloves, and boots. If skin or eye contact occurs, rinse affected area thoroughly with clean water and follow Material Safety Data recommendations.
2. Sprinkle acid solution onto the entire surface in order to allow the acid to reach all areas of the concrete. Adequate coverage is approximately 75 ft²/gallon of acid/water solution. Do not puddle, spread consistently.
3. Scrub the acid solution into the concrete using a stiff bristle broom to remove loose concrete and laitance.
4. Before rinsing, look for areas where bubbling did not occur. These areas have not been sufficiently cleaned and will require mechanical scarifying and additional acid etching.
5. When the acid solution has stopped bubbling (usually after approximately 15 minutes), rinse the floor thoroughly with water or ammonia followed with water. Do not allow the floor to dry before rinsing because the salts formed by the acid reaction may cause problems with the adhesion and performance of the resinous flooring system. Test the pH of the concrete surface to verify that the concrete tests alkaline. Rinsing several times may be necessary.
6. Finally, the floor should be dry mopped to remove standing water and dirt remaining after the acid etching. Allow the floor to completely dry prior to the application of any resinous flooring system. Failures can occur in resinous flooring system applications due to moisture remaining in the substrate.

H. Mechanical Preparation

Contamination, foreign materials, and laitance (cement fines) must be removed to ensure a

satisfactory bond. All dust and debris must be thoroughly removed. Vacuum shot blasting is an effective, low dust method of preparing existing concrete. Other acceptable methods may include grinding with coarse grit diamonds or scarifying. Consult with **Key Resin Technical Service** to review options.

II. OLD CONCRETE

Old concrete surfaces must be structurally sound. Any unsound areas must be repaired prior to proceeding with the resinous flooring installation. For proper patching and repairing, use **Key #502** or other approved Key Resin epoxy mixed with graded aggregates or consult **Key Resin Technical Service**. Remove existing coatings, scale, and loose concrete by rough sanding, sandblasting, shot blasting, or grinding. In some cases where plant conditions allow, a chemical stripper may be used to remove excessive build-up of paints or sealers.

Structurally sound concrete should be mechanically prepared to remove any contamination. Vacuum shot blasting is the best method for achieving a good profile for bonding and should be used where possible. Before installation of any **Key Resin System**, the surface must be examined for moisture vapor transmission using:

ASTM F1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
ASTM F2170	Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method. This test is only an indication and should not be used to determine moisture migration.

Other standards which are applicable to concrete preparation are:

ICRI 3102R13	Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair
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III. NEW CONCRETE

New concrete must be well cured and dry prior to coating. Allow to cure a minimum of 28 days unless using a moisture mitigation system. No curing agents or sealing compounds should be used at any time prior to coating. A light steel trowel finish is recommended when finishing the concrete surface.

Any oil, grease, laitance, or other foreign material must be removed. Steam clean with a strong degreaser such as tri-sodium phosphate. Laitance and other foreign material are best removed by mechanical methods such as vacuum shot blasting, scarification, or grinding.

All new concrete can be mechanically prepared by vacuum shot blasting, grinding, or scarifying. Vacuum shot blasting provides the cleanest environmentally safe area during cleaning. It also provides a mechanically rough surface to achieve a good bond.

When acid etching, use a 3 to 1 dilution of water to acid and follow directions printed previously.

Before the installation of any Key Resin resinous flooring system, the surface should be examined for moisture. Test for excessive moisture vapor using ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes. Maximum allowable R.H. for this test is less than 80%. This is gaining general industry acceptance as the most reliable and preferred test method.

Another procedure that helps determine slab dryness is ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride. The maximum allowable rate is 3 pounds per 1,000 square feet per 24 hours.

WOOD SUBSTRATES

I. GENERAL INFORMATION

Resinous flooring or epoxy terrazzo must always be applied directly to **exterior grade plywood with extended glue line**. **INTERIOR GRADE PLYWOOD** delaminates easily and **SHOULD NOT BE USED** as it could result in a failure of the resinous flooring system. **MARINE GRADE PLYWOOD** contains moisture repellants which could cause a darkening of the resinous flooring system and **SHOULD NOT BE USED**. **FIRE-RETARDANT TREATED PLYWOOD** may be acceptable but must be tested by Key Resin to confirm suitability. All plywood must be completely free of all waxes, varnishes, or other foreign materials. Tile backer board (cement board) may also be used to overlay existing wood floors. To accommodate dynamic loading, wood substrates should be designed for maximum deflection of L/360.

