



Grout Placement

For optimum flow during placement:

- **Mixed Epoxy grout** temperature should be at 80 - 90°F (27 - 32°C)
- **Mixed Cementitious grout** temperature should be at 50 - 70°F (10 - 21°C)

The goal of any grout installation method is to force the grout between the baseplate and the foundation driving out the air as it flows to completely fill the void. Grout installations should always be planned to have the grout flow across the shortest distance of a baseplate.

The two main methods to place grout are pouring (gravity placement) and pumping. Dry packing is possible with some cementitious grouts; refer to Five Star® Technical Bulletin 107 for details.

A. Key Placement Consideration Factors

1. The temperature of the grout, the substrate, and the equipment will affect the place-ability of a grout. Warm grout flows better than cold grout.

Five Star Recommendation: Having the epoxy grout at 80°F - 90°F (27° C - 32°C) will optimize the flow characteristics of the product. Any shortening of working time by elevating the grout temperature will be offset by the grout flow characteristics being enhanced.

2. Grout must be placed without interruption. It is essential that there is a sufficient volume of grout available to completely fill the void under the equipment frame or baseplate. Do not start a grout installation if you are not 100% sure you will complete it. It is very difficult to re-grout after a partially completed grout job, and in some instances, it may be necessary to demolish a partially completed grout install and start over.

Five Star Recommendation: Re-check the dimensions of the installation and the volume of grout available after the equipment is placed and the forms are constructed. Dimensions often change because of surface preparation, equipment leveling, and form construction. Allow up to 10% additional product to account for waste, spills, etc. Using control joints can break up larger installations into smaller installations decreasing the risk of running out of grout. Having back-up or multiple pieces of critical equipment like mixers are recommended for critical grout installations..

3. The properties of the grout itself, the depth of the grout, the roughness of the substrate, the distance a grout must flow, and the surface temperatures of the prepared concrete and the steel that the grout will come in direct contact with are all critical considerations when selecting the grout placement method. Adding additional water to a cementitious grout or holding back aggregate for an epoxy grout should not be a remedy to make a grout flow better.

Five Star Recommendation: Typically, 2 inches (50 mm) should be the planned grout depth. Grout depths less than 1 inch (25 mm) present challenges for grouts flowing distances more than 2 feet.



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4. The recommended method of installing grout is to introduce the grout so that it flows from where it is added to the edges of the baseplate so that air is forced out. For air to be displaced, the grout should be in contact with the substrate and the bottom of the baseplate as the grout moves across the void. Grout must be added in a method that does not introduce air into the mix. A sufficient supply of mixed grout must be available prior to starting the grout pour.

Five Star Recommendation: Grout should always be poured and allowed to flow across the shortest dimension of a baseplate. The grout headbox/funnel should remain at least half full for the entire time grout is being placed. This maintains head on the product and minimizes the amount of air introduced.

5. There must be sufficient space to introduce the grout and a way of venting the air that the grout will displace. Sufficient space for a headbox and venting air are usually incorporated into the formwork. When grout is introduced using a grout hole it is important to make sure that air can be displaced. Grout holes are often used when the support structure below the plate will not allow the grout to flow out to the edges.

Five Star Recommendation: The configuration of the supports on the underside of a baseplate or piece of equipment should be understood when planning grouting. The recommended size for a grout hole is 6 inches (152 mm) in diameter. The recommended size for an air vent is a minimum of ½ inch (13 mm) in diameter.

6. Very few grouts will flow without some motive force moving them along. Most grouts will self-level before they set up. Do not confuse self-leveling with flowing.

Five Star Recommendation: At a minimum every grout installation should have a Headbox/funnel, or some method of keeping a positive force (gravity or head) on the grout to ensure that the grout continues to move and displaces air. If the grout is expected to travel more than 6 to 8 feet (1.8 – 2.4 m), then a pump should be considered.

B. Pouring or Gravity Placement

In applications where the grout needs to flow 8 feet (1.8 m) or less, the grout can be installed by using gravity as the motive force for keeping the grout flowing. A headbox or funnel (cone) is required to keep gravity/head pressure on the grout. The minimum height of the headbox should be from 1/3 to 1/2 the distance the grout must flow.

