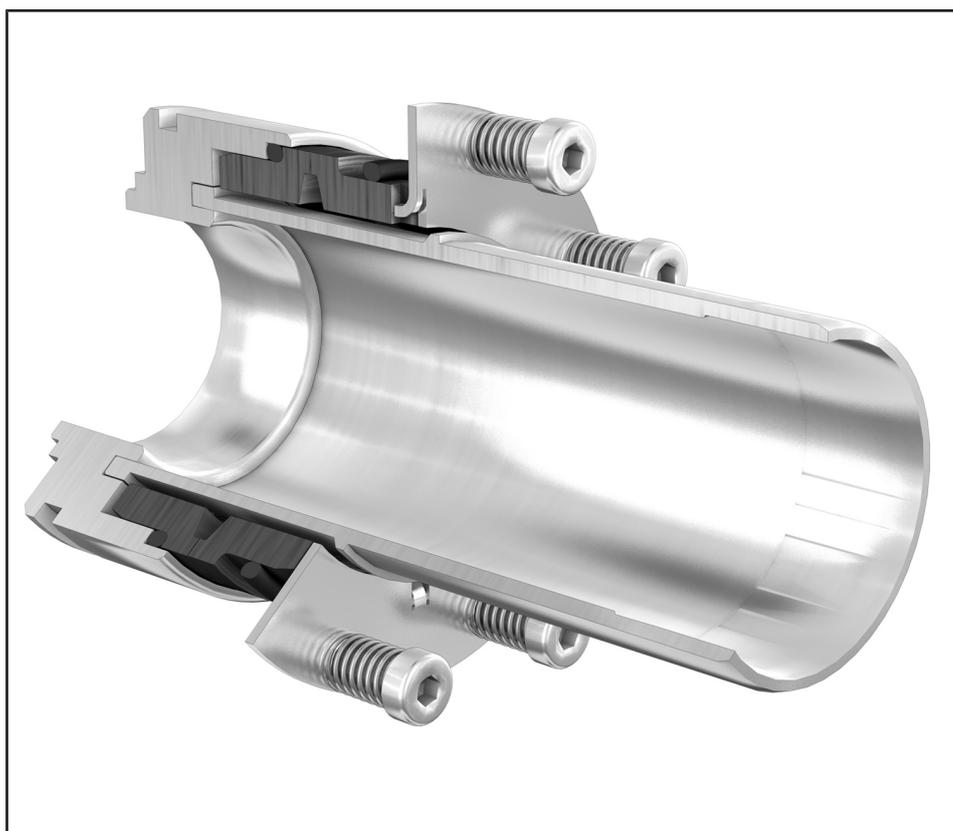


KSB Mechanical Seal

4K / 4KD

For the KWP Type Series

Installation/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 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 centre to maintain the right to claim under warranty.

For any queries: contact.ksbglrd@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 This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	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, dismantling, operating and maintenance instructions that must be observed to ensure safe handling and prevent personal injury and damage to property.

The safety information in all sections of this manual must be complied with.

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 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 in this operating manual.

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.
- The product must not be used in potentially explosive atmospheres.

2.3 Personnel qualification and training

All personnel involved must be fully qualified to transport, install, operate, maintain and inspect the product this manual refers to. The responsibilities, competence and supervision of all personnel involved in 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 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 is 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/Temporary 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

	CAUTION
	<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, permitted lifting accessories.

KSB's standard packaging is suitable for dry transport by forwarding agents (truck, rail, air); special packaging can be provided if specified in the contractual agreement.

	CAUTION
	<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

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

	CAUTION
	<p>Improper storage Damage during storage due to humidity, dirt or vermin! Corrosion of and damage to the mechanical seal!</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 checked and repacked by the manufacturer.

	CAUTION
	<p>Generation and presence of ozone Risk of embrittlement! Damage to elastomers!</p> <ul style="list-style-type: none"> ▷ If the storage area is not sufficiently vented, avoid arc welding as well as the use of high-voltage equipment, electric motors and mercury vapour lamps.

