Technical guide #: **2.020.300.200**

Cat 290 Pump Repair

COMMON STOCKED PARTS

3	PST101802	Cylinder CAT 290
3	PST26112	Cylinder CAT 280
1	PHY027-004	Oil Filler Cap – Black (old 280 & 290's)
1	PST43211	Oil Filler Cap - Red
1	PST14177	O-ring Oil Filler Cap
1	PST8106101	Crankcase Oil
1	PCA92241	Sight Glass – Oil Level
3	PST21985	Back up Ring - Cylinder
6	PST23172	O-ring Cylinder
1	PST24459	Discharge Manifold
1	PST25128	Inlet Manifold
3	PST25301	Oil Seal
6	PST25392	O-ring – Sleeve
3	PST26854	Seal Washer
3	PST28597	Retainer – Seals
3	PST29003	Back up Ring – Sleeve
3	PST29614	Sleeve
1	PST30544	Back up Ring – Piston (Bac-Cup) CAT 290
1	PST43340	O-ring Crankcase Cover
1	PST30023	Kit – Short Cup
1	PST30272	Kit – Hot Cup
1	PST30305	Kit – Prrrrrm-A-Lube Seals
1	PST30431	Kit – Sleeve & Seal
1	PST 30686	Kit – Valve
1	PST30860	Kit – Piston

COMMON NON-STOCKED PARTS

2	14137	Stud (M8 x 41.4) CAT 280
2	85680	Stud (M8 x 99.5) CAT 290
2	26545	Cylinder Bolt (M8 x 62.5) CAT 280
2	81109	Hex Nut (M8) CAT 290
2	101804	Hex Nut – Flanged (M8)
3	20017	Seal Washer
2	24159	Oil Seal – Crankshaft
2	26536	O-ring Oil Bearing Cover

These instructions are for the CAT 290 pump. The instructions for the CAT 280 pump are similar, though some of the parts are different. The parts listed are for both the 280 and 290, except as noted.

Depending on pump and necessary repairs, many of these parts will not be needed. Additional parts may be required. Refer to your CAT 290 Piston pump specification sheet for the parts breakdown and listing.

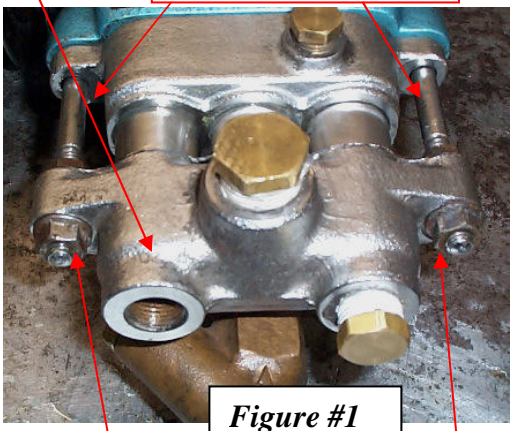
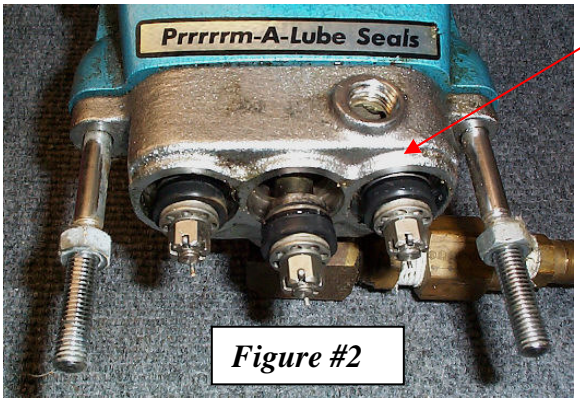


Figure #1

Pumping Section Disassembly & Inspection

- Disconnect the outlet and inlet hoses from the pump. On most machines, the pumping section repairs can be done with the pump still mounted on the machine. If desired, remove the pump from the machine and take pump over to your workbench.
- Use a 13mm wrench to remove the two Hex Flange Nuts holding the Discharge Manifold to the Studs on the pump. **(FIG. 1)** Place your hand under the Discharge Manifold as you pull it away from the Cylinders. The Discharge Manifold should pull away from the Cylinders, and the Discharge Valve Assemblies may fall out as you pull the manifold away. **(FIG. 2 & 3)** You can use a soft mallet to gently tap on the backside of the Discharge Manifold as needed to separate it from the pump. The Cylinders may stick in the Discharge Manifold and pull away from the pump with the manifold. This is OK, as the Cylinders will keep the Discharge Valves Assemblies from falling out. The Cylinders can then be removed from the Discharge Manifold on your workbench. With the Cylinders removed, the Discharge Valves, Seats, Springs and Retainers should fall out when the Discharge Manifold is inverted.

