



BASE INSTALLATION AND ALIGNMENT PROCEDURE

ICS WEAR GROUP
OPERATIONS TEAM

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NOTE: Pump, gear reducers, motors and all other major drive components are NOT shipped pre- aligned on the base!
Successful setting of equipment to achieve proper coupling alignment is achieved solely by the diligence of onsite mechanics and millwright personnel.

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Introduction

This procedure generally outlines how bases supplied by ICS Wear Group can be installed and the equipment mounted on them aligned. Other methods of base installation and equipment alignment can be successful as well.

Steps may need to be taken in addition to those outlined in this procedure to prepare the equipment for operation.

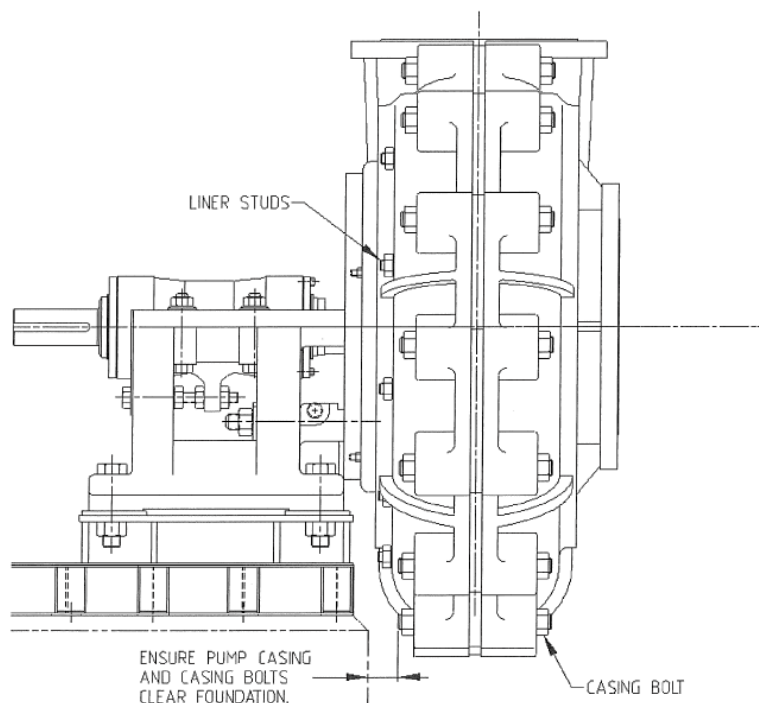
Ultimately it is the responsibility of the equipment installation contractor to properly install, align and prepare equipment to operate properly and meet contractual requirements.

Foundation

Foundations should be heavy and adequate for the supported equipment. Size and makeup of the pump and drive train foundation is the responsibility of the contract Civil Engineer. Design considerations should include upset conditions as well as normal operation.

Attention should be given to ensure clearance between the pump casing and the front of the foundation (see Figure 1). In some cases, it may be necessary to reduce the concrete border at the front of the foundation to allow access to the liner studs and casing bolts.

Figure 1: Foundation Clearance Requirements



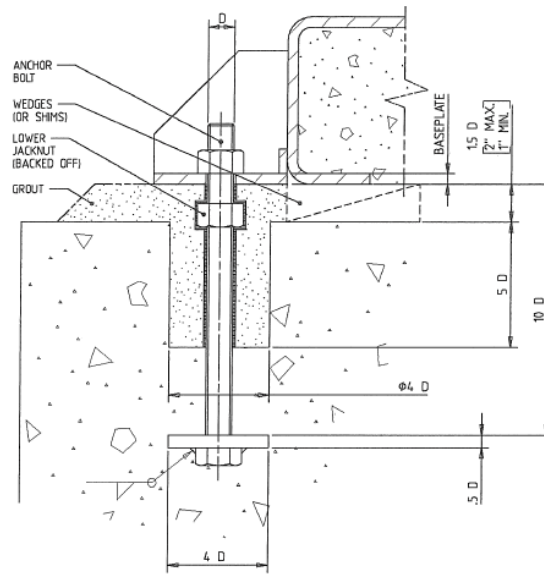


Figure 2: Foundation Bolt Installation

Foundations are usually formed in a High Compressive Strength concrete with suitable anchor bolts generally arranged as shown on Figure 2.

