FLOWSERVE

USER INSTRUCTIONS

GB

General Installation and Operating Instructions for Mechanical Seals

These installation instructions can be used for the following seal types:

Pusher seals: Allpac 4 series, Allpac N series, Centipac 1 series, CRO, D series, DHT series, Europac 306, Europac 6 series, FRO, GSD, GSL, HD series, HSC, HSH, LD, P series, Q series, RO, Simpac 3 series, SRO, U series, UHT series.

Bellows seals: BL, BRC series, BX series, BXH series, BXLS series, BXRH, CBR series, CBS, GSDH, PB, PBR, PBS, PC, X series.

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1 Drawing, Brief Description, Functional requirements

1.1 Assembly Drawing

The assembly drawing is included in the shipping box with the mechanical seal.

1.2 Brief Description

A mechanical seal is a device designed to seal a rotating shaft against a stationary housing, e.g. a pump shaft against a pump casing. The stationary components will consist of a seal ring and (depending on the design) a springloaded element. The spring-loaded element can be a spring or a bellows. The seal ring is sealed against the housing with a secondary gasket, e.g. an O-ring. The rotating components will consist of a seal ring and (depending on the design) a spring-loaded element. The spring-loaded element can be a spring or a bellows. The seal ring is sealed against the shaft with a secondary gasket, e.g. an O-ring.

A mechanical seal can be supplied as a pre-assembled cartridge or in separate components. Assembly is done in accordance with the assembly drawing. A mechanical seal will run in the pumped product or external source fluid. Liquid seals must always have a film of liquid present between the seal faces. Gas seals must always have a film of gas present between the seal faces. The sealing surfaces are separated from each other by a fluid film (liquid or gas) during shaft rotation and in principle operate without contact and thus minimal wear under these conditions.

1.3 Explosion protection

These instructions must be used for mechanical seals when installed in hazardous areas to help ensure explosion protection. Use mechanical seals only in the zone for which it is appropriate. The mechanical seal supplied with an attestation of conformity is good for the following ATEX zone:

II 2GD c (note 1)

II : Group II

2 : Category 2

G : Explosive atmosphere caused by gas and /or vapors

D : Explosive atmosphere caused by dust

c : Ignition protection by constructional safety

Note 1:

A temperature class cannot be given as the actual surface temperature of the mechanical seal depends on the operating conditions of the equipment in which the mechanical seal is installed.

The difference between fluid temperature and seal face surface temperature depends on the operating conditions and the product being sealed. The attestation of conformity is separately supplied with the mechanical seal and contains information to determine the correct temperature class of the mechanical seal depending on pumped fluid, shaft speed, shaft diameter and pressure.

1.4 **Functional requirements**

The proper functioning of a mechanical seal is only achieved once the following conditions have been met:

- The sealing surfaces are lapped within specification.
- Perpendicularity and concentricity between the shaft and the seal chamber face and bore respectively
- Freedom of movement of the spring loaded components in axial direction
- Axial and radial shaft movements within Flowserve or OEM tolerances whichever is the tightest.
- The seal is operated under the conditions for which it was selected.
- The equipment in which the seal(s) is (are) installed is operated within normal parameters (no cavitation, excess vibration etc.)
- Prevention of sedimentation on shaft or sleeve surfaces caused by for instance crystallisation or polymerisation
- Permanent liquid or gas film between the sealing surfaces, depending on seal type.

Failure to meet these requirements will result in excessive leakage and/or shortened seal life and may result in high component and surface temperatures (see ATEX, directive 94/9/EC, EN 13463-1 and prEN 13463-5, 2002).

2 Safety

Please read these instructions carefully. Installation in accordance with the following instructions will contribute to long and trouble free operation of the mechanical seal. For related mechanical seal auxiliary equipment (reservoirs, coolers, etc.), separate instructions will be provided.

The ultimate user must ensure that personnel assigned to handle, install and operate the mechanical seal and related equipment is well acquainted with the design and operating requirements of such equipment.