Freezing, over-pressurizing or improper installation can cause the Discharge Manifold to become deformed or warped. If this happens, the Cylinders and Valve Seats can be hard to remove or damaged. The Discharge Manifold will then need to be replaced. Once you are able to remove the parts, examine the Cylinders and Valve Seats for signs of damage and replace as needed.



CAT 290 Pump with the Discharge Manifold & Cylinders removed.

Figure #2

Discharge Manifold with valve assemblies still in place.

Figure #3

- If the Discharge Manifold is OK, examine the Retainer for wear and replace as needed. We do not stock the Discharge Valve parts individually. We stock the Valve Kit PST30686, which includes three complete discharge valve assemblies and six o-rings for the cylinders. **(FIG. 4 & 5)**

Figure #4

Valve Kit PST30686

Valve Retainer 43442

Valve Spring 43360

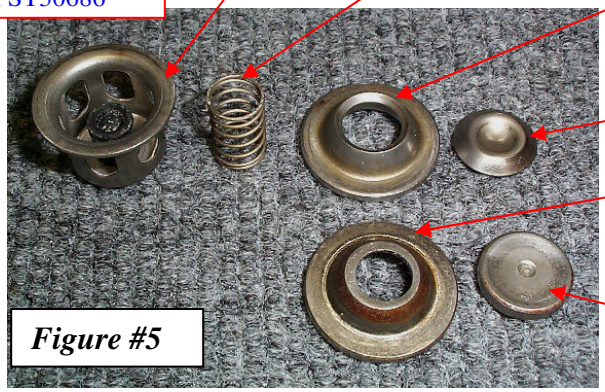


Figure #5

Valve Seat - **Quiet Valve** 43434

Valve – **Quiet Valve** 43723

Valve Seat - **Flat Valve** 29487

Valve – **Flat Valve** 22842

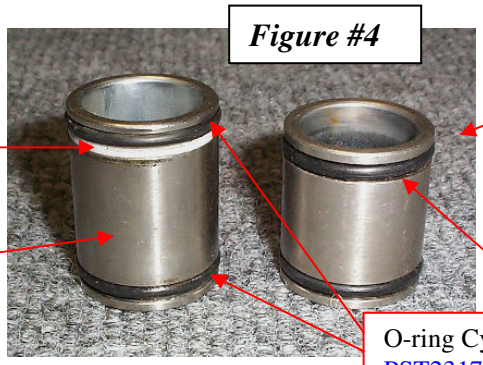
- Examine the three springs for fatigue and replace as needed.

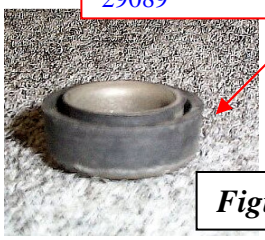
Examine the three Valves for wear, ridges or pitting and replace as needed. Some pumps may have Flat Valves, while most pumps have the saucer shaped Quiet Valve. The Flat Valve seating surface can be lapped on a flat surface using 240-grit paper. The Quiet Valve, due to their shape, must be replaced. Do not mix Quiet Valve and Flat Valve assemblies.

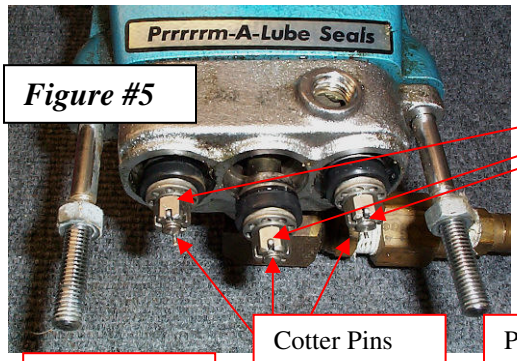
Examine the three Valve Seats for wear, pitting or grooves. The Flat Valve Seats can be lapped on a flat surface using 240-grit paper. The Quiet Valve Seats, due to their shape, must be replaced. Do not mix Quiet Valve and Flat Valve assemblies.