Foundation bolt dimensions given above are typical. Exact embedment and bolt dimensional requirements are job specific and are to be determined by the project Civil Engineer.

Following a suitable foundation curing period, all anchor bolts should be cleaned and aligned to enable fitting of the base.

Prior to grouting it is common for the grout manufacturer to require roughening of the foundation surface. Consult grout manufacturer's installation instructions for their specific requirements. Prior to setting base the entire Anchor Bolt beneath the base and down to the foundation should be wrapped with a suitable protectant to prevent grout from adhering to the threads.

Base Leveling

Install a lower jack nut on each of the foundation bolts (see figure 2) to a level such that when the base is set on them it is not twisted. Using the lower jack nuts, adjust the base height to accurately align the pump suction with the suction pipe, taking into account any pipe centerline offsets.

Once correct vertical height has been reached, shims or wedges (supplied by others) must be placed under the baseplate to maintain desired elevation (see figure 3). Shims and wedges to be removed after the grout cures should be protected with a suitable barrier to allow removal.

Loosen lower jack nut as shown in figure 2 allowing base to sit on shims or wedges. The lower jack nut is to be loosened enough that it will not contact the underside of the base when the anchor bolt is fully tightened later in the procedure.

Tighten the upper anchor bolt nut just slightly to reduce the chance the baseplate will shift during grouting. Take care not to tighten excessively as base twisting could occur. Final tightening of the upper anchor bolt nut will be done after the grout cures.

The anchor bolt and lower jack nut should be suitably wrapped to prevent grout from adhering to them. The protective coating above the lower jack nut should be thick enough that the nut does not contact the grout when the anchor bolt is stretched by final tensioning.

The machined pads of the base should be used as the leveling datum. A common level criterion is 0.1 mm (0.004 inches) of out of level per 500 mm (19.6 inches) for baseplates under seven feet long. On long baseplates this requirement may result in excessive out of level condition. Suggest a level criteria of 0.0127 mm (.0005 inches) per linear foot. The base level criteria should be agreed upon between the end user, the installation contractor and the drive component supplier prior to installation of the base.

Some bases are supplied with jack screws in each of their mounting feet (see figure 3). A steel jack screw support plate (supplied by others) can be placed under the jacking screw to prevent it from settling into the concrete during the leveling procedure. These jack screws may need to be used in conjunction with shims (see figure 3) in the case of heavy assemblies.

Prior to final grouting, wrap the portion of the jack screw that will be exposed to grout with protective tape or other suitable protectant to prevent grout from adhering to the threads. This will allow removal of the jack screw after the grout has set. The jack screw support plate will have to be protected as well if it is to be removed after grouting.

The exact procedure to use the lower jack nut, shims, wedges, jacking screws and jack screw support plate is up to the installation contractor.

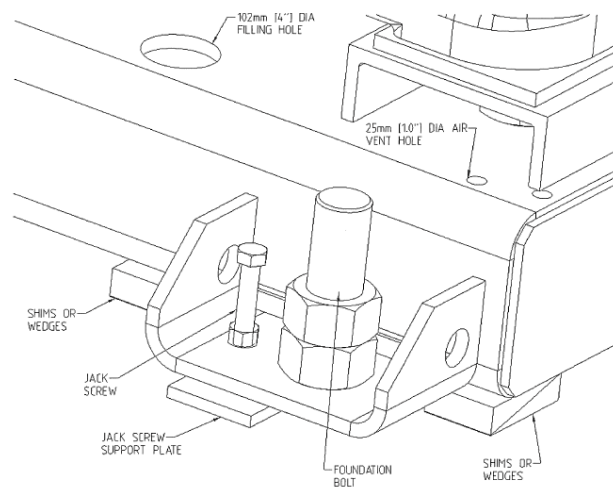


Figure 3: Base Leveling

NOTE: Pump, gear reducers, motors and all other major drive components are NOT pre-aligned at the factory! Successful setting of equipment to achieve proper coupling alignment is achieved solely by the diligence of onsite mechanics and millwright personnel.

