

CEILCOTE® 648 CP Epoxy Grout *ENGINE, COMPRESSOR, AND HEAVY EQUIPMENT GROUTING*

DESCRIPTION:

CEILCOTE 648 CP grout is a high performance, modified epoxy resin-based grout with a variable fill ratio. Installation procedures for this material will differ greatly from cementitious or inorganic grouts.

The installation procedures contained in this bulletin are as specific as possible. They highlight generally accepted, successful field practices for precision grouting. They may be followed, modified or rejected by the owner, engineer, contractor or their representative since they, not Master Builders, are responsible for planning and executing procedures appropriate to a specific installation.

When the planned procedure differs from that discussed herein, the user is urged to contact the local Master Builders representative to determine whether the procedure requires additional or revised information on the use of CEILCOTE 648 CP.

IMPORTANT: READ THIS FIRST

Master Builders, Inc. does not warrant the performance of this product unless the instructions of this document and other related Master Builders documents are adhered to in all respects.

PRE-GROUT CHECKLIST:

THE FOLLOWING CHECKLIST MAY BE USED TO ENSURE THAT ALL NECESSARY STEPS HAVE BEEN TAKEN BEFORE ANY GROUT IS MIXED OR PLACED:

- Store all grout components so temperatures are 60 to 80 °F (16 to 27 °C) before mixing. Keep aggregate dry.
- Check aggregate for dryness - squeeze a handful; if it clumps or packs, it is too wet.
- Foundation should be chipped to remove laitance.
- Any metal surface to be bonded should be sandblasted and kept dry.
- Check that concrete is thoroughly dry.
- Check that bolts and sleeves are sealed and dry.
- Shade the foundation from summer sunlight at least 24 hours before and 48 hours after grouting.
- Enclose and heat surrounding areas, if necessary, to maintain baseplate and foundation temperatures above 50 °F (10 °C). Avoid localized heating (hot spots).
- Jack screws should be coated with putty or wrapped with tape.
- Before assembling the forms, the surfaces of the forms that will be in contact with the grout should be thoroughly coated with two heavy coats of paste wax.
- Check that forms are assembled liquid tight.
- Have caulking or leak stopping material handy in case leaks appear.
- Prepare tools for pushing grout, i.e., banding straps, wood strips, etc.
- Grout mixing tools, wheelbarrow, buckets, etc. must be clean and dry. Cover floor around mixing and grouting areas to aid in cleanup.

Follow safety precautions. Read MSDS sheet. Use necessary safety equipment: dust masks, gloves, goggles, etc.

PREPARATION:

Foundation

1. The foundation should be cured until design strength of the concrete is achieved and foundation is dry. Recommended procedure per ACI Standard 318 is as follows: "Concrete shall be maintained above 50 °F (10 °C), and in a moist condition for at least the first 7 days." [3,000 psi (20.7 MPa) minimum concrete should be specified; higher strength concrete is recommended for optimum performance.]
2. The concrete surface must be chipped so aggregate is exposed to ensure all laitance and weak float are removed. Chamfering the edge of the concrete 45 ° to about a 2 in. (50 mm) width is desirable. (See Figure 1).
3. **The concrete base shall be clean, dry, and free of oil, wax, and other contaminants.**
4. If an anchor bolt sleeve is to be filled, be sure all water is removed. This may be done with a syphon, a vacuum pump or a rubber hose and bulb. The residual moisture must also be removed 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 of a putty consistency which will stick but not harden. Shims or jack pockets may be formed with wood, and forms filled with damp sand.
7. Shims or jack screws should be removed after the grout cures.
8. SHADE THE FOUNDATION FROM SUMMER SUNLIGHT FOR AT LEAST 24 HOURS BEFORE AND 48 HOURS AFTER GROUTING.

Equipment

The bonding surfaces of the base to be grouted should be sandblasted to "white metal" and be free of coatings, wax, grease or scale. Other mechanical methods, such as grinding or sanding, are also effective but do not produce as high a bond strength as sandblasting.

Primer should be used ONLY when a long delay between cleaning and grouting could allow excessiverusting or contamination. If the base must be primed, use CEILCOTE® 680 primer. If the primer has been on the surface to be grouted for more than 1 month, the surface should be abraded and solvent wiped so no residue is left. Priming, if required, must be performed when the relative humidity is less than 80% and the temperature of the surface to be primed is at least 5 °F higher than the dew point.

