

PUMP BASEPLATE INSTALLATION AND GROUTING

by

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Mr. Monroe graduated from Auburn University in 1966, with a B.S.M.E. degree, and has worked for the past 22 years in turbomachinery repair techniques, optical and mechanical alignment, vibration analysis and field balancing, non-destructive testing, mechanical seals, and corrosion. Prior to graduation, he worked as a designer of rocket engine components for NASA at Redstone Arsenal in Huntsville, Alabama, and as a draftsman for TCI (USS) Steel Works in Birmingham, Alabama.

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ABSTRACT

Methods used by the author to level and epoxy grout pump baseplates. The methods used are not the only way pumps can be installed, but if followed, will ensure a 100 percent void free grout job. Execution of the leveling and grouting uses known techniques, but with a new twist, and are designed to shorten the pump installation and alignment time by application of a "one pour" grout procedure.

The reasons for the use of epoxy grout in place of cheaper cementitious grout will be covered along with special baseplate preparations. Pump baseplate installation and grouting techniques covered are applicable to any turbomachinery baseplate, bed rail, or skid installation.

INTRODUCTION

"Why all the fuss over how a pump baseplate is installed and grouted?" The answer is to reduce maintenance costs. Experience has proven that pumps with poorly installed baseplates have more vibration and alignment problems which cause more frequent bearing, mechanical seal, and coupling failures.

Mechanical seals get the "bad rap" for pump failures, because they usually are the first indication of a problem. A mechanical seal failure is not the real problem, but the result of a pump problem. With this in mind, plans were put into action to start at the root of the problem and improve the pump baseplate installation. The plan included the observation of present installation practices, improvements to the installation methods, execution of the new installation methods, and evaluation of the results. The improved methods of baseplate installation described herein yielded a reduction of pump vibration from 0.3 to 0.4 inch per second (ips) to below 0.15 ips. Observations of pumps which had been installed with the new methods indicated much longer "mean time between failure" (MTBF) over existing pumps. The test program started in mid 1982 with the use of epoxy grout. As a result of the test program, epoxy grout is being used almost exclusively for pump baseplate grouting.

The "one time" cost to install epoxy grout was paid for by the reduction of the number of repeated pump failures which averaged \$5,000 to \$10,000 per repair. Cost of epoxy grout ran approximately \$75 to \$80 per cubic foot as compared to \$30 per cubic foot for cementitious grout. But remember, this was a "one time" cost compared to a repeated failure cost had epoxy grout not been used.

Epoxy grout bonds to a properly prepared baseplate, with a 2,000 psi tensile strength bond which transforms the baseplate into a monolith with the concrete foundation. This formation of a single block reduces the natural frequency of the pump baseplate, reducing pump shaft vibrations, and prevents moisture or oil from damaging the concrete under the baseplate. There is no bond when cementitious grout is used and there is a possibility of moisture or oil getting between the underside of the baseplate and foundation.

Pump baseplate installations are like marriage vows, "until death do us part." Once a baseplate has been grouted, maintenance personnel have to live with it until the unit is torn down. In most cases this would be for twenty or more years, so it behooves us to install the baseplate level and with mounting surfaces coplanar.

All the time and effort spent specifying the right pump, materials, mechanical seals, and baseplate can be ruined by poor installation practices. Generally, the least trained person, in terms of pumps, has free reign on how baseplates are set, leveled and grouted. It becomes an even bigger problem when epoxy grout is used, because installation techniques are different from the more commonly known cementitious grout. Over the past three years a four hour training class on epoxy grouting has been conducted for all personnel involved with pump installations. This included both company and contract personnel from the laborers to the engineers. The results have justified the expense and effort of training, because in all cases, inexperienced grouting personnel have correctly installed and grouted pump baseplates void free. It is now the practice for machinists or millwrights to place the grout and have complete responsibility for pump installations, alignments, and commissionings. This practice has fostered ownership and pride in a job well done.

BASEPLATE LEVELING PROCEDURE

It is necessary to discuss the baseplate leveling procedure first, in order to fully understand certain baseplate and foundation preparations. These preparations must be performed before the placement of the baseplate on the foundation.

The following assumptions are made concerning the pump foundation:

- The foundation has been adequately designed to support the pump. Foundation mass for centrifugal pumps should be at least three times the mass of the pump, driver and baseplate. Reciprocating pump foundation mass should be at least five times the pump system mass.
- The foundation should rest on solid or stabilized earth completely independent of other foundations, pads, walls, or operating platforms. A minimum of 3,000 psi steel reinforced concrete should be used.
- The foundation has been designed to avoid resonant vibration conditions originating from normal excitation forces at operating speed or multiples of the operating speed.
- The pump, gearbox (if used), and driver rest on a common foundation.
- The foundation is designed for uniform temperatures to reduce distortion and misalignment.

Do not take these assumptions for granted. Check the foundation at the design stage, not after it has been poured. There are some good computer programs available for foundation designs.

