



1299 Lawrence Dr.
Newbury Park, CA 91320 USA
Phone: (805) 498-6616 Fax: (805) 499-2867
www.smithpumps.com

ED-1
(Rev. C)

Repair Manual for E and D-series Small Capacity Pumps

This manual contains valuable repair information for the DW-1Z, DW-HZ, EG-1Z, and EC-HZ pumps and describes how to change a mechanical shaft seal assembly, gear set, and bypass valve cartridge.

This manual is an addendum to other repair manuals, parts views and illustrations, and parts lists. This manual is visual in nature and should be used as an aid in the repair procedure.

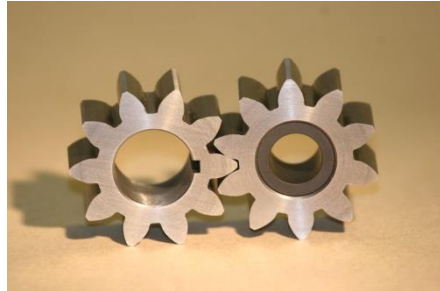
To accomplish a pump repair, the pump must be depressurized. This procedure must be performed according to all applicable Safety Codes and practices consistent with Local, State, and Federal Law and company procedures. NFPA-58 should also be consulted. If you do not know how to safely depressurize the pump and isolate it from the piping system, either contact your immediate supervisor or call us at (805) 498-6616. After the pump has been safely depressurized and isolated from the piping system, the following procedure as described in this manual and others should be followed.



D-series Pump

E-series Pump

Depending on the pump, the repair kits for each model contain different shaft seal assemblies and gears. For the DW-1Z and EG-1Z pumps, a repair kit consists of an E-100Z shaft seal assembly, one EG-5 drive gear, and one EG-6 idler gear.



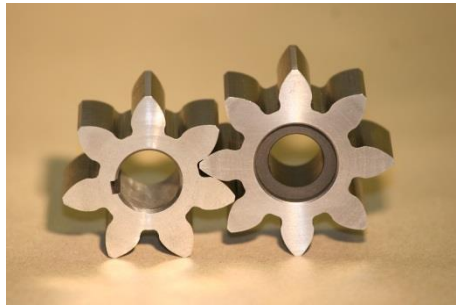
From left to right: EG-5 Drive gear, EG-6 Idler gear



E-100Z Shaft Seal Assembly

For the DW-HZ and EC-HZ pump models, a repair kit consists of an E-100HZ shaft seal assembly, one EG-5H drive gear, and one EG-6H idler gear. Note the difference in the diameter of the drive shaft between the E-100Z and E-100HZ shaft seal assemblies.

Note: smaller diameter for the E-100HZ shaft seal assembly when compared to the E-100Z

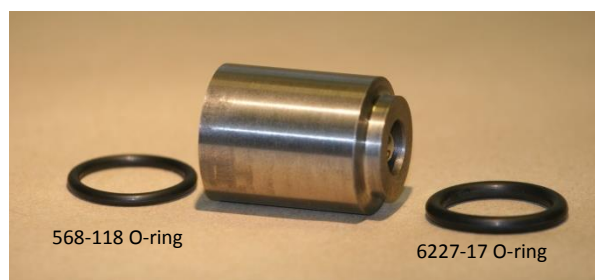


From left to right: EG-5H Drive gear, EG-6H Idler gear



E-100HZ Shaft Seal Assembly

All four of these model pumps utilize the same bypass valve cartridge, the E-20 which contains 2 O-rings, the 6227-17 and the 568-118. Older E series pumps may use the E-20H cartridge, a larger version which was discontinued in 1987 for the EC-HZ pump model. If you are replacing an E-20H bypass valve cartridge please contact the factory. See the following pictures and assembly drawings PI-1 and PI-10 attached for reference.



568-118 O-ring

6227-17 O-ring

E-20 Bypass Valve Assembly w/O-rings

INSTRUCTIONS FOR A SHAFT SEAL ASSEMBLY REPLACEMENT

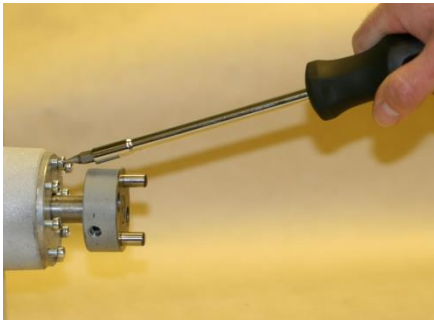
STEP 1:

Separate the pump and motor. Four bolts hold the pump onto the motor and are screwed into the mounting spacers. These bolts can be loosened and removed from the pump cover side. The pump can remain in the pipework.



