

Planigrout® 350 [NA] and Planigrout 310 [NA] epoxy grouts

Introduction

Many commercial, manufacturing, public works and infrastructure facilities have heavy equipment that must be level and secure for daily use. Typically, that equipment may produce a key part to the manufacturing of an item, may move copious amounts of liquid from one tank to another, may generate electricity, or may be in a more aggressive environment and require some additional chemical resistance. The use of epoxy grout in these areas can be essential to the life cycle of the equipment as well as providing support from the equipment base to the concrete foundation.

Precision grouts are meant to fill the void between the equipment's baseplate and the foundation. The goals of using them are to ensure proper load transfer by resisting dynamic loads and to keep a constant contact area for the service life of the equipment. Thus, when selecting an epoxy grout, other properties such as compressive strength, shrinkage, creep resistance, coefficient of thermal expansion, bearing area, flow and modulus of elasticity should be considered. Epoxy grouts, as with non-shrink cementitious grouts, need to be properly chosen for the application type and the end use of the product.

Cementitious grout vs. epoxy grout

When compared to cementitious grout, epoxy grout can withstand a high level of dynamic load. As stated in API 686, Section 2.4, "cementitious grout is suitable as 'filler' material in less demanding applications where vibration, dynamic loading, and temperature extremes are not a concern." Unless the equipment is fully static, the epoxy grout should always be installed. Incorrect grout selection can lead to damage to the equipment, such as excessive vibration, misalignment, oil contamination, etc. Additionally, cementitious grouts are sensitive to oil leakage due to their high porosity and their lower chemical resistance.

This installation guide will help in answering application questions and act as a reference point for the use of MAPEI's epoxy grouting systems. Even if the contractor is familiar with general grouting applications, a pre-job meeting with key representatives – such as the owner, Engineer of Record (EOR), contractor, machine manufacturer and grout manufacturer – is highly recommended. A successful grouting application encompasses proper preparation, form design and proper product placement. Along with addressing those issues, this installation guide will act as an aid in referencing industry documents from ACI and API for a successful placement.

Surface preparation

Successful bonding relies on surface preparation of the concrete substrate as well as the surface of the metal baseplate that encounters the epoxy grout.

Poor bonding can result in grout failure, so this step is crucial to a successful placement.

New concrete must be fully cured for 28 days and dry. At the discretion of the EOR, new high-performance concrete or the use of MAPEI's *Planitop® 18*, *Planitop 18 ES* or *Planitop 18 TG* products may require less time for curing than conventional ready-mixed concrete.

Epoxy grout can be installed on concrete substrate that have cured for as little as 7 days. However, cracks that develop in the substrate after grout installation will transfer to the epoxy grout.

Existing concrete must be structurally sound and free of contamination from oil, fatty acids, chlorides, waxes and sealers that may interfere with proper bonding. In both cases, the area to be used for equipment placement must be able to handle the static loads of equipment placement as well as any anticipated dynamic loads during equipment use.

Some key points for surface preparation are:

- Concrete surface must be clean and free of loose particles, efflorescence, paints, tars, grease, asphaltic materials, bond breakers, curing compounds, wax, and any foreign substance or any conditions that may affect product performance or proper bonding.
- Mechanically profile and prepare concrete surfaces by engineer-approved methods in accordance with the most current ICRI 310.2R Guidelines to obtain an International Concrete Repair Institute (ICRI) concrete surface profile (CSP) of #5 to #10.
- The higher the surface profile, the higher the bond between the grout and the substrate. This should be considered for the installation of equipment with high-impact dynamic loading.



