ISC2 Series
Innovative Standard Cartridge seal designed for general purpose applications.
Installation Instructions for machinery components
Description

This ISC seal is a versatile cartridge mounted mechanical seal, designed for ease of installation and reliable operation. **No seal setting dimensions are required.** Removable setting devices provide proper alignment.

The ISC seal family consists of:

- **ISC2-PX** - Single pusher seal with stationary springs
- **ISC2-PP** - Dual pusher seal with stationary springs
- **ISC2-BX** - Single metal bellows seal with rotating bellows
- **ISC2-BB** - Dual metal bellows seal with rotating bellows
- **ISC2-XP** - Single pusher seal with a pumping device for a Plan 23
- **ISC2-XB** - Single metal bellows seal with a pumping device for a Plan 23

1. Drawing, Brief Description, Explosion Protection, Functional Requirements

This mechanical seal is designed to provide reliable performance under a wide range of operating conditions. 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.

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 spring-loaded 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. To provide lubrication, a film of liquid must always be present between the seal faces. The sealing surfaces are separated from each other by the seal liquid film during shaft rotation and in principle run without contact and thus minimal wear under these conditions.

1.3 Explosion Protection

The ISC2 mechanical seal is a standard cartridge seal and as such regarded as a machine element. Machine elements do not need to comply with Directive 94/9/EC (ATEX 95 product guide) as these are regarded as an integral part of a larger piece of machinery (pump, agitator). This has been confirmed by both the EC ATEX standing committee as well as the European Sealing Association (ESA). Reference is made to following web-sites:

EC ATEX standing committee: http://ec.europa.eu/enterprise/atex/rotating.htm

ESA position statement: http://www.europeansealing.com/statements.html

For applications which require information on expected surface temperatures of the mechanical seal faces, Flowserve document “ATEX 137 information declaration” is available upon request. This document allows users to determine typical surface temperatures based upon seal design, operating conditions and face materials and may be used by the users to comply with ATEX 1999/92/EC (ATEX 137).

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 run 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 seal liquid film between the sealing surfaces

! If these function conditions are not fulfilled, the consumption of product, for example, is increased and parts of the product can escape into the atmosphere. Other effects can include high component temperatures.

See the directive 94/9/EC, 1999/92/EC and EN 13463-5.

Failure to meet these requirements will result in excessive leakage and/or shortened seal life.

2. Safety

DANGER: This means that personal danger or major material damage can occur when no attention is paid to this.

! ATTENTION: This means that important information is pointed out that may also be overlooked by skilled personnel. The information can be important to avoid personal injury or material damage.

Please read these instructions carefully. Installation in accordance with the following instructions will contribute to long and trouble free running 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 run the mechanical seal and related equipment is well acquainted with the design and operating requirements of such equipment.

! For this personnel it may be required to wear protective clothing as per the plant’s safety regulations.

! 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.

EXPLOSION PROTECTION – This means that failure to observe these instructions will involve the risk of explosion in potentially explosive environments which can
cause harm to persons and / or considerable damage to property.

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.

Failure, recovery or fluctuation in power supply to the machine and/or supply system may not expose persons or environment to dangerous situations or harm the functionality of the mechanical seal.

Guards that are provided by the equipment manufacturer have to be in accordance with plant regulations, but should not create additional danger. These guards have to ensure proper access to the working area required for maintenance to the mechanical seal.

The electricity supply of the equipment must be in accordance with directive 2006/95/EC. When machinery is powered by a source of energy other than electricity this may not cause dangerous situations for persons and environment.

3. General

All illustrations and details in these installation 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, 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 sub-
jectected to heavy impacts during transport must not be installed. An inspection by Flowserve or its appointed representative is strongly advised.

If the machine is to be preserved with integrated mechanical seals the preserving medium must not impair the functions of the mechanical seals by e.g. fouling of the seal faces, hardening, or swelling the secondary seals.

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.

The mechanical seal can in principle be transported with suitable means like lifting accessories.

5. Equipment Check

5.1 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.

5.2 Disassemble pump in accordance with equipment manufacturer’s instructions and remove sealing arrangement.

5.3 Check seal documentation for seal design and materials of construction. Verify that the ISC2 seal is designed for the equipment being repaired.