Damage to any of the seal components and in particular the faces may cause (excessive) leakage in liquid or gas form. The degree of hazard depends on the sealed product and may have an effect on people and/or the environment. Components coming into contact with leakage must be corrosion resistant or suitably protected. Normal seal leakage should not result in the formation of an explosive mixture. Plant regulations concerning work safety, accident prevention and pollution must be strictly adhered to.

This mechanical seal has been designed and built to seal rotating equipment. Damages resulting from use in other applications are the responsibility of the user.

3 General

All illustrations and details in these installation and operating instructions are subject to changes that are necessary to improve product performance without prior notice.

The copyright of these instructions is the property of Flowserve. These instructions are intended for Maintenance, Operating and Supervisory personnel and contain regulations and drawings of a technical character that may not, in full or in part, be copied, distributed, or used without authorisation for competitive purposes, or given to others.

It should be understood that Flowserve does not accept any liability for instances of damage and/or malfunctioning incurred through non-adherence to these installation instructions.

4 Transport, Storage

The mechanical seal and related equipment must be transported and stored in the unopened, original shipping box. The warehouse in which the mechanical seals and related equipment are stored must be dry and free of dust. Avoid exposing equipment to large temperature fluctuations and radiation.

Parts or complete mechanical seals that have been dropped or otherwise have been subjected to heavy impacts during transport must not be installed. An inspection by Flowserve or its appointed representative is strongly advised.

After a storage period of 3 years the mechanical seal must be inspected for its “as new” properties. This applies in particular to the seal faces and secondary sealing elements. An inspection by Flowserve becomes necessary.

If the equipment is to be preserved with the mechanical seal(s) installed, the preserving medium must not impair the function of the mechanical seal by e.g. fouling of the seal faces and/or attack the secondary seals.

5 Equipment Check

5.1 Follow plant safety regulations prior to equipment disassembly:

5.1.1 Wear designated personal safety equipment

5.1.2 Isolate equipment and relieve any pressure in the system

5.1.3 Lock out equipment driver and valves

5.1.4 Consult plant Material Safety Data Sheet (MSDS) files for hazardous materal regulations

5.2 Disassemble equipment in accordance with the equipment manufacturer's instructions to allow access to seal installation area.

5.3 Remove existing sealing arrangement (mechanical seal or otherwise).

Clean seal chamber and shaft thoroughly.

5.4 Verify the shaft dimensions as shown on the seal assembly drawing. 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.

5.5 Verify the seal chamber bore or OD pilot fit as shown on the seal assembly drawing.

5.6 Check seal assembly drawings for any modifications (reworks) to be made to the equipment for mechanical seal installation and act accordingly.

5.7 The equipment must be earthed to prevent sparks due to static electricity discharge.

Shaft runout should not exceed 0,05 mm (.002") 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.

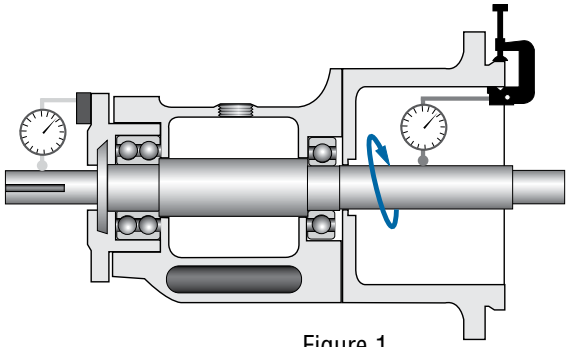

Figure 1

Shaft endplay should not exceed 0,25 mm (.010") TIR, regardless of thrust bearing type. See Figure 2.

