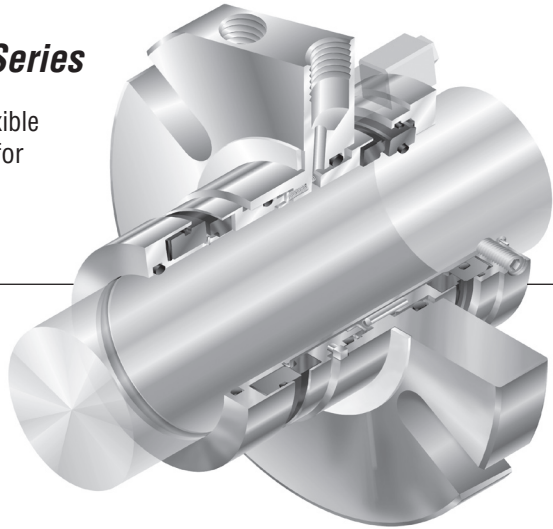


Five Star Seal™ 80 Series

Dual, cartridge mounted, flexible stator pusher seal designed for general service applications 86 and 87

**1 Equipment Check**

- 1.1 Follow plant safety regulations prior to equipment disassembly:
 - 1.1.1 Wear designated personal safety equipment
 - 1.1.2 Isolate equipment and relieve any pressure in the system
 - 1.1.3 Lock out equipment driver and valves
 - 1.1.4 Consult plant Safety Data Sheet (SDS) files for hazardous material regulations
- 1.2 Disassemble equipment in accordance with the equipment manufacturer's instructions to allow access to seal installation area.
- 1.3 Remove existing sealing arrangement (mechanical seal or otherwise). Clean seal chamber and shaft thoroughly.
- 1.4 Inspect surfaces under gaskets to ensure they are free from pits or scratches. Break all sharp corners on shaft steps, threads, reliefs, shoulders, key ways, etc. over which gasket(s) must pass and/or seal against.
- 1.5 Check shaft or sleeve OD, seal chamber bore, seal chamber depth, gland pilot, stud diameter, stud bolt pattern and distance to first obstruction to ensure they are dimensionally the same as shown in the seal assembly drawing.
- 1.6 Check seal assembly drawings for any modifications (reworks) to be made to the equipment for mechanical seal installation and act accordingly.
- 1.7 The equipment must be earthed to prevent sparks due to static electricity discharge.

Shaft runout should be checked against the equipment manufacturer's specifications. Generally, should not exceed 0.05 mm (0.002 inch) TIR (Total Indicator Reading) at any point along the shaft for ball or roller type bearings. For sleeve type bearings, refer to manufacturer instructions. If the equipment is not completely dismantled, verify runout near seal location.

The above values apply to shaft speeds in the range from 1000 to 3600 RPM. For values above and below, consult your Flowserve representative. See Figure 1.

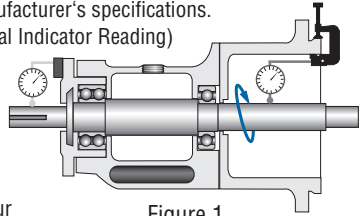


Figure 1

Shaft endplay should not exceed 0.25 mm (0.010 inch) TIR, regardless of thrust bearing type. See Figure 2.

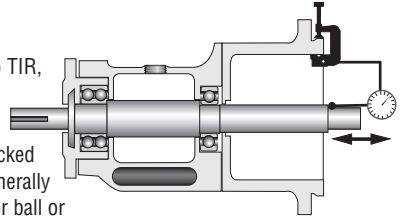


Figure 2

Radial bearing play at seal chamber face should be checked against the equipment manufacturer's specifications. Generally 0.05 - 0.10 mm (0.002 - 0.004 inch) will be applicable for ball or roller type bearings. For sleeve or journal type bearings, values will generally be in the order of 0.10 - 0.15 mm (0.004 - 0.006 inch). If equipment is found outside the general range, contact the equipment manufacturer and your Flowserve representative to verify the equipment's suitability for the seal.

Seal chamber squareness to the shaft centerline should be within 0.0005 mm/mm (0.0005 inch/inch) of seal chamber bore TIR.