ICRI CSP 5:
Medium shotblast



ICRI CSP 6:
Medium scarification



ICRI CSP 7:
Heavy abrasion blast



ICRI CSP 8:
Scabbled



ICRI CSP 9:
Heavy scarification



ICRI CSP 10:
Concrete breaker and
abrasive blasting

- Do not use aggressive mechanical preparation such as bush heads, needle points or concrete breakers at more than 25 lbs. (11.3 kg) to prepare concrete for grouting, as these can increase the concern of micro-cracking in the substrate, which can fail during end use of the equipment being grouted.
- If a more aggressive profile is required with equipment that cannot produce the required CSP, multiple perpendicular passes may be needed to obtain the correct profile.
- If utilizing hydro demolition, wait at least 48 hours or until the concrete is visibly dry before proceeding with the grouting application.
- On existing concrete: Ensure that all contaminated or oil-saturated concrete is removed, and that the placement area is free from soft, unsound concrete.
- Repair all cracks with an appropriate crack injection epoxy such as MAPEI's *Epojet™* [NA] or *Epojet LV* [NA] and allow curing prior to grouting.
- Clean anchor holes with oil-free compressed air to ensure that all dust, dirt and debris have been removed. Anchor holes should be dry before grouting procedures and should be isolated from the epoxy grout with foam insulation.
- Metal surfaces that will encounter the grout should be abrasive-blasted to a near white finish metal and wiped clean with a non-residue solvent such as acetone in accordance with SSPC-SP-5 or NACE-2 requirements.
- Use paste wax, caulk or other means to protect any surfaces not intended to bond with grout, such as shims and jacks.

Refer to API Recommended Practice 686, Section 3.6 and/or ACI 351.5-15, Specification for Installation of Epoxy Grout between Foundations and Equipment Bases, Section 3.1, for more information regarding surface preparation requirements.

Important: All surfaces must be dry before placement of the grout. Any contact of the fresh epoxy with water will negatively affect the resins' curing reaction.

Temperature control

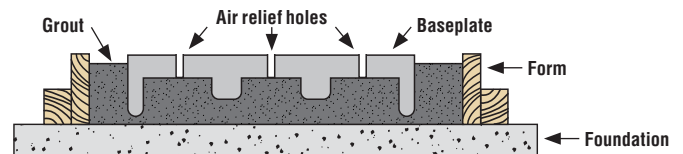
Lower temperature will decrease the epoxy grout fluidity and high temperature will increase cracking due to thermal contraction.

- In the case of ambient temperature below 68°F (20°C), it is encouraged to tent and heat the baseplate and the substrate to a temperature of 73°F (23°C), 48 hours prior to and after the pour.
- In the case of hot weather, the baseplate and substrate should be protected from direct sunlight 48 hours prior to and after the pour.

Preparation of forms

- Build forms from materials that will have adequate strength and durability to handle the weight of the epoxy grout. It is typical to utilize 3/4" (19 mm) well-braced plywood.
- Before formwork is installed, it should be coated with multiple coats of an industrial-grade paste wax to facilitate removal after the grout cures. Heavy-gauge plastic film thicker than 15 mils has also been used as a successful bond breaker on formwork for grouts.
- Install formwork within contract specifications and anchor it securely to the foundation with drilled anchors.
- Seal the formwork with caulk or putty so that the epoxy grout is not able to escape from the formed area.
- Utilize strips that produce a 45-degree angle at all vertical corners within the form and on horizontal edges to eliminate sharp edges.
- Design the forms to create an adequate hydraulic head to facilitate grout placement and flow in one direction. Refer to API Recommended Practice 686, Section 3.7, and/or ACI 351.5-15, Specification for Installation of Epoxy Grout between Foundations and Equipment Bases.
- Forms should extend 2" to 4" (5 to 10 cm) past the length of the baseplate on the installation and non-installation sides, and should extend 1" (2.5 cm) above the bottom of the baseplate. The sides parallel to the placement direction should extend from the baseplate at 1" (2.5 cm) to allow for air displacement from under the placement area.
- Head boxes should be constructed at one end of the placement area and should have a 45-degree angle protruding from the form where being placed. The height of the head box should be 1/5 of the anticipated travel distance under the baseplate.
 - Example: If travel distance under the baseplate is 5 feet (1.52 m), the height of the head box should be 1 foot (0.30 m) high.
- Prior to installation, it is recommended that a pre-installation meeting be held to go over placement methods, including but not limited to:
 1. Confirming tightness of formwork.
 2. Confirming surface preparation and profile.
 3. Confirming proper head box placement.
 - If it is a movable head box, confirm the direction of movement to the sequential placement of grout.
- Inspect and confirm that proper air-relief holes are free and clean of debris and that they remain open during placement.
- Ensure that all removable leveling shims and jacks are accessible during placement. Pads used for leveling jacks should be round with chamfered corners.