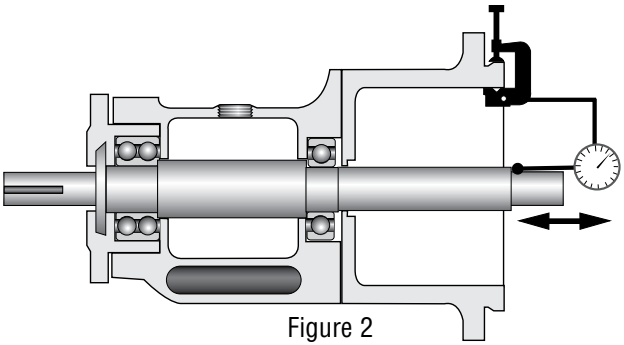

Figure 2

Radial shaft movement should be checked against the equipment manufacturer's specifications. Generally 0,05 - 0,10 mm (.002" -.004") 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 (.004" - .006"). See Figure 3.

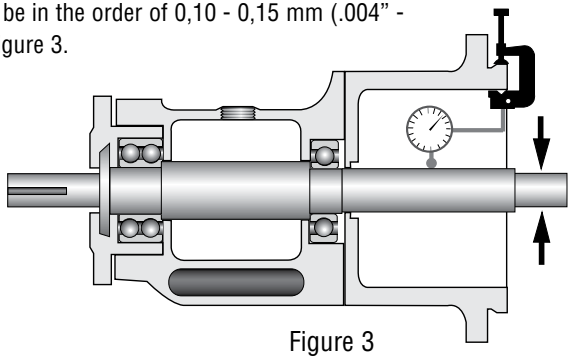

Figure 3

Seal chamber squareness to the shaft centreline should be within 0,015 mm per 25 mm seal chamber bore (.0005" per 1" seal chamber bore).
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 4.

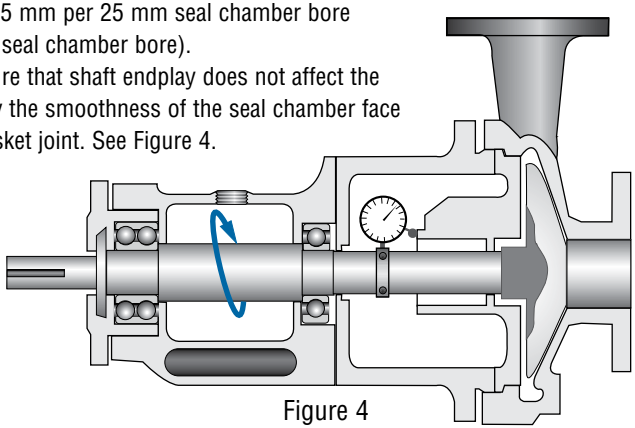

Figure 4

Concentricity of the shaft to the seal chamber bore should be within 0,025 mm per 25 mm shaft diameter (.001" per 1" shaft diameter) to a maximum of 0,125 mm (.005") TIR. See Figure 5.

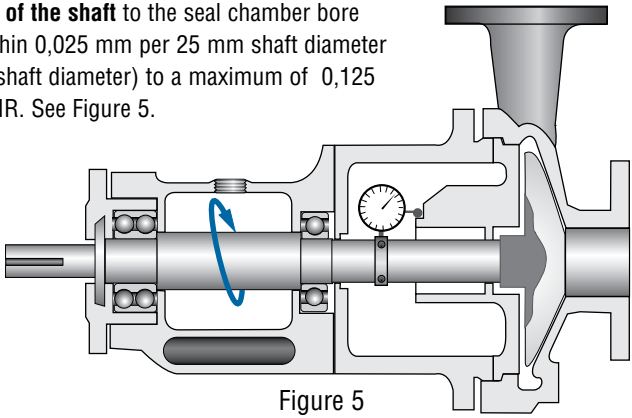

Figure 5

6 Mechanical Seal Installation

Verify that the mechanical seal is in accordance with the order documents, to ensure that the correct seal is being installed.

Correct seal setting is important in the successful operation of a mechanical seal. Cartridge seals unitize the complete seal assembly on a sleeve such that the entire seal is installed simultaneously. Component seals are assembled sequentially on the equipment and require careful measurements to properly locate and lock the rotating components relative to the stationary components. When measuring the setting or securing cartridge seals, always make sure the shaft is in the same position as when the equipment is operating (e.g. including the effects of thermal growth or contraction of the shaft relative to the casing).