5.4 Check seal assembly drawing for any modifications required to the equipment before installation and act accordingly.

5.5 Check shaft or pump sleeve OD, seal chamber depth, seal chamber bore, distance to the first obstruction, gland pilot and gland bolting to ensure they are dimensionally within the tolerances shown on the seal assembly drawing.

5.6 Thoroughly inspect and clean the seal chamber and shaft or pump sleeve. Inspect for corrosion or any defects. Remove all burrs, cuts, dents or defects that might damage gaskets or allow a leak path. Replace worn shaft or pump sleeve. Remove sharp edges from keyways and threads.

5.7 Check equipment requirements as described in Figure 1. Any reading greater than what is allowed must be brought within specifications.

5.8 Handle the ISC2 seal with care; it is manufactured to precise tolerances. The seal faces are of special importance and should be kept perfectly clean at all times.
5.9 **Tools needed** for installation: An open-end wrench and torque wrench sized for the gland bolt nuts; a torque wrench for the set screws. All other tools are provided.

6. **ISC2 Seal Installation**

The installation chamber for the mechanical seal must be checked against the corresponding drawing and table of dimensions. It must be ensured that all dimensions, surface qualities, and tolerances (e.g. concentricity, run-out, fits) are observed. The specifications under e.g. ISO 21049 or API 682, DIN 28161, FLOWSERVE publication FSD 101, FLOWSERVE publication FSD17 must be observed.

**NOTE:** No seal setting measurements are needed to install the seal. Instructions are for end-suction back pull-out pumps. Modification of these procedures may be required for other style pumps. Consult Flowserve for installation support.

Take care that seal cartridge or components of the seal are handled and carried safely during installation of mechanical seal and that the ergonomic principles are followed. In order to prevent personal injuries the operator should also wear protective clothing as per the plant’s safety regulations.

Precautions must be taken for parts of the mechanical seal that will be used as support to step on during assembly operations. These parts must be protected against slipping, stumbling or falling (for example by using a strut).
6.1 Lubricate the shaft or sleeve lightly with silicone lubricant unless otherwise specified.

6.2 Tighten the setting device cap screws to ensure they are tight before installation.

6.3 Slide the ISC2 seal cartridge onto the shaft or pump sleeve with the setting devices toward the bearing housing. See Figure 2.

6.4 Install the seal chamber and bolt it in place on the bearing frame. See Figure 3.

6.5 Position the ISC2 with the gland tight against the seal chamber face.

6.6 Orient the ISC2 seal with the parts aiming as shown on the seal assembly drawing. See Section 7 for Piping Recommendations.

6.7 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.

Recommended ISC2 seal minimum gland nut torque by size range:

<table>
<thead>
<tr>
<th>Seal</th>
<th>inch</th>
<th>1.000 - 2.000</th>
<th>2.125 - 2.750</th>
<th>2.875 - 4.000</th>
<th>4.250 - 6.000</th>
<th>6.250 - 8.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (mm)</td>
<td>(25 - 50)</td>
<td>(54 - 70)</td>
<td>(75 - 102)</td>
<td>(108 - 152)</td>
<td>(159 - 203)</td>
<td></td>
</tr>
<tr>
<td>Torque</td>
<td>15 ft-lbs</td>
<td>20 ft-lbs</td>
<td>30 ft-lbs</td>
<td>35 ft-lbs</td>
<td>40 ft-lbs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(20 N-m)</td>
<td>(27 N-m)</td>
<td>(40 N-m)</td>
<td>(47 N-m)</td>
<td>(54 N-m)</td>
<td></td>
</tr>
</tbody>
</table>

Components provided by the customer for installing the mechanical seal, e.g. the pump cover or fastening screws, must exhibit adequate properties and dimensions. It must not be possible to overstress these components, e.g. the max permitted tightening torque must not be exceeded.

6.8 Assemble the equipment per manufacturer specifications. Avoid pipe strain. Align the coupling per manufacturer specifications.