	<p>CAUTION</p>
	<p>Direct heat exposure Damage to the mechanical seal! Risk of embrittlement! Damage to elastomers!</p> <ul style="list-style-type: none"> ▷ Protect the mechanical seal from heat sources such as sun, heaters and heat radiation.
	<p>CAUTION</p>
	<p>UV light (ionising radiation) Damage to the mechanical seal! Risk of embrittlement! Damage to elastomers!</p> <ul style="list-style-type: none"> ▷ Protect the mechanical seal from light sources such as sunlight, arc welding, fluorescent lamps or halogen lamps.
	<p>CAUTION</p>
	<p>Wet, contaminated or damaged openings and connections Damage to the mechanical seal! Risk of embrittlement! Damage to elastomers!</p> <ul style="list-style-type: none"> ▷ Only open any closed screw plugs and connections at the mechanical seal at the time of installation. ▷ Avoid opening screw plugs, connections and similar before that time.

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>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

	 WARNING
	<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 Designation

Example: SB050M0-4K-XW

Table 4: Designation key

Code	Description	
S	Design	
	K	Short overall length
	N	Standard overall length
	S	Special overall length
B	Type	
	U	Unbalanced
	B	Balanced
050	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
0	Anti-twist lock of mating ring	
	0	Without lock
	1	With lock
4K	Type series, type	
	4K	Mechanical seal, single or in combination with another seal in tandem arrangement, with unpressurised buffer fluid (API Plan 52)
	4KD	Mechanical seal, in combination with another seal in tandem arrangement, with pressurised barrier fluid (API Plan 53).
XW	Special designs	
	XW	Shaft sleeve with anti-swirl devices
	SGF	Design with slim seal faces

4.3 Materials

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

4.4 Design details

Design

- Mechanical seal in modular design
- Single mechanical seal, or in combination with another seal in tandem arrangement
- Stationary type

- Bi-directional
- Multi-spring arrangement
- Balanced

4.5 Configuration and function

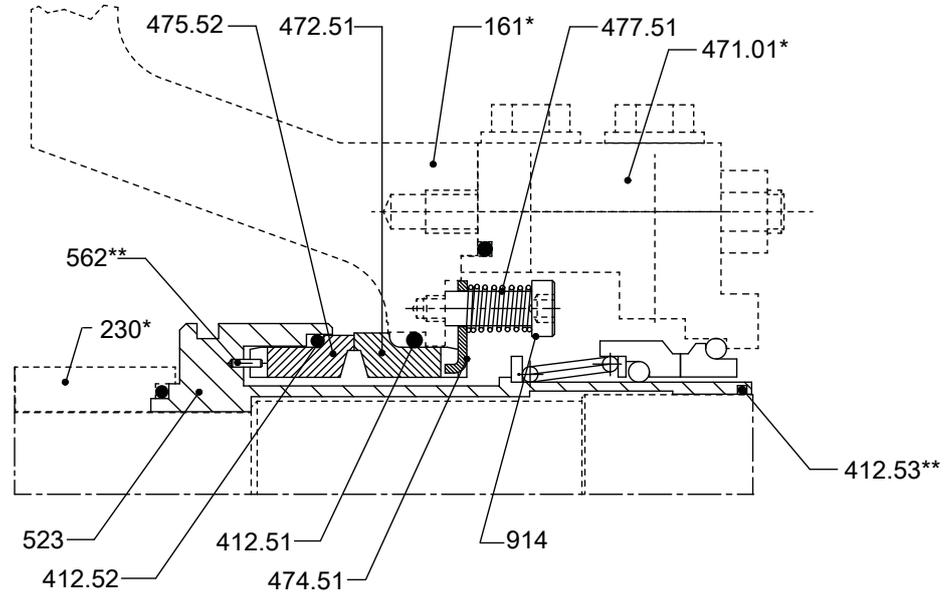


Fig. 1: Sectional drawing of a 4KD

161	Casing cover	475.52	Mating ring
230	Impeller	477.51	Spring for mechanical seal
412.51/.52/.53	O-ring	523	Shaft sleeve
471.01	Seal cover	562	Parallel pin
472.51	Primary ring	914	Hexagon socket head cap screw
474.51	Thrust ring		

*: Required for the mechanical seal to function but not part of the KSB mechanical seal

** : Not for nominal diameters 040, 050, 060, 070

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

4K and 4KD mechanical seals have been specially developed for use in pumps of the KWP type series. The seal chamber of the pump is especially designed for installing these seals.

