



The Chemical Company

## Installation Guide

Application information and suggestions on procedures for precision grouting

# Masterflow<sup>®</sup> 648 CP Plus

High-strength, high-temperature, high-flow epoxy grout

### SURFACE PREPARATION

#### FOUNDATION PREPARATION

1. Cure the foundation until design strength of the concrete is achieved and foundation is dry. Use the recommended procedure according to ACI 351.1R-99, Grouting Between Foundations and Bases for Support of Equipment and Machinery. Minimum concrete compressive strength of 3,000 psi (21 MPa) should be specified; higher strength concrete is recommended for optimum performance.
2. The surface to be grouted must be clean, strong, and roughened to a CSP of 5-9, following ICRI Technical Guideline No. 310.1 RI-2008 to permit proper bond. For freshly placed concrete, consider using Liquid Surface Etchant (See Form No. 1020198) to achieve the required surface profile. Do not use a bushing hammer.
3. Chamfer the edge of the concrete 45 degrees to about a 2" (51mm) width. (See Figure 1 on page 5).
4. If an anchor bolt sleeve is to be filled, be sure all water is removed. Use a siphon, vacuum pump, or rubber hose and bulb. Remove the residual moisture by either forced air or evaporation.
5. Seal the anchor bolt hole with felt, foam rubber, or other means.

6. Cover all shims and leveling screws with putty or clay to keep the grout from adhering. Use model clay, glazing putty, or anything with a putty consistency that will stick but not harden. Shims or jack pockets may be formed with wood, and forms filled with damp sand.
7. Remove shims or jack screws after the grout cures.
8. SHADE THE FOUNDATION FROM DIRECT SUNLIGHT FOR AT LEAST 24 HOURS BEFORE AND 48 HOURS AFTER GROUTING.

### EQUIPMENT PREPARATION

1. If rust scale is present, abrade the bonding surfaces of the base to be grouted; it must be free of coatings, wax, grease, or scale. Mechanical methods, such as grinding or sanding, will suffice, but do not produce as high a bond strength as sandblasting.
2. Primer should be used ONLY when a long delay between cleaning and grouting could allow excessive rusting or contamination. If the base must be primed, use Concrete 1090. If the primer has been on the surface for more than 1 month, abrade and solvent wipe it so that no residue is left.
3. The grout should come up at least 3/4" (19 mm) onto the equipment. Mask the area above it with masking tape.
4. To facilitate cleanup, wax or cover all surfaces where the grout may splash or spill.

### FORMING

1. Protect the foundation and equipment from rain or moisture. Water will tend to prevent grout bond and inhibit cure.
2. Seal off areas that will not be grouted.
3. Place forms no greater than 6" (152 mm) away from the edge of the individual base rail or sole-plate on the sides where the grout is not being poured. Excessive edges create thermal stress and result in excessive cracking. On the pouring side forms are typically 2 – 6" (51 – 152 mm) from the edge of the supporting area. However, this may vary depending on the application. Moderate to large-size equipment and difficult or narrow placement applications should utilize an extended head form (headbox) to create additional head pressure and to enhance placement. Consult your BASF representative for specific recommendations.
4. Before erecting the forms, cover them with EXTRA HEAVY COATS OF PASTE WAX. Forms can be shellacked before waxing to improve release. Keep wax off concrete and steel surfaces. As an alternative to waxing, a polyethylene or other non-bondable film may be used as a release agent. The top of the form should extend at least 3/4" (19 mm) above the bottom of the rail or plate.
5. Forms must be liquid tight. They may be sealed with putty, foam or caulk. Seal wood forms to vertical concrete surface by applying putty, foam, or caulk below top of concrete and then press form into place.

- Expansion joints will reduce the possibility of cracking. On multiple soleplate installations, each soleplate may be isolated. Expansion joints can be made with any material that is resistant to oils and chemicals in the environment and will not allow penetration to the concrete foundation. Oil resistant, closed-cell foam works best. For more information, refer to Appendix MB-12: Expansion Joint Recommendations or contact your BASF representative.