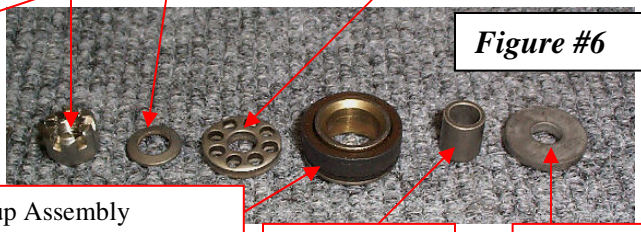
The retainer and spring for the Flat Valve assemblies are different than those for the Quiet Valve shown above.
(Retainer – 22841 Springs – 22031)

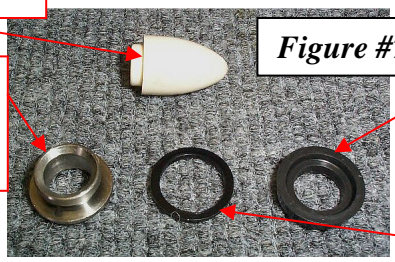
- Remove the Cylinders from the pump, if they did not come off with the Discharge Manifold. Grasp the Cylinders with your hand and with an up and down motion; pull them out of the Inlet Manifold. Examine each of the Cylinder walls for scoring or pitting. Rub your finger inside the Cylinder to feel for scratches or ridges and replace Cylinders as needed.
- One end of the Cylinder has a slightly larger groove on the outside surface for the O-rings. This end has one O-ring and one Back-up ring. (The O-ring is closer to the end of the Cylinder with the Back-up ring behind it and closer to the middle of the Cylinder.) Examine O-ring and Back-up ring and replace as needed. This end of the Cylinder connects to the Discharge Manifold. Most kits include new Cylinder O-rings, so it is normal procedure to replace the Cylinder O-rings when servicing the pump. The Cylinder for the 280 pump is symmetrical and does not have a Back-up Ring. **(FIG. 4)**
- One end of the Cylinder has a slightly smaller groove on the outside surface for the O-rings. It has only a single O-ring. Examine O-ring and replace as needed. This end of the Cylinder connects to the Inlet Manifold. Most kits include new Cylinder O-rings, so it is normal procedure to replace the Cylinder O-rings when servicing the pump. **(FIG. 4)**

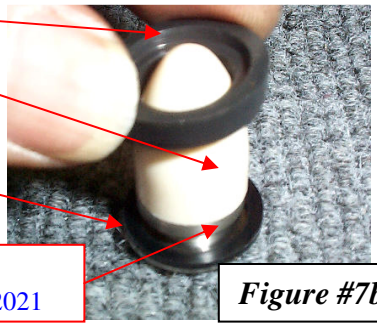












- Remove the Cotter Pin from the end of each of the three Piston Rods. Most kits include new Cotter Pins. Always replace the Cotter Pin with a new stainless steel Cotter Pin. **(FIG. 5)**
- Use a 10mm wrench to remove the Nut from the end of each Piston Rod. Find a spot where you can lay out the Nuts and other parts as you remove the Piston Assemblies so you do not lose or forget to replace parts as you re-assemble the pump.
- Remove the Washer. Remove the Piston Retainer, Spacer, Piston-cup Assembly and Inlet Valve. **(FIG. 5 & 6)**
- Examine the Inlet Valve surface for pitting, scale or grooves. Sand the Inlet Valve using 240-grit paper to smooth pitting and clean surface or replace Inlet Valve as needed.
- Examine the Piston seating surface and lightly sand on flat surface using 240-grit paper. If extreme pitting or sharp edges are found, replace the Piston.
- All Piston and Inlet Valve parts are included in the Piston Kit PST27003. This kit includes three Cup Assemblies, three Inlet Valves, three Spacers, three Piston Retainers, three Washers, three Nuts, three Cotter Pins, three Cylinder Back-up Rings and six O-rings for the Cylinders. **(FIG. 14c)**
- Examine the Cup for wear, cracking, tearing or separation from the piston. If worn replace cup. Cups are included in the Short Cup Kit PST 30023. **(FIG. 14a)** This kit contains three Cups, Six O-rings for the Cylinders, three Cotter Pins and a Cup Inserter.
  - Cup Installation: Remove old Cup. Examine Bac-Cup Ring and replace as needed. (280 pump will not have a Bac-Cup Ring on the Piston) Coat Cup Inserter with oil and place on top of Piston. Push Cup over inserter and onto Piston. Push on edges of Cup to fully seat Cup on Piston and square all edges. **(FIG. 7a & 7b)**
  - Hot Cup: The cup is part of the piston and cannot be separated from the piston. **(FIG. 7)** Replace the complete Hot Cup/ Piston assembly. The Hot Cup Kit, PST 30272, contains three Hot Cup/ Piston Assemblies, three Cotter Pins and six O-rings for the Cylinders. **(FIG. 14d)**