Function Primary ring 472.51, which is the axially movable sealing ring, is pressed to the rotating mating ring 475.52 by springs 477.51. O-rings 412.51, 412.52 and 412.53 are fitted for secondary sealing. Thrust ring 474.51 transfers the spring force and torque from casing cover 161 via springs 477.51 and hexagon socket head cap screw 914 to primary ring 472.51. Shaft sleeve 523, supporting mating ring 475.52, parallel pin 562 and O-ring 412.52, is clamped between impeller 230 and the shaft shoulder. The 4K mechanical seal can optionally be used as a single mechanical seal or in a double seal arrangement. The 4KD mechanical seal must be used in a double seal arrangement. The use as a double mechanical seal requires seal cover 471.01, another mechanical seal, further small parts for fastening and sealing, and a suitable barrier/ buffer fluid for the space between the two mechanical seals.

4.6 Flushing adapter

To prevent deposits at the outboard mechanical seal a flushing adapter can be installed.

Slight leakage to atmosphere will occur during operation. Depending on the contents of the fluid to be sealed off, residues will collect in the outboard seal area. They must be removed by regular flushing with clean water. The free movement of the primary ring must not be impaired by solid deposits.

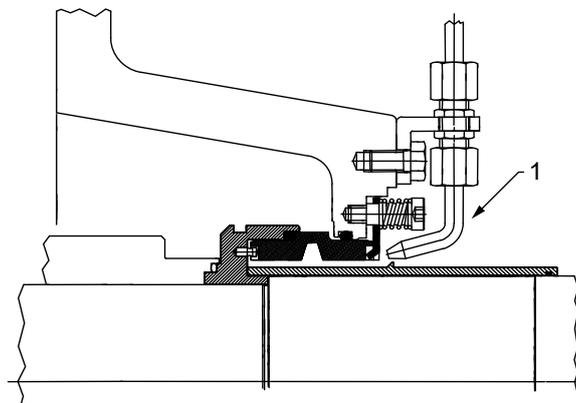


Fig. 2: 4K mechanical seal with flushing adapter

1	Connection for flushing
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Use

- Flushing shall be performed before and after any pump shutdown > 2 days.
- Once a week for 10 minutes at 10 l/min.
- Flushing fluid: clean process water, maximum contamination of 50 µm
- Flushing pressure: 2 to 4 bar

	NOTE
<p>Prior to every flushing procedure, the gap between the rotating shaft sleeve and the thrust ring must be visually inspected. Any leakage or leakage residues / crystals must be reported to the responsible KSB service centre immediately.</p>	

5 Installation/Dismantling

5.1 Permissible aids

- 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)

	<p style="background-color: #FFD700; margin: 0;">CAUTION</p> <p>Impermissible cleaning agents Damage to the seal faces at the mechanical seal!</p> <ul style="list-style-type: none"> ▷ For removing minor contamination use only paper tissue and ethyl alcohol. ▷ Do not use dirty cleaning cloths or cleaning cloths that leave behind lint.
	<p style="background-color: #FFD700; margin: 0;">CAUTION</p> <p>Impermissible assembly aids Sealing elements made of ethylene propylene 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.

5.2 Prerequisites

- 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.
- The design of the connecting components (impeller, shaft, casing cover, etc.) is suitable for the mechanical seal.
- The following installation tolerances are observed:

Installation tolerances

- Shaft run-out
 - P03ax to P06x: 0.03 mm
 - P08sx, P10ax, P12sx: 0.05 mm
- Axial bearing clearance: ≤ 0.2 mm
- Surface quality in the area of the static O-ring seal: ≥ 1.6 μ m
- Max. vibration velocity: $v \leq 4.5$ mm/s

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

5.3 Installing 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.

For dismantling and reassembly observe the general assembly drawing.
(⇒ Section 9.1, Page 23)

	CAUTION
	<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.