#### DEEP-POUR RECOMMENDATIONS

Masterflow 648 CP Plus can be used for deep pours. When pour thickness will exceed six inches (150 mm) or mass exceeds 20 cubic feet (.57 cubic meters)

- Where a deep pour is necessary, 3/8 – 1/2" (9.5 – 13 mm) rebar on 8 – 12" (203 to 305 mm) centers may be used to minimize stress cracking. Locate a bottom tier about 2" (51 mm) above the foundation surface. Space additional tiers, if required, at equal distances in the grout pour, with vertical supports as required. All rebar must be 2" (51 mm) from any grout surface. For detailed information: see BASF technical bulletin "Reinforcing Bar Installation in Epoxy Grouts" or contact BASF Technical Service.
- For deep pours, let existing rebar protrude from the foundation on 12 – 18" (305 – 457 mm) centers around the perimeter and about 6 – 12" (152 – 305 mm) in from the edge. This will tie the deep pour to the foundation. The first pour should be within 2 – 3" (51 – 76 mm) of the bottom of the base. The final pour should not be made until the first pour is hard and has returned to ambient temperature, usually within 24 – 30 hours. (See Technical Data Section for more information)
- For deep-pour applications or situations that preclude the installation of rebar, consider using Masterflow 678 DP Plus. (see Form No. 1019404).

#### MIXING

- AGGREGATE MUST BE COMPLETELY DRY. Store under cover and on pallets. Before using, check aggregate for moisture by squeezing a handful.
- Precondition all components to 70° F (21° C) for 24 hours before using.
- Depending upon the size of the equipment, a suitable crew will consist of 3 workers for mixing and transporting and 4 workers (2 crews of 2 workers) for placement.
- Pour the hardener into a pail of grout resin and stir with paint stir paddle or spatula, by hand until well mixed to a uniform amber color. Keep the mixing paddle submerged to avoid air entrainment. Be sure to scrape sides of pail during mixing. **Note:** If using Masterflow 648 Accelerator refer to mixing instructions on the Accelerator data sheet.
- Pour the mixture into a horizontal shaft mortar mixer or a Kol type mixer without delay.
- Add the grout aggregate, one bag at a time, and mix only until aggregate is completely wetted out to avoid air entrapment. The first batch may be slightly less fluid than later batches because some of the resin is retained on the walls of the mixer. Withholding 1/2 – 1 bag of aggregate from the first batch of a full unit will compensate for lost resin. **CAUTION:** ALWAYS ADD AGGREGATE TO THE MIXER AFTER THE PREMIXED LIQUIDS HAVE BEEN POURED IN.
- Adjust the amount of aggregate used for the temperature and type of pour. The temperature of the grout, foundation, and equipment base are more important than the air temperature because they will affect the grout flow rate. The required flow is related to the grout thickness (between the foundation and base) and the flow distance. The maximum amount of aggregate should be used that will still produce sufficient flow. Lower temperatures reduce flow, so reduce the amount of aggregate used to compensate for the increased viscosity. Large open areas or deep grout pours with short-flow distances will not require the same amount of flow and should be done with higher amounts of aggregate.
- Pour the grout into a wheelbarrow or buckets for transporting to pour-site. Remove it from the wheelbarrow within 10 – 15 minutes or it will be more difficult to place. The grout will not harden

as rapidly after pouring because the concrete and the engine base tend to dissipate the heat and slow hardening.

- After the pour is complete, remove uncured epoxy from the mixer, wheelbarrow and tools with soap and water or a citrus degreaser. Cured material must be removed mechanically.

#### WORKING TIME

The following chart denotes the working time of a fresh grout mix at various ambient temperatures. The working time begins when the hardener is added to the resin. Do not let resin and hardener stand without adding aggregate. This material produces an exothermic reaction (heat generating). If the material exotherms without aggregate, the temperature can cause decomposition or gassing, releasing potentially hazardous fumes. If the catalyzed resin cannot be used immediately, spread the material over a large open surface, which will allow the heat to dissipate normally. The above working times assume product has been properly preconditioned for cold or hot weather use.

#### Working time

TEMPERATURE, °F (°C)	MINUTES
90 (32)	50 – 60
70 (21)	90 – 120
50 (10)	120 – 150

#### HOT-WEATHER GROUTING

- Special care must be exercised when grouting at elevated temperatures, to reduce risks of premature hardening and subsequent cracking.
- If the packaged grout is above 90° F (32° C), chill the sealed pails of grout resin in a tub of ice or cover the pails with water-soaked burlap. It is not necessary to cool the grout below 70° F (21° C).
- PROVIDE SHADE FROM DIRECT SUNLIGHT FOR AT LEAST 24 HOURS BEFORE AND 48 HOURS AFTER GROUTING.

