

# INSTALLATION, OPERATION & MAINTENANCE GUIDE



## TYPE E (TYPE 1 REPLACEMENT)



### Headquarters

291 Hurricane Lane  
Williston, VT 05495

TEL: (802) 878-8307  
FAX: (802) 878-2479

### Brazil

Rua Javaés, 441/443  
Bom Retiro, Sao Paulo  
Brazil CEP 01130-010

TEL: 55-11-3736-7373  
FAX: 55-11-3736-7355

### Gulf Coast

1719 South Sonny Avenue  
Gonzales, LA 70737

TEL: (225) 484-0007  
FAX: (225) 341-8922

### Texas

**Houston**  
7545 E. Orem Drive  
Houston, TX 77075  
TEL: (832) 804-7424

**Odessa**  
801 S. Pagewood Avenue  
Suite 2, Odessa, TX 79761  
TEL: (432) 300-0167

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## **OVERVIEW**

This guide is provided to familiarize the user with, and guide them in the installation, operation & maintenance of the Type E (Type 1 Replacement) component seal. This guide, in addition to the manuals provided by the pump manufacturer and the manufacturer of any auxiliary equipment, should be read in their entirety prior to installation.



## **NOTICE**

Flexaseal does not assume responsibility for misuse, or any damages incurred as a result of the misuse of the supplied sealing system. Contact a Flexaseal representative before making any changes to the provided system or design.

## **WARRANTY**

Flexaseal's limited warranty covers material defects and workmanship for its goods and/or services for a period of six (6) months for new items, or three (3) months for repaired items, from the date of their initial use/installation or delivery, whichever occurs first.

## **SAFETY**

1. Read all instructions thoroughly prior to beginning installation.
2. Installation, operation, removal, and maintenance must only be carried out by qualified personnel who have thoroughly read all instructions.
3. The seal must only be used for its intended application. Flexaseal cannot be held liable for use outside the scope of recommended application.
4. Inspect the replacement seal prior to removal of the old seal or installation of the new seal using the technical information provided in this document. Contact a Flexaseal representative if there are any questions.
5. Follow plant safety regulations and procedures throughout the disassembly/installation process including, but not limited to, the following:
  - Lockout/tagout procedures
  - SDS consultation for any hazardous materials involved
  - Use of proper personal protective equipment
  - Relief of any system pressure and mechanical energy
6. The following symbols have been used throughout the document to highlight important information:
  -  Instructions intended to prevent damage to seal or equipment
  -  Mandatory instructions intended to prevent personal injury or extensive damage to equipment
  - NOTE:** Information to note while installing, or for later use

### **Type E Maximum Operating Conditions**

Temperature	320°F (160°C)
Pressure	150 psi (10 bar)
Speed	4000 fpm (20 m/s)

**PREPARATION**



Verify that equipment has been properly shut off and rendered inoperative according to plant safety protocol (i.e. lockout/tagout).

1. Disassemble pump seal chamber, in accordance with pump OEM instructions, to expose existing seal.

**NOTE:** Document how seal chamber is disassembled for re-assembly.

2. Carefully remove existing seal rotary and stationary assemblies, taking care not to damage shaft or seat counterbore.
3. Clean shaft, shaft sleeve (if present), seal chamber face, and seat counterbore surfaces

of rust, burrs, grit, sharp edges, and set screw damage using fine emery cloth. Wipe clean.

**ATTENTION**

Avoid making flat spots, reducing shaft diameter, or increasing seat bore diameter.

4. If the pump is equipped with a shaft sleeve, verify the condition of it's o-ring or gasket and ensure that it is properly located (fully engaged against step/hook/snap ring).
5. Sealing surfaces and shaft or shaft sleeve must have at least a 63 Ra-µin surface finish as seen in [Figure 1](#).
6. For ease of installation, the leading edge of the shaft or sleeve should be chamfered as shown in [Figure 1](#) and all parts should be deburred.

