

Service Instructions 2300, 2800, 4600 & 5600 Series Alamo Vacuum Pumps (80-200 CFM/ASME)



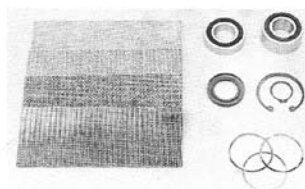
These instructions apply to the large bore (10" dia.) vacuum pump body which has full three inch flanged inlet and exhaust ports.

The following special tools are required for pump servicing.

- No. 88980 Pump Service Kit
- No. 88963 Oil Seal Installation Tool
- No. 88966 Coupling Alignment Gauge 8S
- No. 88967 Coupling Alignment Gauge 6J
- No. 88970 Bearing Installation Tool
- No. 88976 Rotor/End Plate Alignment Gauge
- No. 88977 Snap Ring Pliers - Internal
- No. 88978 Snap Ring Pliers - External
- No. 88995 Wheel Puller Adapter
- No. 88941 Gasket Sealant
- No. 88002 .002" Strip Gauge
- No. 88003 .003" Strip Gauge
- No. 10636 Vacuum Pump Oil (min. 4 gal.)

The following general tools are required for pump servicing.

- Heavy Duty Wheel Puller (2 or 3 Jaw)
- Feeler Gauge Set .002" - .020"
- Allen Wrench Set
- Cold Chisel 1/2 Inch
- Drift Punch 1/4 Inch
- Ball Peen Hammer 16 Oz.
- Lead or Brass Hammer
- Vise-Grip Pliers
- File (8 or 10 Inch Single Mill Cut)
- Single Edge Razor Blades
- Combination Wrenches 5/16 - 3/4 Inch
- Screw Driver 3/16 Inch
- Ratchet & Socket Set 1/2 - 3/4 Inch
- Grease, Orange Oil
- (2) 2 x 4 Wood Block, 6 Inch Long
- Thread Locking Sealant
- Cleaning Solvent



When rebuilding a vacuum pump, the following replacement parts are required and should be on hand before pump servicing starts.

- No. 12507 Vane (4 Required.)
- No. 13601 .002" Shim - Red
- No. 12509 .003" Shim - Green
- No. 12615 .005" Shim - Blue
- No. 12511 Double Row Bearing
- No. 12510 Single Row Bearing
- No. 12512 Beveled Retaining Ring - Internal
- No. 12514 Beveled Retaining Ring - External
- No. 12508 Oil Seal (2 Req'd.) (See Note Below)
- No. 12564 Oil Seal (See Note Below)
- * No. 12582 Replacement Kit 2300 & 4600 Series
- * No. 12592 Replacement Kit 2800 & 5600 Series
- * No. 12583 Replacement Kit 4600 CW Only
- * No. 12593 Replacement Kit 5600 CW Only

(* Optional - Not required in general servicing)

Note: When servicing an Alamo pump that is equipped with a shoulder stop front end plate, one 12508 Oil Seal are required. See Step 9 of Instructions on how to identify the shoulder stop end plate. For an assembly drawing of an Alamo pump and parts callout, refer to Sec. 4B, Page 1e.

Caution - Failure to use the proper tools when rebuilding Vacuum Pumps can result in improper assembly and possible early failure of the rebuilt pump.

Before starting any repair work, inspect the vacuum pump and note its visual appearance. General discoloration of the paint on the pump body indicates overheating. This could be the result of lack of proper lubrication, rotor to pump body contact, cooling fan failure or a high vacuum operating condition. High vacuum could be due to a dirty filter, an improperly adjusted regulator, or a plugged vacuum line. Before installing a re-built vacuum pump, check out the vacuum system completely as well as the lubricating system and the exhaust line to insure that they are in proper working order.

The following is a step-by-step procedure for disassembling and rebuilding a large bore (10" dia.) vacuum pump.