The preferred method of leveling a pump baseplate is illustrated in Figure 1. Jack screws located on both sides of each anchor bolt are used to elevate the baseplate to the level position while the anchor bolt lightly holds the baseplate firm. It may not be necessary to use both jack screws if the baseplate is flat, but both are required if trying to bend the baseplate machined surfaces flat. Notice that circular plates cut from 2.0 in to 2.5 in diameter steel bar stock, approximately 0.5 in thick, are used to prevent the points of the jack screws from digging into the concrete and altering the level. Use just enough tightening force on the jack screws and anchor bolts to hold the baseplate in position until the grout has been poured and cured.

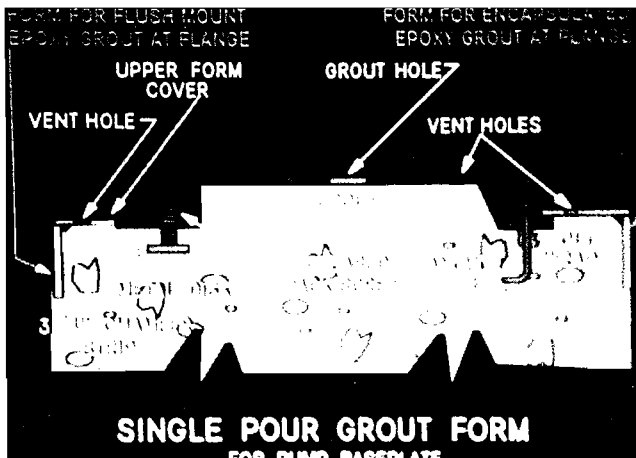


Figure 1. Jack Screws Located on Both Sides of Each Anchor Bolt Are Used to Level and Support the Baseplate Until the Grout Is Poured.

Prior to the baseplate placement on the foundation, the concrete must be chipped to remove the cement rich concrete (called laitance) and expose the aggregate. This provides a

stronger concrete/epoxy grout bond, because the strength of the concrete depends on the aggregate. The chipped surface must be blown clean with oil free air and kept dry. Moisture and oil are the big enemies of good epoxy grout/concrete bonding.

Field experience has indicated that 2.0 in to 3.0 in of epoxy grout are required under the pump baseplate flanges to reach the desired compressive strength. Thinner pours do not generate enough exothermic reaction heat to fully cure the epoxy. Before leveling, the baseplate should be high enough for the 2.0 in to 3.0 in grout thickness.

The use of jack screws for leveling is much faster than the more common method of using square steel plates and shims. Jack screws also eliminate the problem of removing the leveling shims after grout placement. The baseplate should be totally supported by the epoxy grout and not point supported at the leveling shims. Sharp cornered shims should not be left in epoxy grout, because they form stress concentrations and cause cracking. Once the epoxy grout has cured, the jack screws are removed and the holes are filled with epoxy or sealant. *The jack screws are greased prior to installation to allow for their removal.*

Baseplate leveling begins with the pump and driver removed, after checking the pump suction and discharge flanges for proper location and elevation. Piping should not be attached to the pump until the baseplate has been leveled, grouted and the driver/pump aligned. The use of a Starrett 98 Machinist's Level

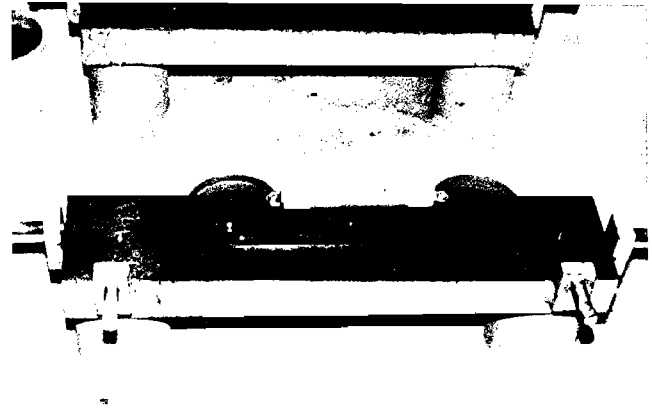


Figure 2. A Starrett 98 Machinist Level Placed on the Driver Mounting Surface Was Used to Level in the Axial Direction.

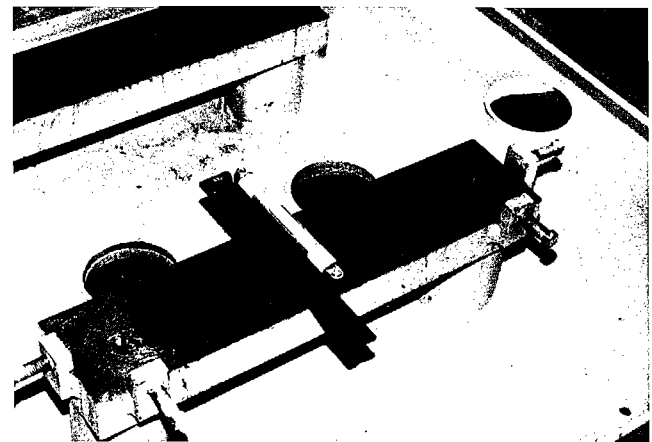


Figure 3. After Leveling Axially, Rotate the Machinist Level 90 Degrees and Adjust the Level.