Note: make sure that shaft endplay does not affect the reading. Verify the smoothness of the seal chamber face for a good gasket joint. See Figure 3.

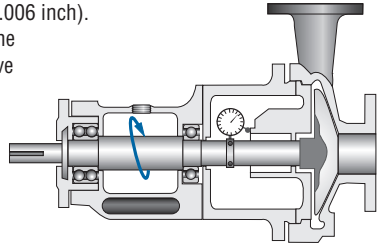


Figure 3

Concentricity of the shaft to the seal chamber bore or gland pilot register should be within 0.025 mm per 25 mm shaft diameter (0.001 inch per 1 inch shaft diameter) to a maximum of 0.125 mm (0.005 inch) TIR. See Figure 4.

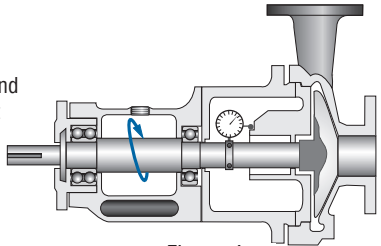
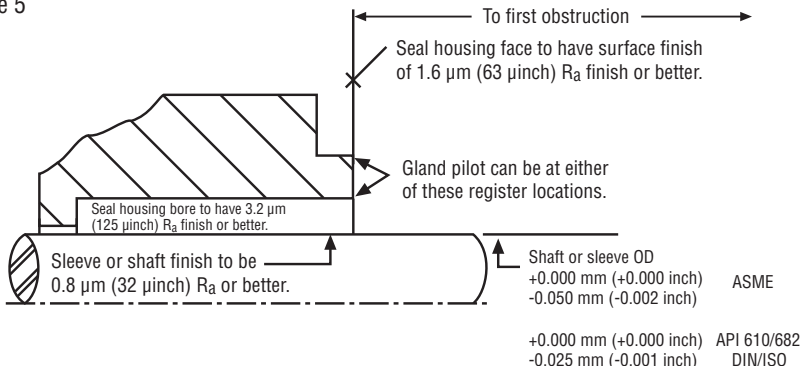


Figure 4

Surface finish requirements

Figure 5



Description

The 86/87 seals are cartridge mounted mechanical seals, designed for ease of installation and reliable operation. **No seal setting dimensions are required.** Rotatable centering tabs provide proper alignment. The flexible stator design compensates for inadvertent misalignment of the seal chamber face. Multiple springs provide uniform face loading and are external of the pumpage, resisting clogging or hang-up. Installation according to the following steps will assure long trouble free life of the 86/87 seals.

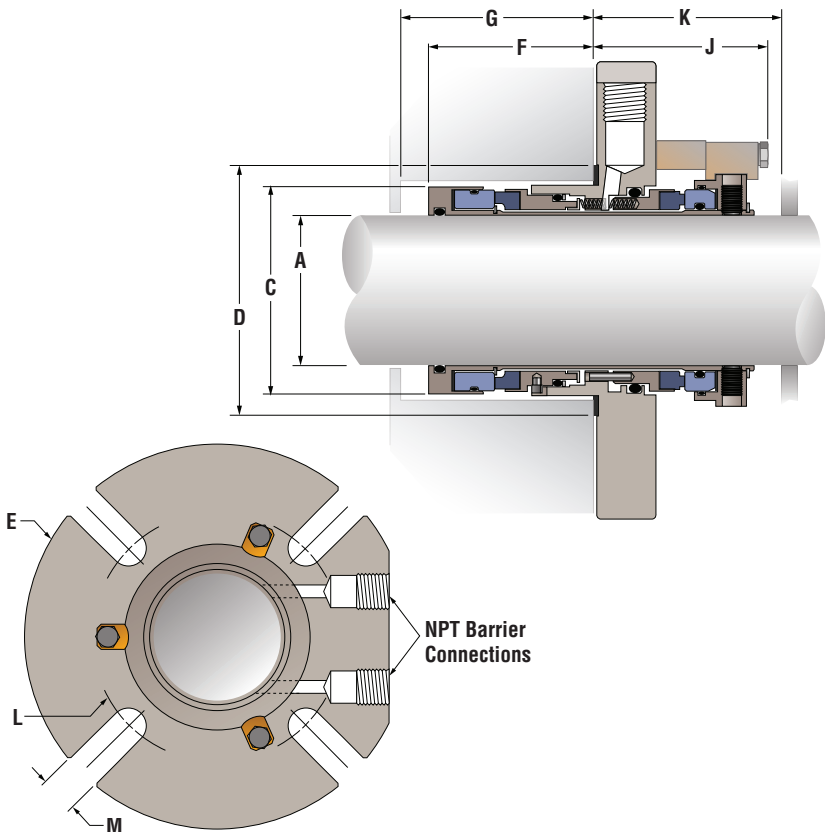
Check equipment dimensions to ensure that they are within the dimensions shown in **Figures 1 and 2**. Critical dimensions include shaft or sleeve OD (**A**), a chamber depth of at least dimension (**G**), minimum and maximum seal housing bore (**C**), and the minimum distance to the first obstruction (**K**). See Figure 6.