In the instance of very heavy pump and drive components, it may be preferable to install the base without the pump, gearbox and motor mounted. As the weight on the base is reduced, it can be jacked up and supported more easily and the chance of it deflecting is reduced. It is ultimately the decision of the installation contractor.

This procedure assumes the drive train components will be installed on the base to establish vertical alignment and piping alignment. In some cases, the drive components may need to be removed to allow access to grout holes.

NOTE: Prior to final grouting, check to ensure all drive train shafts can be properly positioned axially, and in the horizontal and vertical planes, to achieve successful coupling alignment.

Various Base Styles

There are a number of different base plate styles available. They include 3 elements, where the pump, gear drive and motor are mounted on a common base, 2 element and single element. Base construction can vary as well including those made from I-beams, by bending plate, or as a flat plate commonly called a soleplate. These instructions generally apply in all cases. Some modifications may need to be made to accommodate each style.

Preliminary Vertical Alignment

Prior to final grouting check the vertical alignment of the drive train components. Gear reducers and motors are normally supplied without shims installed. Without shims the gear reducer shaft should be lower than the pump shaft to provide a shim allowance. The motor shaft should be even with the gear reducer shaft as the shim allowance is normally the same for both components. See arrangement drawing for the shim allowance designed into the baseplate. It is common for the final shim pack thickness to differ from the design shim allowance.

Full foot shims are normally recommended. This is not always possible if the equipment foot is continuous. Check arrangement drawing for shim source of supply. Shims are not supplied with equipment unless specified. Install shims under the reducer and motor to bring shaft heights to within acceptable preliminary alignment criteria.

Horizontal Alignment

Prior to final grouting check the horizontal alignment of each of the couplings. To begin a multi-element train alignment, the pump is the starting point and must be squared to the base. This means the pump base holes centered on the base plate holes.

In some cases, it may be beneficial to use alignment pins in two of the hold down bolt holes of the pump base (see Figure 4) and one in each casing foot (if the pump being installed has casing feet) to assist in initial pump positioning.

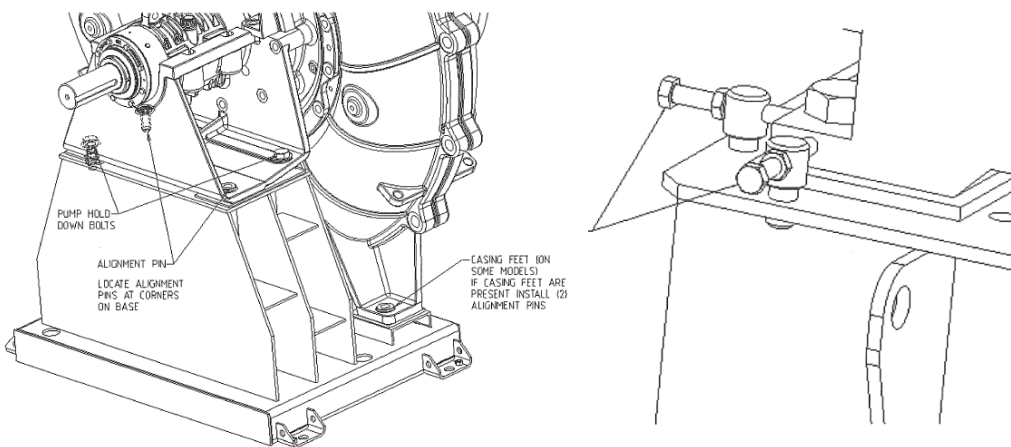


Figure 4: Jacking Bolts

Alignment pins are not normally supplied as they are not considered a standard maintenance tool. Starting at the low speed coupling, use the horizontal jacking bolts on the gear reducer, if provided (see Figure 4), to bring the coupling into parallel and angular alignment. Proceed to the high-speed coupling using the motor horizontal jacking bolts.