### COLD-WEATHER GROUTING

1. Temperatures below 60° F (16° C) make the grout stiff and hard to handle and significantly increase the cure time. The baseplate and foundation may be much cooler than room temperature. In cold weather, store materials in a warm place. For best handling, the temperature of the grout components and mixing equipment should be at least 70° F (21° C).
2. When baseplate and foundation temperatures (measured by a contact thermometer) are less than 50° F (10° C), the grout may be so stiff it will not readily flow. The length and depth of the grout pour also determines the flowability, so heating of the area may be necessary, depending on field conditions.
3. If heating is required, erect an enclosure (typical materials are polyethylene or canvas) around the equipment and foundation to be grouted. Forced air or infrared heaters may be used to obtain the necessary heat to increase the baseplate and foundation temperatures to 50 to 70° F (10 to 21° C). Avoid local hot spots. Apply heat 1 – 2 days in advance of grouting to achieve uniform baseplate and foundation temperatures. Avoid exposure to exhaust from heating equipment. Remove heat during grouting placement.
4. For temperatures from 40 to 50° F (4 to 10° C), consider using Masterflow 648 CP Grout Accelerator to accelerate strength development (see Form 1019308).

### APPLICATION

1. For flat bottom plates and bases, pour the grout from one side through to the other across the short dimension.
2. When grouting closed areas, prevent air entrapment by starting at one end of the form and filling the cavity completely while advancing toward the other end.
3. Masterflow 648 CP Plus grout will flow, but it can be aided with pushing tools like banding straps or plywood strips. Push with long, slow strokes rather than short jabs until no air pockets remain under the frames. **DO NOT VIBRATE.**

### FILL RATIO

- The fill ratio is the weight of aggregate compared to the combined resin and hardener components. Masterflow 648 CP Plus is used at a variable fill ratio from the standard 6.75: 1 ratio to as low as 5.06:1 (high-flow version).
- The standard 1.73 ft<sup>3</sup> (0.049 m<sup>3</sup>) unit of Masterflow 648 CP Plus includes 188 lbs (85.2 kg) of aggregate (or four 47-lb bags). This 6.75:1 fill ratio can be reduced to as low as three bags or a 5.06:1 fill ratio yielding 1.34 ft<sup>3</sup> (0.038 m<sup>3</sup>).
- For projects requiring a fill ratio different than the standard 4 bag mix, simply determine how many bags of aggregate will be used (number of bags x number of units) and purchase the components (resin, hardener, and aggregate) separately.
- Unlike most epoxy grouts, Masterflow 648 CP Plus maintains high bearing area when fill ratios are decreased. In addition, physical properties, including high-temperature performance, remain at high levels.
- Determining the proper fill ratio for a particular project and purchasing accordingly optimizes the cost per ft<sup>3</sup>, flow, and physical properties. A guideline for suggested fill ratios is shown on page 3. In using this guide, keep in mind that the temperature of the foundation and plate is the critical concern; however, grout and ambient temperatures are also important.
- When using Masterflow 648 CP Plus in post-tensioning anchorages, always use the standard aggregate load of 6.75:1.

### Fill Ratio Guideline

TEMPERATURE	1.73 FT <sup>3</sup> UNIT	
	VERY THIN POURS OR VERY LONG DISTANCES	STANDARD POURS
> 90°F (> 32°C)	—	—
70 to 90° F (21 to 32°C)	Up to 1/2 bag	—
50 to 70°F (10 to 21°C)	1/2 to 1 bag	1/2 bag

The chart above provides guidelines for the amount of aggregate that can be removed from a 1.73 ft<sup>3</sup> unit in order to optimize flow and cost per ft<sup>3</sup>. A maximum of 12 lbs of aggregate can be removed from a 0.43 ft<sup>3</sup> unit.

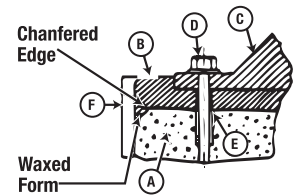


Figure 1 — Regular Equipment

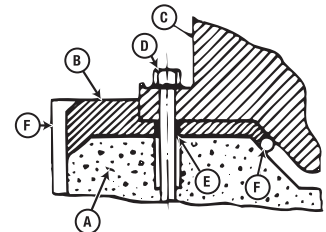


Figure 2 — Engine With Oil Pan

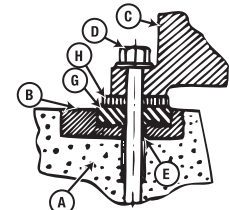


Figure 3 — Rail or Soleplate

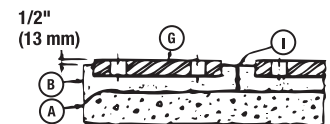


Figure 4 — Typical Rail With Expansion Joint Section

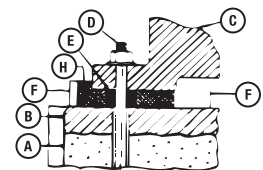


Figure 5 — Typical Epoxy Chock Application

- Key**
- A. Concrete Foundation
  - B. Grout
  - C. Equipment Base
  - D. Anchor Bolt
  - E. Anchor Bolt Sleeve Seal
  - F. Form
  - G. Soleplate or Rail
  - H. Shim or Chock
  - I. Expansion Joint