Check gland bolting to ensure that bolt diameter (**M**) and bolt circle diameter (**L**) conform to the dimensions shown in Figure 6.

Handle the 86/87 with care, it is manufactured to precise tolerances. The sealing faces of the stationary and rotating face are of special importance. They are lapped flat to within three light bands (34.8 millionths of an inch). Keep the sealing faces perfectly **clean at all times**.

86/87 Dimensional Data (inches) for standard bore seal chambers

Figure 6



The images of parts shown in these instructions may differ visually from the actual parts due to manufacturing processes that do not affect the part function or quality.

86/87 Dimensional Data (inches) for standard bore seal chambers

Figure 6

A	C		D	E	F	G		J	K	L	M
Shaft & Seal Size	Box Bore (Min)	Box Bore (Max)	Gasket OD	Gland OD		Box Depth (Min)		Dist to Obst (Min)	Slot Bolt Circle	Bolt Slot Dia.	
1.000	1.750	2.010	2.250	4.000	2.008	2.070	2.146	2.208	2.743	0.438	
1.125	1.750	2.135	2.375	4.000	2.008	2.070	2.146	2.208	2.868	0.438	
1.250	2.000	2.260	2.500	4.000	2.008	2.070	2.146	2.208	2.993	0.438	
1.375	2.000	2.385	2.625	4.000	2.008	2.070	2.146	2.208	3.212	0.531	
1.500	2.250	2.510	2.750	4.500	2.008	2.070	2.146	2.208	3.337	0.531	
1.625	2.375	2.635	2.875	5.000	2.008	2.070	2.146	2.208	3.462	0.531	
1.750	2.500	2.760	3.000	5.500	2.008	2.070	2.146	2.208	3.587	0.531	
1.875	2.625	2.885	3.125	5.500	2.008	2.070	2.146	2.208	3.712	0.531	
2.000	2.750	3.010	3.250	5.400	2.008	2.070	2.146	2.208	3.837	0.531	
2.125	2.875	3.135	3.375	6.000	2.008	2.070	2.146	2.208	4.118	0.688	
2.250	3.250	3.760	4.000	6.000	1.918	1.980	2.146	2.208	4.739	0.688	
2.375	3.375	3.885	4.125	6.000	1.918	1.980	2.146	2.208	4.864	0.688	
2.500	3.250	3.760	4.000	6.000	2.008	2.070	2.146	2.208	4.989	0.688	
2.625	3.625	4.135	4.375	6.000	1.918	1.980	2.146	2.208	5.114	0.688	
2.750	3.750	4.260	4.500	7.000	1.793	1.855	2.271	2.333	5.239	0.688	
2.875	3.875	4.385	4.625	7.000	1.793	1.855	2.271	2.333	5.364	0.688	
3.000	4.000	4.510	4.750	8.000	1.793	1.855	2.271	2.333	5.489	0.688	
3.125	4.125	4.635	4.875	8.000	1.793	1.855	2.271	2.333	5.614	0.688	
3.250	4.375	5.135	5.375	8.000	2.468	2.530	3.073	3.135	6.345	0.813	
3.375	4.500	5.260	5.500	8.000	2.468	2.530	3.073	3.135	6.470	0.813	
3.500	4.625	5.385	5.625	8.500	2.468	2.530	3.073	3.135	6.595	0.813	
3.625	4.750	5.510	5.750	8.500	2.468	2.530	3.073	3.135	6.720	0.813	
3.750	4.750	5.510	5.750	8.750	1.662	1.724	2.825	2.887	6.708	0.813	
4.000	5.250	6.010	6.250	9.000	2.500	2.562	3.033	3.095	7.220	0.813	
4.250	5.500	6.260	6.500	9.500	2.500	2.562	3.033	3.095	7.470	0.813	
4.375	5.625	6.385	6.625	9.500	2.500	2.562	3.033	3.095	7.595	0.813	
4.500	5.750	6.510	6.750	10.000	2.500	2.562	3.033	3.095	7.720	0.813	
4.625	5.875	6.635	6.875	10.500	2.500	2.562	3.033	3.095	8.032	1.000	
4.750	5.750	6.573	6.813	9.500	2.204	2.266	3.075	3.137	7.719	0.813	
4.875	6.125	6.885	7.125	11.000	2.500	2.562	3.033	3.095	8.282	1.000	
5.000	6.500	7.510	7.750	11.000	2.998	3.060	3.595	3.657	8.907	1.000	
5.125	6.625	7.635	7.875	11.500	2.998	3.060	3.595	3.657	9.032	1.000	
5.250	6.750	7.760	8.000	11.500	2.998	3.060	3.595	3.657	9.157	1.000	
5.375	6.875	7.885	8.125	11.500	2.998	3.060	3.595	3.657	9.282	1.000	
5.500	7.000	8.010	8.250	11.500	2.998	3.060	3.595	3.657	9.407	1.000	
5.625	7.125	8.135	8.375	11.500	2.998	3.060	3.595	3.657	9.532	1.000	
5.750	7.250	8.260	8.500	12.000	2.998	3.060	3.595	3.657	9.657	1.000	
5.875	7.375	8.385	8.625	12.000	2.998	3.060	3.595	3.657	9.782	1.000	
6.000	7.500	8.510	8.750	12.000	2.998	3.060	3.595	3.657	9.907	1.000	
6.500	8.500	9.510	9.750	12.000	3.660	3.722	3.825	3.887	10.907	1.000	
7.000	9.000	10.010	10.250	14.000	3.660	3.722	3.825	3.887	11.407	1.000	