Example of an installation sequence for KSB pumps

- ✓ The operating manual for the pump is on hand.
- ✓ The pump and/or machinery has been prepared in accordance with the manufacturer's instructions for installing the mechanical seal.
- ✓ Any corrosion or wear has been removed.
- ✓ The mechanical seal and assembly aids are on hand.
- ✓ The installation of the mechanical seal is carried out in accordance with the installation drawing.
- ✓ The back pull-out unit of the pump has been placed in a clean and level assembly area.
- ✓ The original mechanical seal is fully assembled and undamaged.
 1. Clean the seal faces with a suitable paper tissue and ethyl alcohol.
 2. Insert thrust ring 474.51 into the turned recess on the rear side of casing cover 161.
 3. Slide springs 477.51 onto hexagon socket head cap screws 914.
 4. Thread hexagon socket head cap screws 914 with fitted springs 477.51 through the holes in thrust ring 474.51 and fasten them inside casing cover 161. (⇒ Section 5.5, Page 18)
Important: When tightening the screws, make sure not to block the axial movement of thrust ring 474.51. Make sure that it can move freely.

	CAUTION
	<p>Contact of O-ring with lubricant made of mineral grease or oil Damage to the O-ring!</p> <ul style="list-style-type: none"> ▷ Make sure that O-rings made of ethylene propylene rubber cannot come into contact with mineral oil or mineral grease. ▷ Make sure that O-rings made of silicone rubber cannot come into contact with silicone oil or silicone grease.

5. Apply a suitable lubricant to O-ring 412.51 and the groove in the casing cover.
6. Insert O-ring 412.51 into the groove provided in the casing cover.
7. Carefully install primary ring 472.51.
 - ⇒ The protruding tags of thrust ring 474.51 must engage in the grooves of primary ring 472.51. Important: Make sure that thrust ring 474.51 can still move freely.
8. Completely mount casing cover 161 with the joint ring on the bearing bracket lantern.
9. Tighten the hexagon head bolts. (⇒ Section 5.5, Page 18)

10. For bearing brackets P08sx, P10ax, P12sx (sizes 80, 100, 120): Fit two parallel pins 562 into the mating ring location of shaft sleeve 523.
11. Insert O-ring 412.52 for mating ring 475.52 into shaft sleeve 523.
12. Carefully press in mating ring 475.52.
 - ⇒ Parallel pins 562 must engage in the grooves of the mating ring.
13. Dry and clean the seal faces again.
14. Slide shaft sleeve 523 with mating ring 475.52 onto the pump shaft until it abuts against the shaft shoulder.

Further installation steps for double seals

1. Check that the seal faces are clean and free from any damage.
2. Place shaft sleeve 523 with mating ring 475.52 in a vertical position, shimmed max.13 mm/P03ax, 17 mm/P04ax, 23 mm/P05ax-P06x, 78 mm/P08sx-P10ax-P12sx.
3. Lift casing cover 161 with primary ring 472.51 and thrust ring 474.51. Carefully position it horizontally above shaft sleeve 523. Lower it down, making sure that the seal faces touch each other.
4. Apply a suitable lubricant to O-ring 412.54.
5. Slide disc 500.54 and spring 477.54 with O-ring 412.54 and primary ring 472.54 over the shaft sleeve.
6. Fit mating ring 475.55 and O-ring 412.55 in seal cover 471.01.
7. Dry and clean the seal faces. (E.g. with acetone).
8. Insert O-ring 412.15 into seal cover 471.01.
9. Place seal cover 471.01 on studs 902.02. Fasten the studs with nuts 920.02. Make sure the connections are positioned correctly.
10. Lift casing cover 161 with seal cover 471.01 and the entire mechanical seal. Carefully slide this assembly onto pump shaft 210 and into the bearing bracket lantern.
11. Fasten the components with hexagon head bolts. (⇒ Section 5.5, Page 18)

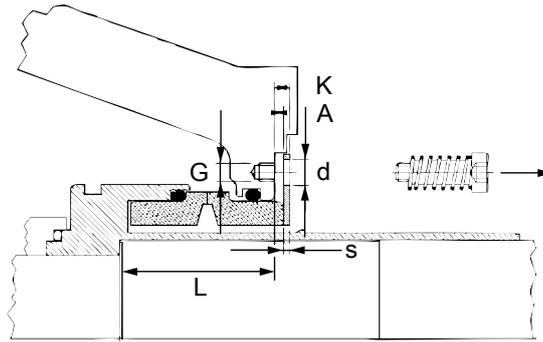
Installing the quench piping for mechanical seals in tandem arrangement