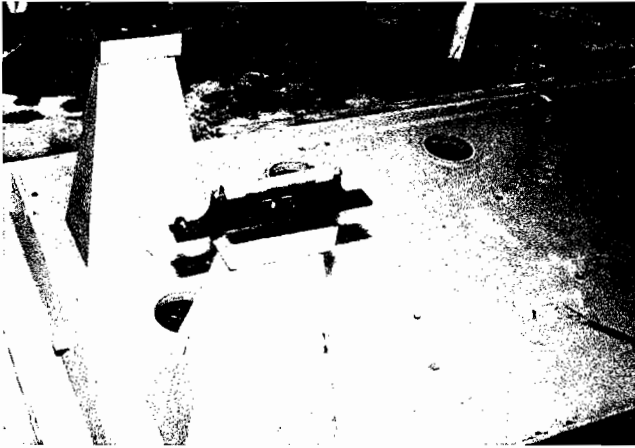


Figure 4. The Pump Mounting Surfaces are Leveled Using the Same Procedure as the Driver Mounting Surfaces.

mounted on the machined surfaces for the driver is illustrated in Figures 2 and 3. The jack screws and anchor bolts are adjusted until a level of 0.0005 in/ft is obtained in two directions 90 degrees apart. The machined surfaces for the pump receive the same treatment (Figure 4) with a maximum elevation variation across the length of the baseplate of 0.010 in. A precision straight edge should be used across the mounting surfaces to check for

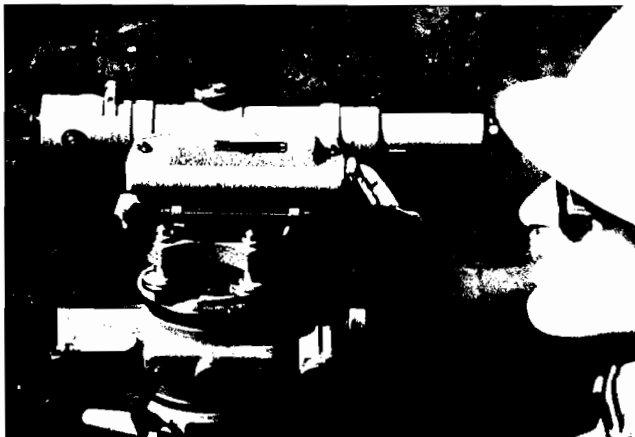


Figure 5. A K&E Model 71-3015 Optical Level Being Set Up and Adjusted Prior to Leveling a Baseplate.



Figure 6. In Hot Weather, Shade the Baseplate for 24 Hours before and 48 Hours after Pouring the Grout.

coplanarity. The mounting surfaces should be coplanar within 0.002 in.

If the baseplate is long (over 15 ft), an optical level similar to the K&E Model 71-3015 might be used to speed up the leveling operation (Figure 5).

Once the baseplate is leveled, grouting operations can begin. If grouting is to be done during hot weather (above 90°F), it should be started early in the morning while the baseplate is level. Check level after the baseplate temperature has stabilized overnight, and shield the baseplate from direct sunlight (Figure 6).

BASEPLATE PREPARATION

Now that the baseplate leveling procedure has been discussed, listed below are some baseplate requirements that should be included in the pump specifications/purchase order:

- All welding on the baseplate shall be completed and stress relieved prior to machining pump and driver mounting surfaces.
- All machined mounting surfaces shall be coplanar to 0.002 in. All baseplate welds shall be continuous (no skip welding) and free of cracks.
- Underside of baseplate shall be sandblasted to white metal and coated with 0.003 in wet thickness of epoxy coating as specified by purchaser.
- All cross bracing on underside of baseplate shall have 2.0 in × 6.0 in minimum opening to allow for grout flow.
- Drill 0.5 in diameter vent holes on 24.0 in centers around periphery of baseplate at the highest point.
- Radius all sharp corners of baseplate flanges. Minimum 1.0 in radius.
- Provide 1/8 in minimum shim adjustment under driver feet for alignment.
- Provide eight alignment positioning screws for driver.
- Machined mounting surfaces shall extend 0.1 in beyond pump and driver feet on all sides.
- Drill and lap two holes on the baseplate flanges, one on each side of the anchor bolt holes, for one-half inch diameter jack/leveling screws.