- Remove the remaining two Hex Nuts from the Studs. Then pull the Inlet Manifold away from the pump body and off of the pump. **(FIG. 8)**

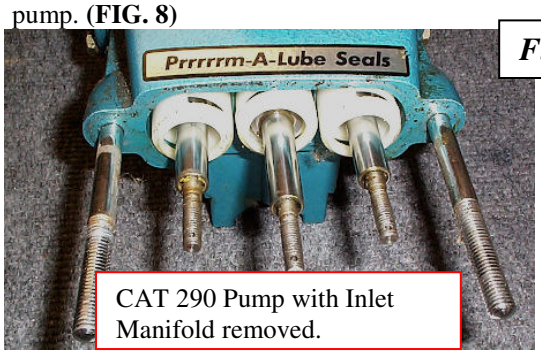
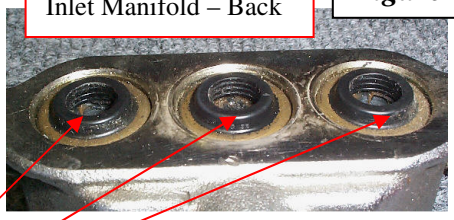


Figure #8

CAT 290 Pump with Inlet Manifold removed.

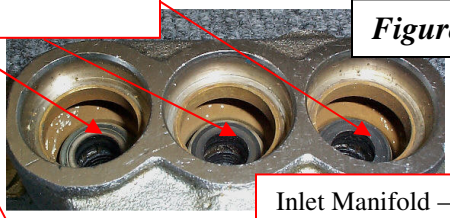
Figure #9

Inlet Manifold – Back



Inlet Seals – Prrrrrm-A Lube 30315

Figure #9a



Inlet Manifold – Front

- On the backside of the Inlet Manifold are the three Inlet Seals, or Prrrrrm-A-Lube Seals. **(FIG. 9)** The Seals can be removed by using a ½" deep well socket and a mallet to drive them out. Insert the socket from the front side and strike it with the mallet to drive the Seals out the back of the Inlet Manifold. **(FIG. 9a, & 9b)**

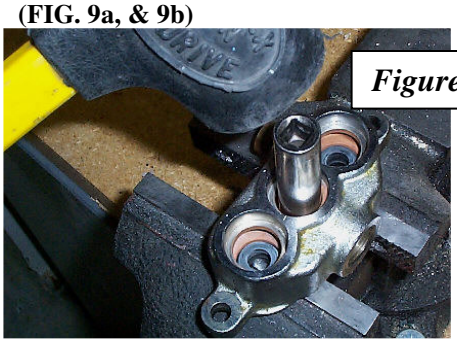


Figure #9b

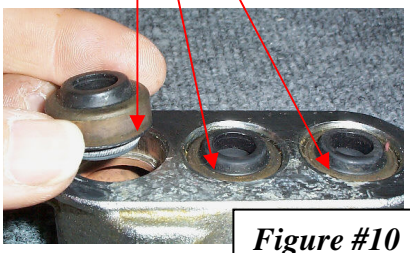


Figure #10

Figure #10a

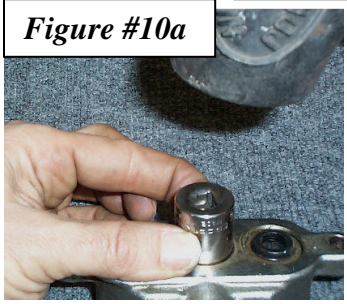


Figure #10b

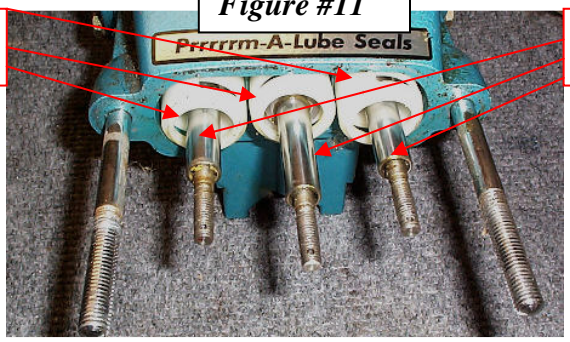
Inlet Seal Kit -Prrrrrm-A Lube PST30305

- To install the new Seals, first lightly coat the outside edge of the Seal with oil and set the Seal **spring side down** onto the opening in the back of the Inlet Manifold. **(FIG. 10)** Use an 11/16" socket and mallet to drive the Seal into the backside of the Inlet Manifold. **(FIG. 10a)** Make sure Seal is setting square and strike the socket with light to moderate force to be sure the Seal is not damaged. Repeat this procedure for all three Seals. Then set the Inlet Manifold aside until ready to re-assemble pump. We do not stock individual Seals. They are sold as a kit. The Inlet Seal Kit PST30305 contains three Prrrrrm-A-Lube Seals, three Cotter Pins and two small sheets of 400-grit sandpaper. **(FIG. 10b)**
- Grasp the Sleeves with your fingers. Do not use pliers, unless your are planning to remove worn or damaged Sleeves. Pliers will damage the Sleeves. With a pulling and twisting motion, remove the Sleeve from the Piston Rod. Repeat this procedure for all three Sleeves. **(FIG. 11, 11a & 11b)**

