

KSB Mechanical Seal

**4HGS / 4HGSC / 4HGSL /
4HGSCL**

Installation/Operating Manual



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Installation/Operating Manual 4HGS / 4HGSC / 4HGSL / 4HGSL

Original operating manual

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1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The order number and order item number of the pump clearly identify the mechanical seal via the corresponding material number in the pump's parts list and serve as identification for all further business processes.

In the event of damage, immediately contact your nearest KSB service facility to maintain the right to claim under warranty.

For any queries contact LPC_Mechanical.Seals@ksb.com

1.2 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.

1.3 Other applicable documents


Table 1: Overview of other applicable documents

| Document | Contents |
|---|---|
| Data sheet | Description of the technical data of the pump (set) in which the mechanical seal is installed. |
| General assembly drawing ¹⁾ | Description of the mechanical seal as part of the sectional drawing of the pump |
| Sub-supplier product literature ¹⁾ | Operating manuals and other product literature describing accessories and integrated machinery components |

For accessories and/or integrated machinery components, observe the relevant manufacturer's product literature.

1.4 Symbols








Table 2: Symbols used in this manual

| Symbol | Description |
|---|--|
| ✓ | Conditions which need to be fulfilled before proceeding with the step-by-step instructions |
| ▷ | Safety instructions |
| ⇒ | Result of an action |
| ⇔ | Cross-references |
| 1. 2. | Step-by-step instructions |
|  | Note Recommendations and important information on how to handle the product |

¹ If agreed to be included in the scope of supply

1.5 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

| Symbol | Description |
|--|---|
|  DANGER | DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury. |
|  WARNING | WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury. |
|  CAUTION | CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions. |
|  | Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (ATEX). |
|  | General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury. |
|  | Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage. |
|  | Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions. |



2 Safety

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
 - Arrow indicating the direction of rotation
 - Markings for connections
 - Fitting direction
- The operator is responsible for ensuring compliance with all local regulations not taken into account.

2.2 Intended use

- This product must only be operated within the limit values stated in the technical product literature for the ambient temperature, fluid handled, speed, density, pressure, temperature and in compliance with any other instructions provided in the operating manual or other applicable documents.

2.3 Personnel qualification and training

- All personnel involved must be fully qualified to install, operate, maintain and inspect the product this manual refers to.
- The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.
- Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.
- Training on the product must always be supervised by specialist technical personnel.

2.4 Consequences and risks caused by non-compliance with this manual

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
 - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
 - Failure of important product functions
 - Failure of prescribed maintenance and servicing practices
 - Hazard to the environment due to leakage of hazardous substances

2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

2.6 Safety information for the user/operator

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Contain leakages of hazardous fluids (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Observe all legal requirements.
- The design of mechanical seals always produces a small amount of leakage.
- Higher leakage may occur especially in the running-in phase. The leakage must be drained off in a controlled way

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the mechanical seal require the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the mechanical seal when the shaft is not rotating.

For mechanical seals installed in pump sets:

- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual.
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning.
- Observe the relevant sections of the corresponding pump operating manual.

2.8 Unauthorised modes of operation

Never operate the mechanical seal outside the limits stated in the data sheet and in this operating manual.

The warranty relating to the operating reliability and safety of the mechanical seal supplied is only valid if the mechanical seal is used in accordance with its intended use.


Any damage caused by dry running shall be excluded from the warranty.

3 Transport/Storage/Disposal


3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.



3.2 Transport


| | |
|---|--|
|  | <div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Improper transport Damage to the mechanical seal!</p> <ul style="list-style-type: none"> ▷ Only transport the mechanical seal in suitable packaging. ▷ Observe the weights, symbols and instructions indicated on the packaging. ▷ Use suitable, approved lifting accessories. |
|---|--|

KSB's standard packaging is suitable for dry transport ,e.g. by truck, rail, air. Special packaging can be provided if specified in the contractual agreement.

| | |
|--|---|
|  | <div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Removing transport locks too early Damage to previously locked components during transport!</p> <ul style="list-style-type: none"> ▷ If transport locks are fitted, do not remove them too early. |
|--|---|

3.3 Storage/preservation

| | |
|---|--|
|  | <div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Improper storage Damage due to humidity, vermin, corrosion and contamination!</p> <ul style="list-style-type: none"> ▷ Avoid outdoor storage. ▷ Observe, check and record the storage conditions. ▷ Regularly check the packaging for any damage. ▷ Regularly check the humidity indicator of shrink-wrapped objects. The relative humidity should be < 50 %. ▷ If the relative humidity indicated for shrink-wrapped objects > 50 %, have the equipment repacked by the manufacturer. |
|  | <div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Improper storage Impairment of O-rings' sealing function!</p> <ul style="list-style-type: none"> ▷ Do not store O-rings together with chemicals, solvents, fuels, acids, etc. ▷ Protect O-rings from light, in particular from direct sun exposure and strong artificial light high in ultraviolet rays. ▷ Check the O-rings for damage before they are fitted. |

| | |
|---|---|
|  | <p style="background-color: #FFD700; margin: 0;">CAUTION</p> <p>Wet, contaminated or damaged openings and connections</p> <p>Damage to the mechanical seal!</p> <p>Risk of embrittlement! Damage to elastomers!</p> <ul style="list-style-type: none"> ▷ Only open screw plugs and connections at the mechanical seal at the time of installation. ▷ Avoid opening screw plugs, connections and similar before that time. |
|---|---|

We recommend taking the following measures for storing the mechanical seal:

For storing the mechanical seal observe standards ISO 2230 and DIN 7716.

Store the mechanical seal in its original packaging, placed on a level surface in a dry, protected room with constant conditions that meet the following requirements:

- Relative humidity < 65 %
- Temperature between 15 °C and 25 °C
- Moderately vented atmosphere
- Dust-free and vermin-free



If properly stored indoors, the equipment is protected for a maximum of 36 months. New mechanical seals are supplied by our factory duly prepared for storage.