Remove 4 cap screws to separate the pump from the motor

STEP 2:

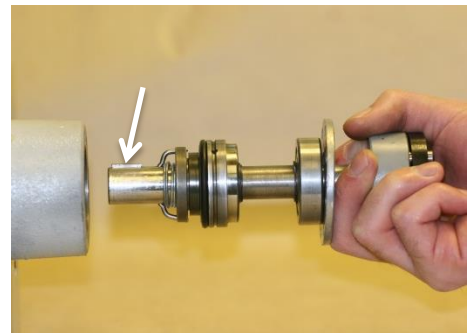


Removal of bearing retainer plate (E-15) held in by 8 head screws

Remove the small screws from the bearing retainer plate at the shaft end of the pump and rotate the shaft so the coupling key is at the 12 O'clock position.

STEP 3:

Pull the shaft straight out of the pump. As an aid in removing the shaft seal assembly, the pump coupling half may be left on the pump drive shaft. What comes out is the shaft seal assembly comprised of two ball-bearings, the seal components and an o-ring, all attached to the drive shaft. This is what we call a shaft seal assembly. Make sure the o-ring comes out as well as the shaft assembly. Remove the pump coupling half if it was left on the pump drive shaft. Refer to PI -1 and PI-10 for reference.



Shaft seal assembly removed with key in 12 O'clock position



Remove the 6227-17 O-ring. The replacement shaft seal assembly comes with a new, replacement o-ring.

STEP 4:

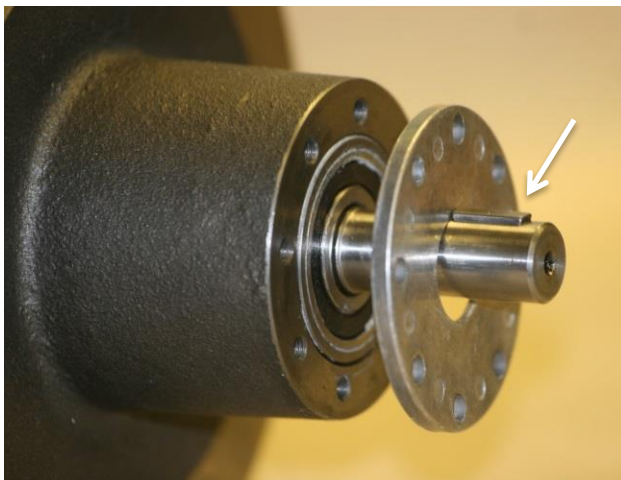
Closely examine the inside of the main housing where the shaft seal assembly came out of. Because there is a bleeder hole in this area, normally grime, rust, or dirt becomes lodged here. Carefully remove the debris and clean as best you can.



Main housing where shaft seal assembly and bleeder hole is located

STEP 5:

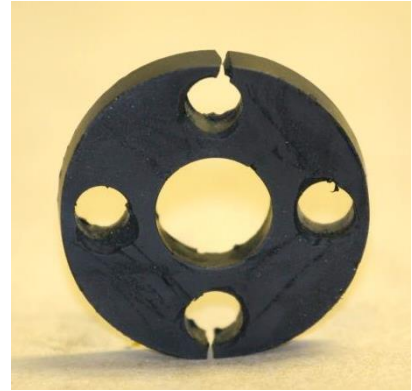
Apply a **small** amount of grease to the inside of the pump housing where the shaft seal assembly will be installed. This will make the installation easier. Never use oil or WD-40 type lubricants. Now slide the replacement seal assembly into place. Make sure that the coupling key is in the 12 O'clock position. This recommendation is made so that the replacement mechanical seal will slide easily through the keyway in the drive gear which cannot be seen. When sliding in the replacement shaft seal assembly and resistance is felt, this means that the drive gear key does not quite line-up with the keyway in the drive gear. If this happens, rotate the shaft a little each way while gently pushing the shaft seal assembly in until the key is felt to enter the drive gear keyway. Then push the shaft seal assembly the rest of the way in. Do not use a hammer to drive the replacement seal in place. If the shaft seal assembly cannot be installed as above due to too much resistance, this may indicate a severely worn-out gear set. Refer to the second part of this manual entitled FOR A GEAR SET REPLACEMENT and follow all steps to replace the gear set.