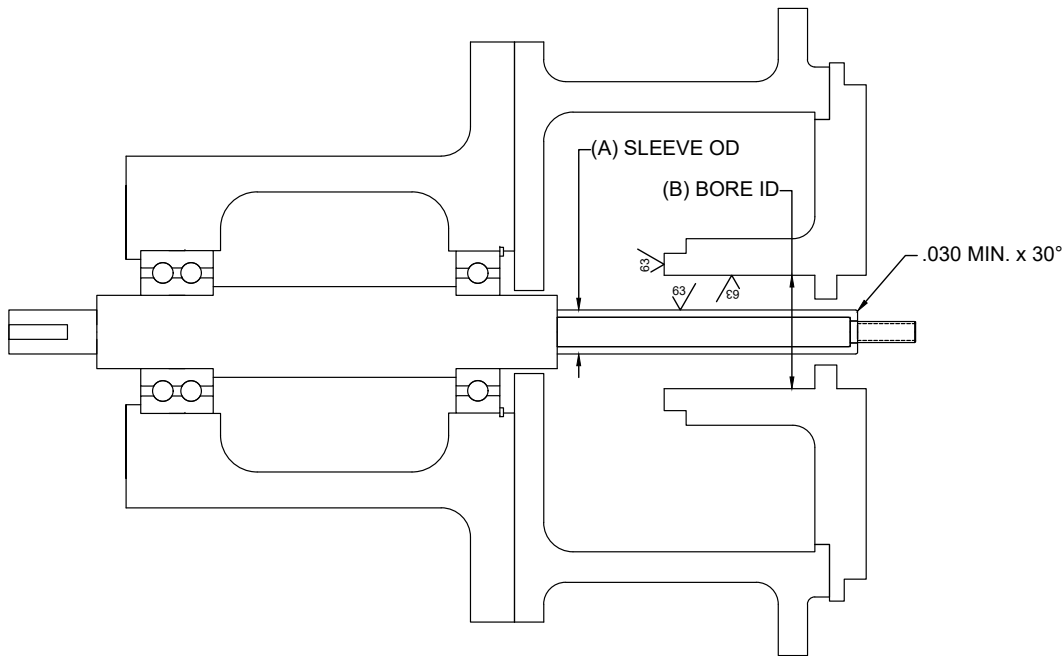


Figure 1: Surface finish and chamfer locations. Fully assembled pump without seal.

**VERIFICATION**

Successful operation of the Type E (Type 1 Replacement) component seal is contingent on conforming equipment dimensions and alignment. Verify the following prior to continuing:

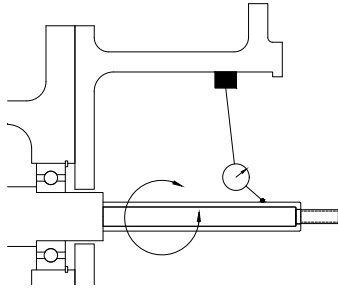


Figure 2: Shaft Runout

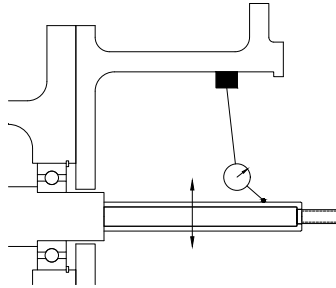


Figure 3: Bearing Fit

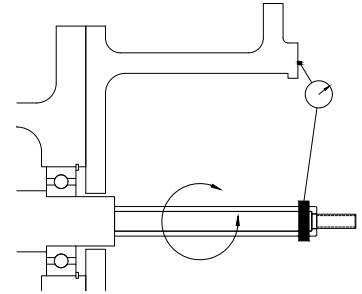


Figure 4: Bearing Frame Perpendicularity

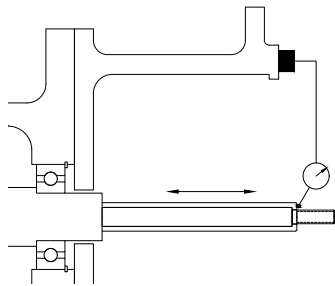


Figure 5: Axial Shaft Movement

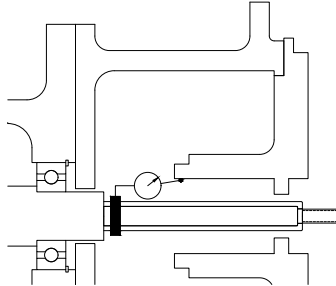


Figure 6: Seal Chamber Bore Concentricity

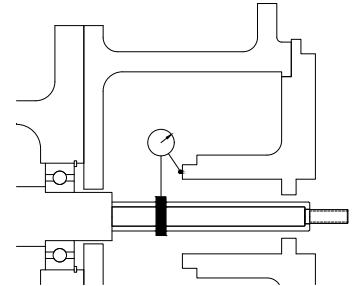


Figure 7: Seal Chamber Face Squareness

**Maximum Alignment Variation (TIR)**

Fig. 2	Radial shaft movement (shaft runout)	0.0015-0.003 in.
Fig. 3	Radial bearing fit	0.002-0.003 in.
Fig. 4	Bearing frame perpendicularity	0.0005 in./in.
Fig. 5	Axial shaft movement (end play)	0.003 in.
Fig. 6	Seal chamber bore concentricity	0.005 in.
Fig. 7	Seal chamber face squareness	0.0005 in./in.

It is imperative to the proper function of this seal that connections, dimensions, finishes, and alignments are all acceptable based on the specified design. If measured values exceed the values given above, adjust the equipment to meet the specifications before installing the seal. These values are rough guidelines and the pump OEM should be used to verify acceptable values whenever possible.

## LAYOUT

- NOTE:** If the seal is being installed on equipment without a preset step, snap ring groove, etc. use the procedure described below to mark the reference distance (using values found on Page 8), otherwise this section can be used to verify the distance of the existing geometry.
- NOTE:** This procedure is designed for **inside-mounted seals**. For outside-mounted seals simply measure back from the chamber face towards the bearing frame for the setting distance. Be sure to account for face and/or collar length for the setting length.