3.4 Return to supplier

1. Remove the used mechanical seal from the system.
2. Always flush and clean the mechanical seal, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the mechanical seal has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the mechanical seal must also be neutralised and dried with anhydrous inert gas.
4. Always complete and enclose a certificate of decontamination when returning the mechanical seal. Always indicate any safety measures and decontamination measures taken.

| | |
|---|---|
|  | <p style="background-color: #0070C0; color: white; margin: 0;">NOTE</p> <p>If required, a blank certificate of decontamination can be downloaded from the following web site: www.ksb.com/certificate_of_decontamination</p> |
|---|---|

3.5 Disposal

| | |
|---|---|
|  | <div> WARNING</div> <p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none">▸ Collect and properly dispose of flushing fluid and any fluid residues.▸ Wear safety clothing and a protective mask if required.▸ Observe all legal regulations on the disposal of fluids posing a health hazard. |
|---|---|

1. Dismantle the mechanical seal.
Collect greases and other lubricants during dismantling.
2. Separate and sort the mechanical seal materials, e.g. by:
 - Metals
 - Plastics
 - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

4 Description

4.1 General description

- KSB mechanical seal

Mechanical seal for installation in pump sets and other rotating machinery in accordance with the manufacturer's instructions.

4.2 Product information as per Regulation No. 1907/2006 (REACH)

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see <https://www.ksb.com/ksb-en/About-KSB/Corporate-responsibility/reach/>.

4.3 Designation

Example: C072M1-4HGSC-Z3

Table 4: Designation key

| Code | Description | |
|------|--------------------------------|--|
| C | Design | |
| | C | Cartridge seal |
| 072 | Nominal diameter | |
| M | Direction of rotation | |
| | M | Bi-directional with multi-spring arrangement |
| | S | Bi-directional with single spring |
| | L | Direction of rotation anti-clockwise |
| | R | Direction of rotation clockwise |
| 1 | Anti-twist lock of mating ring | |
| | 0 | Without lock |
| | 1 | With lock |
| 4HGS | Type series | |
| | 4HGS | Standard design |
| | 4HGSC | Design with cooled mating ring |
| | 4HGSL | Design with internal pumping device |
| | 4HGSCL | Design with cooled mating ring and internal pumping device |
| 1 | Country code | |
| | 1 | Standardised seal for India |
| | 8 | Standardised seal for China |
| Z3 | Customised seal | |
| | Z | Code for customised seal |
| | 3 | Consecutive number |

4.4 Materials

- Depending on the application
- See product literature of the pump
- Selection of suitable material variant on request

4.5 Design details

Design

- Cartridge seal
- Single
- 4HGS and 4HGSC suitable for mode of operation to API Plan 02 and 11

- 4HGS and 4HGSC are bi-directional.
- 4HGSL and 4HGSCSL suitable for mode of operation to API Plan 23
- 4HGSL and 4HGSCSL are uni-directional.
- Axial movability depending on the size
- Torque transmission via clamping disc
- Multi-spring arrangement

4.6 Configuration and function

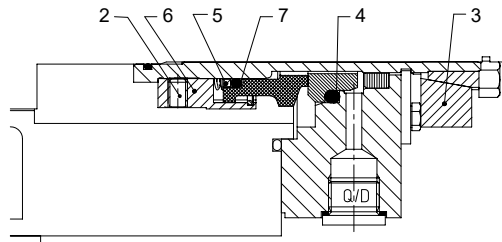
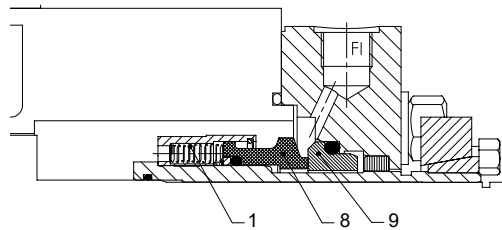


Fig. 1: Sectional drawing_HGS

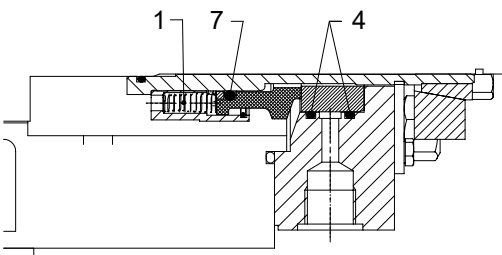
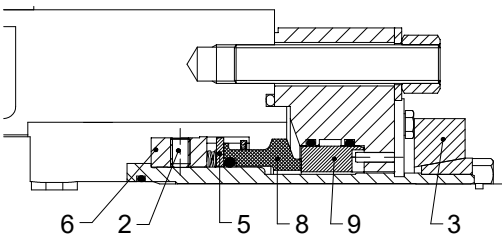


Fig. 2: Sectional drawing_HGSC

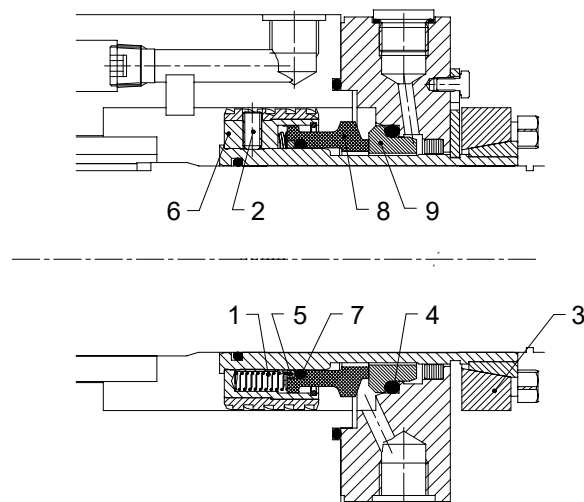


Fig. 3: Sectional drawing_HGSL

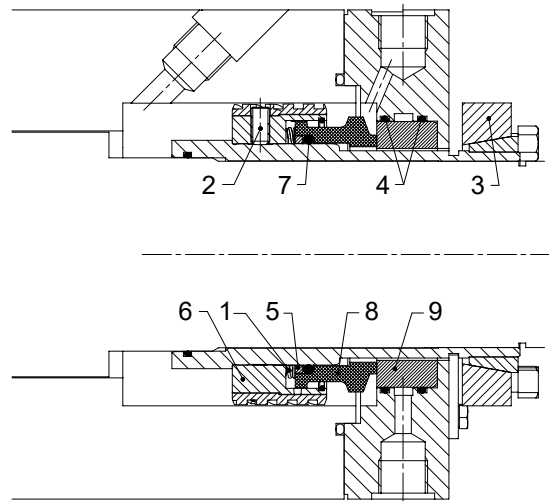


Fig. 4: Sectional drawing_HGSL

Design Mechanical seal for installation in pump sets and other rotating machinery in accordance with the manufacturer's instructions.