If the mounting surfaces are machined to 0.002 in coplanar after the welding has been completed, the same tolerance can be repeated in the field. This helps to eliminate “soft feet” and to speed up alignment. The common practice of machining steel plate mounting surfaces and welding them to the baseplate causes skewed surfaces that cannot be leveled in the field.

A void free grout job is ensured by providing vent holes at the baseplate periphery and in each compartment. Some pump purchasers never look under the baseplate to see how cross bracing makes a good grout job impossible. On occasions, the author has torched openings through braces, to provide a path for grout.

The request for a 1.0 in wider mounting surface on each side of the equipment feet can be a life saver, if baseplate leveling is required with pump and driver mounted. The additional cost of a few more inches of steel plate is peanuts, compared to the flexibility of baseplate leveling with mounted equipment in emergency conditions. A machinist’s level can be placed on the additional margin around the pump and driver, allowing the baseplate to be leveled. This is not the preferred method of leveling, but it will work.

NEW CONCRETE PREPARATION

Freshly poured concrete must be allowed to cure before epoxy grout is applied. As mentioned earlier, moisture will ruin the epoxy grout/concrete bond, even the small amount of mois-

ture from green concrete. It is a good practice to run an ASTM-157-80 concrete shrinkage test to determine when the shrinkage drops to a minimum. This will indicate the end of the chemical reaction of the cement and water, which causes the concrete to cure. If no shrinkage test is run, the following rules of thumb for cure time should be used:

- Standard concrete (five bag mix)—28 days.
- Hi-Early concrete (six to seven bag mix)—seven days.

An additional test for moisture can be made by taping a one foot square piece of plastic garbage bag over the new concrete and allowing it to set overnight. If there is moisture on the underside of the plastic bag the next day, the concrete is not ready for the placement of epoxy grout. Repeat the test until there is no moisture.

During the placement of concrete for the pump foundation, samples of the concrete should be taken to make slump and compressive strength tests. During a routine compressive strength test for a 600 hp pump, a 3,000 psi concrete mix, which had passed the slump test, cracked at 1,400 psi. The foundation was chipped out and the job started over at the expense of the concrete supplier. The concrete mix had been in the truck too long and additional water was added to pass the Slump Test. This retempering of the concrete made it much weaker.

Surface preparation of the new concrete can begin two to three days after the pour, if a sandblasting method is used to remove the laitance and expose the aggregate. The most common method is to wait for the concrete to cure and then chip the laitance with light duty pneumatic hammers. Do not use jack hammers and sharp pointed chisels for chipping. Chamfer all the foundation edges at least 2.0 in to 4.0 in at a 45 degrees angle in order to remove stress concentration. Remove all dust, dirt, chips, oil, water, and any other contaminations, and cover the foundation.

It is a good practice to coat the clean, dry, chipped concrete with a coating of epoxy. This protective coating is a layer of unfilled (without aggregate) epoxy grout, applied with a brush. Once the coating has cured, the concrete is sealed from moisture and oil. If there is a delay in grouting, the surface can be easily cleaned with a spray of degreaser from an air gun (Figure 7).



Figure 7. A Last Minute Cleaning of the Concrete Prior to Grouting Can be Accomplished by Spraying Trichloroethane from an Air Gun.

OLD CONCRETE PREPARATION

Old concrete has already cured, so it does not present the problem of determining moisture content as with new concrete.



Figure 8. A Diamond Tipped Cutter Was Used to Trepan a Sample from Old Concrete for a Compressive Strength Test.

A visual check for foundation cracks must be made after chipping the surface to expose of aggregate. All oil soaked concrete must be chipped away and all cracks repaired. The edges of the old foundation are chamfered as with the new concrete for 2.0 in to 4.0 in at a 45 degrees angle. It is a good practice to trepan a test core of the old concrete and run a compressive strength test (Figure 8). If the compressive strength is under 3,000 psi, the foundation should be replaced. Coat the concrete surface with a protective coating of unfilled epoxy grout.

ANCHOR BOLTS

Anchor bolts should have 10 to 15 times the bolt diameter of free bolt length for proper stretch to develop the design holding force. If epoxy grout is allowed to grip the anchor bolt, the bolt will break at the grout surface even when tightened to the design torque. This requirement must be met at the foundation design stage and might require the use of bolt sleeves in the concrete. If sleeves are used, they must be filled with non-binding materials such as sand, flexible foam, or wax to prevent the epoxy grout from bonding to the anchor bolt. The exposed length of anchor bolt from the top of the concrete to the bottom of the baseplate could be wrapped with one layer of weather stripping and one layer of duct tape. The method most used by the author is a 1/4 in thick layer of John Mansville Duxseal, applied around the anchor bolt and sealed to the concrete and baseplate (Figure 9).

