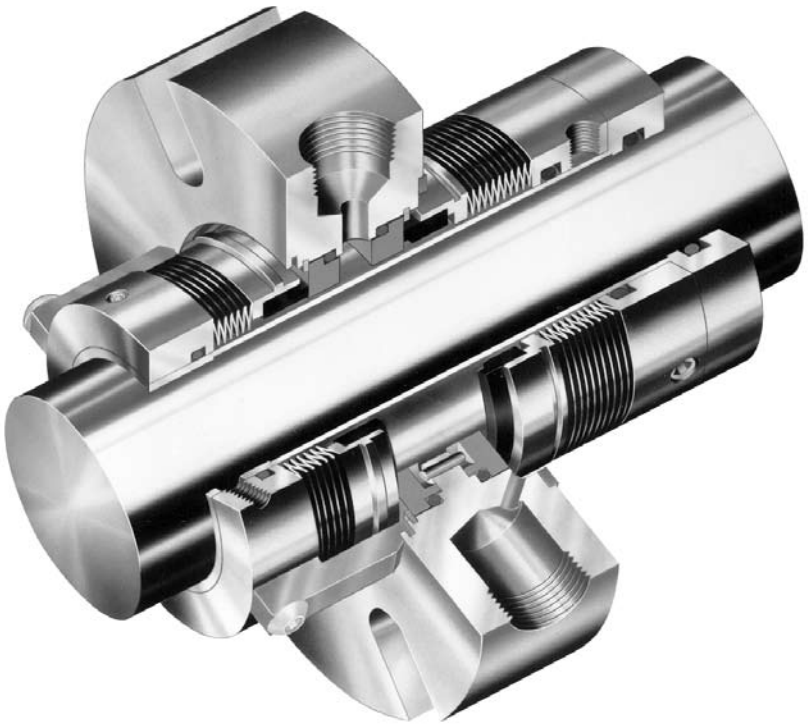




Installation Instructions

X-200

Cartridge dual metal bellows seal
for standard and big bore
ANSI pumps



Congratulations

You have just purchased a reliable, long-life product manufactured by the leading manufacturer of sealing systems in the world. With proper installation and operation, this X-200 seal can be a valuable contributor to your operation by significantly reducing the mean time between planned maintenance (MTBPM) of your rotary equipment.

Description

This X-200 seal is a cartridge mounted end face welded metal bellows mechanical seal, designed for ease of installation. **No seal setting dimensions are required.** Removable setting devices provide proper alignment. The welded metal bellows eliminates shaft fretting and resists clogging or hang-up. Installation according to the following steps will assure long trouble free life of the X-200 seal.

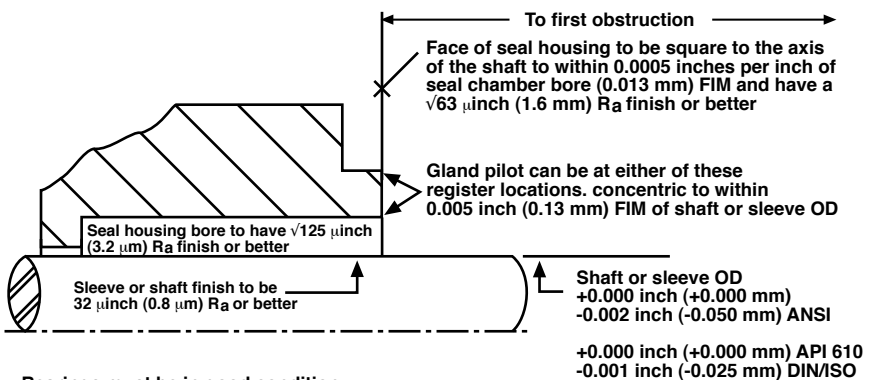
1 Equipment Check

1.1 Follow plant safety regulations prior to equipment disassembly:

- Lock out motor and valves.
- Wear designated personal safety equipment.
- Relieve any pressure in the system.
- Consult plant MSDS files for hazardous material regulations.