Step 1 - Pre-Disassembly Procedure

All external components should be removed from the pump body and it should appear as shown in Fig. 1 prior to disassembly. The working surface should be clean and preferably metal. Remove all the 5/16 x 1" grade 5 bolts from both end plates (Grade 5 bolts are identified by 3 raised radial slashes on the head of the bolt and are required for large vacuum pump assembly). Loosen the setscrews in the coupling flange using a 3/16" Allen wrench if the pump is from a direct drive application. A 2 or 3 jaw puller may be required to remove the flange from the shaft. If the pump is from a belt drive application, remove the drive sheave by removing the 2 locking set screws from the outer diameter of the bushing using a 3/16" Allen wrench. Screw 1 of the set screws into the hole that is threaded on the bushing side only to force the sheave off the tapered bushing.



Fig. 1

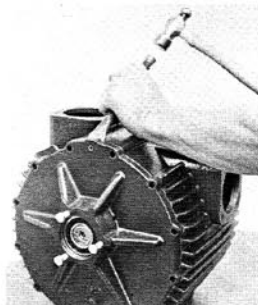


Fig. 2

Step 2 - Loosening End Plates

Using the ball-peen hammer and cold chisel, knock the end plates free from the pump body using the raised tabs located at the top and bottom of the end plates as shown in Fig. 2. Loosen the end plates at this time but do not attempt to remove the end plates from the pump while the pump is in this position. Take 3 of the bolts removed from the end plates and screw them into the bearing hub of the

rear or non-drive end plate. (A wheel puller adapter No. 88995 is included in the pump service kit for use with 2 jaw wheel pullers).

Step 3 - Rear End Plate Removal

Tip the pump onto its top and support the pump using one of wood 2x4 pieces recommended in the general tools section. The wood pieces are very useful to prevent the pump rocking while working on it. Since the rear end of the pump does not have the rotor shaft extending from it, an extender must be used in order to use the wheel puller. A 5/16" bolt can be screwed into the shaft to act as a centering device with a 1/2" deep socket being used as the shaft extension. The wheel puller can then be used to remove the end plate from the pump body as shown in Fig. 3. When removing the end plate from the pump body, support the end plate so that the oil seal will not be damaged. **Mark the end plates with a marker pen** as to drive end or non-drive end so they can be replaced on the same end when rebuilding. With the end plate removed from the pump body, remove the 4 vanes from the rotor and place them aside for later inspection.

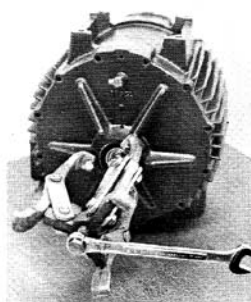


Fig. 3



Fig. 4

Step 4 - Drive Pin Removal

To remove the drive pins from the pump body, squeeze the pins with a pair of vise-grip pliers enough to remove the tension on the drive pin. Hit the side of the vise-grips with a hammer to extract the pins from the pump body. If the drive pins remain in the end plate, drive the pins out using a 1/4" punch.

Step 5 - End Plate & Rotor Assembly Removal

Rotate the pump on the work surface so that the shaft is pointed towards you. Using the same procedure as in step 2, knock the front or drive-end end plate loose from the pump body. Make sure that the front end of the pump is securely supported by a wood block. Grab the shaft of the pump and slowly withdraw the rotor and end plate assembly from the pump body. **Do not allow the rotor to drag over the edge of the pump body or drop to the workbench.**

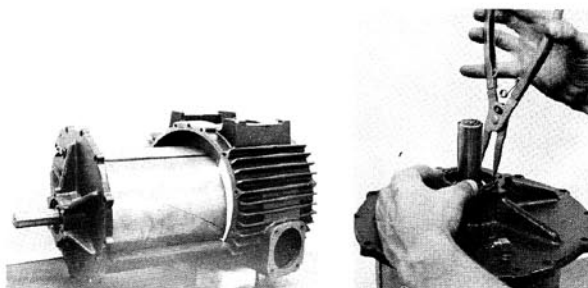


Fig. 5

Fig. 6

Step 6 - Snap Ring Removal

WARNING - Always wear safety glasses when removing or installing snap rings to prevent eye injury. Stand the rotor and end plate assembly vertical, supported by the 2x4 wood blocks with the shaft extension pointed up. Remove the external and internal snap rings using the appropriate snap ring pliers found in the pump service kit. When removing the external or shaft mounted snap ring (No. 12514) be careful to open the snap ring no more than necessary. The external snap ring can be easily sprung, which will prevent proper axial rotor location when rebuilding the pump.