To ease installation, gaskets may be lightly lubricated. Lubricant must be compatible with both handled product and gasket material. Generally, silicon grease is suitable but this should be verified before applying.

Caution: avoid over compressing a bellows. This could result in reduced spring force and length.

Some mechanical seals are sensitive to direction of rotation. Verify that the direction of rotation of the shaft corresponds to that of the mechanical seal before installation.

6.1 Installation of Cartridge Type Seal with Setting Plates. See Figure 6.

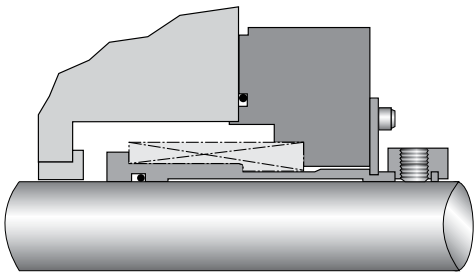

Figure 6

6.1.1 Check assembly drawing, bill of material and seal assembly prior to installation.

6.1.2 Install the seal onto the shaft and locate the gland against the face of the seal chamber.

6.1.3 Orient the ports on the seal gland(s) as indicated by the seal assembly drawing and connecting piping.

6.1.4 Evenly torque gland bolts/nuts to prevent cocking of the gland or uneven gland pressure against the seal chamber.

Do not tighten drive arrangement screws.

6.1.5 Complete the remaining equipment assembly including thrust bearings, if applicable.

6.1.6 Ensure the setting plates are correctly located and engaged.

6.1.7 Tighten drive arrangement screws to the torque values shown on the seal assembly drawing.

6.1.8 Assemble interconnecting piping as per API-plan and piping instructions as given in paragraph 7. See also (if applicable) auxiliary system installation and operating manual.

6.1.9 Disengage setting plates from the sleeve and secure tightly in disengaged position.

6.1.10 Inspect equipment and driver alignment in accordance with coupling and/or equipment manufacturer's instructions.

6.1.11 After bringing the unit up to operating conditions (pressure and temperature), recheck pump to driver alignment. Make adjustments as necessary.

6.2 Installation of a Cartridge Type Seal with Centring Tabs.
See Figure 7.

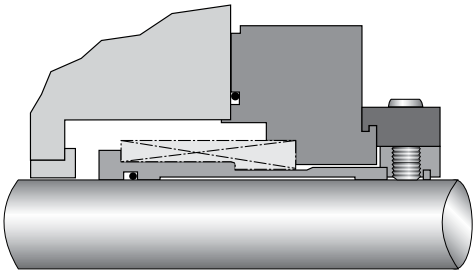

Figure 7

6.2.1 Check assembly drawing, bill of material and seal assembly prior to installation.

6.2.2 Install the seal onto the shaft and locate the gland against the face of the seal chamber.

6.2.3 Orient the connections on the seal gland(s) as indicated by the seal assembly drawing and connecting piping.

6.2.4 Install gland bolts/nuts, but do not tighten. The gland must be free to move radially.

6.2.5 Complete the remaining equipment assembly including thrust bearings, if applicable.

6.2.6 Ensure the centring tabs are correctly located and engaged.

6.2.7 Evenly torque gland bolts/nuts to prevent cocking of the gland or uneven gland pressure against the seal chamber.

6.2.8 Tighten drive arrangement screws to the torque values shown on the seal assembly drawing.

6.2.9 Assemble interconnecting piping as per API-plan and piping instructions as given in paragraph 7. See also (if applicable) auxiliary system installation and operating manual.

6.2.10 Remove centring tabs and store them in a known place.

6.2.11 Inspect equipment and driver alignment in accordance with coupling and/or equipment manufacturer's instructions.

6.2.12 After bringing the unit up to operating conditions (pressure and temperature), recheck pump to driver alignment. Make adjustments as necessary.