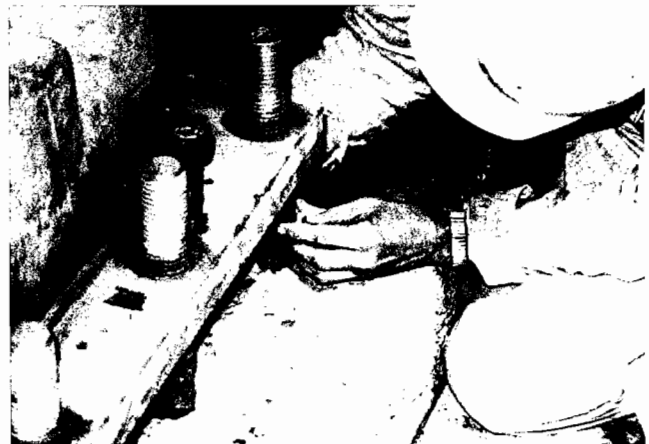


Figure 9. The Anchor Bolts Were Coated with Duxseal to Prevent the Bonding of Epoxy Grout to the Bolt Free Length.

GROUT FORMS

Forms to contain epoxy grout must be of a heavy duty design because epoxy grout is approximately 2.5 times as heavy as concrete. Forming material should be a minimum of 3/4 in thick plywood with 2.0 × 4.0 bracing. *If in doubt make it stout.* All surfaces coming in contact with the epoxy grout must receive three coats of Johnsons' paste wax to prevent bonding to the wood. Allow time for the wax to penetrate into the wood and dry before applying the next coat (Figure 10).

Forms are to have 1.0 in-45 degree chamfer strips at all vertical corners and at the horizontal surface of the grout. A liquid tight form is made by using RTV sealant at all joints and at the mating surfaces of the foundation (Figure 11).



Figure 10. Three Coats of Paste Wax Must Be Applied to All Grout Form Surfaces Coming in Contact with Epoxy Grout.



Figure 11. Two Beads of RTV Sealant Were Applied to the Sides of the Foundation to Form a Liquid Tight Seal with the Grout Forms.

Up until this point, all the requirements for the grout forms have been those used for many years. Most API designed baseplates required two grout pours, one to fill the void between the concrete and the baseplate flanges, the second to fill the void between the baseplate flange to the top of the baseplate. If the free surfaces of the grout at the baseplate flanges are confined, the 6.0 in to 7.0 in higher grout level at the top of the baseplate can be filled in one pour. A wooden top form shown in Figure 12, is attached to the sides of the grout forms and the top of the baseplate flanges. Vent holes (1/2 in diameter) are drilled in the

top forms on 24 in centers to allow air to escape as the grout flows from the center of the baseplate to the edges. When the grout begins to run out of the vent holes, duct tape is used to cover the holes and the filling operation continues (Figure 13). The use of this method allows a one pour grout job which should be completed in 45 minutes and forms removed 24 hours later. If the temperature at the time of the pour is above 80°F, the pump and driver can be mounted when the forms are removed. A two pour grout job doubles the labor cost for grouting and lengthens the completion time of the installation.

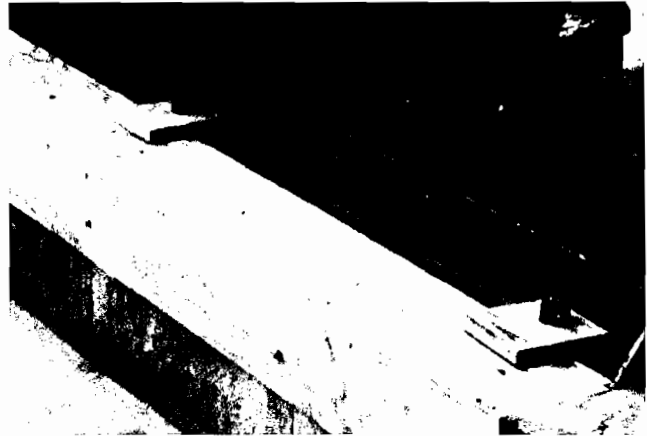


Figure 12. The Free Surface of the Grout Is Covered by a Top Form to Enable the Baseplate to Be Filled in One Pour. Notice the Air Vent Holes.



Figure 13. Duct Tape Was Used to Stop Flow of Grout Out Vent Holes as Baseplate Grouting Continued.

EPOXY GROUT PLACEMENT

The pump baseplate is ready for grouting after the following last minute checks are made.

- Baseplate under surfaces are free of oil, scale, dirt or moisture and sealed with a coating of unfilled epoxy grout.
- Concrete surface is clean, free of oil, dirt and moisture. It is sealed with a coating of unfilled epoxy grout.
- Anchor bolt sleeves are filled with non-bonding material.
- Exposed surfaces for anchor bolts are covered with Duxseal.
- Jack screws are lubricated for easy removal.
- Circular steel plates are under each jack screw point.

- Vent holes are in correct locations and unobstructed.
- Forms are at proper height and properly braced.
- Forms in contact with grout are properly waxed.
- Grouting materials are in unopened containers, dry and stored at 70°F to 80°F for 24 hours prior to placement.
- Sufficient quantities of grout materials are on hand at site to complete work. (Add 25 percent to calculated grout requirement.)