B.1. Headbox



A headbox may be constructed from any suitable material (i.e., plywood, sheet metal, fiberboard). It acts as a reservoir and a funnel for the grout. Its primary function is to provide a means of applying head pressure to keep grout flowing. Headboxes do not have to be elaborate but should be rigid and sized to hold a sufficient volume of grout so that the level of grout does not drop below half the height of the box. Headboxes are typically moved along by sliding them, so a means of maintaining their position in the grout form is often incorporated into the design.

Formwork on the side where a headbox is placed is typically adjusted to accommodate the headbox. When pouring grout into the headbox, grout shall be introduced in a manner to avoid air entrapment (pour grout slowly down the side of the box).

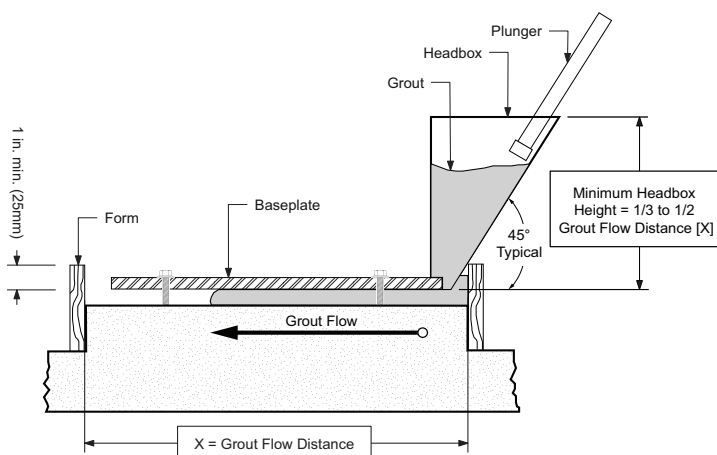
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B.1. Headbox (cont'd)



Care must be taken during grouting to keep the headbox at least half full of material to ensure even grout flow and maintain head pressure. To increase the rate of flow from a headbox, manually apply pressure in addition to the hydraulic head by using a plunger. A plunger is a tool, usually fabricated on the job site, made from two pieces of wood nailed together to form a T. The stem is the plunger handle, and the crossbar which is just slightly smaller than the width of the headbox, applies the pressure.

The headbox must be moved along the longer length of the baseplate keeping pace with the advancing grout front. Grout is continually added to the headbox, and the grout is allowed to flow under the plate until it rises above the bottom edge of the baseplate on the opposite side.



ON LARGE PLACEMENTS, MULTIPLE HEADBOXES ARE OFTEN EMPLOYED. THE GROUT IN THE PHOTO ABOVE PROBABLY NEEDS TO FLOW 6-8 FEET (1.8 - 2.4 M.).



ON LARGER REPETITIVE GROUT INSTALLATIONS MULTIPLE OR SPECIALIZED HEADBOXES MAY BE CONSTRUCTED TO EXPEDITE THE PLACEMENT PROCESS.



ON SMALL APPLICATIONS A HEADBOX CAN BE AS WIDE AS THE PLATE SO IT DOES NOT NEED TO BE MOVED. ALSO IT CAN CONTROL THE GROUT AND SPEED UP THE GROUT FLOW.



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C. Pumping

Pumping grout is one of the most effective ways to ensure that the grout completely fills the space between the bottom of the baseplate and the foundation. Pumping grouts should be considered when

Pumping grout adds a high degree of complexity to the grout installation. If pumping is the best installation method, serious consideration should be given to using a contractor who specializes in pumping grout. Experienced contractors not only have the know-how to install the material, but they also have the necessary equipment. If mistakes are made while grout is being pumped, the installation as well as the equipment are at risk of being compromised or ruined.

- A large volume of grout under a single piece of equipment or under multiple pieces of equipment / base plates needs to be installed.
- The grout is required to flow more than 8 feet (2.4 m) to be properly installed.
- Restrictions exist (i.e., low clearances, irregular surfaces, etc.) that will impede the grout's flow.
- The equipment configuration will restrict access to the space required to gravity place the grout.
- Venting the displaced air will be difficult.

C.1. Pumping

Pumping requires that the grout selected have a long working time, is sufficiently flowable, and will not segregate as it is subjected to the pressure required to move the material.

The Five Star® grout that is selected should specifically mention pumping as an acceptable installation method on the product's Five Star® Technical Data Sheet. Grouts with working times of less than 30 minutes typically are not considered to be good grouts for pumping. Contact your Five Star® Technical Sales Representative if you are considering pumping a grout that does not specifically mention pumping as an acceptable installation method.