6.3 Installation of a Component Type Seal. See Figure 8.

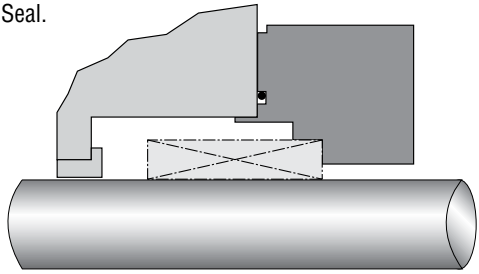

Figure 8

6.3.1 Check assembly drawing, bill of material and seal components prior to installation. Ensure seal faces and joints are free of scratches, contamination and other damage. Prior to installation, wipe lapped surfaces clean with a lint free cloth and quick drying solvent. Lubrication of seal faces is not recommended unless specified on the seal assembly drawing.

6.3.2 Assemble seal chamber and shaft (including thrust bearings, if applicable) and verify/scribe the seal setting distance as shown on the assembly drawing. Other setting aids such as spacer rings may be indicated on the assembly drawing.

6.3.3 When applicable, pre-assemble the rotating and stationary components or sub-components of the seal in accordance with the assembly drawing.

6.3.4 Assemble the seal components sequentially onto the equipment, fastening the rotating components. Locate the gland(s) against the face of the seal chamber.

6.3.5 Orient the connections on the seal gland(s) as indicated by the seal assembly drawing.

6.3.6 Evenly torque gland bolts/nuts to prevent cocking of the gland or uneven gland pressure against the seal chamber.

6.3.7 Complete the remaining equipment assembly including thrust bearings, if applicable.

6.3.8 Assemble interconnecting piping as per API-plan and piping instructions as given in paragraph 7. See also (if applicable) auxiliary system installati on and operating manual.

6.3.9 Inspect equipment and driver alignment in accordance with coupling and/or equipment manufacturer's instructions.

6.3.10 After bringing the unit up to operating conditions (pressure and temperature), recheck pump to driver alignment. Make adjustments as necessary.

6.4 Installation of Seals with Hooked Sleeves (overhung pumps). See Figure 9.

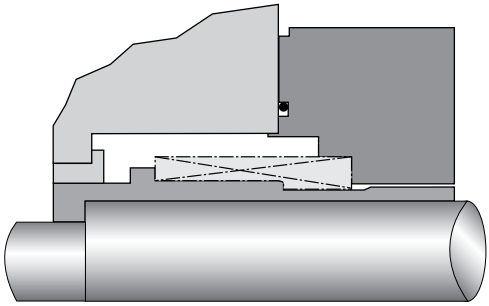

Figure 9

6.4.1 Check assembly drawing, bill of material and seal components prior to installation Ensure seal faces and joints are free of scratches, contamination and other damage.

Prior to installation, wipe lapped surfaces clean with a lint free cloth and quick drying solvent. Lubrication of seal faces is not recommended unless specified on the seal assembly drawing.

6.4.2 Assemble seal chamber and shaft (including thrust bearings, if applicable) and verify the distance from the seal chamber face to the end of the shaft as shown on the assembly drawing.

6.4.3 When applicable, pre-assemble the rotating and stationary components or sub-components of the seal in accordance with the assembly drawing.

6.4.4 Assemble the seal components sequentially onto the equipment. Locate the gland(s) against the face of the seal chamber. If applicable, install drive keys as indicated on the seal and/or pump assembly drawing.

6.4.5 Orient the connections on the seal gland(s) as indicated by the seal assembly drawing and connecting piping.

6.4.6 Evenly torque gland bolts/nuts to prevent cocking of the gland or uneven gland pressure against the seal chamber.

6.4.7 After the impeller nut is properly torqued, check that the sleeve is completely seated.

6.4.8 Complete the remaining equipment assembly including thrust bearings, if applicable.

6.4.9 Assemble interconnecting piping as per API-plan and piping instructions as given in paragraph 7. See also (if applicable) auxiliary system installation and operating manual.

