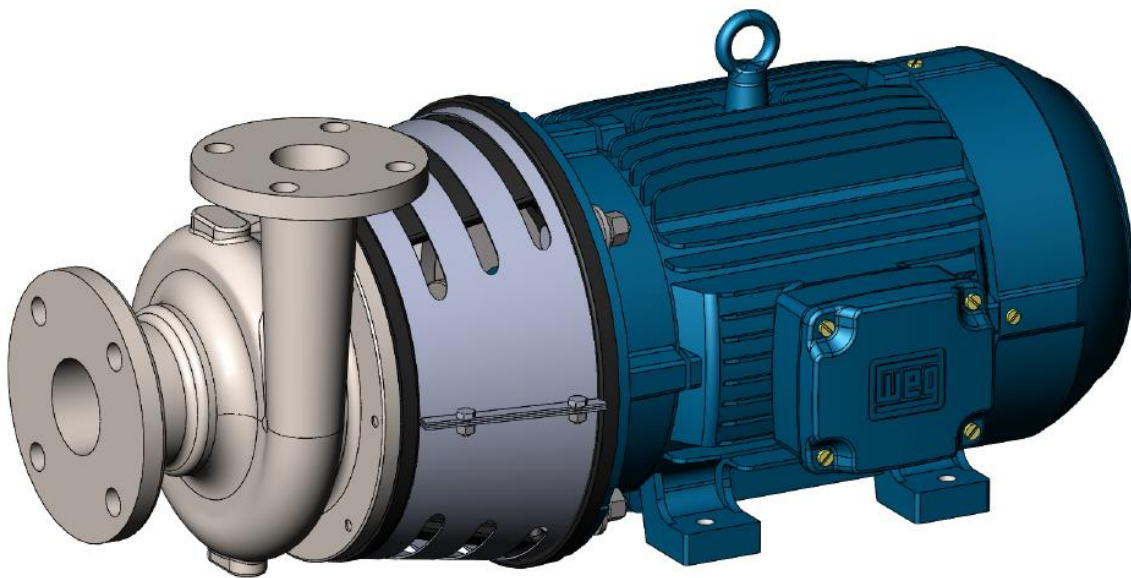


Ampco Pumps Company



Z-Series: Metric Components Service Manual



This service manual includes installation, operation, and maintenance instructions for Ampco Pump Company's Z-Series: ZCM and ZCHM. Failure to learn the correct procedures for installing and servicing the pump from this manual could result in equipment failure.



PUMP INSTALLATION

Receiving pumps:

Visually inspect shipping crate(s)/pallet(s) for damage. Ampco pumps will be shipped in boxes labeled Ampco Pumps or in crates. If there is any damage it is imperative to notify the driver at the time of delivery. Failure to do so will make it difficult, if not impossible, to file a damage claim and Ampco Pumps will not be held accountable. Please contact Ampco Pumps shipping department with damage details ASAP.

Once unpacked, carefully inspect the pump for any damage that may have occurred during shipping. Attempt to turn the impeller, it should turn freely. There should be a little noise from the seal which is normal. If there is metal-to-metal contact when the impeller is turned then shipping damage is likely. Leave the protective covers on the inlet and discharge connections until the pump is installed and is ready to be connected to the piping to stop debris from getting into the pump.

Pump Location

Use the following pump location guidelines to help ensure proper pump performance:

- Locate the pump so that the shortest and most direct possible suction piping can be used.
- To facilitate priming, ensure a steady flow, and provide positive suction head, locate the pump below system level, when possible.
- Ensure the NPSH available to the suction end is always equal-to or greater-than the specified NPSH required on the pump performance curve by considering the pump's location in relation to the entire system.

Foundation (if applicable)

The base attached to the pumping unit has pre-drilled mounting holes so that the pumping unit can be fixed to a foundation, providing a permanent rigid support. The foundation is necessary in order to absorb vibration, strain, and shock on the pumping unit. The foundation should be about 6 inches longer and wider than the pump base and have a depth of about 20 times the diameter of the foundation bolts.