Step 7 - End Plate & Rotor Disassembly

With the end plate and rotor assembly supported vertically and 3 5/16" bolts screwed into the bearing hub, attach the wheel puller (and the No. 88995 Wheel Puller Adapter, if necessary). The double row bearing is a press fit onto the shaft and into the housing and will require considerable force to remove the end plate.

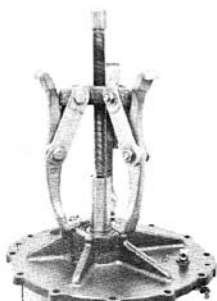


Fig. 7

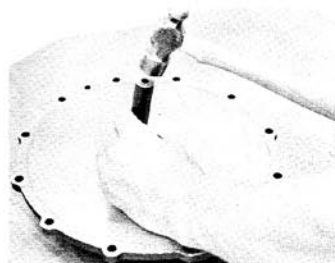


Fig. 8

Step 8 - Bearing and Oil Seal Removal

To remove the bearings from the end plates, leave the 5/16" bolts screwed into the bearing hub and position the end plates on the bench with the machined surface facing up. **Note: The 88995 Wheel Puller Adapter must be removed.** Gently tap the bearing using a 1/2" dia. brass rod as a punch. Do not use a steel rod. To remove the oil seal, turn the end plate so the machined surface faces down and

gently tap around the outer diameter of the seal using the brass rod. Care should be used to prevent damage to the oil seal if replacement is not necessary. Inspect the oil seal carefully to determine if replacement is required.

Step 9 - End Plate Inspection

Carefully inspect the end plates. If the machined surfaces of the end plates are free of rotor rub marks or other deep scoring they can be re-used. The end plates should be replaced in their previous positions (drive or non-drive end positions). **On pumps manufactured after Nov. 1988, the front and rear end plates are different.** The month and year of pump manufacture are stamped on the end of the rotor shaft. The front or drive end plate can be easily identified by the fact that the bore contains a shoulder to act as a positive locator for the double row bearing and requires a 12564 Oil Seal be installed in the 2.25 inch bore. The rear end plate remains as before and requires the 12508 Oil Seal. **Never use 2 shoulder stop type end plates when rebuilding an Alamo vacuum pump.**

In cases of using new end plates, it should be noted that the existing drive pins or drive pin locations can not be used. The end plates provided with the replacement kits have 1/8" dia. pilot holes 5 deg. off center which must be drilled out to 5/16" dia. for drive pin installation when pump assembly is completed. The 5/16" dia. hole should be drilled 1/4" deep into the pump body.

Used end plates should be cleaned of gasket sealant using a single edged razor blade and any nicks or burrs removed using a 8-10 inch single cut mill file. Clean the end plates with a cleaning solvent and place aside for later use.

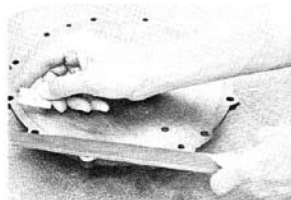


Fig. 9

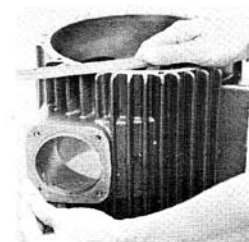


Fig. 10

Step 10 - Pump Body Inspection



Fig. 11

Prior to pump assembly, the pump body should be inspected and cleaned. Check for wear or rotor contact marks at top dead center of the bore, between the intake and exhaust ports. If the bore is not galled too badly, it can be smoothed using 240 grit emery paper. The intake and exhaust ports should be cleaned of gasket material or sealant using a single edged razor blade. The sides of the pump body should be cleaned and deburred using the single cut file as shown in Fig. 11 with the note that **the file must be held parallel to the machined surfaces at all times.**

Step 11 - Rotor & Shaft Assembly Inspection

The rotor and shaft assembly is the final major component that should be inspected prior to pump rebuilding. Other than overall general appearance of the rotor assembly, the other areas of inspection should include the vane slots, the oil seal mating surfaces(on the shaft), and the condition of the rotor surface.