Replacement shaft seal assembly inserted into main housing with key in 12 o'clock position to fit drive gear keyway also in 12 o'clock position

STEP 6:

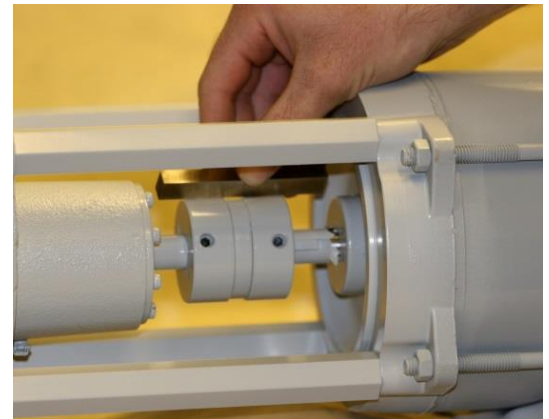
Now replace the bearing retainer plate, screws, and coupling half. Also, this is a good time to inspect the flexible drive coupling insert. If it is damaged, or the coupling halves are damaged, replace them.



Damaged FD-20 Coupling Insert

STEP 7:

Bring the motor back in contact with the pump, align the coupling and insert the mounting spacer bolts. Tighten these bolts. For proper coupling alignment between motor and pump shafts, lay a straight edge over the tops of the two halves as shown. Do not sandwich the coupling insert tightly between the two halves or leave space between the halves and insert. The coupling halves should be just making contact with the insert.



Proper Coupling Alignment using Straight Edge



VC-20 Coupling with FD-20 Insert

For EG-1, DW-1, and DW-H series pumps, a Smith VC-20 coupling with an FD-20 insert is recommended.

For EC-H series pumps, a Smith VC-30 coupling with an FD-30 insert is recommended.



VC-30 Coupling with FD-30 Insert



From left to right: VC-30 coupling with FD-30 insert next to VC-20 coupling and FD-20 insert

STEP 8:



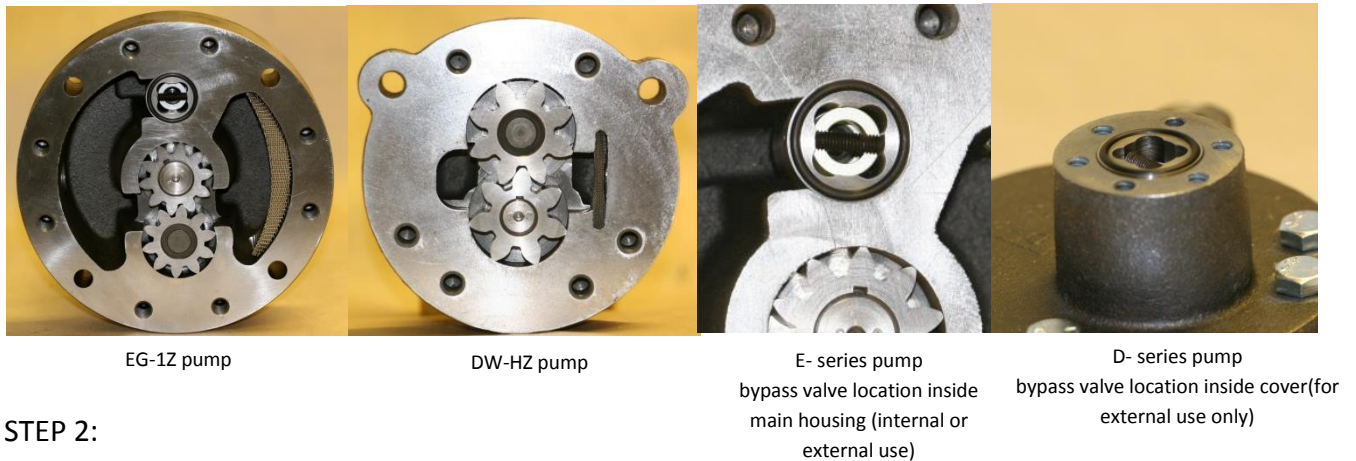
Tightening of coupling set screw using allen wrench

Tighten the coupling set screw and rotate the pump shaft to make sure it turns freely.