KSB's mechanical seals 4HGS / 4HGSC / 4HGSL / 4HGSL are cartridge seals that have been especially developed for use in pumps of the HG type series. The 4HGSC KSB mechanical seal is fitted with a cooled mating ring; the 4HGS KSB mechanical seal is not fitted with a cooled mating ring. 4HGSL is fitted with a cooled mating ring and, in addition, an internal pumping device. The 4HGSL KSB mechanical seal is fitted with an internal pumping device.

Function The primary ring 8, which is the axially movable sealing ring, is pressed to the stationary mating ring 9 by the springs 1 and the hydraulic pressure. The thrust ring 5 transmits the spring force and the torque from the torque-transmitting element to the primary ring 8. The torque from the shaft sleeve is transmitted to the primary ring by the grub screws 2 in the torque-transmitting element 6. Torque transmission from the shaft to the shaft sleeve is effected by a clamping disc in the locking ring 3. The O-rings 4 provide sealing between the mating ring and the seal cover. They also form a boundary for the cooling channel (4HGSC and 4HGSL). The O-ring 7 provides sealing between the primary ring and the shaft sleeve. It also ensures axial movability of the primary ring. The remaining O-rings provide sealing between the seal



components and the pump components. The internal pumping device of KSB's mechanical seals 4HGSL and 4HGSCL serves to circulate the fluid handled through the cooler.

To prevent dry running of the seal, the pressure at the seal must be equal to or higher than the ambient pressure. The seal chamber must be completely vented. To prevent vaporisation of the fluid in the sealing clearance, the difference between the actual pressure and the vapour pressure must be sufficiently large. Cooling of the mating ring reduces the temperature and consequently lowers the vapour pressure. The cooling quantity depends on the application parameters.

5 Installation/Dismantling

| | |
|---|---|
|  | <p>NOTE</p> <p>Priority shall be given to the installation instructions and/or installation sequence in the documents of the pump set into which this mechanical seal is to be installed. This also applies to the dismantling instructions and/or dismantling sequence.</p> |
|---|---|

5.1 Permissible aids

| | |
|---|---|
|  | <p>CAUTION</p> <p>Impermissible cleaning agents</p> <p>Damage to the seal faces at the mechanical seal!</p> <ul style="list-style-type: none"> ▷ For removing minor contamination use only paper tissues and ethyl alcohol. ▷ Do not use dirty cleaning cloths or cleaning cloths that leave behind lint. |
|  | <p>CAUTION</p> <p>Impermissible assembly aids</p> <p>Sealing elements made of ethylene propylene diene rubber perishing or swelling up!</p> <ul style="list-style-type: none"> ▷ Never let sealing elements come into contact with mineral oil base lubricants. ▷ Use permissible lubricants only. ▷ Verify that the assembly aids are silicon-free. |

- Lubricants²⁾
 - Permanent lubricants, such as non-mineral grease (Klüber Asonic HQ 72-102) are used for elastomers that do not serve to transmit the torque. Examples are mating rings with an anti-twist lock or primary rings that move axially relative to the pump components.
 - Non-permanent lubricants such as a soap solution, for example, are used for elastomers that serve as a sealing element and, in addition, transmit the torque. An example would be a mating ring without anti-twist lock.
- Recommended cleaning agent for seal faces and grub screws: ethyl alcohol
- Thread-locking agent: Loctite, No. 243
- Open-ended wrench, ring spanner, socket wrench (cleaned, no impact tools)
- Torque wrench (cleaned)




5.2 Prerequisites

- Shaft run-out to ISO 5199:
 - For shaft diameter ≤ 50 mm: 0.05 mm max.
 - For shaft diameter 50 to 100 mm: 0.08 mm max.
 - For shaft diameter > 100 mm: 0.10 mm max.
- Face run-out of the shaft in relation to the vertical connection surface of the casing:
 - For shaft speed ≤ 750 rpm: 0.2 mm max.
 - For shaft speed > 750 rpm to 1000 rpm: 0.15 mm max.
 - For shaft speed > 1000 rpm to 1500 rpm: 0.08 mm max.

²⁾ Lubricants must be compatible with all fluids used. They must not be aggressive to the secondary sealing elements.

- For shaft speed > 1500 rpm to 3000 rpm: 0.025 mm max.
- Permissible centre offset between the pump casing and the shaft:
 - Max. 0.2 mm for seals without pumping ring
 - Max. 0.1 mm for seals with pumping ring
- The seal faces are clean and have not been touched with fingers.
- The mechanical seal is in proper condition and complete.
- The elastomers are free from any contamination, cracks, softening, hardening, stickiness and discolouration.
- The mechanical seal has been placed down on a clean and level surface.

5.3 Installing the mechanical seal

| | |
|---|--|
|  | <p>CAUTION</p> <p>Use of grease or other permanent lubricants Torque transmission impeded / overheating of and damage to the pump!</p> <ul style="list-style-type: none"> ▸ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal. ▸ Use soft soap to reduce any friction caused during assembly. ▸ Never coat the mechanical seal faces with grease or oil. |
|  | <p>NOTE</p> <p>In the area of the clamping disc the shaft must be absolutely grease-free.</p> |
|  | <p>NOTE</p> <p>For mechanical seals with internal pumping device (4HGSL, 4HGSCL) the direction of rotation must be observed.</p> |

The rules of sound engineering practice and the pump manufacturer's general provisions apply. Tidiness and cleanliness are essential for proper execution of the installation work.