6.9 With the impeller, shaft, coupling and bearings in their final operating position, tighten the drive collar set screws. See Figure 4.
Inaccurate tightening of these screws can lead to unsafe situation as mechanical seal may move out of the seal chamber when pressure is applied.

Recommended ISC2 seal minimum set screw torque by size range:

<table>
<thead>
<tr>
<th>Seal (inch)</th>
<th>1.000 - 2.500</th>
<th>2.625 - 2.750</th>
<th>2.875 - 8.000</th>
<th>2.875 - 8.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (mm)</td>
<td>(25 - 60)</td>
<td>(67 - 70)</td>
<td>(75 - 203)</td>
<td>(75 - 203)</td>
</tr>
<tr>
<td>Gland Size</td>
<td>All</td>
<td>All</td>
<td>Standard Bore</td>
<td>Enlarged Bore</td>
</tr>
<tr>
<td>Torque</td>
<td>40 in-lbs</td>
<td>120 in-lbs</td>
<td>150 in-lbs</td>
<td>240 in-lbs</td>
</tr>
<tr>
<td></td>
<td>(4.5 N-m)</td>
<td>(13.5 N-m)</td>
<td>(16.9 N-m)</td>
<td>(27.1 N-m)</td>
</tr>
</tbody>
</table>

6.10 Remove the setting devices from the drive collar by loosening the cap screws. See Figure 5. Save the setting devices and fasteners for future use when the pump impeller is reset or when the seal is removed for repairs.

Vibrations must be prevented from transferring to the installed ISC2 during operation, e.g. through structural measures implemented on the machine.

The machine to take the ISC2 must be earthed in accordance with the applicable regulations for electrical installations (e.g. VDE rules) to conduct away any electrostatic build-up and so prevent spark formation.

6.11 Turn the shaft by hand to ensure unobstructed rotation.

6.12 See Functional Recommendations before start-up.

Conduct a static pressure test. Do not exceed the max. pressures.

7. Piping Recommendations

7.1 Install and maintain an adequate piping plan. Ensure that piping is connected to the correct pipe ports to prevent unsafe situations. The connections on the mechanical seal are properly marked.
The ISC2 seal requires a clean, cool environment for maximum seal life. Typical piping plans are listed below. Contact Flowserve for additional piping plan information or technical support.

Plan 11: default inner seal flush from pump discharge on horizontal pumps (single seals)
Plan 13: default inner seal flush and vent from pump suction on vertical pumps (single seals)
Plan 21: inner seal flush from pump discharge through a cooler for use with hot products (single seals)
Plan 23: inner seal flush from internal pumping device through cooler (ISC2-XP and ISC2-XB designs)
Plan 32: inner seal clean external flush for use with abrasive products or products that are incompatible with the seal (single seals)
Plan 52: dual seal circulation through a low pressure reservoir (dual seals)
Plan 53: dual seal circulation through a pressurized reservoir (53A), finned tube array (53B) or piston accumulator (53C) (dual seals)
Plan 62: external quench on atmospheric side of seal (single seals)

7. For dual seals, LBI (Liquid Barrier Inlet) and LBO (Liquid Barrier Outlet) are marked on the gland. ISC2 seals are unidirectional and piping the correct inlet and outlet is important to proper circulation. The liquid barrier inlet should draw from the bottom of the support system while the liquid barrier outlet feeds the top of the system.

Forced ventilation of the seal chamber must be ensured when the circulation pipe is connected. Should there be gas or air pockets in the sealing chamber, these can accumulate with the rotation at the outer diameter of the seal gap at machine start-up. This causes the machine to run dry at the seal gap for an indefinite period, and the seal faces can become damaged.

7.3 For running a dual pressurized seal (double seal), supply a clean, compatible barrier fluid at a pressure at least 5 psi (1.7 bar) above the seal chamber pressure. See Figure 6. The pressure of the barrier fluid must not exceed the recommended maximum pressure.

Monitoring the liquid circulation is a recommended measure for ensuring that the mechanical seal runs properly.

Suitable measures must be implemented to prevent errors in the handling of shut-off and throttling devices installed in the fluid supply.