Seal Chamber Requirements

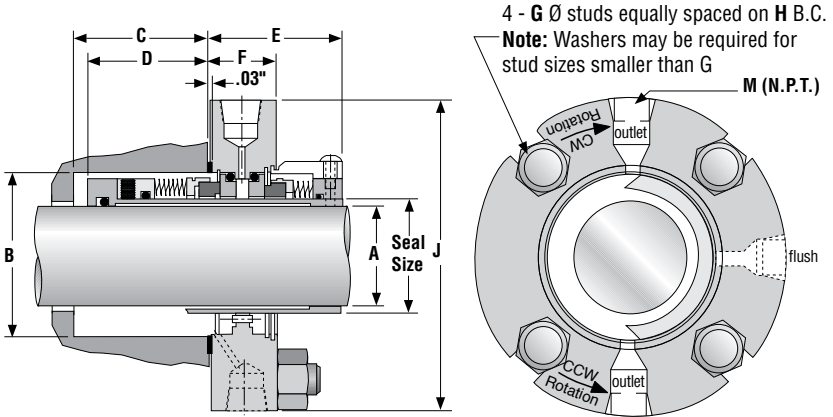
Figure 1



- Bearings must be in good condition
- Maximum lateral or axial movement of shaft (end play) = 0.010 inch (0.25 mm) FIM
- Maximum shaft runout at face of seal housing = 0.002 inch (0.05 mm) FIM
- Maximum dynamic shaft deflection at seal housing = 0.002 inch (0.05 mm) FIM

X-200 Dimensional Data

Figure 2



Dimensional Data for X-200 Seal, inch

Seal Size	A	B	B	C	D	E	F	G	H	J	M
+0.000 -0.002	±0.001	min.	max.	min.				max.	min.		(N.P.T.)
1.125	1.000	1.750	1.875	1.78	1.69	2.00	1.02	0.375	2.75	3.75	0.375
*1.250	1.125	1.750	2.000	1.78	1.69	2.00	1.02	0.500	3.00	3.88	0.375
1.375	1.250	2.000	2.125	1.97	1.88	2.00	1.02	0.500	3.12	4.25	0.375
*1.500	1.375	2.000	2.250	1.97	1.88	2.00	1.02	0.375	3.25	4.25	0.375
1.625	1.500	2.250	2.500	1.97	1.88	2.00	1.02	0.375	3.75	4.75	0.375
1.750	1.625	2.375	2.625	1.97	1.88	2.00	1.02	0.500	3.75	4.75	0.375
1.875	1.750	2.500	2.750	1.97	1.88	2.00	1.02	0.500	3.75	5.00	0.375
2.000	1.875	2.625	2.875	1.97	1.88	2.00	1.02	0.500	3.88	5.00	0.375
2.125	2.000	2.750	3.000	1.97	1.88	2.00	1.02	0.625	4.12	5.12	0.375
2.250	2.125	2.875	3.250	1.97	1.88	2.00	1.02	0.625	4.38	6.00	0.375
2.375	2.250	3.000	3.375	1.97	1.88	2.00	1.02	0.625	4.62	6.50	0.375
2.500	2.375	3.250	3.625	2.16	2.06	2.09	1.11	0.625	5.00	6.38	0.375
2.625	2.500	3.375	3.750	2.16	2.06	2.09	1.11	0.625	5.00	6.62	0.375
2.750	2.625	3.500	3.875	2.16	2.06	2.09	1.11	0.750	5.75	7.25	0.375
2.875	2.750	3.750	—	2.16	2.06	2.62	1.58				0.750
†3.000	2.750	3.875	—	2.16	2.06	2.62	1.58				0.750
3.000	2.875	3.875	—	2.16	2.06	2.62	1.58				0.750
†3.125	2.875	4.000	—	2.16	2.06	2.62	1.58				0.750
3.125	3.000	4.000	—	2.16	2.06	2.62	1.58				0.750
†3.250	3.000	4.125	—	2.16	2.06	2.62	1.58				0.750
3.375	3.125	4.250	—	2.16	2.06	2.62	1.58				0.750
3.500	3.250	4.375	—	2.28	2.19	2.75	1.71				0.750
3.625	3.375	4.500	—	2.28	2.19	2.75	1.71				0.750
3.750	3.500	4.625	—	2.28	2.19	2.75	1.71				0.750
3.875	3.625	4.750	—	2.28	2.19	2.75	1.71				0.750
4.000	3.750	4.875	—	2.28	2.19	2.75	1.71				0.750
4.125	3.875	5.000	—	2.28	2.19	2.75	1.71				0.750