Epoxy grouts have a narrow temperature range for mixing and placement. This range is from 50°F to 90°F for best pot life, flow ability and curing. Can epoxy grout be poured at temperatures below or above these limits? The answer is yes, but special procedures must be followed and the grout manufacturer should be consulted. Low temperature accelerators can be added for cold weather pours with the foundation and baseplate covered and heated. In the Gulf Coast area, the problem is with temperatures above 95°F. The author has occasionally stored epoxy grout and aggregate in air conditioned offices for 48 hours to increase the pot life on hot days. In hot weather, construct temporary shelters over the baseplate to provide shade 24 hours before and 48 hours after the grout placement.

It is a good practice to rope off a work area in congested construction sites to set up the grouting operation. Move all of the grouting material and tools inside the roped off area just before the job starts. *Do not have epoxy grout stored out in the hot sun for days before the grout pour.* Keep all personnel who are not part of the grout team out of the area. Have all the grout team take their smoke, water or pitstop break before the epoxy grout mixing begins. Once started, there is no stopping until the job is complete and the tools cleaned. If executed properly, the time laps from mixing to cleaning is 45 minutes.

With temperature conditioned grout at the pump site and all the check list items completed, it is time to mix grout. There are two ways to mix the grout:

- In a wheelbarrow with a mortar mixing hoe.
- In a motorized concrete or mortar mixer.

Both methods work well, but for a large grout job (10 units or more) the motorized mixer should be used. If the hand mixing method is used, have two wheelbarrows and stagger their mixing sequence to provide a continuous supply of grout to the men making the pour. The author prefers the hand mixing method because of better control of the mixing and less tendency to over mix. When using a motorized mixer, limit the mixer blade speed to a maximum of 15 rpm. A mortar hoe used to mix grout is

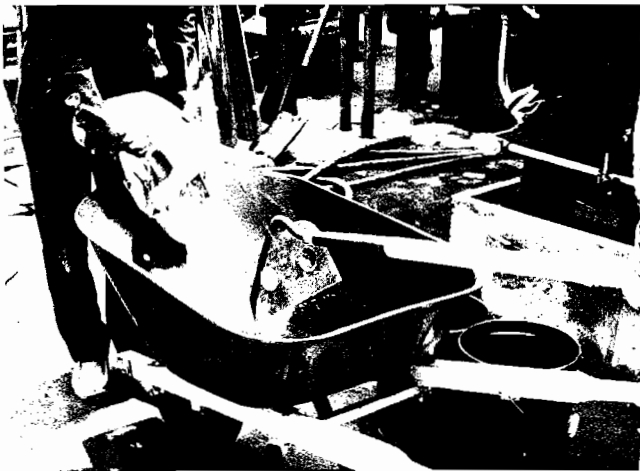


Figure 14. Aggregate Was Slowly Added to the Epoxy and Mixed with a Mortar Hoe.

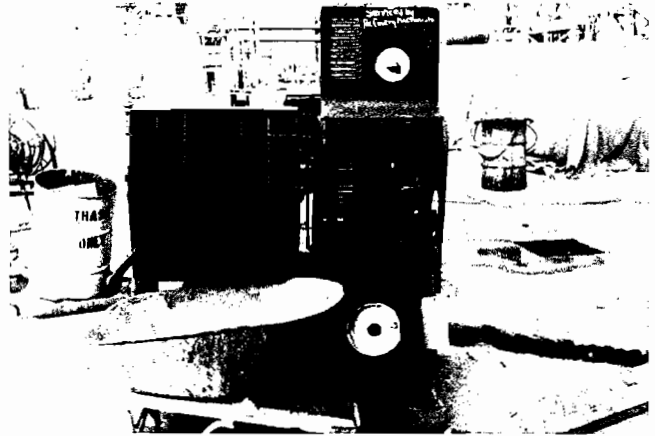


Figure 15. A Motorized Mortar Mixer Can Be Used but Maximum Mixer Blade Speed Should Be 15 RPM.

shown in Figure 14, while a typical motorized mortar mixer is shown in Figure 15.

Most grout manufacturers furnish epoxy resin containers large enough to hold both the "A" part (resin) and the "B" part (hardener), so use this container for mixing. Add the hardener to the resin and mix by hand with a paddle for three to five minutes (Figure 16). Mix slowly to prevent air entrainment, because this causes the grout to foam and have air bubbles. A "jiffy mixer" can be used with a variable speed drill, because it is designed to mix without entraining air. A stop watch should be used to time the epoxy resin mixing and to record the total time required for grout placement. If the grout container is not large enough to hold the total epoxy mixture, use a clean five-gallon can. Be sure to remove all of the hardener from its storage can and place it in the epoxy resin. *No partial units of epoxy resin and hardner are to be used.*



Figure 16. The Epoxy Resin and Hardener Being Mixed by Hand for Three to Five Minutes in the Resin Container.