INSTRUCTIONS FOR GEAR, BYPASS VALVE, AND STRAINER SCREEN REPLACEMENT

STEP 1:

While leaving the pump in the depressurized pipework, remove all of the bolts that hold the pump cover onto the main housing, including the mounting spacer bolts, and remove the cover. Once removed, you will see the gear set and built-in strainer screen. For the EG-1Z and EC-HZ, the bypass valve cartridge can also be seen in the main housing along with the drive gear above the idler gear. For the DW-1Z and DW-HZ, the bypass valve cartridge is housed in the pump cover and the drive gear is below the idler gear in the main housing. For more details, refer to PI-1 and PI-10.



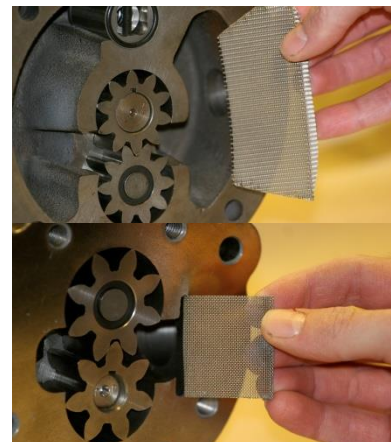
STEP 2:

Before removing the idler gear and drive gear, take note which face of the gear is pointing up. Sometimes the drive gear is a little difficult to remove by hand and a screw driver must be used to pry it out. Care should be taken if a screw driver is used so the gear pockets are not damaged. If small burrs are created, these can be removed by carefully using a small file.

STEP 3:

Remove the built in strainer screen. The strainer screen for the EG-1Z and EC-HZ pumps is larger than the screen used for the DW-1Z and DW-HZ pumps. Clean and remove any particles within the screen that have been trapped over time.

E-21 built in strainer screen for
E-series pumps



D-21 built in strainer screen for
D-series pumps

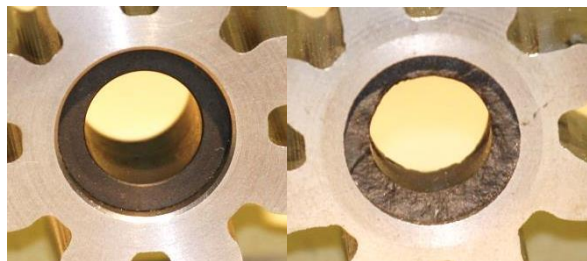
STEP 4:

This step involves an inspection of the gear set. Carefully inspect the gear set for wear. Any wear that appears obvious means that the gear set must be replaced. Take a look at the gear tooth profile. It should be symmetric and follow a convex curve from the tip of the gear tooth to the root of the gear. If it does not, the gear should be replaced. If there is significant wear along this profile, the gear should be replaced.



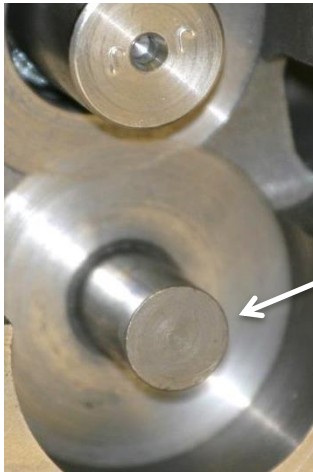
From left to right: A gear with no wear, a worn out gear that needs replacement

Inspect the bushing pressed into the idler gear for signs of eccentric wear. The internal bore of this bushing should be a perfect circle and smooth. If it is not, either the bushing or idler gear should be replaced.



From left to right: Idler gear bushing that has no wear, gear/bushing that needs replacement

If the gear set appears to be in good condition, it can be reused again. To maximize the life of a used gear set when reinstalling into the pump, turn the gear faces over and install with the face of the gear that was pointing up, into the gear pockets first. In other words, install the gear set backwards. This will allow the opposite gear tooth profile to do the work.