As Required

* this seal size uses the N-CBR inner seal rotary unit.

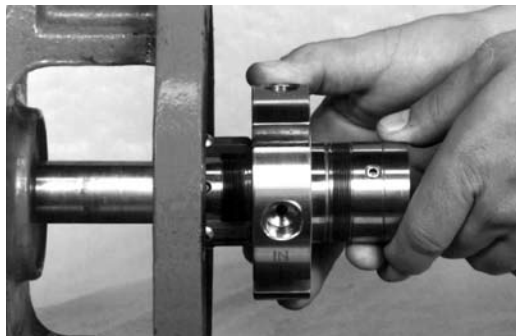
† preferred design for these shaft sizes. Use whenever possible.

- 1.2 **Disassemble equipment** in accordance with equipment manufacturer's instructions to allow access to seal installation area.
- 1.3 **Remove existing mechanical seal and gland** or compression packing and packing gland (follower flange).
- 1.4 Make sure the **shaft or sleeve** is free of burrs, cuts, dents, or corrosion that might cause leakage past the sleeve gasket, as shown on the assembly drawing. Replace worn shaft or sleeve. **Remove sharp edges** from keyways and threads.
- 1.5 Make sure the **seal housing face is clean** and free of burrs, cuts, dents, or corrosion that might cause leakage the gland gasket or misalign the seal gland.
- 1.6 **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 (C), minimum and maximum seal housing bore (B), and the minimum distance to the first obstruction, (E) plus 0.125 inch.
- 1.7 **Check gland bolting** to ensure that bolt diameter (G) and bolt circle (H) conform to the dimensions shown in Figure 2.
- 1.8 **Handle the X-200 seal with care**, it is manufactured to precise tolerances. The sealing faces of the rotating face and stationary face are of special importance. They are lapped flat to within three light bands (34.8 millionths of an inch). **Keep the seal faces perfectly clean at all times.**

2 X-200 Seal Installation

Tools needed:

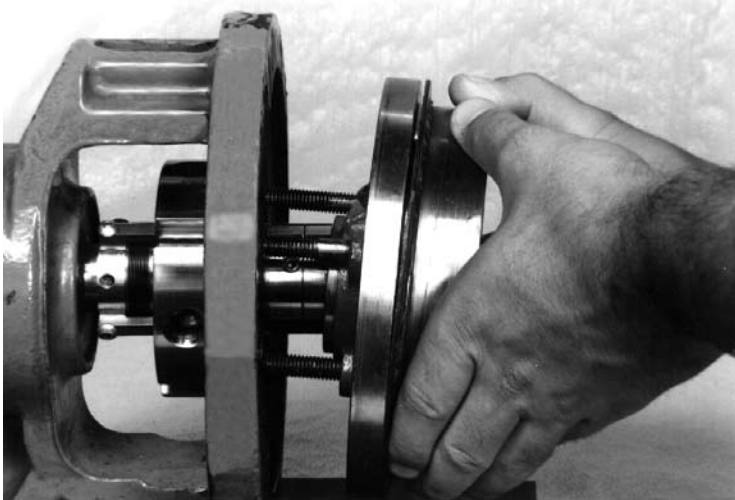
- **Open end wrench** for gland nuts
- **Allen wrenches** provided
- **Silicone lubricant** provided



Install X-200 Seal Cartridge

Figure 3

- 2.1 **Lubricate the shaft** or sleeve OD lightly with silicone lubricant provided and **slide the complete X-200 cartridge seal onto the shaft**, Figure 3, with the end with the setting devices toward the bearing housing.