The grout should come up at least 3/4 in. (20 mm) onto the equipment, it may be advisable to mask above the area with masking tape.

To permit easy 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. Areas not to be grouted must be sealed off.
3. Forms should be no greater than 6 in. away from the edge of the individual base rail or soleplate 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 in. to 6 in. from the edge of the supporting area. However, this may vary depending on the application. Moderate to large size equipment or difficult/narrow placement applications should utilize an extended head form to create additional head pressure and enhance placement. Consult your Master Builders representative for specific recommendations.
4. Forms must be liquid tight. They may be sealed with putty or caulking. Seal wood forms to vertical concrete surface by applying putty or caulk below top of concrete, then press form into place.
5. 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 nonbondable film may be used as a release agent. The top of the form should extend at least 3/4 in. (19 mm) above the bottom of the rail or plate. Seal all forms with putty or caulking.

6. 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 is best.

For more information, see the expansion joint and rebar Technical Bulletin or contact your Master Builders sales representative.

Deep Pour Recommendations

Where a deep pour is necessary, 3/8 in. to 1/2 in. (9.5 to 13 mm) rebar on 8 to 12 in. (20.3 to 30.5 cm) centers may be used to minimize stress cracking. A bottom tier should be located about 2 in. (50 mm) above the foundation sur-face. Additional tiers, if required, should be spaced equal distances in the grout pour with vertical supports as required. All rebar must be 2 in. from any grout surface.

For deep pours, it is best to let existing rebar protrude from the foundation on 12 to 18 in. (30.5 to 45.7 cm) centers around the perimeter, about 6 to 12 in. (15.2 to 30.5 cm) in from the edge. This will serve to tie the deep pour to the foundation. The first pour should be within 2 to 3 in. (50 to 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 to 30 hours.

(See Cure Time vs. Temperature Section.)

Tools

1. Obtain tools for pushing grout under the equipment. Use 1/4 in. (6.4 mm) plywood strips, sheet metal strips, barrel staves, etc.
2. Clean and dry the mortar mixer [3 to 6 ft³ (0.085 to 0.17 m³) size]. Remove all possible concrete. A cement mixer is also acceptable, but a greater amount of air may be mixed in.
3. Clean and dry a wheelbarrow and buckets or shovels for transporting the grout.
4. Get plenty of rags for wiping hands and tools.
5. Ready a pail for solvent (Toulene, MEK or lacquer thinner) for cleaning tools.

Grout

1. **AGGREGATE MUST BE COMPLETELY DRY.** It should be stored under cover and on pallets. Before using, check aggregate for moisture by squeezing a handful.
2. In cold weather, store in a warm place for at least 24 hours; 70 °F (21 °C) is preferred.
3. In hot weather, store in a relatively cool, shaded area.

Installing Crew

Depending upon the size of the equipment, a suitable crew will consist of three men for mixing and transporting, and four men (two crews of two men) for placement.

SAFETY:

CEILCOTE 648 CP Grout - is a three component epoxy grout formulated for industrial and professional use only and must be kept out of the reach of children. These products contain chemicals which may be potentially HARMFUL to your health if not stored and used properly. Hazards can be significantly reduced by observing all precautions which are found on material safety data sheets, and product labels. Please read this literature carefully before using product.

FLASH POINT (Pensky-Martens Closed Cup):

CEILCOTE 648 CP Liquid 229 °F (109 °C)

CEILCOTE 648 CP Hardener 230 °F (110 °C)

Refer to the product's Material Safety Data Sheet (MSDS) for more information.

MIXING:

Full Unit: 230 lb (104 kg) Yields 1.73 ft³ (.05 m³)
 CEILCOTE 648 CP Grout Liquid one 22.3 lb (9.2 kg)
 CEILCOTE 648 CP Grout Hardener one 7.6 lb (3.5 kg)
 CEILCOTE 648 CP Grout Aggregate four 50 lb (22.7 kg)

Mixing Instructions

1. Do not add solvent, water or any other material to the grout.
2. Do not alter the liquid/hardener proportions.
3. Pour the hardener into a pail of grout liquid and stir until well mixed (approximately three minutes).
Do not add air.
4. Pour the mixture into the mixer without delay.
5. Add the grout aggregate, one bag at a time, and mix until completely wet (approximately two minutes). The first batch may be slightly less fluid than later batches because some of the liquid is absorbed in wetting the mixer. Withholding 1/2 to 1 bag of aggregate from the first batch of a full unit will compensate for lost liquid. **WHEN MIXING AGGREGATE WITH THE PRE-MIXED LIQUID AND HARDENER THE AGGREGATE SHOULD BE Poured INTO THE MIXING VESSEL AFTER THE PREMIXED LIQUID AND HARDENER HAVE BEEN PLACED IN THE VESSEL.**
6. The amount of aggregate used should be adjusted for the temperature and type of pour. The temperature of the grout, foundation and equipment base are more important than the air temperature since 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. At lower temperatures, flow is reduced, so the amount of aggregate is reduced 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.