Rotor ends must be free of nicks and burrs and should be cleaned using a mill file as shown in Fig. 11. The rotor assembly should be cleaned with solvent and the vane slots wiped clean with a rag wrapped around the file and liberally soaked with solvent.

Step 12 - Oil Seal Installation

Inspect the oil seals for wear. The Viton material should be pliable and not brittle. The lip should not have any cracks and the spring must be in place. If there is any doubt about the oil seal, replace it. To install a new oil seal, use the No. 88993 Oil Seal Installation Tool which locates the seal at the proper depth. Install the seal from the machined surface side of the end plate with the spring facing down. Press or gently tap the seal to the full depth of the shoulder on the installation tool as shown in Fig. 12. The dimensions for the 88993 Oil Seal Installation Tool are shown in Fig. 16. Lightly grease the lip area of both oil seals to ease assembly and provide lubrication on initial start-up.

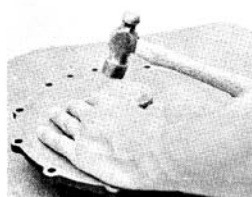


Fig. 12

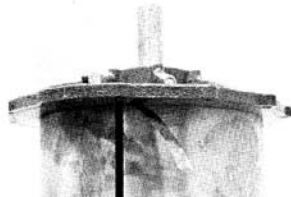


Fig. 13

Step 13 - End Plate and Rotor/Shaft Assembly

The assembly of the front end plate to the rotor/shaft assembly is critical and extra care in assembly will pay dividends. This part of assembly controls the axial position of the rotor which is critical to prevent the rotor from rubbing on either the front or rear end plate.

The rotor/shaft assembly should be supported vertically using the two wood blocks as previously mentioned. The front end plate should be carefully placed over the shaft and allowed to rest on the end of the rotor. Care must be used in positioning the end plate over the shaft so as not to cut the oil seal lip on the square edged shoulder on the shaft.

Note: For installation instructions when using the shoulder stop end plate see alternate instruction below.

Place the No. 88976 Rotor/End Plate Alignment Gauge on the shaft and lower it into the bearing hub. Rotate the gauge to be sure that the gauge is bottomed against the rotor. Put light hand pressure on the top of the alignment gauge and using a feeler gauge, measure the gap between halves of the alignment gauge. Make several measurements around the gauge. Subtract .004" from the average of your readings, and use that amount of shim (select from 12509, 12615, or 13601 shim) for the first trial.



Fig. 13a



Fig. 13b

With the shims in place on top of the 12522 Bearing Stop, position the No. 12511 Double Row Bearing on the shaft and using the No. 88970 Bearing Installation Tool, drive the bearing into the end plate with either a lead or brass hammer or a press (see Fig. 13b). **Always use the No. 88970 Bearing Installation Tool or similar to install the bearings. DO NOT HAMMER DIRECTLY ON THE BEARING.**

Alternate instructions for the Shoulder Stop End Plate

For an initial trial, place a .002 in. shim against the shoulder in the end plate. Press or drive the No. 12511 Double Row Bearing firmly against the shoulder. **Note: When using the shoulder stop end plate, the total amount of shims required will be .000 to .005 in.**

Using the No. 88977 and No. 88978 Snap Ring Pliers, install the No. 12512 Internal Snap Ring and the No. 12514

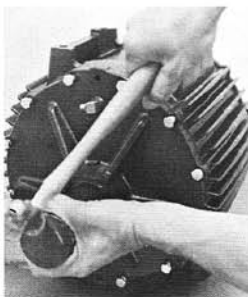


Fig. 14c



Fig. 15

Take the No. 88003 .003" Strip Gauge and insert it into the pump while turning the pump by hand. The rotor should lock up with the .003" feeler gauge inserted to the top of the pump. Remove the feeler gauge. This final check of clearance is very important since a pump with insufficient clearance will run hot and possibly bind up while a pump with excessive clearance will have excessive internal leakage and poor performance.