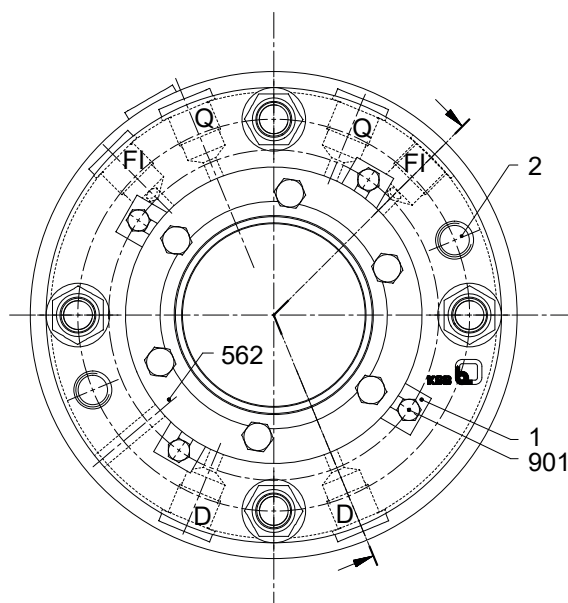


Fig. 5: Mechanical seal, axis cross-section

| | | | |
|---|----------------|-----|-------------------|
| 1 | Transport lock | 562 | Parallel pin |
| 2 | Jacking thread | 901 | Hexagon head bolt |

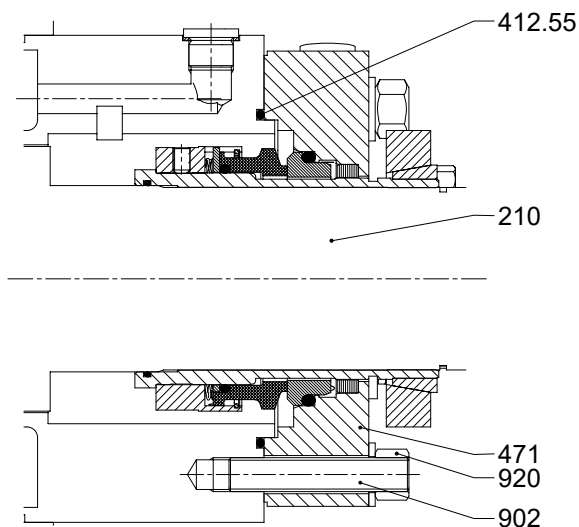


Fig. 6: Mechanical seal, sectional drawing

- ✓ The operating manual for the pump set is on hand.
 - ✓ The pump has been prepared in accordance with the operating manual for installing the mechanical seal.
 - ✓ The mechanical seal, clamping disc and assembly aids are on hand.
 - ✓ The installation drawing is on hand and observed.
1. Properly remove any corrosion or wear.
 2. Carefully guide the mechanical seal onto shaft 210 until seal cover 471 abuts discharge cover 163.
 3. Make sure that O-ring 412.55 is properly fitted in the groove and is undamaged. Apply a suitable lubricant to the O-ring if required.
 4. Fasten the mechanical seal to discharge cover 163 with studs 902.
 5. Install the bearing and align the shaft as described in the pump operating manual.
 6. Fasten the mechanical seal to discharge cover 163 with studs 902, washers and nuts 920. Tighten the studs crosswise in several increments.

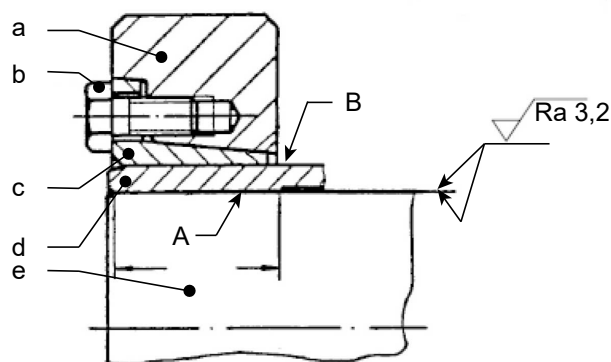


Fig. 7: Installation of the clamping disc

| | | | |
|---|-------------|---|-------------------------|
| A | Grease-free | B | Lubrication permissible |
|---|-------------|---|-------------------------|

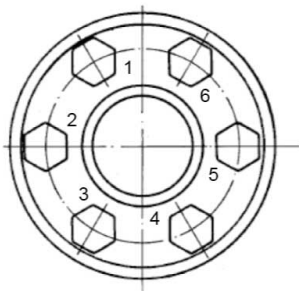


Fig. 8: Clamping disc, view Z

7. Degrease the shaft sleeve (d) and shaft (e).
8. Grease the outer surface of shaft sleeve B in the area of the clamping disc seat. Slide the clamping disc onto the shaft sleeve (d).³⁾
9. Make sure that the locking screws (b) are undone.
10. Slide the shaft sleeve (d) onto the shaft (e). Tighten the locking screws (b) evenly counter-clockwise – not crosswise – until the front side faces of the outer ring (a) align with those of the inner ring (c).
11. Remove and store the transport lock 1.
12. Fit the cover and gland packing.
13. Carry out further installation instructions given in the pump's operating manual.

5.4 Removing the mechanical seal

The rules of sound engineering practice and the pump manufacturer's general provisions apply. Tidiness and cleanliness are essential for proper execution of the installation work.