2 86/87 Installation

Note: No seal setting measurements are needed to install the 86/87 seals. Instructions are for vertically split case end-suction ANSI pumps. Modification of the procedure may be required for other style pumps. Consult Flowserve.

2.1 Tools needed for installation:

- An open end wrench for the gland bolt nuts
- 1/8" and 3/16" hex wrench (provided)
- 5/16" and 3/8" open end wrench (provided)
- Silicone Lubricant

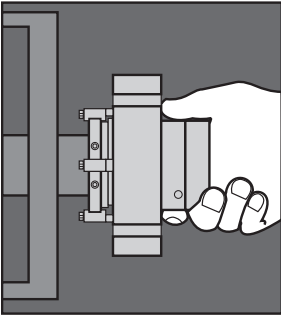


Figure 7

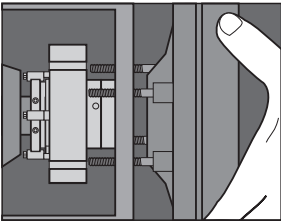


Figure 8

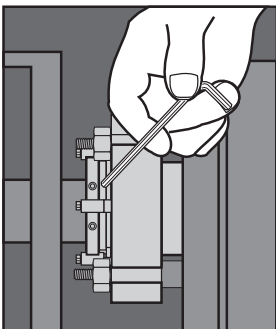


Figure 9

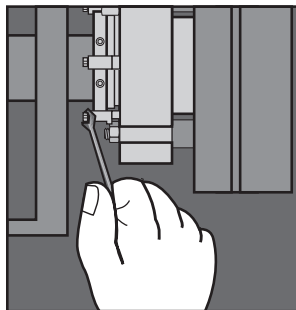


Figure 10

2.2 **Lubricate the shaft** or sleeve lightly with silicone lubricant.