General Piping Notes

- Pipe hangers or other supports must be used at proper intervals to ensure proper piping support near the pump. **Do not use the pump to support piping!**
- When flange bolts are tightened no strain should be transmitted to the pump, thus suction and discharge piping should be supported independent of the pump and care should be taken that the pump and piping are properly aligned.
- Piping must be as straight as possible. Avoid all unnecessary bends and fittings. When bends are necessary use 45° or long-sweep 90° pipe fittings in order to decrease minor friction losses.
- Make sure all flanged joints have matching inside diameters and properly aligned mounting holes – especially close to the pump.
- **Do not force piping when making connections. This can cause the impeller to rub on the casing or premature seal failure.**

Suction Piping

It is very important that suction piping be selected and installed such that it minimizes pressure loss and allows sufficient liquid flow into the pump. A proper suction piping system design can eliminate many NPSH problems. The following precautions should be followed to ensure a proper suction piping system.

- Suction piping must be kept as direct as possible. It is suggested that any elbows be kept at least 5 pipe diameters away from the pump's suction flange.
- Suction piping length should be at least ten times the pipe diameter overall.
- When suction piping has a larger diameter than the pump suction opening an eccentric reducer must be used, with the taper oriented down. (Note: Do not use a concentric reducer)
- Suction piping must never have a smaller diameter than the pump suction opening.
- When possible, horizontal suction piping should follow an even gradient.
- For suction lift conditions it is recommended that the suction piping have a gradual upward slope approaching the pump. For positive suction head the suction piping should have a gradual downward slope approaching the pump.



- High point such as loops or arcs must be avoided as they may create air pockets, throttle the system, and produce erratic pumping.
- A valve must be installed in the suction piping in order to isolate the pump during shutdown and maintenance, and to facilitate pump removal. If two or more pumps are connected to a single suction line, each pump should be isolated by a separate valve.
- Gate valves need to be positioned so that air pockets are not produced. If NPSH is critical, globe valves should not be used. (**Note: During operation all valves installed on the suction line must be at full open**)
- To enable the pump operator to monitor pump performance, properly sized pressure gauges may be installed in gauge taps on pump suction and discharge nozzles. Pressure gauges will also indicate the presence of cavitation, vapor binding, or other unstable operation by showing wide fluctuations in suction and discharge pressures. For these reasons Ampco highly recommends gauges.

Discharge Piping

To ensure proper pump performance the following precautions regarding discharge piping should be followed:

- If the discharge piping distance is short the piping can be the same diameter as the pump discharge opening.
- Long horizontal lengths of discharge piping should maintain an even gradient.
- A valve needs to be installed near the pump's discharge opening to prime and start the pump, as well as to isolate the pump during shutdown, maintenance, and to facilitate pump removal.
- High points should be avoided in discharge piping as they can entrap air or gas and retard pump operation.
- If liquid hammer might exist, such as when check valves are used, the discharge gate valve should be closed prior to pump shutdown.



Priming

The Z-Series pump is not a self-priming pump and must be completely filled with the pumping liquid before operation. If the system has a positive suction head priming can be done by opening the valve in the suction piping as well as the pump's air vents to allow the liquid to enter the pump casing. Rotate the shaft by hand to free entrapped air from the impeller and then ensure that all air has been forced out by the liquid before closing the air vents. If the pump has a suction lift, priming must be done by using foot valves, ejectors or manual filling of the pump casing.

CAUTION!

Running the pump dry will result in serious damage to the mechanical seal.

Pre-Start Checklist

Before operating the Z-Series pump ensure that all of the following requirements are met

- Check that all motor and starting device wirings match the wiring diagram.
- Make sure the shaft rotates clockwise when viewed from behind the motor.
- Refer to motor instructions before starting if the motor has not been operated over an extended period of time.
- Make sure that that voltage, phase, and line circuit frequency match what is specified on the motor data plate.
- Turn shaft by hand to make sure it rotates freely.
- Tighten all gauge and drain tap plugs. When not in use, close the gauge cocks on pumps fitted with pressure gauges.
- Check that all flange bolts are tightened and the suction and discharge piping is not leaking.