Seal Retainer PST28597

Figure #11a

Figure #11



Sleeve PST29614

Figure #11b

- Examine the Sleeve for scoring or etching. Small scratches can be sanded out with 400-grit sandpaper. Replace Sleeves as needed. Sleeve & Seal Kit, PST30431 **(FIG. 14b)**, can be used if Seals and Sleeves are both being replaced. This kit contains three Sleeves, three Inlet Seals (Prrrrrm-A-Lube), six Sleeve O-rings, three Barrier Slingers and three Cotter Pins.
- Remove Sleeve O-rings and white plastic Back-up Ring from the piston rod. Examine O-rings and Back-up Rings and replace as needed.
  (FIG. 12)
- Remove plastic Seal Retainers. Examine retainers for signs of damage. Replace as needed. **(FIG. 11 & 11a)**
- Remove Barrier Slingers. Replace as needed. Remove Seal Washers. **(FIG. 12)**

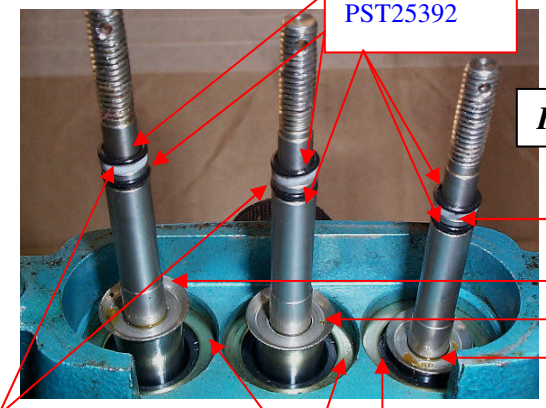


Figure #12

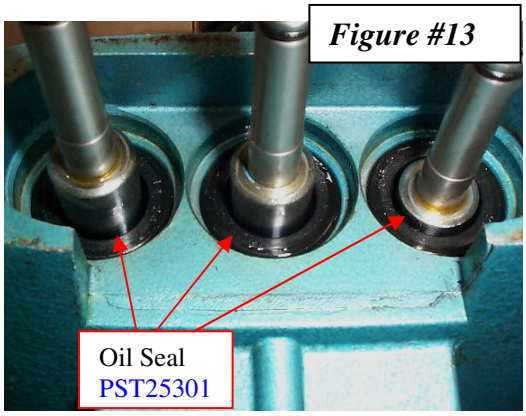


Figure #13

- Examine the three Oil Seals for signs of drying, cracking or leaking. Replace as needed. If the Oil Seals are to be replaced, drain the crankcase oil before removing the Oil Seals. The Oil Seals can be pulled out from the front using a pick tool. Make sure Oil Seal Washers behind Oil Seals have remained in position and are in place prior to installing new Oil Seal.
  (FIG. 13 & 14)
  Push new Oil Seals into place using a deep well socket pushed with your hand or lightly tapped with a mallet. **(FIG. 13)**

Figure #14

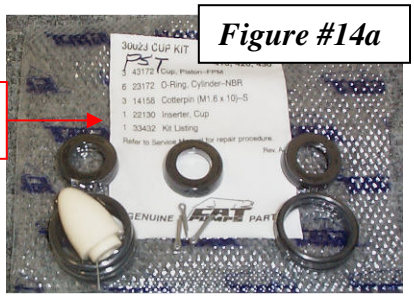


Figure #14a

Figure #14b

Figure #14c

Figure #14d

Re-assembly

- With Oil Seals replaced or determined to be OK, replace the Seal Washers and Barrier Slingers. **(FIG. 12)**
- Replace the Seal Retainers. **(FIG. 11 & 17)**
- Place one Sleeve O-ring into groove on Piston Rod. Place Sleeve Back-up Ring against shoulder on Piston Rod, then place one Sleeve O-ring against Back-up Ring. Lubricate O-rings and Back-up Ring with Super Lube or Silicone lubricating gel. Repeat this procedure for all three Piston Rods. **(FIG. 15)**