When the epoxy has been mixed, place it into a wheelbarrow or motorized mixer and remove all the epoxy from the can. Use a putty knife to remove the last drop. Slowly pour the aggregate into the epoxy to allow the air trapped in the aggregate to escape. Approximately one gallon of air is entrained in each bag of aggregate, which causes air bubbles in the cured grout. Fold the aggregate into the epoxy until the aggregate is completely wet. Add all the bags of aggregate and mix until completely wet. Use the containers that the epoxy resin was mixed in for the place-



Figure 17. The Resin Containers Are Used to Place Grout in the Center Baseplate Grout Holes.

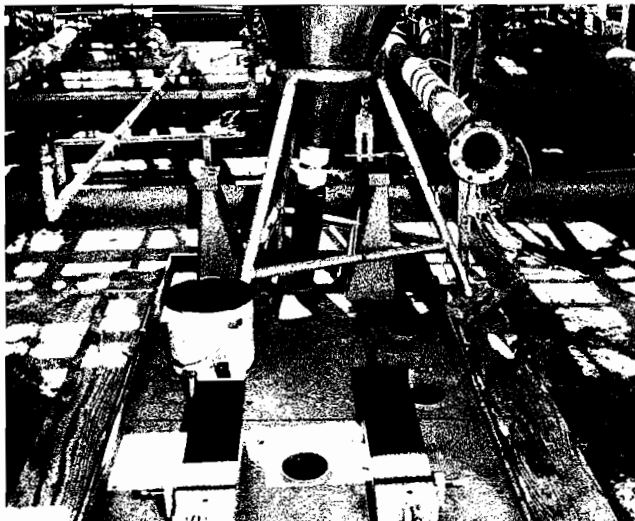


Figure 18. An Elevated Funnel Was Used on this Grout Job to Provide the Head Necessary to Push Grout Out the Baseplate Vent Holes.



Figure 19. Notice the Air and Grout Flowing from the Baseplate Vent Holes. A Vent Hole Was Drilled on Each Side of the Braces.

ment of grout. Slowly pour the grout into the baseplate grout holes to allow air to escape. Pour from the center of the baseplate and allow the grout to flow to the outside edges, displacing the air through the vent holes. (Figure 17). *Do not use vibrators or rodding to place epoxy grout.* Continue to fill the baseplate until the grout runs out the vent holes on the wooden top form at the baseplate flanges (Figure 13). Cover the vent holes with duct tape and continue to fill the baseplate until grout escapes from the vent holes at the top of the baseplate. A large funnel located two or three feet above the baseplate can be used to provide the force necessary to push the grout out of the vent holes as shown in Figures 18 and 19. Another method used to compress the grout is a homemade positive displacement pump made by Malcolm Murray. The grout pump cylinder in Figure 20 is being used as a funnel to fill the baseplate. The placement is shown in Figure 22 of the grout pump piston in the cylinder to force the grout out the vent holes. All the air being displaced under the baseplate by grout is shown in Figure 22.

Random grout samples should be taken during the grout pour and placed in waxed 4.0 in wooden cubes for compression strength testing at 24 hours, three-day and seven-day intervals. Record the time, date, ambient temperature and location of the grout pour on the samples. This is good information to put in the pump maintenance history file for future reference.



Figure 20. The Cylinder of a Grout Pump Was Used as a Funnel to Fill the Baseplate.



Figure 21. Once the Cylinder Was Filled, the Piston of the Grout Pump Was Installed and Pushed Down.

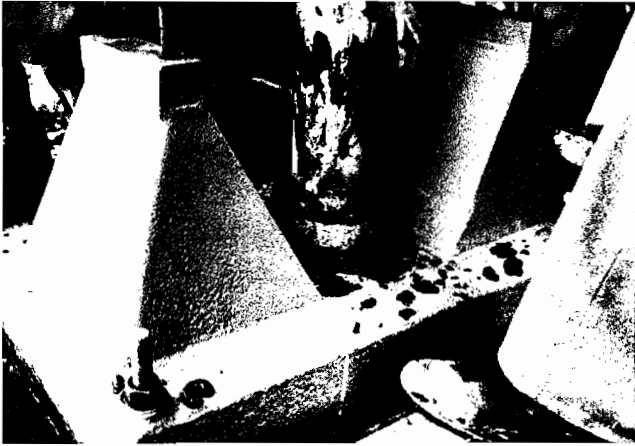


Figure 22. Notice the "Grout Worms" Pressured Out of the Vent Holes Around the Anchor Bolts by the Grout Pump.