Pump Operation

WARNING

Operating the pump without an approved coupling guard installed could result in operating personnel injury.

Start Up Instructions

1. Set the suction line gate valve to full open and close the discharge line gate valve.
2. Fill the suction line and prime the pump.
3. Start the motor and immediately check the pump and suction piping for leaks.



4. As soon as the pump reaches operating speed, open the discharge gate slowly until complete system flow is achieved. There may be valve chatter during transient period

during valve adjustment. Be aware that the pump's motor is specified for the flow and pressure specified by the customer and that higher flow rates could damage the motor.

5. Check for leaks in the discharge piping.
6. (For pumps with pressure gauges) Open gauge cocks and record pressure reading. Check that the pump is performing as specified by the performance curve.

Shut Down Instructions

(Note: If the pump will be shut down for an extended period refer to the Extended Duration Shutdown)

1. Slowly close the discharge piping gate valve. (Closing valve too quickly can cause hydraulic shock)
2. Turn off power supply to the pump.

Short Duration Shutdown

For short shutdown periods the pump can remain filled but make sure the pump is fully primed prior to restarting. If the pump is subject to freezing conditions then the pump exterior should be insulated or heated and the fluid within the pump casing must be kept moving in order to prevent freezing.

Extended Duration Shutdown

For extended duration shutdowns close the suction piping gate valve or if no suction valve is installed then drain the suction line to stop liquid flow to the suction nozzle. Remove pump drain and vent tap plugs as required and completely drain the pump casing. If the pump will be subjected to freezing conditions during shutdown then all liquid must be completely blown out of all passages and pockets using compressed air or the pump must be filled with an antifreeze solution to prevent damage.

Assembly – ZCM/ZCHM

*Refer to the parts list appended to this manual for the part name and quantity corresponding to each number in Figure 9.

- 2) Attach the stub shaft [6] and locking collar [7] to the motor and the motor adapter [5] as shown in Figure 1.

- 1) Begin with the bare motor. Ensure that the shaft and C-face areas are clean.

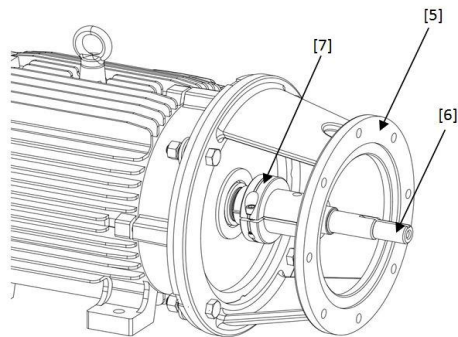


Figure 1: Step 2 Illustration

3) Measure the stub shafts axial location with respect to the outer-most face on the adapter as shown in Figure 2. This will dictate the impeller clearance to the pump casing. Once the dimension is set, tighten the collar screw to 20 ft-lbs [27 Nm]. Ensure that the collar [7] remains all the way against the shoulder on the stub shaft [6] (in the outboard direction). **Once the stub shaft's axial location is set, do not remove the screw unless you believe it is not in its original location.**