7.4 For dual unpressurized (tandem seal) operation, supply a clean, compatible buffer fluid at a pressure below the seal chamber pressure. The pressure in the seal chamber must not exceed the recommended maximum pressure.
7.5 **Quench and Drain ports on single seals should be plugged if not used** as a good housekeeping practice. Note: the quench and drain ports are smaller than the flush port as a distinguishing feature.

⚠️ Escaping leakage must not form an explosive mixture.

7.6 **Dual seal recommendation**: For enhanced seal performance and reduced coking, use **DuraClear** as a barrier fluid. Refer to DuraClear brochure FSD123 or contact a Flowserve representative for further details.

### 8. Functional Recommendations

8.1 **Remove lock outs** on equipment and valves.

8.2 **Do not start up the pump dry** dry to check motor rotation or for any other reason. Open valves to flood pump with product fluid. Ensure that the seal flush or support system is operating. Vent air from the casing of the pump and the seal chamber before start-up.

⚠️ It must be ensured that the machine is protected against penetration by dust and / or that dust deposits are removed at regular intervals so that they cannot exceed a thickness of 5 mm on the surfaces of the faces.
It must be ensured, e.g. in the form of a level monitor, that the sealing chamber is completely vented and filled with fluid in all running states if it is to minimise the heat generated by friction and therefore the surface temperature of the seal elements.

If the application limits for running in accordance with these instructions cannot be observed, the temperature of the supply liquid and/or the installed components must be monitored at all times by a device that shuts down the machine once a critical temperature is reached. This device can consist of resistance thermometers or thermoelements.

The seal chamber must be vented carefully before startup.

8.3 **Observe the start-up.** If the seal runs hot or squeals, check the seal flush system. Do not allow the pump to run for any extended time if the seal gets hot or squeals.

8.4 **Do not exceed corrosion limits.** The ISC2 seal is designed to resist corrosion through proper material selection. Do not expose the ISC2 seal materials of construction to products outside of their corrosion limits. Consult Flowserve for chemical resistance recommendations.

8.5 **Do not exceed pressure and speed limits** established for the ISC2 seal.

8.6 **Do not exceed the temperature limits** of the ISC2 seal based on the materials of construction. For dual seals using supply tanks with cooling coils, turn on cooling water to the supply tank before start-up.

8.7 **Do not start up or run the ISC2 seal dry.** The seal chamber, pump and support systems should be thoroughly vented before start-up. Buffer or barrier fluid must flood the seal cavity of dual seals at all times during running. Process fluid must be in the seal chamber at all times during single seal running. Do not exceed the recommended maximum pressure and speed limits shown in the ISC brochure.

At all running temperatures the product must not come within 20 K of its evaporating point. Should this not be the case during certain situations (e.g. machine shutdown, start-up) forced circulation or adequate cooling of the supply fluid must be generated to promote heat removal.

Escaping leakage must not form an explosive mixture.

9. **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.
Operator must persuade himself before starting disassembling of mechanical seal that the external of the equipment is cool enough to be handled without risk.

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.

Dismantling of the mechanical seal is only allowed after machine has been stopped.

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

10. System check

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

Routine maintenance of the mechanical seal extends to the monitoring of the set values for pressure, temperature, and leakage quantity.

Maintenance to the mechanical seal is only allowed after machine has been stopped.

The required area for operating the machine or doing maintenance to the mechanical seal must be easy accessible.

11. Repairs

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 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.

All Flowserve Corporation, Flow Solutions, products must be installed in accordance with Flowserve installation instructions. Failing to do so or attempting to change or modify Flowserve products will void Flowserve’s limited warranty. Flowserve’s limited warranty is described fully in Flowserve’s Standard Terms and Conditions of Sale. Flowserve makes no warranty of merchantability or fitness for a particular purpose and in no event shall Flowserve be liable for consequential or incidental damages.
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While the information and specifications contained in this literature are believed to be accurate, they are supplied for informative 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, regarding any matter with respect to this product. Because Flowserve is continually improving and upgrading its product design, the specifications, dimensions and information contained herein are subject to change without notice. Should any question arise concerning these provisions, the purchaser/user should contact Flowserve Corporation at any one of its worldwide operations or offices.

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