Check gear reducer and motor hold down holes to ensure all hold down bolts can be installed through both the feet of the equipment and the base holes. If hold down bolts cannot be installed it may be necessary to move the pump. Even if the drive train has been shipped to site as an assembly it may still be necessary to move the pump.

Due to the inherent flexibility of the base plate assembly, drive train components are not doweled in place when factory installed. If there are no other alternatives than to move the pump, the amount of adjustment is most commonly determined on a trial and error basis, moving the pump incremental amounts and checking for motor bolt clearance.

Several iterations of equipment positioning may be necessary to achieve coupling alignment and installation of all hold down bolts. Movement of the pump may affect alignment of the suction and discharge piping and may induce loads on the pump casing causing binding of the pump.

Repositioning of the base plate may be required to allow for proper alignment of equipment and minimization of applied piping loads.

WARNING: Never exceed the maximum allowable pump nozzle loadings. Personal injury or equipment damage may result.

Coupling Spacing

Prior to final grouting, check for proper axial spacing of the couplings and shafts. Design spacing is included on the arrangement drawing. In some cases the couplings are installed overhung on the shaft due to the usable shaft length being less than the coupling length.

If the motor requires a Limited End Float coupling, move the motor rotor to magnetic center prior to measuring coupling spacing. See manufacturer's installation and operation manual for recommended procedure to move the motor rotor without damaging the bearings. It may be necessary to move the gear reducer or motor to achieve the correct axial spacing.

Piping Alignment

Prior to final grouting, check that the pump flanges line up with the suction and discharge piping. Excessive piping misalignment can cause high pump nozzle loads, corresponding high foundation loads, pump casing deflection and shaft displacement. This can result in the impeller rubbing, sealing problems with both mechanical seals or packing, operational problems and coupling misalignment

WARNING: Never exceed the maximum allowable pump nozzle loadings. Personal injury or equipment damage may result.

Shaft Rotation

Check that shafts turn freely on all equipment. An arrow is cast into the pump casing that indicates correct impeller rotation. If free impeller rotation cannot be achieved, consult the pump assembly manual for proper impeller adjustment procedure.

Final Grout

Install grout following the installation recommendations of the grout manufacturer. Grouting should be done shortly after base leveling as bases can creep or sag over time if supported only by jacking bolts.

Flow grout of the correct consistency between the base and the foundation around the full extremity of the base as shown in Figure 2. When absolute minimum vibration is required the entire base cavity will require filling. If fill and vent holes (see Figure 7) have not been provided consult factory for the proper location of these holes. Fill the entire base plate cavity once the perimeter grout has sealed the base plate perimeter.

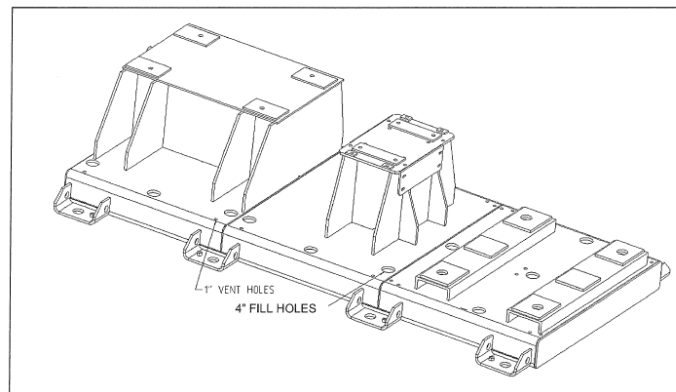


Figure 5: Three Base Plate

Tighten Foundation Bolts

After the grout is adequately cured, the support wedges or shims may be removed. Voids left by their removal may be filled. Back off or remove completely the base Jack Screw (see Figure 3) and Jack Screw Support Plate.