For larger pours, drill air relief holes of 1/4" to 1/2" (6 to 13 mm) in diameter at various sections to ensure proper placement. Additionally, access ports can be added at the mid-length to divide the pour distance.



Drilling of air relief holes at strategic location in the steel baseplate will prevent trapping air during the installation of Planigrout 310 and Planigrout 350.

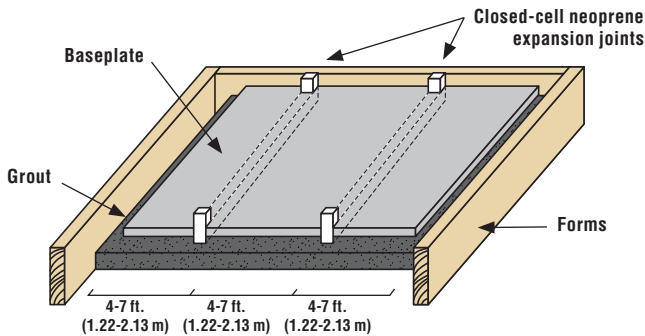
Expansion joints

For large volumes of epoxy grout, expansion joints may be added to control vertical cracking.

Expansion joints should be installed every 4 to 7 feet (1.22 to 2.13 m) perpendicular to the long axis of the baseplate. The joints should be installed at stress concentration points.

Closed-cell neoprene or foam at a thickness of 3/4" to 1" (19 mm to 2.5 cm) is recommended as an expansion joint material. Styrofoam strips are not recommended.

After the grout sets, the exposed section of the joint should be sealed with a caulk, such as *Mapeflex® P1 FT* or *Mapeflex P2 NS*.

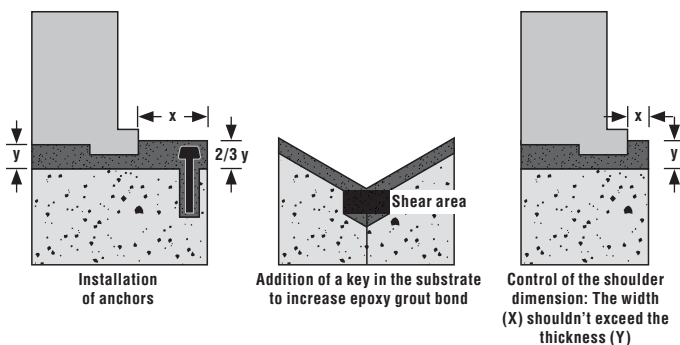


Installation of expansion joint to control vertical cracking in large volume pour

Anchors

Anchors can be added to prevent delamination at the shoulders between the epoxy grout and the substrate. This phenomenon is usually called "edge-lifting." These anchors should be embedded at least 4" (10 cm) in the concrete. Anchors can be either rebar wickets, dowels or bolts with attached washer. There should always be at least 2" (5 cm) of epoxy grout covering the anchors or the rebars.

Additionally, to enhance the contact surface of the grout at the shoulders, the substrate corners should be chamfered at a radius of 30 degrees.



Solutions to prevent vertical cracking at the epoxy grout shoulders

Mixing

Before product use, take appropriate safety precautions. Refer to the Safety Data Sheets for details.

Epoxy grout kits contain three components – resin, hardener and aggregate – that need to be mixed according to the steps below to ensure proper performance.

1. Condition all materials to between 75°F and 90°F (24°C and 32°C) for at least 24 hours before mixing.
2. Mix only complete units of parts A and B. Do not thin the mixture with solvents or add more aggregate than allowed for the pre-measured kit of *Planigrout 310* and *Planigrout 350*.
3. Add Part B to the Part A pail and mix the material with a low-speed drill (at 300 rpm) and paddle mixer for 3 minutes or until blended uniformly. Do not introduce air into the epoxy while mixing. While mixing, remove all material from the sides of the mixing vessel to ensure that the epoxy is fully blended. Precaution: Do not let the pure resin mix sit. Immediately add the aggregate to lower the thermal peak.
4. After blending parts A and B, transfer the mixed material to a mortar mixer and add Part C one bag at a time, waiting until the aggregate from each consecutive bag is wetted out before adding the next bag. Once all four bags of aggregate have been added and are wetted out, discharge the material and proceed with grout placement. For the first batch of material, remove 0.5 bags of Part C to compensate for the loss of resin in the mixer and the equipment.
 - Never utilize a rotary drum concrete mixer for epoxy grout, as the material will not mix uniformly and the possibility of air entrapment is greater.
 - Stage your horizontal shaft mortar mixture on an elevated surface at a sufficient height to pour directly into your wheelbarrow, buckets or pump.
5. Flow of material can be adjusted for *Planigrout 350* by utilizing less than four bags of aggregate. However, do not utilize less than 3 bags of the supplied aggregate.

