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# **SUBSTRATE PREPARATION**

## **For ARDEX Underlayments and Toppings**

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### Substrate Preparation

The key to success when installing ARDEX products is to achieve a good bond between the substrate and the underlayment or topping. Proper preparation of the surface is the most important factor in achieving this bond.

Whatever topping or underlayment is used to level, smooth or repair a substrate's surface, it will only be as strong as the surface to which it is bonded. The surface, therefore, must be sound, clean and free of oil, grease, wax, dirt, asphalt, curing and sealing compounds, latex and gypsum compounds, dust, paint, or any contaminant which might act as a bond breaker.

The methods required to properly prepare the substrate vary with the type of substrate, its surface and condition. Many times, several methods of preparing a substrate are available. Some methods are used because they are cheaper, easier or faster, depending upon the size of the job. However, taking short cuts in proper substrate preparation can be an invitation to installation problems and failures.

This brochure is by no means an all-inclusive guide, but is intended to give recommendations for the proper preparation of many common substrate conditions.

### Concrete

Concrete substrates must be solid. Overwatered, frozen or otherwise weak concrete must be removed mechanically to provide a sound base. In addition, concrete should be evaluated for moisture, and be free of oil, grease, wax, dirt, asphalt, curing and sealing compounds, latex and gypsum compounds, dust, paint, or any other contaminant which might act as a bond breaker.

### New Concrete

There are two important reasons to avoid the installation of ARDEX products over concrete which is less than 28 days old.

First, drying and shrinkage cracks may occur as the concrete cures. Installing ARDEX products over "green" concrete will result in the cracks telegraphing through the ARDEX layer as they develop in the concrete. To avoid this, allow the concrete to cure a minimum of 28 days, and repair any cracks before proceeding with the installation of the ARDEX material.

Secondly, ARDEX primers must be installed over a completely dry surface to assure proper bonding. Under many conditions concrete may not be free of excess moisture before 28 days. (See section for proper primer selection and priming instructions.)

### Moisture

Neither ARDEX primers nor leveling or patching products create a moisture barrier. If the concrete slab is dry enough to allow the primers to dry, but still has a moisture content exceeding the specifications of a flooring system, the moisture could migrate through an ARDEX underlayment or topping and affect the bond of the flooring adhesive or sealer.

ARDEX underlayments and toppings are intended for interior use over dry substrates only. Do not use in areas of constant water exposure nor in areas exposed to permanent or intermittent substrate moisture, as this may jeopardize the performance of the topping, or the underlayment and the floor covering system. ARDEX primers, underlayments and toppings are not vapor barriers and will allow free passage of moisture.

**Follow the directives of the floor covering manufacturer regarding the maximum allowable substrate moisture**

**content and test the substrate prior to installing any ARDEX products.** Where substrate moisture exceeds the maximum allowed, Ardex recommends the use of the ARDEX MC™ MOISTURE CONTROL SYSTEM. For further information, please refer to the Ardex Technical Brochures.

### Forced Drying

If forced drying of the concrete slab is used, care must be taken that no oils are present in the air source. Also, if entire rooms are heated by Salamander heaters or other heaters using fossil fuels, the exhaust must be vented. This will prevent carbon dioxide from combining with the calcium hydroxide in fresh concrete, which can form a weak layer of calcium carbonate on the surface – a process known as carbonation. If carbonation does occur, the substrate must be mechanically cleaned.

### Curing Compounds

Curing compounds are bond breakers which will inhibit the ability of an underlayment or topping to bond to the concrete substrate. Regardless of the type of curing compound used, even dissipating curing compounds, it must be completely mechanically removed prior to proceeding with the installation of the underlayment or topping.

### Acrylic Sealers

Acrylic sealers do not oxidize and flake off from exposure to ultraviolet light and air. Although some acrylic sealers contain no bond-breaking oils, waxes, resins or rubbers, a good bond cannot be guaranteed. Therefore, complete removal is required.

### Laitance, Weak Surface Areas and Frozen, Frost-Damaged or Overworked Concrete

These surfaces are unsuitable for toppings or underlayments. Any signs of spalling, scaling, delamination, crumbling or laitance must be removed down to solid, clean concrete. A hammer or heavy instrument should be used to sound out weak, hollow and unsound material.

### Contaminated Concrete

All oil, grease, wax, dirt, chemicals, asphalt, latex and gypsum compounds, dust, paint, or any contaminant which might act as a bond breaker must be completely removed before installing an ARDEX underlayment or topping.