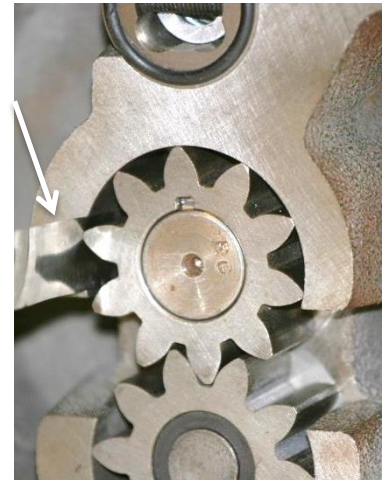


Gear pocket in good condition

Before installing a new or used gear set, the pockets and cover should be inspected for unusual wear. Carefully look at the gear pocket sides to determine if any wear has occurred. You are looking for any obvious gouge marks, uneven wear patterns, etc. Also, inspect the bottom of the gear pockets for the same signs of significant wear.

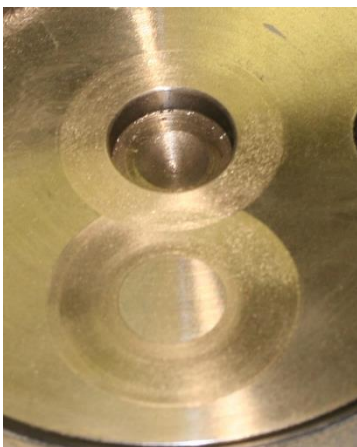
E-9

To see if any of this unusual wear has occurred, install a new idler gear over the idler gear shaft (E-9) and place a feeler gauge in between the outside diameter of the gear and the gear pocket. Do the same for the drive gear over the drive shaft. If a **0.004** feeler gauge or higher can be placed into this space, then the gear pocket is worn excessively and either the main housing should be replaced or the pump should be exchanged.



Feeler gauge check

Normal cover gear contact rings;
cover can be reused again



In a similar fashion, the cover (E-2 or D-2) should also be inspected for wear. Normally, the gear set will leave circular contact rings on the cover. The cover should only be replaced if these contact rings are deep and felt by running your thumbnail over them.

Also, inspect the idler gear shaft that supports the idler gear. While this shaft rarely must be replaced, check for obvious signs of damage.

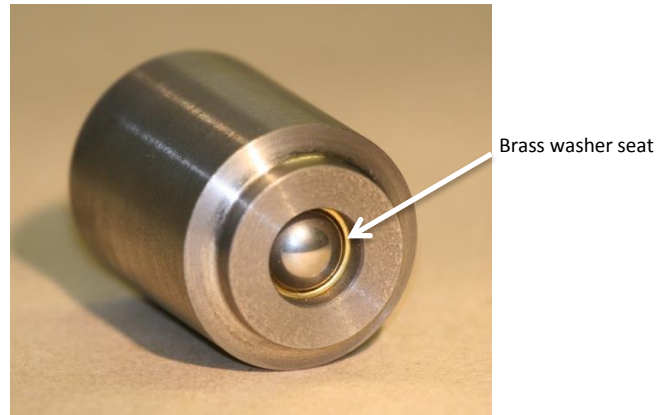


Idler gear shaft in good condition

STEP 5:

The bypass valve cartridge should also be inspected. A good rule of thumb when deciding to replace the cartridge or not is to always replace if the pump is **10 years old or older**. Look at the bottom of the cartridge where the ball seats on the brass washer to make sure that debris has not lodged between the ball and the washer. This will allow pumped product to continually circulate through the cartridge and will cavitate the pump if used for internal bypass. If debris is found, lift-up the ball and blow the debris away. If the cartridge appears to be damaged in any way, it should be replaced. If the cartridge is to be reused always replace the old o-rings with 2 new o-rings (6227-17 and 568-118). See PI-1 and PI-10. Note: For older EC-HZ pumps manufactured before 1987, the larger E-20H bypass valve was discontinued. Contact the factory for more information.

E-20 bypass valve used in E and D series pumps



STEP 6

Before replacement parts are installed in the pump, all old sealant left on the face of the pump main housing and cover (E-2 or D-2) must be removed. This is important as old sealant can lift the pump cover enough so slippage occurs within the pump and could cause cavitation.



Old sealant being removed; a razor blade or any lubricant such as WD-40 can be used

STEP 7:

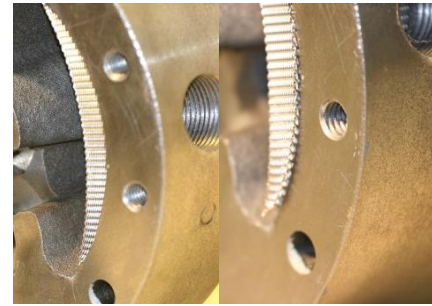


6230-28 O-ring

Replace the cover o-ring (6230-28 for E-series, 6230-14 for D-series); do not reuse the old one.