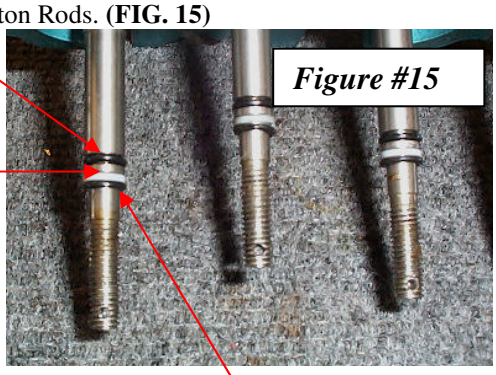


Figure #15

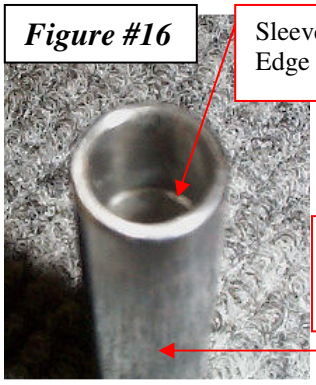


Figure #16

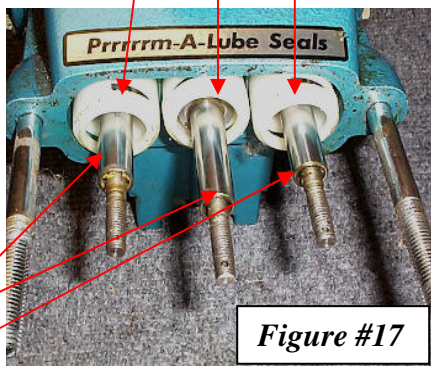


Figure #17

- One end of each Sleeve is slightly larger than the other end. Look into the end of the Sleeve and you can see the edge of the bore approximately ¼" in from the larger end. This machined counter bore end goes onto the Piston Rod first. **(FIG. 16)** Immerse the Sleeve in oil and carefully push and twist the Sleeve onto the Piston Rod. Be sure Sleeve is pushed all the way down to where it is touching the Barrier Slinger. Repeat this procedure for all three Piston Rods. **(FIG. 17)**
- Insert the ends of the Piston Rods into the Inlet Seals on the backside of the Inlet Manifold and slide the Inlet Manifold onto the Piston Rods and Studs. The Studs are inserted through the holes on the Inlet Manifold mounting flanges. Push the Inlet Manifold up against the Seal Retainers and the pump body.
- Thread the two Hex Nuts onto the two Studs with the flat side pointing out away from the pump body. **(FIG. 18)**
- Place the Inlet Valves onto the Piston Rods against the Sleeve.
- Place the Spacers onto the Piston Rods.
- Place the Piston Cup Assemblies onto the Piston Rods.
- Place the Piston Retainers onto the Piston Rods.
- Place the Washers onto the Piston Rods.
- Thread the Nuts onto the ends of the Piston Rods. Use a 10mm wrench and tighten to 55in.lbs. (4.4ft.lbs. or 6 Nm.)
- Insert new stainless steel Cotter Pins onto holes on the end of the Piston Rods. Bend the ends back to secure the Cotter Pin in place. **(FIG. 18)**

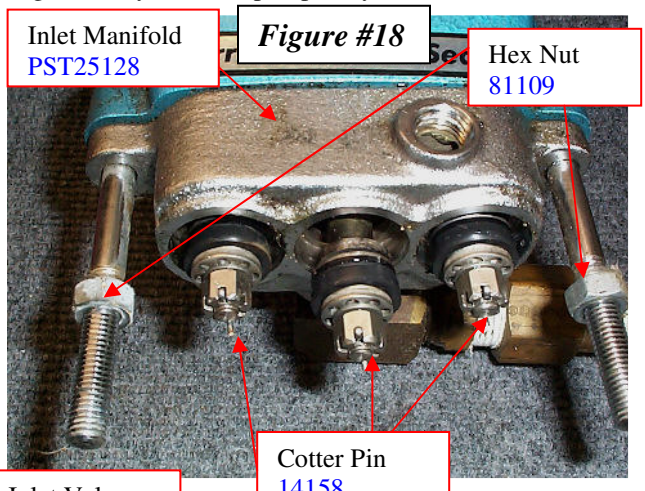
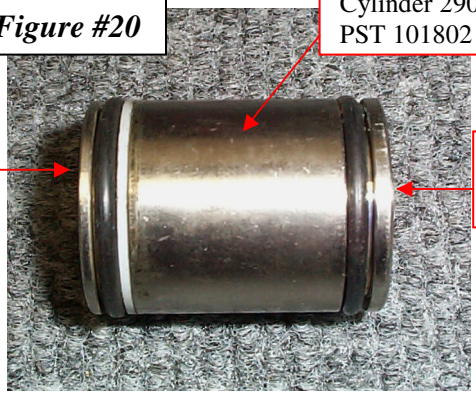