Install pump backplate

Figure 4

- 2.2 **Install the pump back plate** (stuffing box), Figure 4. **Position the X-200 seal gland flush connection, port a** in Figure 7, **in the 3:00 o'clock position** for normal installations with CW rotation (9:00 o'clock for CCW rotation) for optimum heat removal. Alternate positioning of the gland may be necessary with some pump designs to permit seal piping to clear the bearing housing. Refer to the assembly drawing that is supplied with the seal for proper positioning. **Bolt the back plate in place** on the bearing housing.
- 2.3 **Position the X-200 cartridge gland** with the gland gasket in place against the seal chamber (stuffing box) face, install flat washers on the studs to prevent misalignment, and **tighten the gland nuts** evenly, cross staggering the adjustment of the nuts. Do not over tighten.
- 2.4 **Assemble the pump, adjust the bearings, set the impeller and connect the coupling** so that the shaft is in its operating axial position. Any subsequent axial adjustment of the shaft requires resetting of the seal. Connect pump piping, allow no pipe strain on the pump casing.

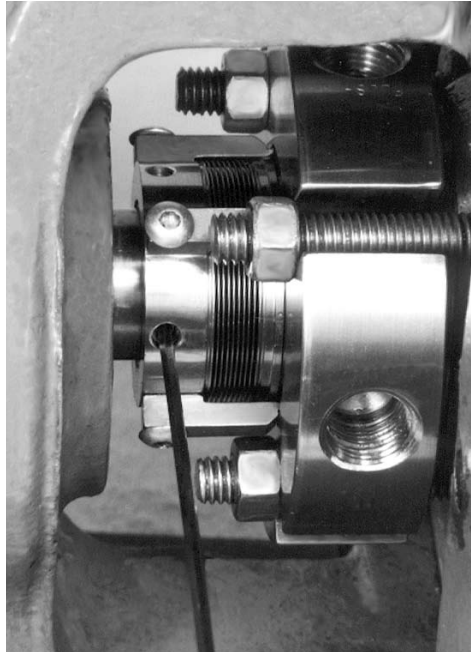
2.5 **Tighten the set screws** on the X-200 cartridge collar with the Allen wrench provided, Figure 5.

2.6 **Remove setting devices** by removing the cap screws with the Allen wrench provided, Figure 6. Save the setting devices for use if pump impeller must be reset or if the X-200 is removed for maintenance.

2.7 **Turn the shaft** by hand to ensure free operation.

2.8 **Pipe up the gland connections** to the X-200 seal, see section 3.

2.9 **See Operational Recommendations**, section 4, before starting pump.



Tighten drive collar set screws
Figure 5



Remove setting devices
Figure 6

3 Piping

- 3.1 **Pipe a product bypass flush** from the pump discharge to the X-200 seal flush port, **a** Figure 7. To maximize seal life, Flowserve recommends that a product bypass flush be used whenever possible with a X-200 seal installed in conventional stuffing box. A bypass flush is not necessary when an enlarged tapered or cylindrical seal chamber is used. If a bypass flush is not used, plug the flush port **a**.
- 3.2 **Taps **b** and **c** in the gland are buffer / barrier fluid inlet and outlet ports.** Which is the inlet port depends on the direction of shaft rotation.