STEP 8:

Install the strainer screen making sure that the wire strands are below the surface of the pump main housing face and tucked securely into the inlet pocket. If one wire strand lies on top of the cover face, the cover could be lifted up enough so that slippage will occur in the pump, resulting in cavitation and poor pump performance.



Correct installation

Wrong installation
(wire above surface face)

STEP 9:

Install the bypass valve cartridge with 2 new o-rings; one for the top and bottom. (See PI-1 or PI-10). Do not reuse old o-rings. The bypass valve cartridge is installed in the cover (D-2) for the DW-1Z and DW-HZ pumps and in the main housing for the EG-1Z and EC-HZ pumps.



6227-17 o-ring inserted first into E-series main housing

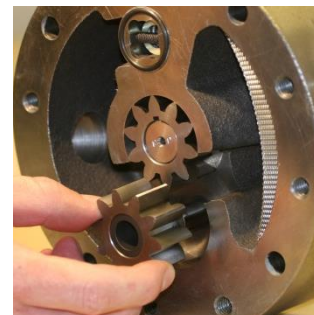
E-20 cartridge with 568-118 o-ring into E-series main housing

6227-17 o-ring inserted first into D-series pump cover

E-20 cartridge inserted into D-series pump cover

STEP 10:

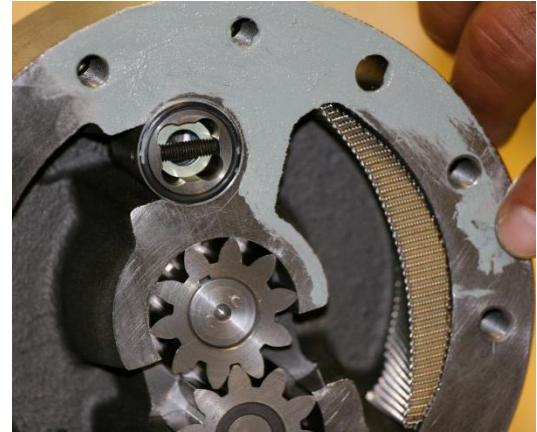
Install the gear set. Do not hammer them into place. The drive gear can only be installed in one way. Best practice is to install the drive gear first. Simply slide the drive gear over the pump drive shaft so that the key engages inside the drive gear keyway. Push the drive gear all the way down the drive shaft until it stops. Likewise, install the idler gear over the idler gear shaft.



EG-6 idler gear installed after EG-5 drive gear

STEP 11:

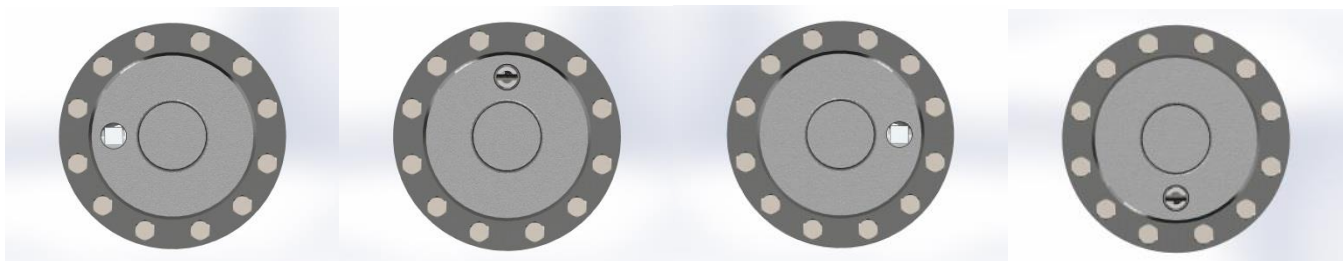
After all of the above replacement parts have been installed as outlined above, PLS#2 or Gasoila Soft-Set, Teflon based sealant should be applied to the face of the pump main housing only. Never apply sealant to the cover, gears, bypass valve cartridge, or shaft seal assembly. The old sealant from the cover and main housing should be removed per STEP 6. Caution: The sealant should be applied very sparingly and only smeared on with a very thin layer. If the sealant is over-applied, the excess may enter the gear pockets and cause damage or pump seizure.