Tighten foundation bolts to the torque recommended by the foundation designer. Foundation bolt torque should be rechecked after a suitable period of operation.

Final Alignment Check

Hold Down Bolt Tightening

Once final position of the drive train elements has been arrived at and coupling alignment requirements have been met, all hold down bolts should be torqued to the equipment manufacturer's recommendation.

For the pump hold down bolt torque use the table in Appendix A of this bulletin. It is important to establish the grade or property class of the fastener as well as the type of lubricant used before tensioning fasteners to the torques listed.

The magnitude of the torque applied to each hold down fastener should be documented. This will allow verification all bolts have been tightened prior to start up.

Thermal Rise

Thermal shaft rise of each of the drive train components is not normally supplied as a part of the document submittal package. This data can be supplied upon request. Care should be taken if the coupling alignment is corrected for thermal rise to ensure the offset is made in the correct direction. Initial coupling misalignment to account for thermal rise should not exceed the motor/gearbox/coupling manufacturer's maximum allowable for initial misalignment.

Piping Installation

Install suction and discharge piping. Tighten control rods across expansion joints in accordance with the piping designer's requirements. Failure to do this properly may expose the pump to excessive Nozzle Loading.

The bolt torque required to properly attach and seal the suction and discharge pipe work to the pump should be agreed upon between the piping engineer/manufacturer and the pump manufacturer. This agreement should include required washers and nut retention means.

When attaching nonmetallic flanges to the pump, much lower torques are commonly required than would be considered normal for a given fastener size. Applying an incorrect torque to the suction or discharge flange bolts can result in leaks or damage to the bolts, pump and/or pipe flange.

WARNING: Never exceed the maximum allowable pump nozzle loadings. Personal injury or equipment damage may result.

After pipe installation recheck the low speed coupling alignment. Check that the pump rotates freely. If the pump does not rotate freely or if the coupling alignment has changed evaluate the piping alignment to determine if the piping support can reduce the flange force on the pump.

Check Motor Rotation

Once all components rotate freely with the piping installed and couplings are aligned and spaced in accordance with the coupling manufacturer's recommendation, the motor rotation should be checked. This can be done by very briefly starting or 'bumping' the motor.

Check the motor manufacturer's start up instructions to establish the proper procedure for bumping motor. If the motor has Limited End Float requirements special considerations may be necessary. Install all required lubricants and follow the manufacturer's start up instructions prior to bumping the motor. An arrow is cast into the pump casing that indicates correct impeller rotation. When determining the correct motor rotational direction take into account any change in direction that occurs through the gear box.

WARNING: If the pump is started backwards personal injury and equipment damage can result.

Assemble Couplings

Once proper motor rotation has been established, assemble and lubricate the couplings following the coupling manufacturer's recommendations.

Check Gear Reducer Manual for Start up Instructions

Check gear manufacturers Installation and Operation Manual for startup instructions such as lubrication requirements, cooling system considerations and breather installation.

Check Motor Manufacturer's Manual for Start up Instructions

Check motor manufacturers Installation and Operation Manual for startup instructions such as lubrication and alignment requirements.

Record Final Coupling Alignment

Recheck final alignment to ensure it complies with each of the equipment manufacturers specifications. The allowable misalignment that applies to each coupling is the tightest specification of the coupled elements. If a conflict exists, it should be brought to the attention of the equipment supplier prior to completing alignment.

Record final alignment dimensions for future reference. This is also the final check to ensure the drive train rotates freely.

Install Coupling Guards

Once all applicable guards have been properly installed the base plate installation is complete.