Tighten the bolts on the end plates using an alternating pattern to 200 in. lbs. torque. Check that the pump still rotates freely by hand. If not, the pump rotor is misaligned and can lead to early bearing failure. Rotor misalignment can be corrected by turning the pump onto its top and blocking it to prevent rocking. Loosen the end plate bolts on both ends of the pump and repeat step 13. Another possible cause is that an excess amount of gasket sealant was used and has been squeezed into pump body, interfering

with vane operation. If this is case, the end plates will have to be removed and the sealant removed. Return to Step 3 of the instructions and repeat rebuilding procedure.

With the final clearance check completed with the pump turning freely and all bolts properly torqued, check to see if the drive pin holes in the end plates are aligned. If they are exactly aligned, replace the drive pins by driving them in with a ball peen hammer. If the holes are not exactly aligned, drill new 5/16" dia. holes offset either to the right or left of the existing holes. Install drive pins in the new holes.

Add approximately 1/4 cup of Surge Vacuum Pump Oil to the pump and rotate the pump by hand to distribute the oil. Close up both the intake and exhaust ports with masking tape to prevent dirt or chips from getting into the pump.

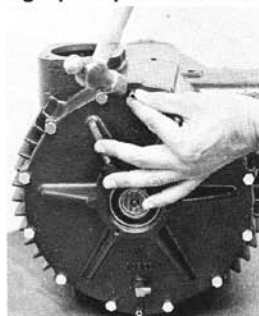
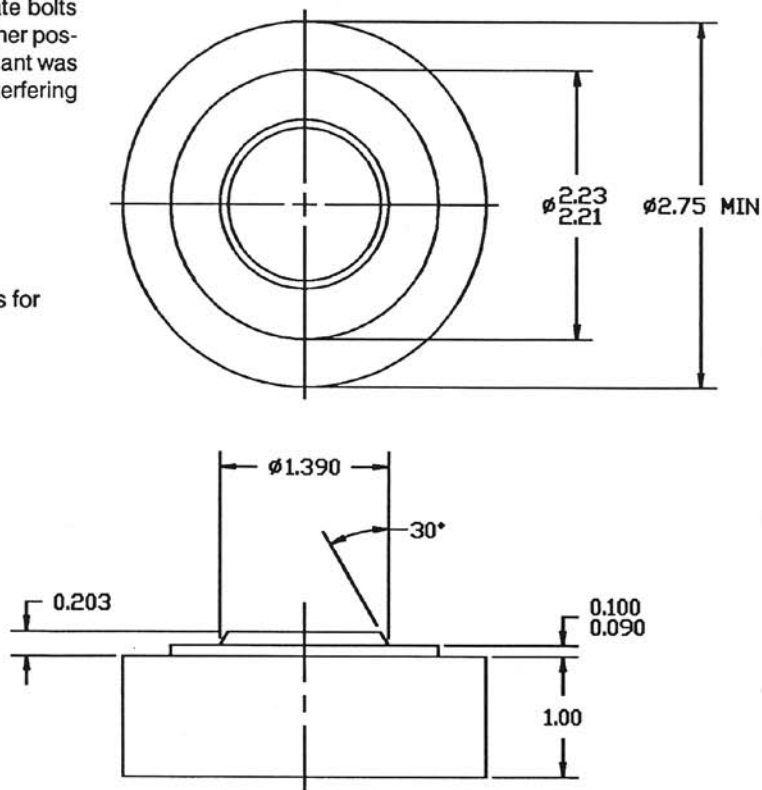


Fig. 15a



Fig. 15b

Fig. 16 - Dimensions for 88993 - Oil Seal Installation Tool



External Snap Ring. Note: Both of these snap rings are beveled and must be installed with the beveled side facing up.

With both snap rings installed, use a feeler gage to measure the clearance between the end plate and rotor as shown in Fig. 13c. The clearance should be .004 to .005 in. and the end plate should rotate freely on the shaft. If this clearance is not obtained, the pump will not operate as designed and will result in early failure. If less than .004" clearance is measured, then shims must be added to bring the clearance to the desired value. **For example, if the clearance is measured as .002", then a .002" or .003" shim must be added beneath the bearing. If the clearance is more than .005" then an equivalent amount of shims must be subtracted to reduce the clearance to .004 - .005".** Return to Step 7 of these instructions and repeat Steps 7, 8, 9, and 13.