Shaft Rotation from Exposed End of Gland

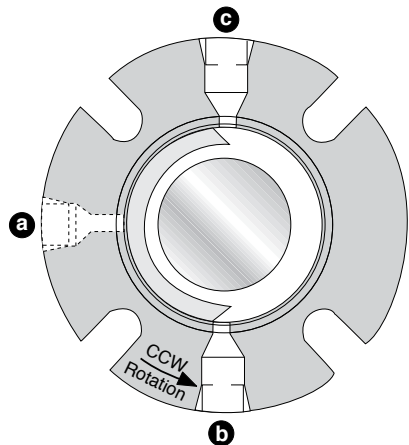
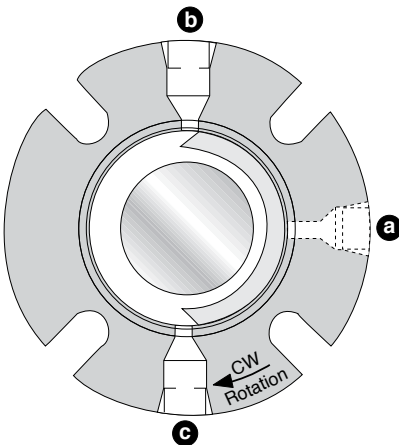
Figure 7

Clockwise Rotation (CW)
(most ANSI pumps)

Inlet Port **c**
Outlet Port **b**

Counterclockwise Rotation (CCW)

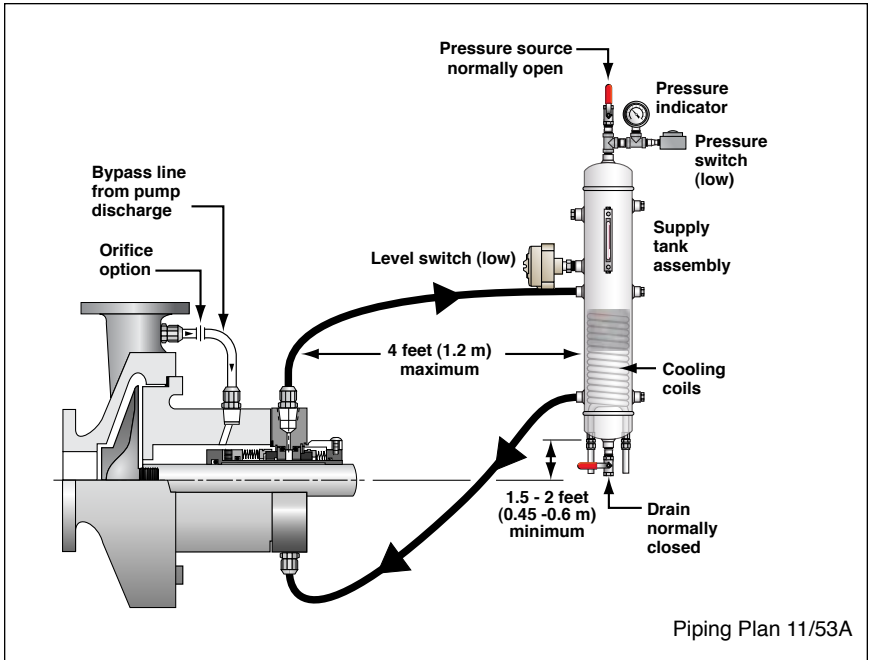
Inlet Port **b**
Outlet Port **c**



- 3.3 For **pressurized dual seal** mode of operation, supply a clean compatible barrier fluid to the inlet port at a pressure at least 25 psi above the pressure of the product acting on the outside of the inner seal. The barrier fluid should be piped from the outlet port past a pressure gauge and through a flow control valve to waste or recovery system. The valve in the outlet line should be adjusted to a flow adequate to remove seal generated heat and to maintain the pressure between the X-200 inner and outer seals at least 25 psi above the product pressure acting on the outside of the inner seal. Flowserve can supply information on barrier fluid flow requirements based on seal size, product temperature, barrier fluid characteristics, and shaft speed.
- 3.4 For **unpressurized dual seal** mode of operation, supply a clean compatible buffer fluid to the inlet port at a pressure below that of the product acting on the outside of the inner seal. The buffer fluid should be piped from the outlet port past a pressure gauge and through a flow control valve to waste or recovery system. The valve in the outlet line should be adjusted to a flow adequate to remove seal generated heat and to maintain the pressure between the X-200 inner and outer seals below that of the product pressure acting on the outside of the inner seal. Flowserve can supply information on buffer fluid flow requirements based on seal size, product temperature, barrier fluid characteristics, and shaft speed.
- 3.5 The Flowserve supply tank is designed to work with the X-200 seal to form a self-contained sealing system. The patented² circulating feature in the X-200 provides a positive buffer / 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. Cooling coils are available with the supply tank to extend operating limits. The supply tank can be used with the X-200 seal in the dual pressurized, Figure 8, or dual unpressurized, Figure 9, operating modes.
- 3.6 Good piping practices:
- minimize line losses
 - use large diameter tubing
 - only upward sloping lines
 - use long radius bends
 - minimize component losses
 - optimize for thermosyphon
 - check rotation direction
 - test for leaks