Figure #18

Figure #19

Lubricate the Piston Cups and the inside surface of the Cylinders with Super Lube or Silicone lubricating gel. Also lubricate the O-rings on the outside of the Cylinder. Place the Cylinders over the Pistons and insert the single O-ring end of the Cylinder into the Inlet Manifold. Be careful not to pinch or damage Cylinder O-ring as you push the Cylinder into the manifold. **(FIG. 20)**

Figure #20



- Insert the Valve Retainers into the Discharge manifold. Place the Spring over the center post of the Retainer. Set the Valve on top of the Spring with the **dimpled side up**. (Concave side down. Convex side up) Insert the Valve Seat on top of the Valve with the **dish side down**, so the Valve will seat against it. **(FIG. 21, 22 & 23)**

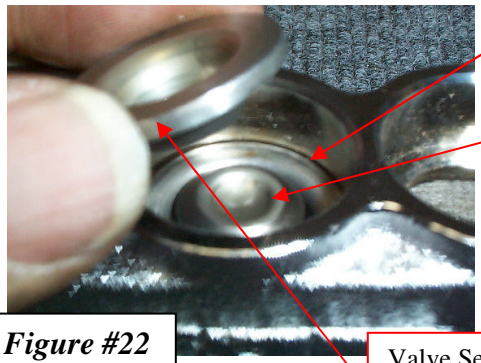
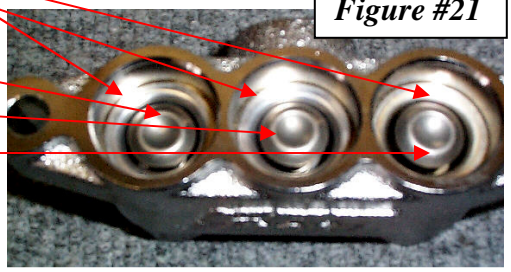


Figure #22

Figure #21



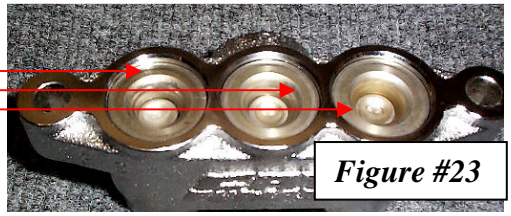


Figure #23

- Place the Discharge manifold onto the pump, inserting the ends of the Cylinders with the O-ring and Back-up Ring into the manifold. The Studs Are inserted through the holes on the Discharge Manifold mounting flanges.
  Be careful not to pinch or damage Cylinder O-ring as you push the Cylinder into the manifold. Also be sure the Discharge Valve Assemblies do not fall out as you turn the manifold during the procedure.
- Place the two Flanged Hex Nuts onto the Studs. Use a 13mm wrench and tighten to 115in.lbs. (9.4ft.lbs. or 13 Nm.) **(FIG. 24)**
- Use a 13mm wrench to tighten the other two Hex Nuts up against the backside of the Discharge Manifold Mounting Flanges.
- Reconnect the hoses to the pump.
- Check the oil level and add or change the pump crankcase oil as needed.
- Run machine and test pump operation.

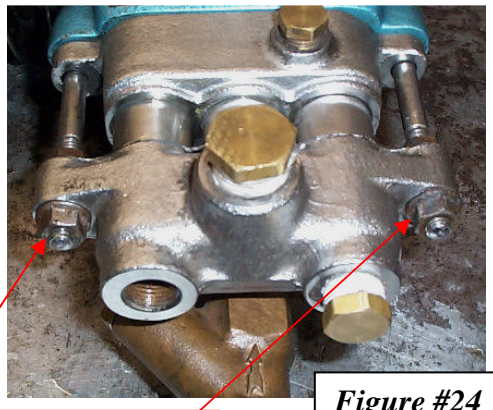
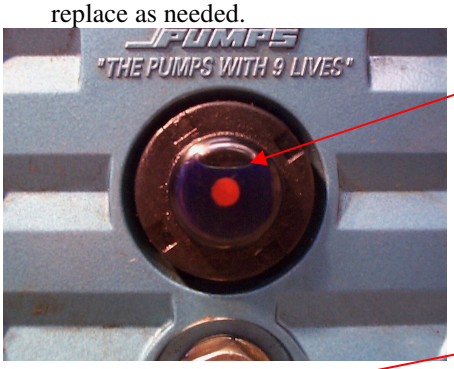