2.3 **Install the complete 86/87** cartridge assembly onto the shaft or sleeve with the setting devices near the bearing housing. See Figure 7.

2.4 **Install the pump back plate** (seal chamber) and bolt it in place on the bearing frame. See Figure 8.

2.5 **Position the 86/87** with the gland tight against the seal chamber face. Turn the gland so that the barrier taps are positioned so that the associated piping will clear the bearing frame. **Tighten the gland nuts** evenly in a diagonal sequence. Do not over tighten the gland nuts, as this can warp seal parts and cause leakage.

2.6 **Assemble the pump.** Avoid pipe strain. Align coupling properly.

2.7 With the impeller, shaft, coupling, and bearings in their final operating positions, **tighten the 86/87 set screws.** See Figure 9.

2.8 **Rotate the setting device 180°.** Loosen the hex head bolts holding the bronze setting devices and rotate 180° to clear the drive collar. Retighten the hex head bolts to store the setting devices on the gland. See Figure 10.

2.9 **Turn the shaft** by hand to ensure unobstructed operation.

2.10 See **Operational Recommendations** before start-up.

3 Piping

- 3.1 Taps **b** and **c** in the gland are buffer/barrier fluid inlet and outlet ports. Use Figure 10 to determine which ports to use as inlet and outlet.

	Inlet	Outlet
Clockwise (CW)	Port c	Port b
Counterclockwise (CCW)	Port b	Port c

Note: Outlet port position should be located above Inlet port for optimum operating performance

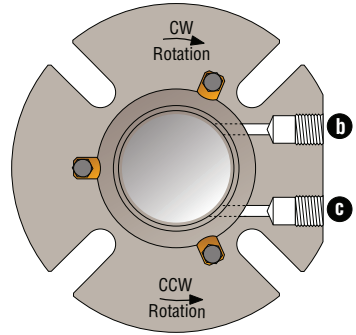
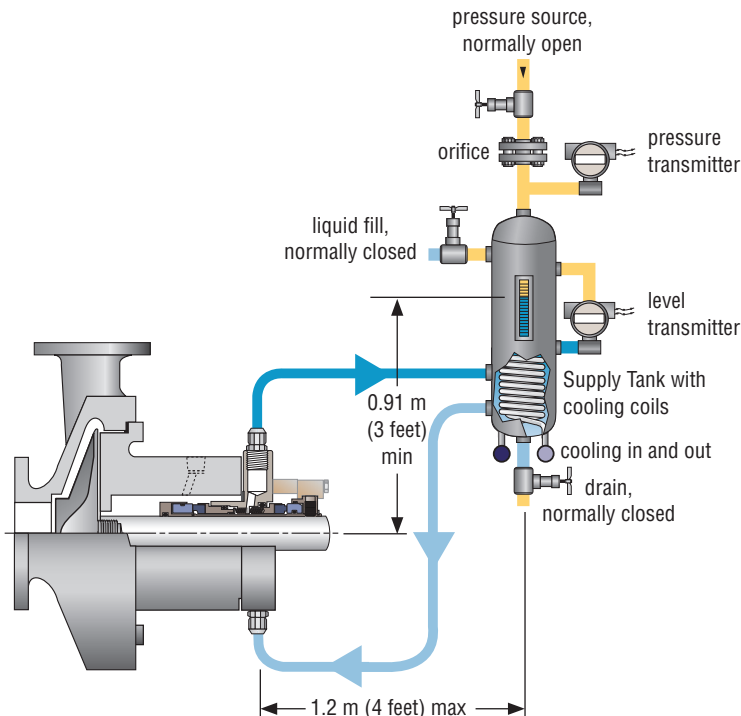