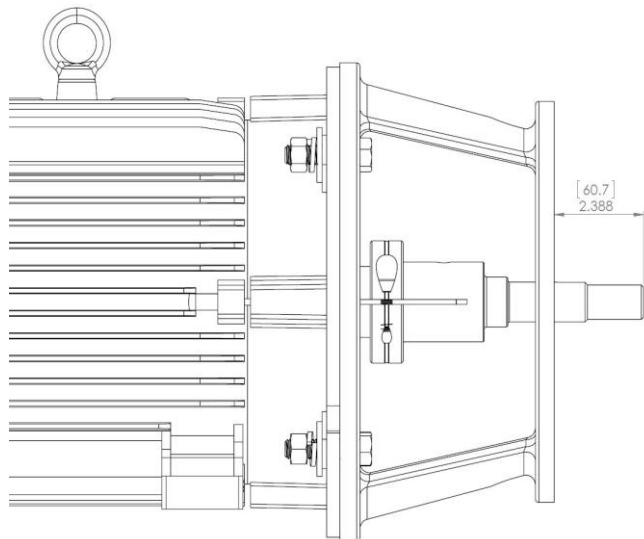


Figure 2: Shaft to adapter measurement

4) The remaining pump assembly is now ready to be performed. (For double seal assembly refer to instructions listed in Appendix B) First the stationary seal [16+17] must be pressed into the cover or stuffing box [4]. Temporary rubber emulsion or water should be used on the elastomer, and the seal should be pressed in by hand. Attach the cover to the pump adapter [5], or attach the stuffing box to the cover. Then place the cover in the pump adapter. This may require screws with the large flat covers.

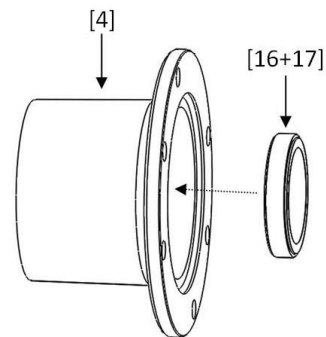


Figure 3: Step 4.1, stationary seal into stuffing box

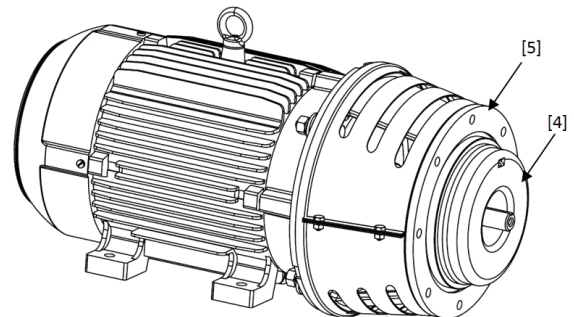


Figure 4: Step 4.2, cover mounted to adapter

5) The shaft sleeve [12] should now be prepped by applying the seal and o-rings [13+14]. Use temporary rubber emulsion or water and push on the rotating seal portion [15+18+19] of the elastomer bellows seal onto the shaft sleeve [12]. Put the o-ring(s) [13+14] into their grooves in the shaft sleeve

and then place the seal spring into the rotating seal element. Once the shaft sleeve is prepped, push it onto the stub shaft until it seats against the shoulder.

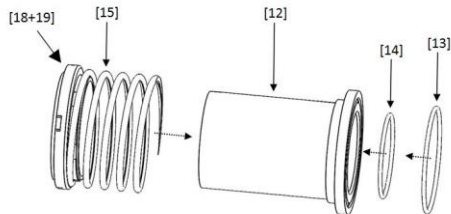


Figure 5: Stub shaft preparation

6) Place the casing gasket [9] onto its spot on the cover [4].

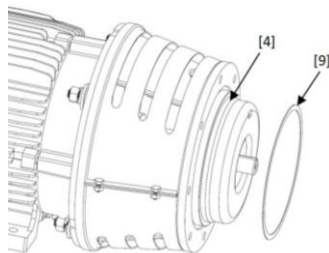
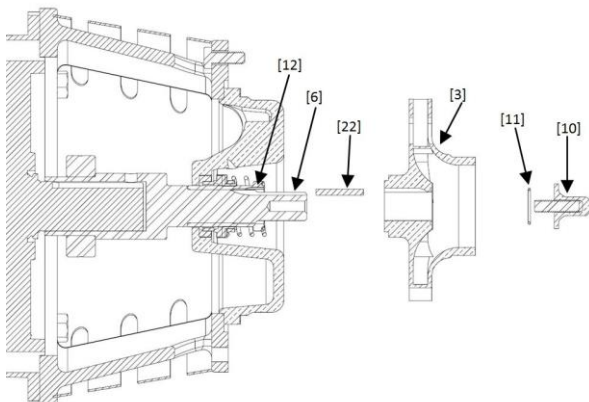


Figure 6: Cover gasket on to cover

7) Place the key [22] into the stub shaft [6] and align it so it also engages in the shaft sleeve [12]. If you have a stepped key, the taller side goes toward the motor. Install the impeller [3] onto the shaft [6]. Apply the gasket or o-ring [11] and torque the impeller screw to 50-60 ft-lbs [68-81 Nm]. Use blue thread-locker on the threads.