Reducing the number of bags of preblended aggregate that comes with *Planigrout 350* can increase flowability of the mixture for easier placement when tighter tolerances of formwork and/or length of travel is expected. However, a reduction in mixed volume will be realized and should be accounted for prior to ordering the material for the project. For *Planigrout 310*, do not use less than 4 bags of aggregate in an attempt to create a more flowable mixture. Mix complete kits. For *Planigrout 350*, do not use less than 3 bags of aggregate in an attempt to create a more flowable mixture.

Product application

Read all installation instructions thoroughly before installation.

1. Place *Planigrout 310* or *Planigrout 350* into the forms from one location or entry port to ensure a consistent flow direction to minimize the effects of trapping air.
2. Use a head box to create head pressure and assist in product placement. Move the head box if needed for larger baseplates to ensure complete encapsulation. The use of chains or strapping in a sawing motion can aid in moving the grout the length of the baseplate as well.
3. Ensure that *Planigrout 310* or *Planigrout 350* is placed consistently. If a head box is used, do not allow the volume of grout to completely empty within it.

4. Examine the forms for leaks and plug all leaks with putty or a fast-setting cement, such as MAPEI's *Planiseal® Plug*, if there is leakage during placement.
5. When forms are filled to the desired depth, the exposed surface may be lightly misted (avoid puddling) with undiluted *Mapecrete® Film* or a suitable solvent such as xylol or toluene, and then finished with a trowel or brush.
 - For deep pours, use *Planigrout 350*, which has a low exotherm reaction so it can be installed up to 18" (46 cm) thick. Otherwise, the grout can be installed in multiple pours. The next layer should be done after 24 hours. Note that there is no cold-joint between epoxy layers. The last layer of the epoxy grout should be at least 2" (5 cm) thick to ensure proper contact with the baseplate.
 - If wedges are used, they should be removed before the grout sets. After the grout is cured, the void left by the wedges can be grouted.

Quality control

A compressive strength test should be done as per ASTM C579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing Method B.

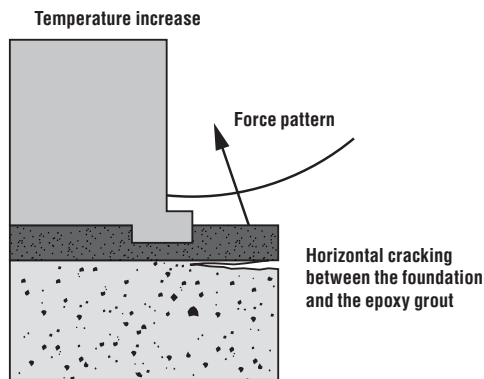
Due to thermal contraction of epoxy grout, vertical cracking can appear on the shoulders. These cracks do not affect the performance of the grout beneath the baseplate. If required, these cracks can be injected with a two-component epoxy resin such as *Epojet* or *Epojet LV*.

In the case of outdoor installations, the epoxy grout can develop cracks on the shoulder long after the installation when exposed to an excessive temperature gradient. Refer to the "Preparation of forms" section above for solution to limit cracking.

Cleanup

- Clean equipment with a soap-and-water solution. Cured material can only be removed mechanically.

Using soap and water to clean equipment can be aided by charging the mixer with 3/8" (10 mm) rounded pea gravel. This will aid in cleaning and removing larger accumulations in the mixer. Alternatively, a large scrub brush can be used for fine deposits of resin only.



Effects of temperature variation on epoxy grout shoulders