### Oil and Grease

Cementitious underlayments or toppings will not bond to a concrete substrate that is contaminated with oil or grease. Even trace amounts of oil will prevent a good bond. Chemical methods may be successful at removing oil if it has not penetrated too deeply; however, the material used to remove the oil or grease may itself leave a contaminant behind. To remove any doubt, the substrate should be mechanically cleaned down to sound, solid, uncontaminated concrete.

### Asphalt and Tar-Based Residues

Although quite different in composition, both asphalt and coal tar-based residues on concrete substrates pose their own threats to the performance of an underlayment or topping. Roofing asphalt is often found on concrete roof decks upon which new floors are to be built. Tar products can also be found as a contaminant in these vertical expansion projects, as well as in the adhesive used on old wood block floors in warehouses and factories.

With the exception of cutback adhesive residue (see "Cutback Adhesive on Concrete"), all asphalt and coal tar-based materials found on concrete substrates to receive any

topping or underlayment must be completely mechanically removed down to clean, sound, solid concrete prior to the installation of any ARDEX underlayment or topping.

### Lightweight Concrete

There are two categories of lightweight concrete that could typically be found on a project: structural lightweight and lightweight insulating concrete. Structural lightweight is generally categorized with a density of over 100 lb./cu. ft. and a compressive strength in excess of 3000 psi.

Lightweight insulating concrete substrates are typically used for sound or thermal insulation, are not structural, have low compressive strengths, and exhibit soft, weak surfaces. These substrates are not suitable for the installation of ARDEX underlayments or toppings, as they do not provide a solid, structural surface which can serve as a substrate. Cellular lightweight, vermiculite, gypsum, perlite and other lightweight fill materials are typically used in this category of insulating concrete.

Ardex does not recommend the installation of ARDEX products over concrete that has a density of less than 100 lb./cu. ft. or a compressive strength below 3000 psi. If both of these criteria are met, as is the case with certain structural lightweight concrete, we recommend the installation of test areas to determine the suitability of the installation for the intended use and to ensure that the lightweight concrete has the cohesive integrity to remain bonded within itself.

### Recommended Methods for Preparing Concrete Substrates

The best way to remove any contamination in a concrete substrate is by an approved mechanical method. Mechanical cleaning removes the contaminant and the concrete to which it is adhered leaving only a clean, sound and solid surface behind. Ardex recommends that all concrete substrate preparation proceed using one or more of the following mechanical methods: shotblasting, scarifying, grinding, sandblasting, scabbling (bush hammering), chiseling, and in some cases, high-pressure water blasting.

Mechanical abrasion methods such as scarifying, scabbling and chiseling are aggressive methods recommended to remove unsound areas. Grinding can also be effective, but is slow for large areas. Sandblasting is an excellent method for cleaning weak surface areas, if environmental restrictions permit its use. High-pressure water blasting may also be effective for some weak surfaces; however, the concrete must be allowed to dry before proceeding with any patching or smoothing work.

One of the most cost-effective methods for removing a wide variety of contaminants from a large area of concrete is to use shotblasting. Using different sizes of steel "shot", a shotblast machine can remove a variety of sealers, coatings, curing compounds and other contaminants quickly and effectively, leaving behind a surface ready to receive the specified ARDEX underlayment or topping.

The best way to remove most contaminants is by scarifying, shotblasting or similar mechanical method. Removal must be deep enough to eliminate all penetrated contaminants.

### Methods to Avoid

Acid washing (or acid etching) is not recommended because it is difficult to control, to fully remove the residue, and to properly neutralize. Further, the acid can penetrate into the porous concrete and chemically react with the cement, thus affecting the long-term integrity of the concrete. Acid washing will not satisfactorily remove grease and oil.

The use of sanding equipment is not an effective method to remove curing and sealing compounds.

All types of solvents should be avoided. Their use will drive oil, grease and other contaminants further into the concrete, only to permit their release back to the surface at a later time. **Physically removing oil-contaminated concrete is the only sure way to ensure a clean substrate.**

Sweeping compounds can leave an oily or waxy film on the surface of the concrete. Their use can create a bond breaking layer which will result in a flooring system failure. Using a dry clean broom, sweep and vacuum the surface prior to placing any underlayment or topping.

Also, never use adhesive removers or solvents to remove contaminants from porous concrete. These materials can carry contaminants into the pores of the concrete, which will later migrate back to the surface resulting in a floor covering bond failure.