6.4.10 Inspect equipment and driver alignment in accordance with coupling and/or equipment manufacturer's instructions.

6.4.11 After bringing the unit up to operating conditions (pressure and temperature), recheck pump to driver alignment. Make adjustments as necessary.

7 Piping Instructions

Piping instructions are detailed on the mechanical seal assembly drawing.
These instructions must be followed precisely to ensure correct seal operation. For auxiliary systems: carefully read the operating instructions provided with the system.

Minimize restrictions, especially in closed loop piping arrangements. Unless otherwise specified, the minimum internal diameter for pipe, tubing and connecting hardware should be 12,7 mm (.500").

Total pipe length and number of bends should be kept to a minimum. Use smooth, large radius bends; do not use elbows, tees, etc. Orifices should be installed as far away from the seal gland as possible. An exception to this rule should be made for orifices fitted to drain piping. To avoid clogging of the orifice it is advisable to install it in the seal gland so that the generated heat will serve to keep the leaked product fluid.

For "loop type" systems (API-plan 23, 52 and 53 A, B, C)

Pipe runs should be sloped continuously up or down to allow adequate circulation, proper venting and draining. Make sure that the loop, including seal gland, does not include vapor traps. Unless otherwise specified, reservoirs and coolers must be mounted 40 to 60 cm (15" to 24") above the seal inlet or outlet connection, whichever is the highest, to promote thermosyphoning in standby condition.

Seals equipped with excess leakage detection

Excess leakage detection, often used with single or non-pressurized dual seals, is commonly achieved by monitoring liquid level or pressure increases. With such an arrangement, the drain line for normal leakage must slope downward continuously to the point of exit (e.g. sump). Refer to the seal assembly drawing for additional piping requirements including the proper location of the restriction orifice and instrumentation.

8 Performance Testing of Pumps

Pump manufacturers will often perform pump performance tests on water with the mechanical seal installed. If the pump product used during field operation is not equal to water, seal designs and face materials require special precautions to prevent damage to the seals during these tests. For example, on seals with two hard faces, the seals may be provided with faces in alternate materials more suitable for the pump test medium. These faces are to be replaced with faces in the selected materials at the conclusion of the testing. A mechanical seal equipped with a hard face comination can be safely operated on water provided the pressure does not exceed 5 bar and the speed does not exceed 10 m/s.

When high temperature seals with graphoil gaskets are tested on water during a pump performance test, the seals must be carefully dried after the test to prevent vaporization of water absorbed by the gaskets when the pump is brought to its (high) operating temperature.

Contact your Flowserve representative for additional information.

9 Operational Recommendations

9.1 The pressure and temperature in the seal chamber or of the barrier fluid must not exceed the recommended maximum seal limits. The shaft speed must also not exceed the seal's limits.

9.2 For seals using external cooling and/or an external flush, apply cooling and/or flush prior to seal start-up. Avoid inadvertent operation of valves located in the cooling system that might result in shutting off the cooling flow.

9.3 Single and dual non-pressurized (tandem) seals require adequate vapor pressure margin in the seal chamber to prevent flashing of the product at the seal faces.

9.4 Dual non-pressurized (tandem) seals require the buffer fluid pressure to be maintained at a value lower than the seal chamber pressure. Buffer fluid pressure is usually equal to atmospheric or vapor recovery system pressure, unless other wise specified.

9.5 Dual pressurized (double) seals require the barrier fluid pressure to be maintained at least 2 bar (30 psi) above the seal chamber pressure, unless otherwise specified. It is imperative to pressurize the barrier prior to pressurizing the equipment. Likewise, do not de-pressurize the barrier system until the equipment has been fully isolated, depressurized and vented.

9.6 Flowserve can supply information on barrier fluid temperature and flow requirements based on product type, seal size, product temperature, barrier fluid characteristics and shaft speed. The buffer/barrier fluid must contain little or no additives for anti-wear/oxidation. Automotive antifreeze should never be used. Ensure that the barrier fluid is clean and compatible with the product.