Figure 7: Step 7 illustration



8) Ensure the impeller does not rub against the cover by turning it by hand. You are now ready to attach the pump casing [1]. Have the screws ready and apply the casing to the cover. Tighten all the casing screws in an alternating fashion to 25 ft-lbs [34 Nm].

Again, check the pump for rubbing by rotating the stub shaft. If the impeller contacts, look into the suction flange on the pump and see if it is bound against the front wear ring. If it is,

please repeat step 2 and ensure you have the correct measurement.

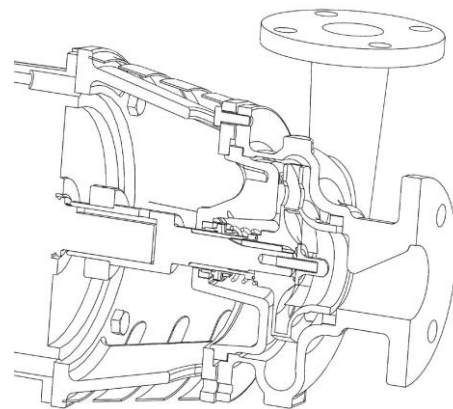


Figure 8: Step 8 illustration

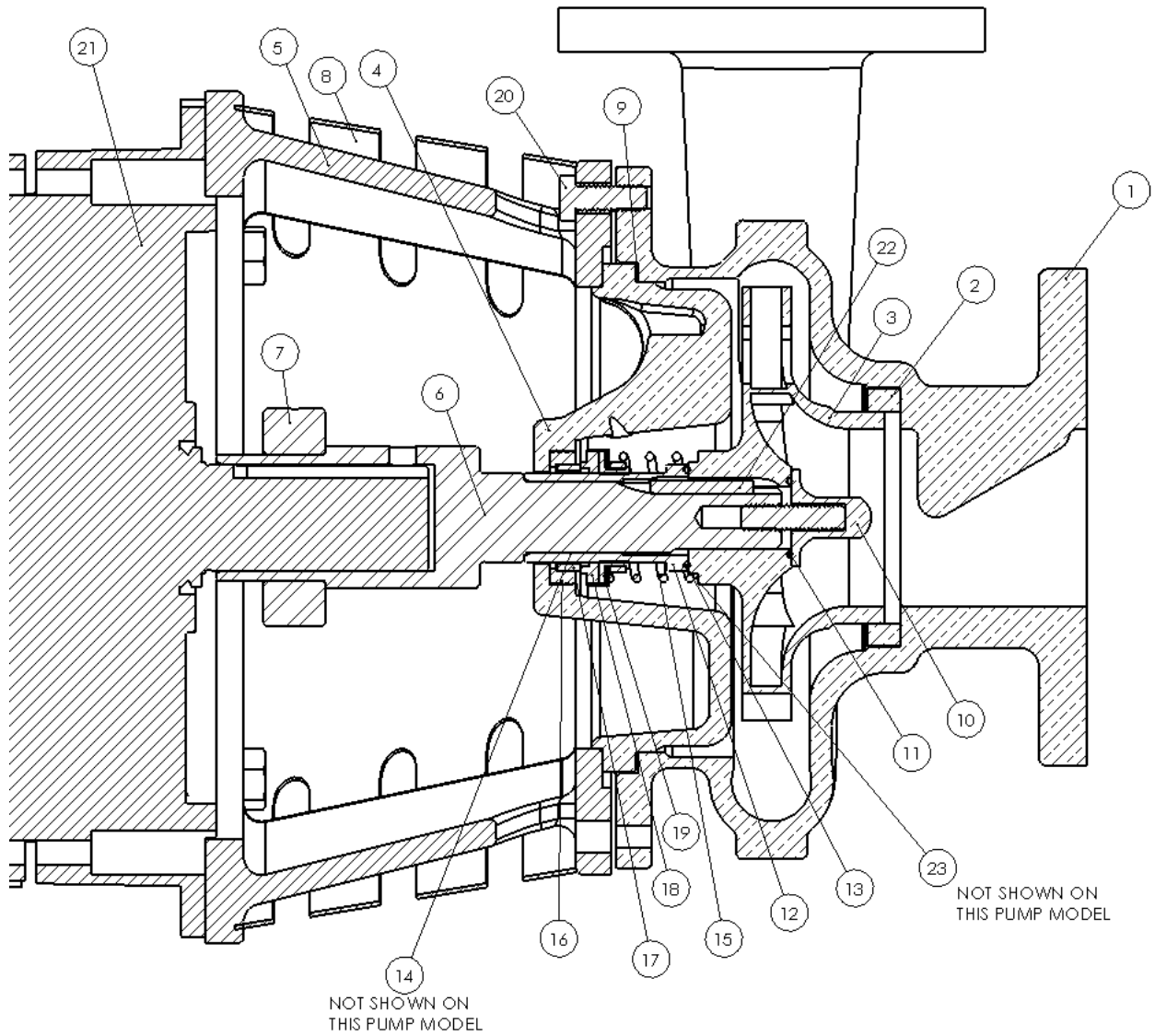


Figure 9: Type 21 seal cross section parts diagram

Appendix: A

Parts List

| Number | Description | Qty. per pump |
|---------------|-----------------------|----------------------|
| 1 | Pump Casing | 1 |
| 2 | Casing Wear Ring | 1 |
| 3 | Impeller | 1 |
| 4 | Rear cover | 1 |
| 5 | Motor Adapter | 1 |
| 6 | Stub Shaft | 1 |
| 7 | Shaft Collar | 1 |
| 8 | Adapter Guard | 2 |
| 9 | Cover Gasket | 1 |
| 10 | Impeller Screw | 1 |
| 11 | Impeller O-Ring | 1 |
| 12 | Shaft Sleeve | 1 |
| 13 | Shaft Sleeve O-Ring 1 | 1 |
| 14* | Shaft Sleeve O-Ring 2 | 1 |
| 15 | Seal: Spring | 1 |
| 16 | Seal: Cup | 1 |
| 17 | Seal: Seat | 1 |
| 18 | Seal: Face | 1 |