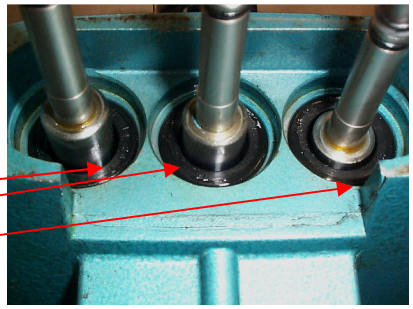
Figure #24

CRANKCASE

1. Check crankcase oil level. Check crankcase oil for traces of water in the oil. Add or change oil as needed. If oil has water in it, replace three Oil Seals on Piston Rods. Refer to pumping section instructions. Check Crankshaft Oil Seals for signs of damage, wear or leakage. Replace as needed. Install with **spring side toward oil**. Flush crankcase before refilling with oil. Check Oil Sight Glass for signs of cracking or leaking. Clean glass or replace as needed.



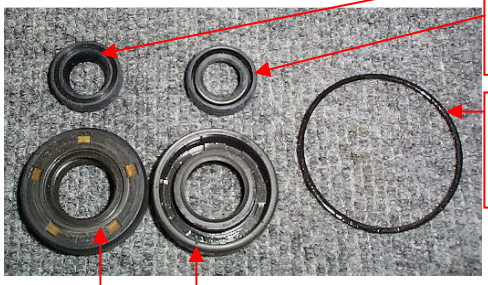
Oil level must be above the red dot, but not to the top of the sight glass.



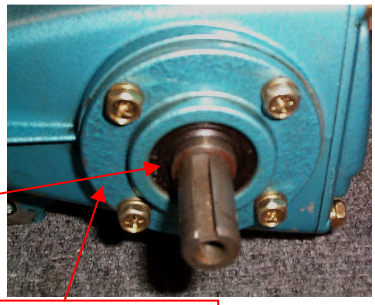
Check Oil Seals

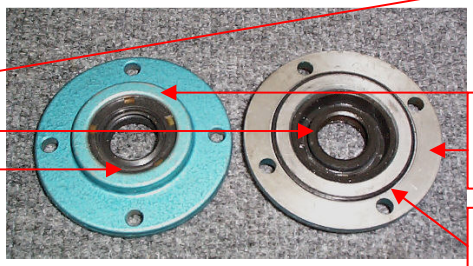
Sight glass removal tool

Oil Seal
PST25301



O-Ring – Bearing Cover
26536





Oil Seal – Crankshaft
24159

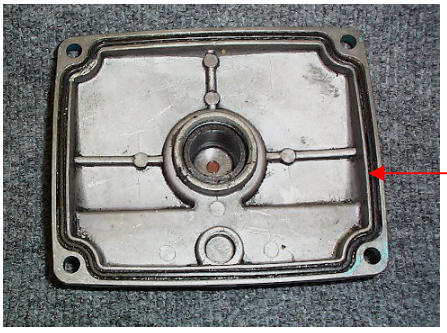
Bearing Cover
27950

O-Ring – Bearing Cover
26536

2. With the Discharge Manifold, Piston Assemblies, Inlet Manifold, Seal Retainers, and Barrier Slingers removed, examine the Oil Seals for signs of damage, wear or leakage. Replace Oil Seals as needed. Torque bearing cover screws to 50-in. lbs. or 4.0-ft. lbs.

3. Rotate crankshaft by hand to feel for smooth bearing movement. Make sure each piston rod moves back and forth as crankshaft is rotated. Torque connecting rod bolts to 95-in. lbs. or 7.96-ft. lbs.

4. Remove Crankcase Cover and examine Connecting Rods and Crankshaft for damage. Replace Connecting Rods, Piston Rods, Crankshaft, Seals and Bearings as needed. Before proceeding with crankcase repairs, determine estimated cost of repairs and decide if it is more economical to replace pump with a new pump or to complete the needed repairs. Torque the crankcase cover screws to 50-in. lbs. or 4.0-in. lbs.



Rear cover of crankcase removed to expose crankshaft and connecting rods.

Rear Cover O-Ring
PST43340

Connecting rod bolt (1 of 6)
Torque to 95-in. lbs. or 7.96-ft. lbs.