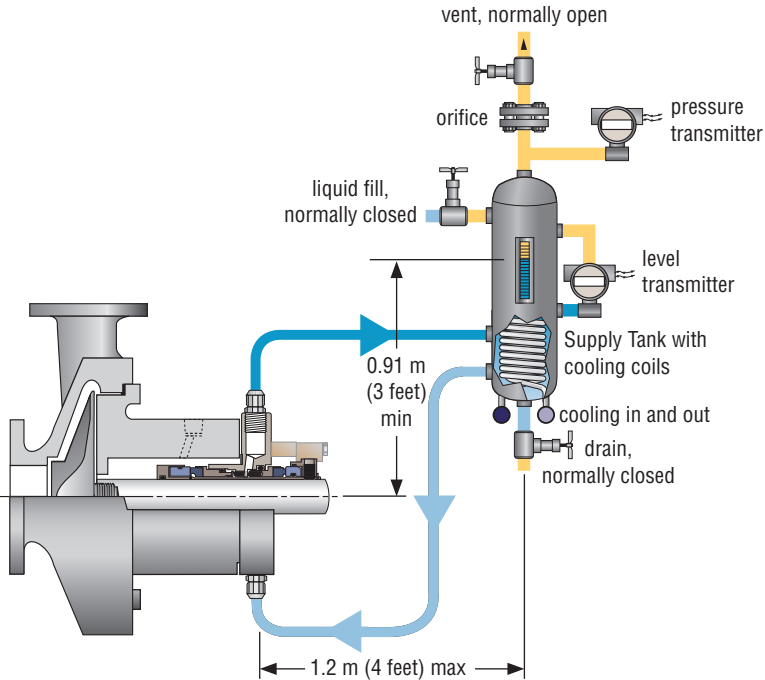
Figure 10

- 3.2 For **dual seal pressurized seal** operation, supply a clean compatible barrier fluid to the inlet port at a pressure at least 170 kPa (25 psi) above the stuffing box pressure. See Figure 11. Flowserve can supply information on barrier fluid flow requirements based on seal size, product temperature, barrier fluid characteristics, and shaft speed. Consult your Flowserve representative for assistance.

Dual 86/87 Pressurized with Supply Tank

Figure 11





- 3.3 For **dual seal un-pressurized** operation, supply a clean compatible buffer fluid to the inlet port at a pressure below the stuffing box pressure. See Figure 12. Consult Flowserve, Flow Solutions for assistance. Flowserve can supply information on buffer fluid flow equipments based on seal size, product temperature, barrier fluid characteristics, and shaft speed.
- 3.4 The **Flowserve Supply Tank** is designed to work with the 86/87 seal to form a self-contained sealing system. Consult your Flowserve representative about a suitable system. The circulating feature in the 86/87 seal provides a positive barrier fluid flow from the seal cavity to the Supply Tank and back to the seal. In most cases the natural cooling of the piping and tank are adequate to remove seal generated heat. Consult your Flowserve representative for system limits. Cooling coils are available with the Supply Tank to increase heat dissipation. The Supply Tank can be used with the 86/87 seal in both the dual pressurized or dual unpressurized operating modes.

4 Operational Recommendations

- 4.1 **Do not exceed corrosion limits.** The 86/87 seal is designed to resist corrosion by most chemicals. However, do not expose the 86/87 materials of construction to products outside of their corrosion limits. Consult Flowserve, Flow Solutions for assistance.
- 4.2 **Do not exceed the Pressure limits** of the 86/87 seal, consult Flowserve, Flow Solutions for assistance.
- 4.3 **Do not exceed the temperature limits** of the 86/87 seal. The materials of construction are listed on the box label. Turn on cooling water to the supply tank before start-up if the tank has coils.
- 4.4 **Do not start up or run the 86/87 seal dry.** Buffer/barrier fluid must be in the seal cavity at all times during pump operation.

For special problems encountered during installation, contact your nearest Flowserve Sales and Service Representative or Authorized Distributor.



TO REORDER REFER TO

B/M # _____

F.O. _____

5 Repair

This product is a precision sealing device. The design and dimension tolerances are critical to seal performance. Only parts supplied by Flowserve should be used to repair a seal. To order replacement parts, refer to the part code and B/M number. A spare backup seal should be stocked to reduce repair time.

When seals are returned to Flowserve for repair, **decontaminate the seal assembly** and include an order marked **"Repair or Replace."** **A signed certificate of decontamination** must be attached.

A Safety Data Sheet (SDS) must be enclosed for any product that came in contact with the seal. The seal assembly will be inspected and, if repairable, it will be rebuilt, tested, and returned.

FIS152eng REV 09/2018 Printed in USA

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