- ✓ The operating manual for the pump set is on hand.
 - ✓ The pump has been prepared in accordance with the operating manual for removing the mechanical.
1. Fit the transport lock 1 to the mechanical seal with hexagon socket head cap screw 914.52.
 2. Remove the bearing as described in the pump operating manual.
 3. Carefully loosen the locking screws (b) by a quarter of a turn, proceeding in clockwise direction.
 4. Remove the locking screws.
 5. If necessary, use the jacking threads 2 to remove the outer ring (a) from the inner ring (c).
 6. Properly remove any corrosion at the shaft.
 7. Pull the shaft sleeve (d) off the shaft.
 8. Pull the clamping disc off the shaft sleeve.
 9. Carefully and evenly pull the mechanical seal off shaft 210. If the seal is hard to remove, the jacking thread (2) can be used.
 10. Completely remove the mechanical seal from the shaft.
 11. Carry out further dismantling instructions given in the pump's operating manual.







NOTE

If clamping discs are contaminated, clean them prior to re-using them for clamping. Also re-lubricate the conical surfaces between outer ring and inner ring as well as the screws. (⇒ Section 5.3, Page 16)



³ Use a solid lubricant with high molybdenum disulphide content on a MoS₂ basis with a friction coefficient $\mu = 0.04$.

6 Operation

6.1 Safety instructions for operation

| | |
|---|---|
|  | <p>CAUTION</p> <p>Air intake via the seal faces Dry running of the seal and consequential seal failure!</p> <ul style="list-style-type: none"> ▷ For single seals the pressure in the seal chamber of the pump must always be higher than the ambient pressure. |
|  | <p>CAUTION</p> <p>Unsuitable fluid to be sealed off Damage to the machinery!</p> <ul style="list-style-type: none"> ▷ Take appropriate measures to ensure that the fluid to be sealed off at the mechanical seal is in liquid condition no matter what the operating status of the pump. This applies in particular when starting up and stopping the pump. ▷ If the fluid to be sealed off forms deposits while the pump set cools down or during standstill of the pump set, the seal chamber must be flushed through with a clean liquid. The quantity and type of flushing liquid has to be defined by the operator for the specific material combination of the mechanical seal. |
|  | <p>CAUTION</p> <p>Excessive rise in temperature Damage to the mechanical seal!</p> <p>Dry running or damage to the elastomers, incrustations at the seal faces, etc.</p> <ul style="list-style-type: none"> ▷ Shut down the pump as described in the operating manual. |
|  | <p>NOTE</p> <p>If the operating limits indicated are observed and the instructions given in this manual are complied with, the mechanical seal can be expected to give trouble-free operation. If the values during operation are not within the specified limits, the mechanical seal must be removed from the system and sent to KSB for inspection.</p> |

6.2 Emissions

| | |
|---|--|
|  | <p>WARNING</p> <p>Incorrect handling of the fluid to be sealed off Risk of injury!</p> <ul style="list-style-type: none"> ▷ If the fluid to be sealed off and/or the buffer fluid have to meet the requirements of the German Hazardous Substances Regulations, the regulations on handling hazardous substances (safety data sheets to Directive 91/155/EEC) and the accident prevention regulations must be heeded. |
|  | <p>NOTE</p> <p>If a reduction in leakage cannot be observed or if other failures occur, the mechanical seal must be shut down, removed from the system and sent to KSB for inspection.</p> |



NOTE

Any leakage must be drained off in a controlled way and safely disposed of. Components which may come into contact with the seal leakage must either be corrosion-resistant or must be adequately protected.

- For physical and technical reasons a mechanical seal cannot be leak-free.
- Leakage can be either in liquid or gaseous form. Its aggressiveness corresponds to that of the fluid to be sealed off.
- The quantity of leakage is influenced by several factors:
 - Seal selection
 - Manufacturing tolerances
 - Operating statuses
 - Smooth running of the pump
- In the running-in phase of the mechanical seal higher leakage can occur.

6.3 Operating limits



NOTE

Always observe the operating limits in the product literature and the other applicable documents.



NOTE

The following values are limits that depend on the seal face materials and elastomer materials. As the characteristics influence each other, operation at minimum/maximum limits is not possible for all characteristics at the same time.

Table 5: Operating limits⁴⁾

| 4HGS | Bearing bracket | Maximum temperature | Maximum pressure | | Maximum speed | Axial displacement |
|--------|-----------------|---------------------|------------------|--------|---------------|--------------------|
| | | | Dynamic | Static | | |
| | | [°C] | [bar] | [bar] | [rpm] | [mm] |
| C050M1 | HG 1,2 | ≤ 90 ⁵⁾ | 30 | 40 | 3600 | +/- 3,5 |
| C072M1 | HG 3,4 | ≤ 90 ⁵⁾ | 30 | 40 | 3600 | +/- 3,5 |
| C080M1 | HG 5 | ≤ 90 ⁵⁾ | 30 | 40 | 3600 | +/- 3,5 |
| C086M1 | HG 6 | ≤ 90 ⁵⁾ | 30 | 40 | 3600 | +/- 3,5 |

Table 6: Operating limits

| 4HGSC | Pump size | Maximum temperature | Maximum pressure | | Maximum speed | Axial displacement |
|--------|-----------|---------------------|------------------|--------|---------------|--------------------|
| | | | Dynamic | Static | | |
| | | [°C] | [bar] | [bar] | [rpm] | [mm] |
| C050M1 | HG 1,2 | ≤ 150 | 30 | 40 | 3600 | +/- 3,5 |
| C072M1 | HG 3,4 | ≤ 150 | 30 | 40 | 3600 | +/- 3,5 |
| C080M1 | HG 5 | ≤ 150 | 30 | 40 | 3600 | +/- 3,5 |
| C086M1 | HG 6 | ≤ 150 | 30 | 40 | 3600 | +/- 3,5 |

⁴⁾ To dissipate friction heat, fluid circulation from the discharge nozzle (API Plan 11) is recommended.