**ATTENTION** Do not scratch the shaft or sleeve when scribing during the layout procedure

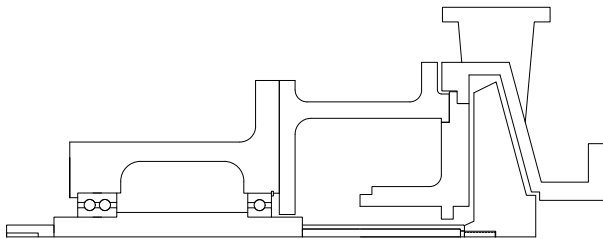


Figure 8: Fully assembled pump without seal

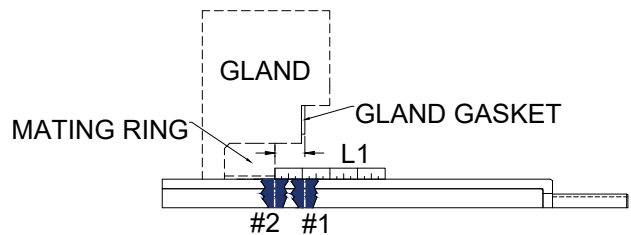


Figure 10: Measure seal face location

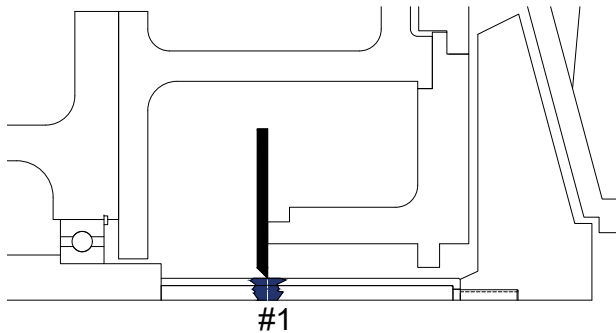


Figure 9: Layout dye application and scribing

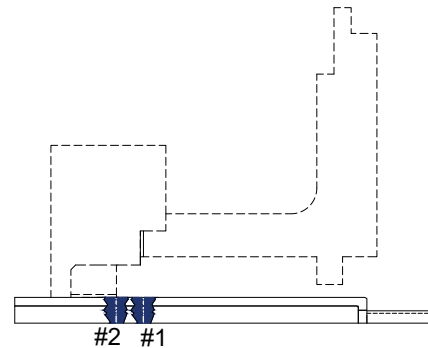


Figure 11: Scribe location of seal face

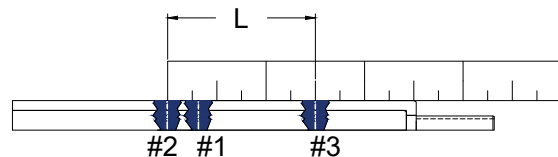


Figure 12: Setting length scribe

To scribe the right locations for the component seal setting length use the following procedure:

1. Reassemble the pump, including the shaft sleeve, seal chamber cover, and impeller as shown in [Figure 8](#). After adjusting impeller, apply layout dye to the shaft (or shaft sleeve) at the face of the seal chamber, and scribe a line in the dye showing the location of the chamber face as shown in [Figure 9](#).
2. Measure the distance from the stationary mating ring face to the seal chamber face. This can be accomplished by simply measuring the distance from the top of the gland gasket to the mating ring as seen in [Figure 10](#). The future location of Line #2 is shown as a reference for the reader.

3. Disassemble the pump and apply layout dye at the approximate location of the seal face. Measure the seal face distance (L1) from Scribe #1 and scribe Line #2 into the dye as shown in [Figure 11](#).
4. From the seal face location, measure back along the shaft to the specified setting length (L) and scribe a third line (Scribe #3, [Figure 12](#)).

**ATTENTION** If lock collar is being used, add collar thickness to seal set length before scribing setting length. This is an important distinction when using a lock collar to avoid over-compressing the seal faces.

## SEAL INSTALLATION

The following steps are for the installation of **inside-mounted** seals. The layout and marking of shaft for installation should have already been completed as described earlier.

**NOTE:** It is essential to use a suitable lubricant when installing a seal, as different lubricants will work better with different elastomers.

**ATTENTION** Do not use ethylene propylene bellows with hydrocarbon-based liquids. Do not use grease on any elastomer bellows.

1. Remove seal from packaging and inspect for damage to any components and seal faces.



Grease, scratches, or nicks on seal faces may cause leakage.

2. Ensure shaft and seal housing have been properly cleaned as described in the preparation section.
3. Evenly press the mating ring into the gland. Be careful to keep the face clean and use a suitable and compatible cleaning solvent if the face gets smudged or dirty.
4. Gently position the gland with installed mating ring on the shaft facing, but clear of, the seal chamber.



Be careful to not damage the mating ring while setting the gland into position.

5. Lightly lubricate the shaft and the elastomeric bellows with a suitable and compatible

lubricant. Slide the seal on the shaft facing the bearing housing.

6. Position the back of the spring to line up with the setting length scribe line. If using a spring holder or optional lock collar, be sure to account for this extra length as shown on [Page 4](#).
7. Fix the seal in position using the optional lock collar or other suitable methods. If using the lock collar and set screws alternately tighten the provided set screws to the specified torque value according to the table below.
8. Ensure the seal faces are clean and dry using a suitable and compatible cleaning solvent for the face material and elastomers.
9. Reassemble the pump according to OEM specifications.
10. Bring the gland with the mating ring installed into position and make sure that it mounts concentric to the shaft.
11. Bolt the gland to the seal chamber using a crossing pattern according to torque requirements if they are specified in the pump OEM. Be sure not to overtighten the gland bolts as this may distort the gland and mating ring resulting in seal leakage.

The following steps are for the installation of **outside-mounted** seals.