| 19 | Seal: Retainer | 1 |
| 20 | Cover screws | 8 |
| 21 | Motor | 1 |
| 22 | Shaft Key | 1 |
| 23* | Seal Spring Retainer | 1 |

*NOT PRESENT ON ALL MODELS

Double Seal Assembly Instructions

***Refer to Figure 11 for part numbers referenced within double seal assembly instructions.**

The double seal-supplied pumps require sub-assembly of the stuffing box prior to installation on the pump. Below are the steps required (Refer to Figure 10 and Figure 11):

1. Press the inboard stationary seal [2] into the inner cavity of the stuffing box [1] (DX8307347)
2. Press the outboard stationary seal [7] into the gland [9] (DX8307337)
3. Prepare the shaft sleeve [3] (DX8307367):
(Refer to Figure 9)
 - a. With the flanged edge facing the inboard direction (toward the impeller) first put the shaft sleeve through the seal face in step 1. Apply the inboard rotating seal [4] onto the shaft sleeve with the use of temporary rubber emulsion lubricant or clean water. **You must do this sideways as gravity will allow the inboard seal face to drop out of the bellows.**
 - b. Place the spring [5] onto the shaft sleeve and make sure it seats around the inboard seal from step 3a.
 - c. Apply the outboard rotating seal [6] onto the shaft sleeve in the reverse direction of the inboard seal again using temporary rubber emulsion lubricant or clean water.