Other key factors to consider about grout when it is pumped:

- Pumping raises the grout temperature and shortens the working time while reducing its consistency. Plan to keep the mixed grout temperature as cool as possible prior to introducing it to the pump.
- Pumping usually requires that additional grout be available because of the volume of material that is wasted in priming pumps, hoses, etc. as well as grout left in the hoses when the pump is shut down or moved. Be sure to have additional grout on hand to make up for these anticipated waste factors.

C.2. Equipment

There are a variety of pumps and mixer/pump combinations available. Five Star recommends that the installer contact the pump manufacturer for their recommendation on how to use their equipment to pump a specific grout product. Many equipment manufacturers have either tested or have experience with pumping Five Star® cementitious and epoxy grouts. Key factors for pump selection:

- The size of the job will dictate the size of the pump and the number of pumps required. On critical installations it may make sense to have more than one grout pump available
- The diameter and length of the hoses as well as the nozzle configuration need to be determined. Five Star recommends that hose sizes less than two inches in diameter not be considered.

NOTE: Pumping moves a lot of material in a short amount of time. There must be sufficient mixing capacity on hand to support the pumping.



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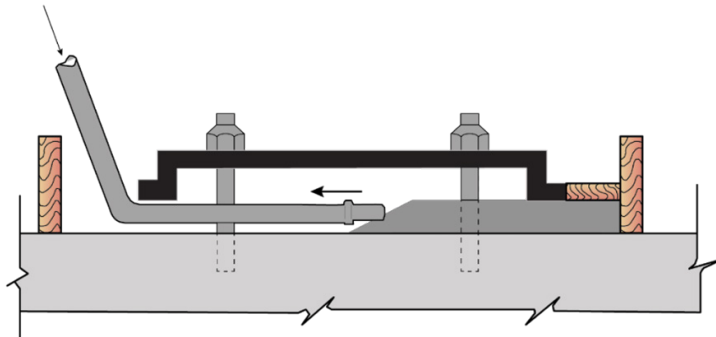
C.3. Pumping Procedure

How grout will be pumped will vary with the material and equipment used, the shape and type of equipment being grouted, and the configuration of the jobsite. Five Star recommends that the proposed pumping equipment and procedures be submitted to the project engineer for approval prior to deciding upon the installation method. On larger installations, Five Star recommends a “pump demonstration test” be conducted with the actual equipment and materials being used to verify that the grout will be successfully installed.

Key planning consideration factors for pumping grout:

- The pump shall be positioned to minimize the pumping distance. Keep the discharge line as close to horizontal as possible.
- All hose connections must be watertight. Quick connect couplers are recommended for ease of installation and cleaning.
- An adequate volume of mixed grout must be on hand to keep the pump hopper at least half full. The grout shall be placed into the pump hopper in a manner that prevents air entrapment.
- Large volumes of water are required for cleaning, priming, and flushing pumps and equipment.
- A waste collection and disposal method for priming material, unused grout, and cleaning materials should be identified and available.

GROUT



1. Flush and clean the pumping equipment before use.
2. Pass the grout through a #4 screen prior to placement into the pump hopper.
3. Immediately prior to pumping, prime the pump and lines with a priming slurry. The priming slurry should be completely discharged with only grout flowing through the hose before grouting commences. Grout shall not be used until a uniform consistency is obtained at the discharge nozzle.



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C.3. Pumping Procedure (cont'd)

4. Begin pumping the grout at the most distant point (far end of the space to be grouted) so that it flows towards the source pushing air ahead of it. This allows the grout to be introduced and air to be vented from the same point. This technique is sometimes referred to as “reverse tremie”.



“LAY FLAT” HOSE IS OFTEN USED TO TRANSPORT GROUT TO THE FAR END OF THE FORMS UNDER EQUIPMENT. THE HOSE IS EASY TO INSTALL AND IS “PULLED BACK” AS THE GROUT IS PUMPED.



OTHER METHODS INCLUDE USING LONG PVC NOZZLES TO TRANSPORT THE GROUT.

5. As the grout is pumped in, back the nozzle out slowly so that it always remains submerged within the grout to prevent air entrapment.
6. Flush and clean the pumping equipment immediately after it is done being used. Serious damage to the equipment will result if the grout is allowed to begin setting or set up in the pump and hoses.

For further information, please contact your local Five Star® Technical Sales Representative.