The following recommendations are made in gallons (L) of aggregate removed from each unit. (In some cases, it may be desirable to add aggregate to the unit.) One gal (3.8 L) of aggregate weighs approximately 15 lb (6.8 kg).

Gallons (L) Removed or Added

Temperature °F (°C)	Thin Pours or Long Flow Distances Under Equipment	Normal Conditions	Thick Pours, Open Areas or Short Flow Distances
Above 90 °F (Above 32 °C)	1 gal (3.8 L)	-	Add 1 gal \\ (Add 3.8 L)
70° to 90 °F (21° to 32 °C)	2 gal* (7.6 L)	1 gal (3.8 L)	-
50° to 70 °F (10° to 21 °C)	2 gal* (7.6 L)	2 gal* (7.6 L)	1 gal (3.8 L)

* No more than 2 gal (7.6 L) should be removed from a unit without first consulting Master Builders.

No more than 1 full bag of aggregate should be removed from a full size (4 bag) unit or 12 lbs from a 0.43 cu.ft. unit.

7. Pour the grout into a wheelbarrow or buckets for transporting to the jobsite. Remove it from the wheelbarrow within 10 to 15 minutes or it will be more difficult to place. It does not harden as rapidly after pouring because the concrete and the engine base tend to dissipate the heat and slow hardening.
8. After the job is complete, clean the mixer, wheelbarrow and tools with Toulene, MEK, or lacquer thinner. Use proper safety procedures when using flammable solvents for cleaning.

Working Time

The following chart is a guide for the working time of a fresh grout mix at various ambient temperatures. The working time of a CEILCOTE 648 CP grout mix begins when the hardener is added to the liquid. Do not let liquid and hardener stand without adding aggregate. This material produces an exothermic reaction (heat is generated). If the material is allowed to exotherm without aggregate, the resulting temperature can cause decomposition or gassing, releasing potentially hazardous fumes. If the catalyzed resin cannot be used immediately, the material should be spread over a large open surface which will allow the heat to dissipate normally. See safety precautions.

Temperature °F (°C)	Working Time - Minutes
90 (32)	50 to 60
70 (21)	90 to 120
50 (10)	120 to 150

GROUT PLACEMENT:

Temperature Control

Summer Grouting:

Avoid high temperatures while grouting in the summer. High ambient temperatures will increase the amount of cracking which may occur during the colder winter months.

If the packaged grout is above 90 °F (32 °C), chill the sealed pails of grout liquid 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 SUMMER SUNLIGHT FOR AT LEAST 24 HOURS BEFORE AND 48 HOURS AFTER GROUTING.

Winter Grouting:

Temperatures below 60 °F (16 °C) make the grout stiff and hard to handle; cure time is significantly increased. The baseplate and foundation may be much cooler than room temperature. In cold weather, materials should be stored in a warm place. For best handling, the grout component should be at least 70 °F (21 °C).

When baseplate and foundation temperatures (measured by a contact thermometer) are less than 50 °F (10 °C), the grout may be so stiff that it will not readily flow. Flowability is also determined by the length and depth of the grout pour, so field judgment may be necessary to determine if area heating is required.

If heating is required, an enclosure (typical materials are polyethylene or canvas) should be erected 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 °F to 70 °F (10 °C to 21 °C). Avoid local hot spots. Heat should be applied 1 to 2 days in advance of grouting so uniform baseplate and foundation temperatures are achieved. Avoid exposure to products of combustion. During grouting placement, it is desirable that heat be removed.

Placing the Grout

1. For flat bottom engines, the grout should be poured from one side through to the other.
2. When grouting closed areas, start at one end of the form and fill the cavity completely as you advance toward the other end to prevent air entrapment.
3. CEILCOTE 648 CP grout will flow, but it can be helped along with pushing tools such as banding straps or plywood strips. Push it with long, slow strokes rather than short jabs until there are no air pockets under the frames. Do not vibrate!
4. Where grout cannot be adequately worked to fill the cavity due to large size or limited space, a head box will greatly assist flow. A sturdy wooden box or sheet metal funnel about 1 to 2 ft (0.3 to 0.6 m) deep may be used.
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 CEILCOTE 648 CP 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:

Jack screws may be loosened and equipment placed in operation when design strength of the grout has been achieved.