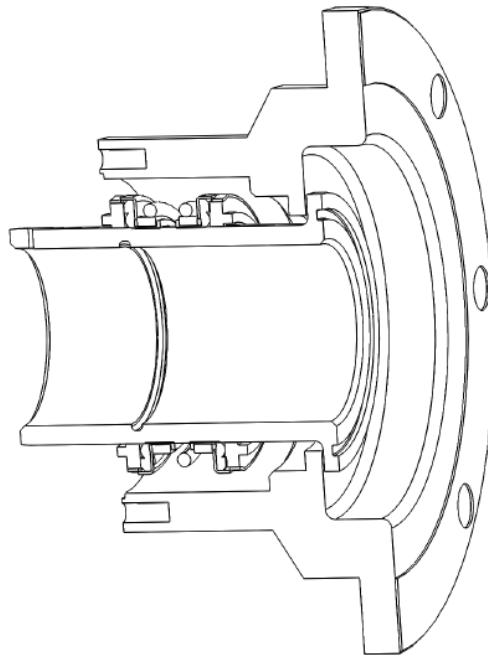


Figure 10: Double Seal

Double Seal Assembly Instructions

4. Place the gland [9] with the outboard stationary seal so that it locates on its pilot in the rear of the stuffing box. **Do not forget the o-ring [8] (GX5042814)**
5. Tighten the 4 screws [11/10] (GX5501110) evenly and carefully.
6. Prepare the shaft sleeve: Place the O-ring in the groove inside the sleeve, and the O-ring on the shoulder's face– the double seal sub-assembly is now complete and can be assembled onto the pump. Slide the shaft sleeve onto the stub shaft until it seats on the shoulder of the shaft.

Continue pump assembly with step 6.

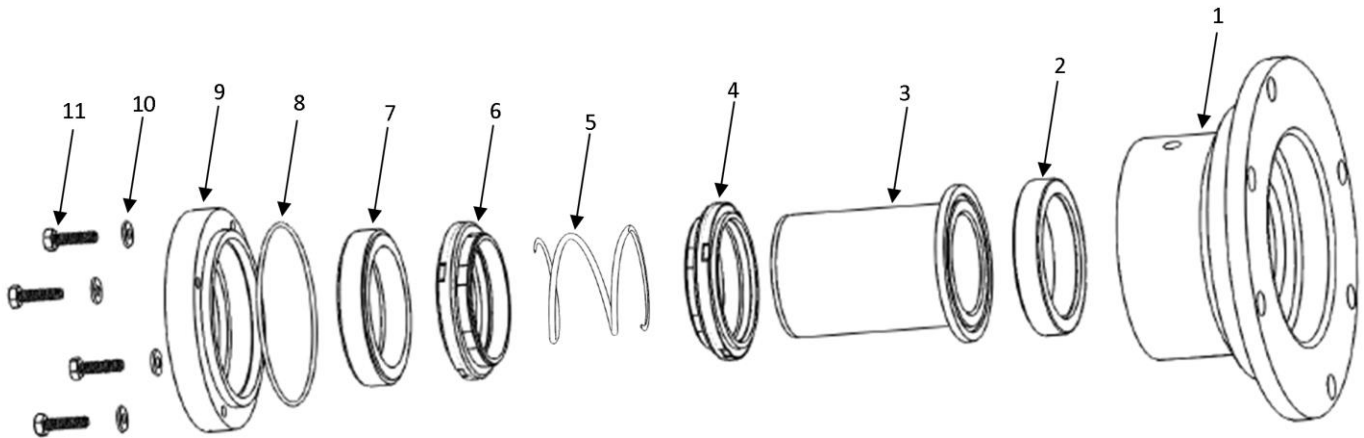


Figure 11: Double seal parts list

| Number | Description | Qty. per pump |
|--------|--------------------------|---------------|
| 1 | Stuffing Box | 1 |
| 2 | Inboard Stationary Seal | 1 |
| 3 | Shaft Sleeve | 1 |
| 4 | Inboard Rotating Seal | 1 |
| 5 | Seal Spring | 1 |
| 6 | Outboard Rotating Seal | 1 |
| 7 | Outboard Stationary Seal | 1 |
| 8 | Gland O-Ring | 2 |
| 9 | Gland | 1 |
| 10 | Washer | 1 |
| 11 | Hex Screw | 1 |