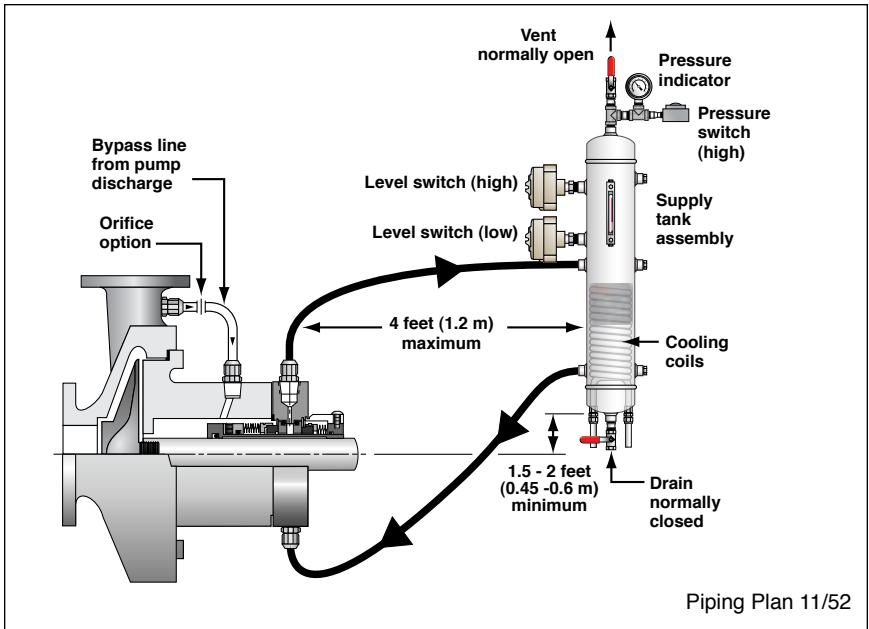
Dual pressurized X-200 with Supply Tank

Figure 8



Dual unpressurized X-200 with Supply Tank

Figure 9



4 Operation

Following these recommendations will ensure maximum MTBPM of the X-200 seal.

- 4.1 **Do not exceed corrosion limits.** The X-200 is designed to resist corrosion by most chemicals. However, do not expose the X-200 materials of construction to products outside of their corrosion limits. The X-200 assembly drawing lists the materials of construction. For chemical resistance ratings consult Flowserve.
- 4.2 **Do not exceed the Pressure-Velocity (P-V) limits.**
- 4.3 **Do not exceed the temperature limits** of the X-200. The materials of construction are listed on the assembly drawing. For the temperature limits of materials consult Flowserve. Turn on any cooling water to the supply tank before start-up.
- 4.4 **Do not start up or run the X-200 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.

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. These are available from numerous Flowserve stocking locations. To order replacement parts, refer to the part code number and B/M number. A spare backup seal should be stocked to reduce repair time.

When repairs are not conducted at the customer's location, **decontaminate the seal assembly** and return it to Flowserve, with an order marked **"Repair or Replace"**. **A signed certificate of decontamination** must be attached. **A Material Safety Data Sheet (MSDS) 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 in its original condition.



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