Immediately after the completion of the grout pour, clean all tools and mixing equipment. Water can be used to remove the wet grout in (Figure 23) by the use of a fire water monitor. After grouting, clean up operations are made easier, if the machined surfaces of the baseplate are greased or covered with plastic, and sand is sprinkled on the slab in the path from the mixer. There will be grout spills in the process of grouting, and they are easy to shovel up when mixed with sand (Figure 24).

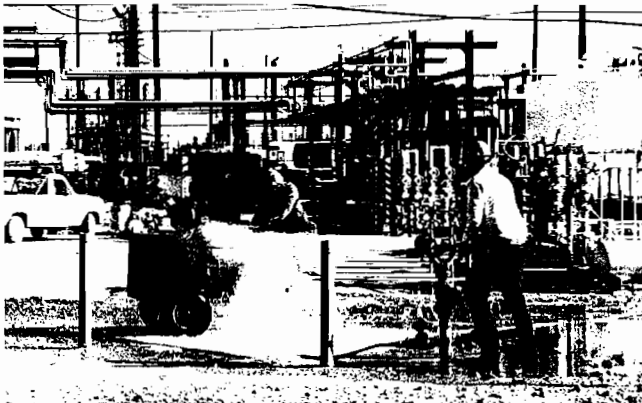


Figure 23. Motorized Mixers and Tools Can Be Cleaned of Epoxy Grout with Water if Done Immediately after Grout Placement.



Figure 24. A Sand Path from the Mixer to the Pump Makes Clean Up Much Easier.

As the epoxy grout begins to harden, form a dome of grout over the baseplate grout holes to prevent a low spot that might hold water (Figure 25). The grout extrusions at the baseplate vent holes can be removed at this time or broken off flush with the baseplate when they have cured. Wait 24 hours before removing the grout forms and three days before removing the jack screws. Clean the thread lubricant from the jack screw holes with a degreaser and fill the holes with epoxy, RTV, or liquid rubber to seal out moisture and oil. A small but important point that has not been covered is the greasing and insertion of the coupling guard bolts into the baseplate. Epoxy grout will use those tapped holes as air vent holes if not plugged. It is very hard to drill and tap the holes after being filled with grout.

After the jack screws have been removed, torque all the anchor bolts to their designed load. This should be the first and last time the anchor bolts are tightened. Check the grout job for voids by ringing the baseplate with a hammer (Figure 26). A good grout job will sound like hitting a lead plate and voids will ring like a bell. If you have followed this procedure to the letter, you will have no voids in the grout, but there is a repair procedure for filling voids in old baseplates.

BASEPLATE GROUT VOID REPAIR

Ring the baseplate with a hammer as mentioned above and draw the outline of the void on the baseplate with a magic mark-



Figure 25. When the Epoxy Grout Begins to Stiffen, Mold a Dome over the Grout Hole to Prevent Forming a Pool for Water.



Figure 26. A Hammer Was Used to Test This Baseplate Grout Job for Voids.

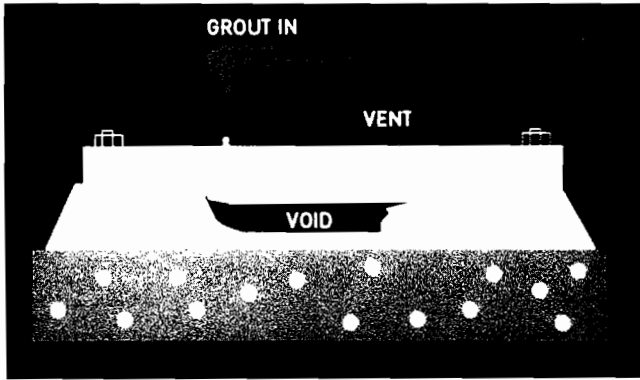


Figure 27. Voids in a Poor Grout Job Can Be Filled by Pumping Unfilled Epoxy Grout Through a Hole in the Baseplate. Notice Vent Hole at Opposite Side of the Void.



Figure 28. This Machinist Used a Clean Grease Gun to Fill a Void under the Baseplate with Unfilled Epoxy Grout.

er. After the void has been defined, drill two holes into the void on opposite sides. Tap one hole and insert a grease fitting. The other hole should be used as a vent to prevent the lifting of the baseplate as unfilled epoxy grout is pumped into the void with a grease gun (Figures 27 and 28). Pump the epoxy grout into the void until the void is filled and grout runs out the vent hole. Remove the grease fitting, allow the grout to cure, and grind both holes smooth. This procedure should be considered a patch job and in no way a permanent fix.

CONCLUSIONS

At this point, the baseplate installation and grouting is complete and the pump and driver are ready to be installed and mechanically aligned. The method of using jack screws for leveling baseplates and the reasons for using epoxy grout have been presented. Some of the subtleties for baseplate, foundation and grout form preparations have been covered and the procedure for the mixing/placement of epoxy grout presented. A procedure for a "one pour" grout placement of pump baseplates has been outlined, so the next step is the application of this procedure. A void free grout job is obtainable, but attention to details is required.