⁵⁾ Higher temperatures possible on request

Table 7: Operating limits

| 4HGSL | Pump size | Maximum temperature ⁶⁾ | Maximum pressure ⁶⁾ | | Maximum speed | Axial displacement |
|---------------|-----------|-----------------------------------|--------------------------------|--------|---------------|--------------------|
| | | [°C] | Dynamic | Static | | |
| | | | [bar] | [bar] | | |
| C050R1/C050L1 | HG 1,2 | ≤ 220 ⁷⁾ | 30 (5300 rpm) | 40 | 5300 (30 bar) | +/- 3 |
| C072R1/C072L1 | HG 3,4 | ≤ 220 ⁷⁾ | 30 (3000 rpm) | 40 | 4550 (25 bar) | +/- 3 |
| C080R1/C080L1 | HG 5 | ≤ 220 ⁷⁾ | 30 (3000 rpm) | 40 | 4250 (25 bar) | +/- 3 |
| C086R1/C086L1 | HG 6 | ≤ 220 ⁷⁾ | 30 (3000 rpm) | 40 | 3820 (25 bar) | +/- 3 |
| C092R1/C092L1 | HGC 5 | ≤ 220 ⁷⁾ | 22 (3450 rpm) | 30 | 3450 (22 bar) | +/- 3 |
| C102R1/C102L1 | HGC 6 | ≤ 220 ⁷⁾ | 22 (3450 rpm) | 30 | 3450 (22 bar) | +/- 3 |

Table 8: Operating limits

| 4HGSL | Pump size | Maximum temperature ⁶⁾ | Maximum pressure ⁶⁾ | | Maximum speed | Axial displacement |
|---------------|-----------|-----------------------------------|--------------------------------|--------|---------------|--------------------|
| | | [°C] | Dynamic | Static | | |
| | | | [bar] | [bar] | | |
| C050R1/C050L1 | HG 1,2 | ≤ 220 ⁷⁾ | 30 (5300 rpm) | 40 | 5300 (30 bar) | +/- 3 |
| C072R1/C072L1 | HG 3,4 | ≤ 220 ⁷⁾ | 30 (3000 rpm) | 40 | 4550 (25 bar) | +/- 3 |
| C080R1/C080L1 | HG 5 | ≤ 220 ⁷⁾ | 30 (3000 rpm) | 40 | 4250 (25 bar) | +/- 3 |
| C086R1/C086L1 | HG 6 | ≤ 220 ⁷⁾ | 30 (3000 rpm) | 40 | 3820 (25 bar) | +/- 3 |

**** Water quality: Partly or fully desalinated boiler feed water (electrical conductivity < 100 µS). Requirements to VGB guideline, edition 02/1989 or TRD611 Gr IV (05/1991) when using salt-free oxygen bonding chemicals and inhibitors. For an SiO₂ content > 10 mg/l or a fluid forming SiO₂, contact the LPC in Pegnitz (Germany).

⁶⁾ The maximum pressure must not occur at the same time as the maximum speed. The corresponding maximum values are indicated in brackets.

⁷⁾ Depending on the operating mode, water quality**** and margin to the vaporisation temperature. Max. 150 °C during standstill.

7 Maintenance

7.1 Maintenance/inspection

**NOTE**





The operator is responsible for conducting checks.

- The mechanical seal is low in maintenance. Replace wear parts as necessary.
- Proper operation includes regular checks of the temperature and leakage (drainage) and of the mechanical seal's quench liquid pressure and fill level.
- When a system maintenance inspection or pump maintenance inspection is conducted, the mechanical seal should also be inspected. The seal faces should be reworked and all elastomer joint rings and springs should be replaced by new ones. KSB is available for inspecting the mechanical seal.

7.1.1 Intervals

- Oil change interval: see data sheet

8 Trouble-shooting

| | |
|---|--|
|  | <div>  WARNING </div> <p>Improper work to remedy faults Risk of injury!</p> <ul style="list-style-type: none"> ▸ For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer. |
|  | <div>NOTE</div> <p>Prior to conducting any work on the mechanical seal during the warranty period contact the manufacturer. KSB Service will be pleased to help you. Non-compliance with this instruction will lead to forfeiture of any and all rights to claims for damages.</p> |
|  | <div>NOTE</div> <p>For any failures you cannot remedy or whose cause cannot be identified, contact the responsible KSB service centre.</p> |

What to do in the event of a fault/malfunction

- Determine and document the nature of the fault/malfunction.
- Monitor the development of leakage quantity. If necessary, shut down the pump as described in the operating manual.
A steady flow of leakage indicates mechanical seal damage.

Maintenance work, service work and installation work by KSB Service

- KSB Service GmbH | Service Center Pegnitz
E-mail: service-center.pegnitz@ksb.com
- KSB Service LLC | Service Center Abu Dhabi
E-mail: ksb@ksb.ae

Contact for general queries:

- E-mail: LPC_Mechanical.Seals@ksb.com

Further contact addresses:

- <https://www.ksb.com/en-global/contact>

9 Related Documents

9.1 General drawings with list of components

9.1.1 4HGS cartridge seal

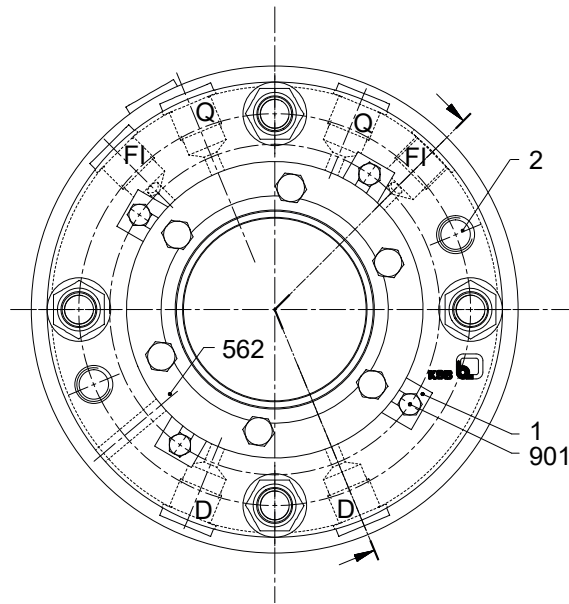


Fig. 9: 4HGS axis cross-section

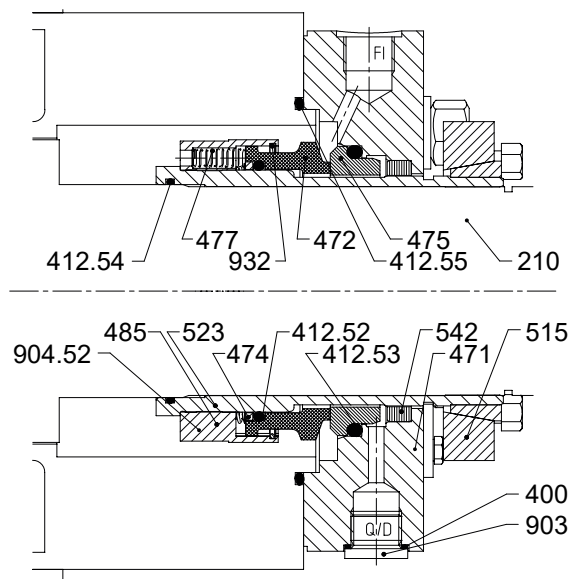


Fig. 10: 4HGS section

Table 9: List of components

| 1 | Transport lock | 485 | Torque-transmitting element |
|--------------------|----------------|--------|-----------------------------|
| 2 | Jacking thread | 515 | Locking ring |
| 210 | Shaft | 523 | Shaft sleeve |
| 400 | Gasket | 542 | Throttling bush |
| 412.52/.53/.54/.55 | O-ring | 562 | Parallel pin |
| 471 | Seal cover | 901 | Hexagon head bolt |
| 472 | Primary ring | 903 | Screw plug |
| 474 | Thrust ring | 904.52 | Grub screw |

| | | | |
|-----|----------------------------|-----|---------|
| 475 | Mating ring | 932 | Circlip |
| 477 | Spring for mechanical seal | | |

9.1.2 4HGSC cartridge seal

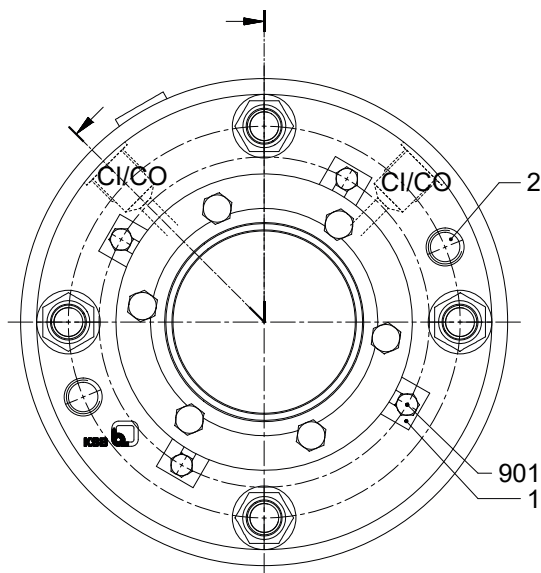


Fig. 11: 4HGSC axis cross-section

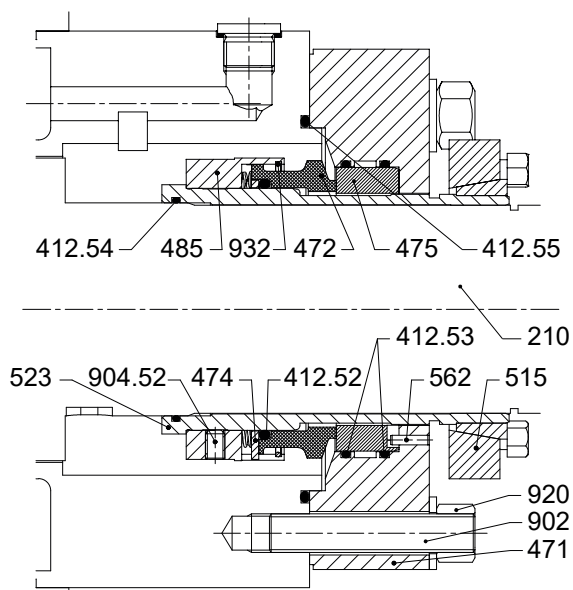


Fig. 12: 4HGSC section

Table 10: List of components

| | | | |
|--------------------|----------------|--------|-------------------|
| 1 | Transport lock | 515 | Locking ring |
| 2 | Jacking thread | 523 | Shaft sleeve |
| 210 | Shaft | 562 | Parallel pin |
| 412.52/.53/.54/.55 | O-ring | 901 | Hexagon head bolt |
| 471 | Seal cover | 902 | Stud |
| 472 | Primary ring | 904.52 | Grub screw |
| 474 | Thrust ring | 920 | Nut |

| 475 | Mating ring | 932 | Circlip |
|-----|-----------------------------|-----|---------|
| 485 | Torque-transmitting element | | |