4. Where grout cannot be adequately worked to fill the cavity (because of large size or limited space), a head box will greatly assist flow. Use a sturdy wooden box or sheet metal funnel about 1 – 2 ft (0.3 – 0.6 m).
5. Check frequently for leaks. Leaks do not self-seal. If not stopped, they will cause voids.
6. If a multi-pour installation is necessary, sprinkle a small amount of Masterflow 648 CP Plus aggregate on the first pour's surface as the grout solidifies. Before placement of the second pour, brush the loose aggregate from the first pour's surface. Another method is to sandblast and brush clean the first pour's surface.

#### CURING

1. Back off leveling screws when design strength of the grout has been achieved. Apply final torque to all bolts and place equipment into service.
2. The grout will not harden below a temperature of approximately 35° F (2° C). For cold weather grouting use Masterflow 648 Accelerator. Refer to the Masterflow 648 Accelerator data sheet.
3. For best results, install and cure the grout at temperatures above 55° F (13° C). Water will inhibit the cure and strength of the grout; protect the installation from rain until it hardens.

#### COLD-WEATHER CURING

For cold weather grouting use Masterflow 648 Accelerator. Refer to the Masterflow 648 Accelerator data sheet.

1. The foundation and the equipment base will probably be cooler than room temperature unless room temperature has been constant for some time. Use the foundation and engine temperature, therefore, in estimating cure time.
2. Temperatures vary so radically, day vs. night, atmospheric vs. metal surface, that field judgment must still be used as the final measure. Cured grout should have a solid, almost metallic feel when struck with a hammer. Be sure to check as close to the base of the equipment as possible.

#### CLEAN UP

After the pour is complete, remove uncured epoxy from the mixer, wheelbarrow and tools with soap and water or a citrus degreaser. Cured material must be removed mechanically.

#### HEALTH, SAFETY AND ENVIRONMENTAL

Read, understand and follow all Material Safety Data Sheets and product label information for this product prior to use. The MSDS can be obtained by visiting [buildingsystems.basf.com](http://buildingsystems.basf.com), e-mailing your request to [basfbcst@basf.com](mailto:basfbcst@basf.com) or calling 1(800)433-9517. Use only as directed.

**For medical emergencies only, call ChemTrec® 1(800)424-9300.**

#### BASF Corporation Building Systems

889 Valley Park Drive  
Shakopee, Minnesota 55379

[www.BuildingSystems.BASF.com](http://www.BuildingSystems.BASF.com)

Customer Service 1(800)433-9517  
Technical Service 1(800)243-6739



**LIMITED WARRANTY NOTICE:** Every reasonable effort is made to apply BASF exacting standards both in the manufacture of our products and in the information which we issue concerning these products and their use. We warrant our products to be of good quality and will replace or, at our election, refund the purchase price of any products proved defective. Satisfactory results depend not only upon quality products, but also upon many factors beyond our control. Therefore, except for such replacement or refund, BASF MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, RESPECTING ITS PRODUCTS, and BASF shall have no other liability with respect thereto. Any claim regarding product defect must be received in writing within one (1) year from the date of shipment. No claim will be considered without such written notice or after the specified time interval. User shall determine the suitability of the products for the intended use and assume all risks and liability in connection therewith. Any authorized change in the printed recommendations concerning the use of our products must bear the signature of the BASF Technical Manager.

This information and all further technical advice are based on BASF's present knowledge and experience. However, BASF assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights. In particular, BASF disclaims all CONDITIONS AND WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. BASF SHALL NOT BE RESPONSIBLE FOR CONSEQUENTIAL, INDIRECT OR INCIDENTAL DAMAGES (INCLUDING LOSS OF PROFITS) OF ANY KIND. BASF reserves the right to make any changes according to technological progress or further developments. It is the customer's responsibility and obligation to carefully inspect and test any incoming goods. Performance of the product(s) described herein should be verified by testing and carried out only by qualified experts. It is the sole responsibility of the customer to carry out and arrange for any such testing. Reference to trade names used by other companies is neither a recommendation, nor an endorsement of any product and does not imply that similar products could not be used.

**For professional use only. Not for sale to or use by the general public.**