The grout will not harden below a temperature of approximately 35 °F (2 °C). Deterioration of the grout will not occur at low temperatures.

Water will inhibit the cure and strength of the grout, so it must be protected from rain until it hardens.

Cold Weather Curing

The foundation and the equipment base will probably be cooler than room temperature unless room temperature has been constant for some time. Thus, the foundation and engine temperature must be used in estimating cure time.

Cure Time Vs. Temperature

The following chart is a guide for final cure time. As mentioned above, the baseplate and foundation may be cooler than room temperature.

Compressive Strength When Cured At:

Time	55 °F	(13 °C)	73 °F	(23 °C)	90 °F	(32 °C)
Hours	psi	MPa	psi	MPa	psi	MPa
8	—	—	700	(5)	9,400	(66)
16	—	—	7,000	(49)	13,700	(96)
24	1,300	(9)	11,500	(81)	16,000	(112)
48	9,400	(66)	16,400	(115)	18,500	(130)
72	13,900	(98)	17,100	(120) 1	9,000	(134)
96	16,700	(117)	18,000	(127)	20,000	(141)

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.

CRACKING:

CEILCOTE grout and other epoxy-based grouts will sometimes develop cracks. Cracking is generally caused by thermal stresses, temperature differences from season to season, and operating to non-operating temperatures.

Cracking often occurs on the shoulder surface near sharp corners of the baseplate and at anchor bolts. Horizontal edge cracks may occur just below the grout/concrete interface, especially in outdoor installations exposed to low temperatures. Chamfering the concrete edge helps reduce this cracking.

The amount of potential cracking is reduced if proper installation procedures are followed.

If cracks develop, use CEILCOTE 648 CP Liquid and Hardener for crack repairs.

FINISHING AND CLEANUP:

A smooth finish may be obtained by spraying or brushing the surface with Xylene or mineral spirits. Best results can be obtained by smoothing the surface several times just prior to the hardening of the grout surface. Clean tools and mixer with ketone solvents, T-410, or lacquer thinner .

TYPICAL INSTALLATION PROCEDURES

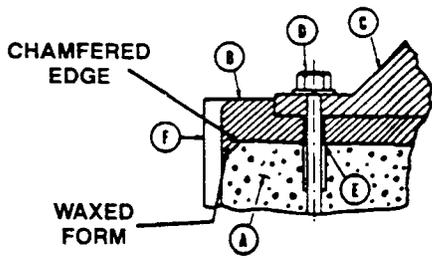


Figure 1. — REGULAR EQUIPMENT

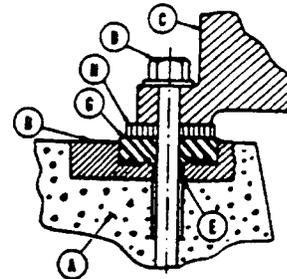
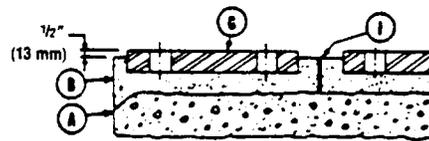


Figure 3. — RAIL OR SOLEPLATE

- 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



TYPICAL RAIL WITH EXPANSION JOINT SECTION

Figure 4.

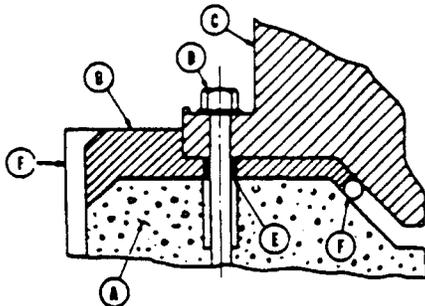
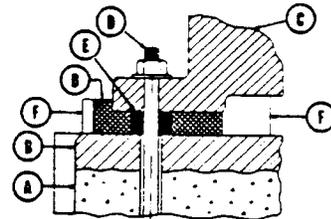


Figure 2. — ENGINE WITH OIL PAN



TYPICAL EPOXY CHOCK APPLICATION

Figure 5.

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