9.1.3 4HGSL cartridge seal

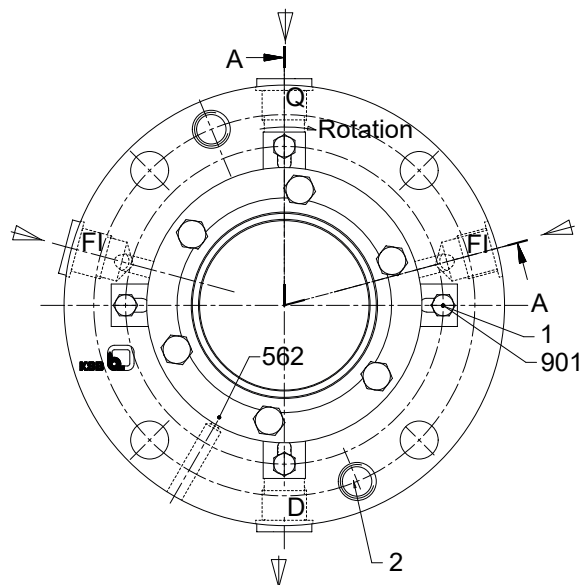


Fig. 13: Cross-section axis of 4HGSL

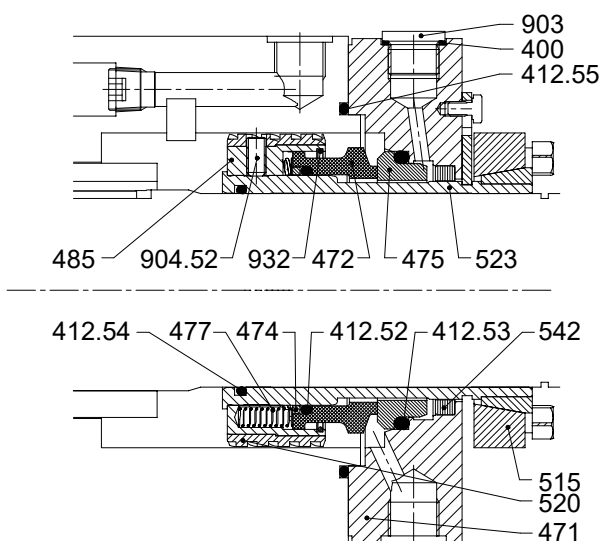


Fig. 14: Sectional drawing of 4HGSL

Table 11: List of components

| 1 | Transport lock | 515 | Locking ring |
|--------------------|----------------|--------|-------------------|
| 2 | Jacking thread | 520 | Sleeve |
| 400 | Gasket | 523 | Shaft sleeve |
| 412.52/.53/.54/.55 | O-ring | 542 | Throttling bush |
| 471 | Seal cover | 562 | Parallel pin |
| 472 | Primary ring | 901 | Hexagon head bolt |
| 474 | Thrust ring | 903 | Screw plug |
| 475 | Mating ring | 904.52 | Grub screw |

| | | | |
|-----|-----------------------------|-----|---------|
| 477 | Spring for mechanical seal | 932 | Circlip |
| 485 | Torque-transmitting element | | |

9.1.4 4HGSCL cartridge seal

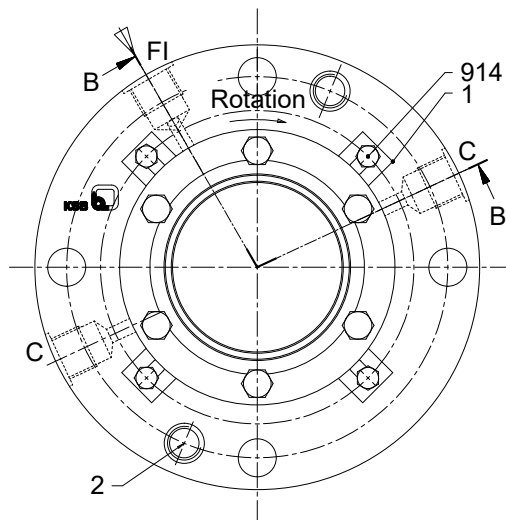


Fig. 15: 4HGSCL axis cross-section

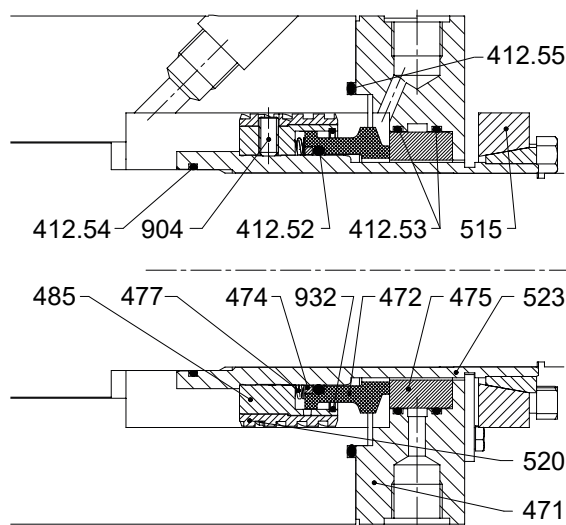


Fig. 16: 4HGSCL section

Table 12: List of components

| | | | |
|--------------------|----------------------------|--------|-------------------------------|
| 1 | Transport lock | 485 | Torque-transmitting element |
| 2 | Jacking thread | 515 | Locking ring |
| 412.52/.53/.54/.55 | O-ring | 520 | Sleeve |
| 471 | Seal cover | 523 | Shaft sleeve |
| 472 | Primary ring | 904 | Grub screw |
| 474 | Thrust ring | 914.52 | Hexagon socket head cap screw |
| 475 | Mating ring | 932.52 | Circlip |
| 477 | Spring for mechanical seal | | |

10 Certificate of Decontamination

Type:
Order number /
Order item number⁸⁾:
Delivery date:
Application:
Fluid handled⁸⁾:

Please tick where applicable⁸⁾:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return⁸⁾:
Comments:
.....

The product / accessories have been carefully drained, cleaned and decontaminated inside and outside prior to dispatch / placing at your disposal.

We herewith declare that this product is free from hazardous chemicals and biological and radioactive substances.

For mag-drive pumps, the inner rotor unit (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) has been removed from the pump and cleaned. In cases of containment shroud leakage, the outer rotor, bearing bracket lantern, leakage barrier and bearing bracket or intermediate piece have also been cleaned.

For canned motor pumps, the rotor and plain bearing have been removed from the pump for cleaning. In cases of leakage at the stator can, the stator space has been examined for fluid leakage; if fluid handled has penetrated the stator space, it has been removed.

- ☐ No special safety precautions are required for further handling.
☐ The following safety precautions are required for flushing fluids, fluid residues and disposal:

.....
.....

We confirm that the above data and information are correct and complete and that dispatch is effected in accordance with the relevant legal provisions.

.....
Place, date and signature

.....
Address

.....
Company stamp

⁸ Required field

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