### Cutback Adhesive over Concrete

Asphalt-based cutback adhesive remaining on a concrete floor after removing old vinyl tile and other flooring represents one of the most difficult and risky substrates for the installation of new flooring. Bleed-through of the cutback adhesive residue can adversely affect the new adhesive and floor covering being installed.

Complete mechanical removal of cutback (i.e. grinding, sanding, blasting) can be hazardous, as old cutback adhesive may contain asbestos. **Do not sand or grind adhesive residue. Harmful dust may result.** Inhalation of asbestos dust may cause asbestosis or other serious bodily harm. Please consult the adhesive manufacturer and all applicable government agencies for rules and regulations concerning the removal of flooring and adhesives that contain asbestos.

Floor covering manufacturers, the Resilient Floor Covering Institute, and ASTM F710 specifically recommend against the use of solvents and adhesive removers to treat adhesive coated substrates. Residues from their use have been cited as contributing to numerous floor covering failures.

Specific ARDEX underlayments can be installed over a thin layer of cutback or other non-water-soluble adhesive residue. Since the weakest link of the system will be the bond of the adhesive to the substrate, it is important that the adhesive be very thin, firm and have a good bond to the substrate.

Thick accumulations, powdery, brittle or otherwise weak adhesive layers must be removed, but only with extreme caution. Use the wet-scraping method as outlined in the Resilient Floor Covering Institute's "Recommended Work Procedures for Resilient Floor Coverings" to remove thick areas and build-ups of adhesive, and any areas that are weak and not well-bonded to the substrate. (A reproduction of the procedures is available from the Ardex Technical Service Department.) The remaining residue should appear to be nothing more than a transparent stain on the concrete. Check the substrate for hollow spots, latex patches or other weak areas and remove them. Wet-mop the substrate to remove all debris and loose material.

It is the responsibility of the installation contractor to ensure the substrate is properly prepared prior to the installation of the ARDEX material.

### Cracks and Joints

All cracks in new and old concrete should be repaired to inhibit their ability to reflect or telegraph up into the surface of a bonded topping or underlayment. However, it is still possible that some cracks will reflect into the surface. In most cases, small hairline cracks do not pose a threat to the performance of the underlayment, topping or floor covering to be installed.

If the crack is larger than a hairline ( $1/32$ "), flashpatching with ARDEX FEATHER FINISH® SELF-DRYING, CEMENT-BASED FINISHING UNDERLAYMENT is necessary to prevent the crack from reflecting into the flooring. However, this may not be an appropriate solution for a topping such as ARDEX SD-T® SELF-DRYING, SELF-LEVELING CONCRETE TOPPING, since flashpatching may be aesthetically unacceptable. One method to minimize the effect is to plan saw-cuts into the finished floor design based upon the presence of saw-cuts and joints in the substrate. This will allow cracks to telegraph in straight lines within the saw-cut joints in the topping, masking their presence and making for a more aesthetically pleasing floor.

Large dormant cracks, such as those typically found due to settlement or in control joints, can be cleaned out, opened up with a crack chaser where necessary, and patched with a suitable cementitious patching compound such as ARDEX SD-P® SELF-DRYING, FAST SETTING CONCRETE UNDERLAYMENT or ARDEX FEATHER FINISH®.

If cracking is active, structural defects must be remedied before attempting to repair the cracking. Consult an engineer on the project or request the services of a structural concrete repair professional to deal with crack repair methods such as gravity filling small cracks (1/4" max. width) with epoxy. If the crack is larger or extends entirely through the concrete slab, the use of epoxy injection following manufacturer's instructions is often recommended.

Expansion or isolation joints are designed into the building, and their integrity must be maintained. Do not install any topping or underlayment product over a joint designed to allow differential movement between concrete pours. **Honor all moving joints in the slab up through the underlayment or topping.**

### Other Substrates

#### Wood Subfloors

Although the preparation required is the same for any type of wood substrate, a distinction must be made with regard to the suitability of certain types of wood substrates depending upon the product being installed. For applications requiring a self-leveling underlayment such as ARDEX K-15® SELF-LEVELING UNDERLAYMENT CONCRETE or ARDEX SD-L™ SELF-DRYING, SELF-LEVELING FLOORING UNDERLAYMENT, the subfloor must be a minimum of 3/4" tongue and groove, APA-rated, Type 1, exterior exposure plywood, or OSB equivalent. Solid hardwood flooring such as stripwood is also acceptable as a substrate. The wood subfloor must be structurally sound and solid, fixed securely and must conform to local building codes. To provide a solid base, re-nail all boards or plywood panels exhibiting movement. Open joints should be filled with ARDEX FEATHER FINISH®.