1. Follow steps [1.](#), [2.](#), and [3.](#) from inside-mounted seal installation procedure.

2. Lightly lubricate the shaft and the elastomeric bellows with a suitable and compatible lubricant. Slide the seal on the shaft with the seal face oriented towards the impeller.
3. Mount the mating ring, gasketing, or other secondary seals to the seal chamber. Be sure that the lapped face is facing outward toward the seal assembly face.
4. Same as step 11. for inside-mounted seals.
5. Same as step 9. for inside-mounted seals.
6. Bring the gland/seal chamber assembly into position on the pump, making sure not to damage the mating ring face.
7. Bring the seal assembly into position with the reference scribe. Be sure to account for extra length from the optional lock collar if it is used.
8. Same as step 7. for inside-mounted seals.

### Cup Point Set Screw Torque Specifications

Screw Size	Alloy Steel	Stainless	Screw Size	Alloy Steel	Stainless
#10	36 in.-lbs.	26 in.-lbs.	M4	2.0 N-m	1.5 N-m
1/4	87 in.-lbs.	70 in.-lbs.	M6	7.9 N-m	6.1 N-m
5/16	165 in.-lbs.	130 in.-lbs.	M8	19.6 N-m	15.4 N-m
3/8	290 in.-lbs.	230 in.-lbs.	M10	37.0 N-m	29.5 N-m
1/2	620 in.-lbs.	500 in.-lbs.	M12	60.3 N-m	48.3 N-m

## **BEFORE STARTING THE EQUIPMENT**

1. Ensure the pump shaft is properly aligned at the coupling with the motor.
2. Check that all gland plate bolts and all screws are securely fastened.
3. Once pump is reassembled, turn shaft by hand if possible to ensure free rotation, if not, recheck installation.
4. Verify that all plumbing and piping plans for the seal are connected and configured correctly.
5. Flood the pump, vent all air from the seal chamber, and check seal for leakage.
6. Ensure all plumbing and venting are free of

obstruction and that the chamber is filled with liquid. Check that all alarms connected to auxiliary systems are properly functioning to alert personnel if any issues arise.

**ATTENTION**

Dry-running is a major cause for leakage and/or failure of mechanical seals. It is imperative that the seal chamber be completely vented prior to startup and that adequate lubrication is supplied to the seal.

7. Start the pump per pump manufacturer's recommendations, observe for proper operation, and check for excessive heat at the seal gland.

**ATTENTION**

Check periodically during operation to ensure that seal is not overheating.

## **OPERATION & MAINTENANCE**

If leakage is detected, it should be addressed as soon as possible to prevent hazards and protect personnel. Leakage could come from a number of leak paths in the seal, or be caused by changes in the pump operation or condition. Although seals should be inspected regularly for signs of leakage, a properly selected and functioning mechanical seal will run for extended durations without need for extra attention and should not be disturbed unnecessarily (i.e. shut down and disassembled without cause). Below is an inexhaustive list of possible causes of leakage.

## Primary Causes

- Worn seal faces
- Damaged bellows
- Damaged O-rings
- Damaged springs

## Secondary Causes

- Change in duty conditions
- Dry-running
- Worn bearings
- Increased vibration

It is important to periodically inspect and maintain flush systems, shaft alignment, and consistent duty parameters to ensure the seal performs as designed. Often, there is a case of cause & effect with machinery and processing issues upstream that can cause a seal to leak. Check for the root cause of leakage when disassembling equipment for inspection or service.

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## **DECOMMISSIONING EQUIPMENT**

When decommissioning equipment it is important to ensure that the pump has been fully isolated from the process and power sources for personnel safety. Pressure and fluid should be fully released before disassembly of the equipment is to begin.



If the equipment has been used with toxic or hazardous fluids, ensure that it is decontaminated and neutralized before decommission begins. There is often residual fluid remaining from the draining process so consult the pump OEM for special cases.

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## **REMOVING THE SEAL**



Before opening the pump to remove the seal the warning stated above regarding toxins and hazardous products must be reiterated. Make note of all fluids contained in pump, drain and decontaminate before opening the housing for seal service.

1. Make sure all fluid has been drained and vented. Equipment should be shut down and locked/tagged out according to OEM and plant specifications.
2. Dismantle equipment sufficiently so that the gland plate and seal housing are exposed and accessible for service.
3. Remove gland nuts/bolts in an even manner and set the gland plate aside.
4. Remove the seal in reverse manner of how it was installed.