9.7 This seal is designed to resist corrosion by the product(s) listed on the assembly drawing. Do not expose the seal materials to products other than those shown on the assembly drawing. The seal assembly drawing lists the materials of construction. Consult your Flowserve representative when in doubt or when using the seal for another application than for which it was selected.

9.8 Liquid seal requirements: Do not start the equipment dry. Open valves to flood equipment with product. Vent all air and/or product vapor from the equipment casing and the seal chamber before start up. Vent casing and tubing of heat exchange (if applicable). Process fluid must flood and pressurize the seal chamber at all times for single seal and non-pressurized dual seals. Barrier fluid must flood dual seals at all times during equipment operation.
Gas seal requirements: Do not apply liquids to gas seal designs. Non-pressurized dual seals with the outboard seal designed to operate in gas must be connected only to a gas purge, if applicable.

9.9 When required, dry steam should be applied to the quench connection. Use a needle valve (or other flow restriction) to provide 0.1 bar (1 to 1.5 psi) steam to the quench connection on the seal gland.

This should result in wisps of steam exiting the seal gland area. Ensure that all condensate is drained from the supply line and open the steam quench slowly before the pump is preheated to prevent thermal shock.

9.10 Start up equipment in accordance with normal operating procedures unless specifically requested otherwise by Flowserve.

If the equipment is not operating properly (e.g. seals and/or bearings running hot, cavitation, heavy vibration, etc.), shut down the equipment, investigate and remove the cause.

10 Shut down, disassembly

The equipment can be shut down at any time. Before the mechanical seal can be removed the equipment must be de-pressurized and drained.

Barrier pressure (if applicable) must be relieved after the equipment has been de-pressurized.

Product may be released during removal of the mechanical seal. Safety measures and protective clothing may be required as per the plant's safety regulations.

Further disassembly of the mechanical seal must be done according to the supplier's specifications.

11 System check

Checking of the system, limits itself to monitoring pressure, temperature, leakage and consumption of barrier (buffer) fluid, when applicable.

12 Spare parts, repairs

This mechanical seal is designed to provide reliable operation under a wide range of operating conditions. However, repairs will be necessary when the seal reaches the end of its normal life expectancy or when it has been operated outside of its design capabilities.

This product is a precision sealing device. The design and dimensional tolerances are critical to seal performance. Only parts supplied by Flowserve should be used to repair this seal. These are available from the numerous Flowserve stocking locations.

To order replacement parts, refer to the part code, order number or B/M number, which can be found on the assembly drawing. It is recommended to keep a spare seal on stock to reduce equipment downtime.

All liabilities and warranties to Flowserve for damage incurred through the use of non-original replacement parts and accessories will be rendered null and void.

Please note that special manufacturing and delivery specifications exist for all parts of our products manufactured or produced by ourselves and the replacement parts are always offered in accordance with the latest technology and with the most current regulations and laws.

Flowserve seals can normally be reconditioned. When repair is necessary, the seal should be carefully removed from the equipment (reinstall the centring tabs or setting plates if applicable).

Decontaminate the seal assembly and return it to a Flowserve authorized repair facility 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, a quotation will be made for restoring it to its original condition. Upon acceptance of the quotation, the parts will be rebuilt, tested, and returned to sender.

FLOWSERVE®

TO REORDER REFER TO
B/M # _____
F.O._____

The information and specifications presented in this product brochure are believed to be accurate, but are supplied for information purposes only and should not be considered certified or as a guarantee of satisfactory results by reliance thereon. Nothing contained herein is to be construed as a warranty or guarantee, express or implied, with respect to the product. Although Flowserve Corporation can provide general application guidelines, it cannot provide specific information for all possible applications.

The purchaser/user must therefore assume the ultimate responsibility for the proper selection, installation, operation and maintenance of Flowserve products. Because Flowserve Corporation is continually improving and upgrading its product design, the specifications, dimensions and information contained herein are subject to change without notice.

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