There are also a variety of other types of wood subfloors recommended by flooring manufacturers for certain grades or types of floor covering. OSB, wafer board, 1/4" or 1/2" plywood, lauan plywood, and other types of wood composites may be recommended as being suitable to receive a certain manufacturer's flooring. If the manufacturer of the finished goods approves that substrate as being suitable, and the surface requires smoothing or flashpatching, ARDEX FEATHER FINISH® can be used over any type of wood. The installation of the underlayment board must be performed in strict accordance with the manufacturer's written instructions. Do not use ARDEX FEATHER FINISH® as a short cut to bypass specific installation instructions, such as sanding the surface of the underlayment board, unless the manufacturer permits the use of a skimcoat product.

The surface of any type of suitable wood subfloor must be clean and free of all oil, grease, wax, dirt, varnish, shellac, or any other contaminant that might act as a bond breaker. If necessary, to obtain a clean surface, sand down to bare wood. Vacuum all dust and debris. A commercial drum sander can be used to sand larger areas.

Do not use solvents, strippers or cleaners to remove contamination from the surface of the wood. Only clean, bare wood is a suitable surface. If contamination exists that cannot be effectively removed, an overlay of 1/2" APA-rated, Type 1, exterior exposure plywood may be used as an alternative to complete removal and replacement of the wood.

#### Non-Porous Substrates

Smooth, dense, solid substrates such as burnished concrete, ceramic and quarry tile, natural stone, cementitious and epoxy terrazzo, and solidly bonded epoxy coatings can be smoothed with an ARDEX underlayment prior to the installation of new flooring. The surface of these substrates must be clean and

free of all contaminants including oil, grease, wax, etc. Due to the non-porous character of these substrates, sealers, dressings and surface treatments can often be completely removed effectively using professional stripping agents. As an alternative, and where stripping is not a sufficient technique, mechanically cleaning can be used to remove all foreign matter from all of the above non-porous substrates.

Please note that all hard surface tile substrates must be thoroughly evaluated for the bond of the individual tiles. All tiles that are not solidly bonded must be completely removed, including the setting mortar, down to clean, sound, solid concrete.

#### Notes

Epoxy coatings can be suitable as substrates to receive certain ARDEX products. It is imperative that the soundness of the bond strength of the coating be evaluated thoroughly before attempting to install an underlayment product over it. One way of ensuring a good bond is to attempt mechanical removal. If removal is difficult or impossible, install a test area as recommended below. If removal can be done readily using a mechanical method, continue removal to clean, sound, solid concrete.

#### Metal Subfloors

Metal subfloors are found in certain hospital applications, as well as on naval and commercial sailing vessels. For example, lead, aluminum, or copper foil installed over a concrete substrate are used to shield x-ray and MRI testing rooms in hospitals. Naval vessels, commercial cruise liners, and casino boats likely have steel decking as the subfloors throughout the ship. Such surfaces often need to be smoothed with a cementitious underlayment prior to the installation of new finish flooring.

All metal substrates must be clean and free of rust, oil, grease, and all other contaminants. Steel decking must be structurally sound and properly anchored. Metal foils must be 100% solidly bonded to the substrate.

Sandblast, wire brush or use other mechanical methods to remove rust and other contaminants from the surface of the metal. For steel decking, paint the surface with an anti-corrosive coating to prevent rust from recurring. Aluminum, copper and lead do not require this treatment.

The only system Ardex promotes to smooth metal substrates is the ARDEX K 15® AND ARDEX E 25™ UNDERLAYMENT SYSTEM. Specific instructions for this installation are available from the Ardex Technical Service Department.

#### Precautions

Although we have presented a variety of substrate conditions and offered technical recommendations for each, we cannot anticipate every possible substrate condition. For this reason, we recommend that this guide be used as a general reference for preparing substrates to receive ARDEX products, and that a test installation be placed to ensure suitability as follows:

**Always install an adequate number of properly located test areas, including the finish flooring or sealers, to determine the suitability of the product for its intended use. As floor coverings and sealers vary, always contact and rely upon the manufacturer for specific directives, to include such requirements as maximum allowable moisture content, adhesive or sealer selection, and intended end use of the product.**

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