PLS #2 Sealant being applied to main housing, not cover

STEP 12:

With the cover o-ring replaced, bolt the cover onto the main housing. Be careful here to install the cover in the same position it was when removed from the pump main housing. A ½ -inch tapped hole exists in the cover for the EG-1Z pump and a ¾- inch tapped hole for the EC-HZ pump. This hole may have a plug in it or may be used to pipe back to the vapor space of the supply tank. Make sure the cover is reinstalled so that this hole is located in the same position it was when the cover was removed. Chances are if the cover has a pipe plug in it, the cover can be reinstalled so that the plug is in the 9-O'clock position. If the cover does not have a plug in it but was used to pipe back to the supply tank, the cover can be reinstalled in the 12-O'clock position. This assumes that the pump was not mounted to the motor upside down. If the pump was mounted upside down then the cover must be reinstalled at the 3-O'clock position if it has a pipe plug in it or at the 6-O'clock position if piped back to the vapor space of the supply tank.



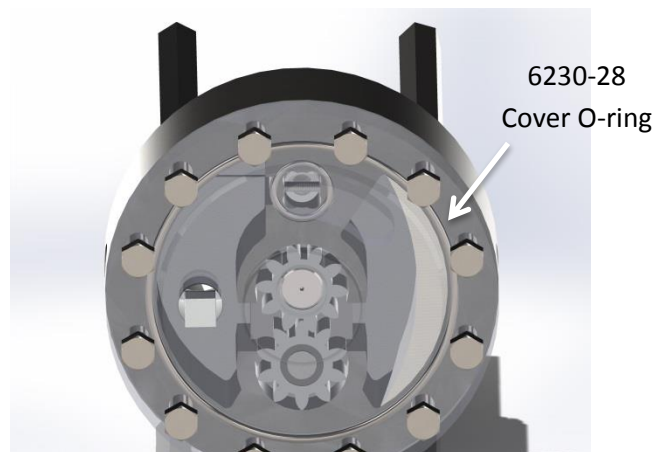
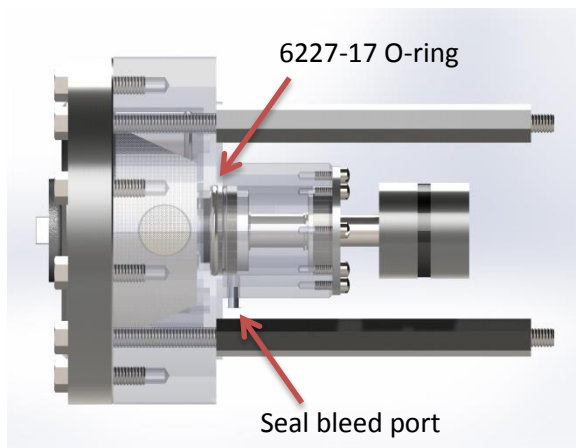
9 O'clock
(plug in place, internal bypass)

12 O'clock
(plug removed, external bypass)

3 O'clock
(Pump upside down with plug in place, internal bypass)

6 O'clock
(Pump upside down with plug removed, external bypass)

Rotate the pump drive shaft by hand to make sure the gear set is rotating smoothly. If no binding can be felt, the repair is complete and the pump can be put back into service. Repressurize the pump according to all applicable Safety Codes and practices consistent with local, state, or federal law and company procedure. NFPA-58 should be consulted. If you do not know how to safely repressurize the pump, either contact your immediate supervisor or contact us at (805) 498-6616. Check the pump for any signs of product leakage. The use of an electronic device is recommended. If a hissing can be heard, this is an example of product leakage although the product leakage can occur without making any noise. Check to make sure all o-rings were installed as per the procedure in this manual. If the product leakage is exiting the pump from the seal bleed hole, either the o-ring on the outside diameter of the shaft seal assembly is missing or damaged, or the mechanical shaft seal itself is damaged. Replace or install one or the other. If the leakage is exiting between the cover and the main housing, the cover o-ring is missing or damaged. Replace or install this o-ring. It is very unusual and rare that a pin hole in the cover or main housing casting is the cause of product leakage. If it is determined that a pin hole exists, immediately take the pump out of service and replace the casting or the pump. Destroy the casting containing the pin hole.



In cases where the pump is severely worn, it may be more economical to exchange the pump. All Smith distributors stock exchange pumps as well as repair kits. Contact your local Smith distributor for details on the Exchange Plan.