A. Plywood used to cover existing wood floors:

1. Clean and fasten existing wood floor to the floor joists.
2. If the floor is completely sound, fasten ½" **Exterior grade plywood "C" plugged with an extended glue line** to the existing floor. Stagger the plywood for strength.
3. ¾" **DFPA Exterior or ¾" DFPA Underlayment grade plywood with exterior glue line** must be used if the existing floor cannot be cleaned or is not sound.
4. All plywood must be completely free of all waxes, varnishes, or other foreign materials.
5. Secure plywood with exterior grade glue.
6. Use **Screws** at six (6) inch centers around panel edges and support.
7. Stagger all panel joints, fill joints with rigid epoxy such as **Key #502**, and cover joints with fiberglass cloth and epoxy resin. Treat individual joints or overlay the entire substrate with fiberglass.
8. Lightly sand the floor surface to insure proper adhesion of the resinous flooring or epoxy terrazzo system. Remove all dust with a vacuum cleaner.
9. Prime surface with appropriate primer prior to system application. Surface will require double priming due to porosity of plywood.
10. Install the Key Resin flooring system as specified.

B. Plywood used for new construction (plywood is laid directly on the joist):

1. ¾" **exterior grade plywood "C" plugged with an extended glue line** must be used.
2. All plywood must be completely free of all waxes, varnishes, or other foreign materials.
3. Use **Screws** at six (6) inch centers around panel edges and support.

4. Stagger all panel joints, fill joints with rigid epoxy such as **Key #502**, and cover joints with fiberglass cloth and epoxy resin. Treat individual joints or overlay the entire substrate with fiberglass.
5. Lightly sand the floor surface to insure proper adhesion of the resinous flooring system. Remove all dust with a vacuum cleaner.
6. Prime surface with appropriate primer prior to system application. Surface will require double priming due to porosity of plywood.
7. Install the Key Resin flooring system as specified.

C. Applications with Flexible Crack Isolation Membrane:

Note: Use flexible membrane for additional absorption of deflection or movement at joints.

1. After preparing and priming the wood substrate as prescribed above, coat substrate with 32-40 mils of Key #580 Flexible Membrane. Allow to cure.
2. For additional reinforcement, apply second coat of Key #580 Flexible Membrane at 15-20 mils, imbed and saturate Key Fiberglass Scrim Cloth. Allow to cure. Alternatively use Key #502 to adhere and saturate Key Fiberglass Scrim Cloth.
3. Install the Key Resin flooring system as specified. **IMPORTANT:** The use of flexible membrane typically requires a minimum 1/16" thick aggregate reinforced flooring system for best performance over the membrane. Contact Key Resin Technical Service for recommendations.

METAL SUBSTRATES

I. Preliminary Preparation

- A. Metal substrates must be structurally sound prior to any resinous system being applied.
- B. Remove all foreign materials such as oil and grease with solvents or other degreasing compounds.
- C. All scaling and rust must also be removed mechanically by sanding, sandblasting, or grinding.

II. Treat the blasted/abraded surface with a phosphoric acid solution as described below in order to prevent rust formation if the surface is left exposed for some time prior to application of the resin system.

- A. Always use a 10% solution of Phosphoric Acid.
- B. Mix acid solution in either glass, plastic, or earthen containers (never use metal containers), by adding Phosphoric Acid to water. **NEVER VICE-VERSA** due to heating or splashing which may occur.

Workers should be protected with safety glasses, rubber gloves, and boots. If skin or eye contact occurs, rinse affected area thoroughly with clean water and follow Material Safety Data recommendations.

- C. Apply phosphoric acid solution by either paint brush or rubber squeegee and allow metal surface to **AIR DRY**. **DO NOT FLUSH METAL SURFACE WITH WATER.**

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- III. **Protect surface from contamination until the primer is applied.**
- IV. **Wipe metal surface with MEK solvent immediately before primer application.**

For more in-depth information concerning the preparation of metal surfaces, contact **Key Resin Technical Service**.

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