### **NOTE:**

It is important to check the scribe reference each time a seal is re-installed even if the same components are being re-installed.



If a part is going to be returned for service or to any third party, all shipments should have appropriate safe-handling instructions securely attached to the package.

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## DIMENSIONAL DATA

d	d(mm)	D	L	t
0.500	12	0.937	1.187	0.312
0.625	14-16	1.093	1.312	0.312
0.750	18	1.218	1.312	0.312
0.875	20-22	1.343	1.375	0.312
1.000	24-25	1.500	1.562	0.375

1.125	28	1.625	1.625	0.375
1.250	30-32	1.812	1.625	0.375
1.375	33-35	1.875	1.687	0.375
1.500	38	2.000	1.687	0.375

1.625	40	2.250	2.000	0.375
1.750	43-45	2.375	2.000	0.375
1.875	48	2.500	2.125	0.375
2.000	50	2.625	2.125	0.375

2.125	53	2.812	2.375	0.375
2.250	55	2.937	2.375	0.500
2.375	60	3.062	2.500	0.500
2.500	63	3.187	2.500	0.500

2.625	65	3.375	2.750	0.500
2.750	70	3.500	2.750	0.500
2.875	73	3.625	2.875	0.500
3.000	75	3.750	2.875	0.500

3.125	80	4.000	3.125	0.500
3.250	-	4.125	3.125	0.500
3.375	85	4.250	3.125	0.500
3.500	-	4.375	3.125	0.500

3.625	90	4.500	3.250	0.562
3.750	95	4.625	3.250	0.562
3.875	-	4.750	3.375	0.562
4.000	100	4.875	3.375	0.562

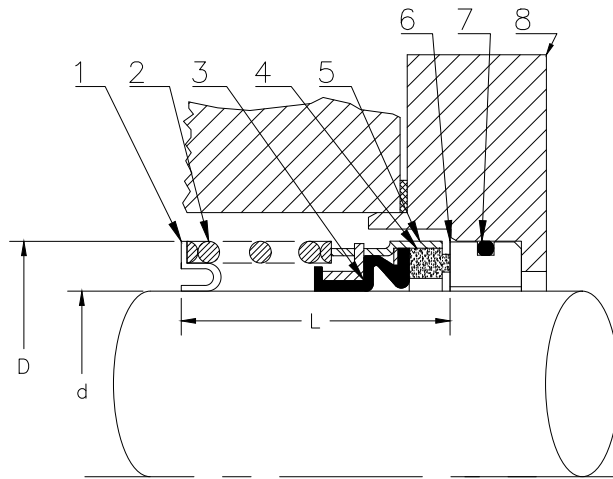


Figure 13: Spring holder configuration

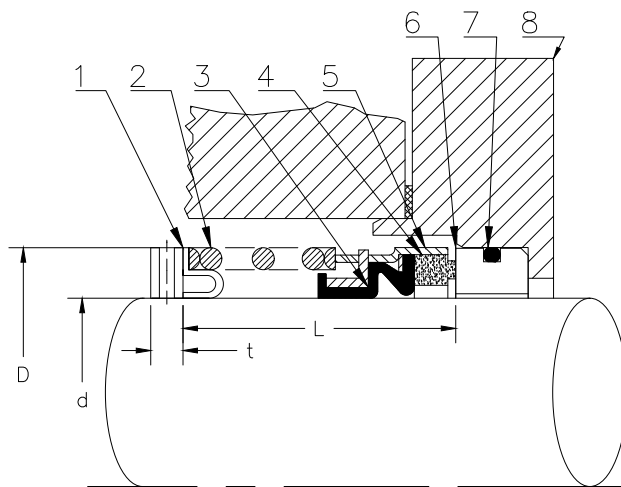


Figure 14: Set screw collar configuration

Part	Description
1	Spring Holder/Set Screw Collar
2	Spring
3	Elastomer Bellows
4	Rotating Seal Ring
5	Retainer
6	Stationary Seal Ring
7	Static O-ring
8	Gland