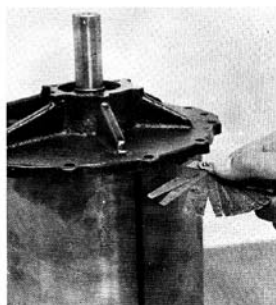


Fig. 13c



Fig. 14

Step 14 - Pump Body Assembly

The vanes should be wiped to remove excess oil only. The vanes should always be lightly coated with oil. Visually inspect the vanes for cracks and delaminations. The sealing area that rubs against the housing should not be chipped. If the condition of the vanes is doubtful, replace them.

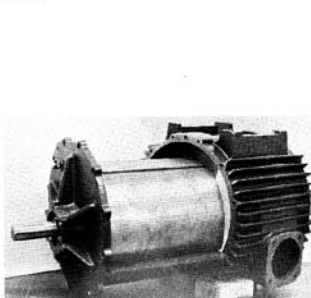


Fig. 14a

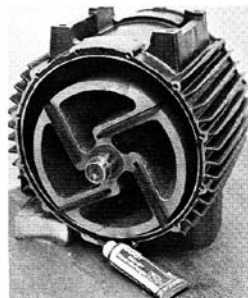


Fig. 14b

Take the cleaned pump body and turn it over on its top with the exhaust port down and the intake port to your right. This is the proper position for assembling a left hand or CCW rotation pump. If assembling a right hand or CW rotation pump the intake port should be to your left. The wood blocks should be placed under the intake port and at the front of the pump to prevent rocking. Run a small bead (no larger than 1/32") of gasket sealant No. 88941 near the out-

side edge of the pump end flange. Run the sealant bead around the inside of the tapped holes as shown in Figs. 14 and 14b. Be careful not to apply an excess of sealant as the excess will be forced to the inside of the pump and will interfere with proper action of the vanes.

With the pump bore facing you and the pump body supported by the blocks to prevent rocking, take the rotor/shaft assembly with front end plate and slowly insert it into the pump. Rotate the end plate so that the bolt patterns match and insert the 5/16" bolts and screw them hand tight only. Two of the bolts should be tightened snugly with a wrench so that the end plate can be shifted using a hammer.

Turn the pump around and reposition the wood blocks. Using the same procedure from above, apply No. 88941 Gasket Sealant to the rear flange. Take the cleaned pump vanes if they are usable or four(4) new No. 12507 Vanes and place them into the slots in the rotor. **Note: The beveled surface on the vanes should lie flat against the housing.** The vanes should slide freely into the slots. If they do not, they should be replaced or changed to a different slot.

WARNING - Do not grind, sand, file, or otherwise attempt to alter the size of the 12507 vanes. The vanes contain asbestos fibers and breathing the dust from the vanes is hazardous to your health.

Position the remaining end plate against the flange and install the bolts hand tight. Be careful not to slide the end plate against the flange causing sealant to get inside the pump. Two(2) bolts should be tightened snugly as was done on the front end plate. Install the No. 12510 Single Row Bearing into the end plate using the No. 88970 Bearing Installation Tool as shown in Fig. 14c. As a final check, tap each end plate downward with a hammer (do not strike the end plates near the drive pin locations) to insure that the rotor is resting at the top of the pump body. The pump shaft should not be able to be turned.

Step 15 - Final Clearance Check

Turn the assembled pump over onto its feet and slide the No. 12528 Coupling Flange or the pump bushing onto the shaft and install the key. This will allow the rotor to be turned easily by hand while checking pump clearance. With the pump positioned as shown in Fig. 15, attempt to turn the shaft by hand. If unable to rotate the shaft, tap the top of the end plates lightly downward with a hammer while attempting to turn the shaft. Stop tapping as soon as the shaft begins to turn.

Taking the No. 88002 .002" Strip Gauge in the right hand, insert it into the pump through the exhaust port while turning the shaft as shown in Fig. 15. Move the shim toward the outside edge of the pump to check the clearance between the rotor and top of the pump body. **The end plate should be adjusted so that the rotor will still turn with the .002" strip gauge inserted to the top of the pump.** Repeat this procedure for the other end of the pump.