1. Connect the piping for the quench supply to seal cover 471.01.

	<p>NOTE</p> <p>Route the piping so as to avoid any high points. If high points cannot be avoided, vent these points separately. Lay the pipes with a continuously rising slope. This ensures self-venting of the pipe and the mechanical seal.</p>
	<p>NOTE</p> <p>In order to keep the quantity and pressure in the quenched area down, installing an orifice plate or a pressure reducer on the inlet side is recommended together with a shut-off valve, strainer, solenoid valve and control valve.</p>

Checking the installation

1. Unscrew and remove one of the hexagon socket head cap screws 914 together with compression spring 477.51 from casing cover 161.
2. Use sliding calipers to determine the reference dimension and compare it against the table below.


Fig. 3: Checking the installation

A	Required dimension
L	Reference dimension prior to installation
K	Reference dimension after installation

Table 5: Reference dimension

Bearing bracket	Nominal diameter	G	d	S	A	L	K
			[mm]				
P03ax	40	M6	8,5	2	5	36,00	3,5 to 6,5
P04ax	50	M6	8,5	2	5	35,75	3,5 to 6,5
P05ax	60	M6	8,5	2	5	44,75	3,5 to 6,5
P06x	70	M6	8,5	2	5	50,75	3,5 to 6,5
P08sx	80	M10	13	3	7	52,50	5,0 to 9,0
P10ax	100	M10	13	3	7	52,50	5,0 to 9,0
P12sx	120	M10	13	3	7	54,50	5,0 to 9,0

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.

For dismantling and reassembly observe the general assembly drawing.
(⇒ Section 9.1, Page 23)

Example of a dismantling sequence for KSB pumps

- ✓ The operating manual for the pump is on hand.
 - ✓ The mechanical seal is accessible.
 - ✓ The back pull-out unit of the pump has been placed in a clean and level assembly area.
 - ✓ The pump and/or machinery has been prepared in accordance with the manufacturer's instructions for dismantling the mechanical seal.
1. Pull shaft sleeve 523 with mating ring 475.52 and O-ring 412.52 off the shaft using an extractor in the removal groove in shaft sleeve 523.
 2. Pull mating ring 475.52 out of shaft sleeve 523.
 3. Undo the hexagon head bolts. Remove casing cover 161 with the joint ring as well as primary ring 472.51 with secondary seal 412.51 and spring arrangement from the bearing bracket lantern.
 4. Press primary ring 472.51 with secondary seal 412.51 out of casing cover 161.
 5. Undo hexagon socket head cap screws 914 with springs 477.51 and thrust ring 474.51.

Dismantling steps for a double mechanical seal

1. Separate the pipes of the barrier/buffer fluid supply system from seal cover 471.01.
2. Undo the hexagon head bolts at the bearing bracket lantern.
3. Position the spacer so as to support shaft sleeve 523.
4. Carefully pull casing cover 161 with seal cover 471.01 and the entire mechanical seal in tandem arrangement off the bearing bracket lantern / pump shaft. Place them down in a horizontal position.
5. Undo nuts 920.02 of studs 902.02 at seal cover 471.01. Remove the seal cover with O-ring 412.15.
6. Remove mating ring 475.55 and O-ring 412.55 from seal cover 471.01.
7. Slide primary ring 472.54 with O-ring 412.54 as well as spring 477.54 and disc 500.54 off shaft sleeve 523.
8. Undo hexagon socket head cap screws 914. Remove springs 477.51 and thrust ring 474.51.
9. Lift casing cover 161 and turn it so that primary ring 472.51 and O-ring 412.51 can be removed.
10. Remove primary ring 472.51 and O-ring 412.51 from the shaft sleeve.

5.5 Tightening torques

Table 6: Tightening torques for bolted/screwed connections³⁾⁴⁾

Material	C35E+QT/ C35+N	A4-70/ A4-70	8.8 A2A/ 08
Stamp mark	YK/ Y	A4-70/ A4-70	8.8 / 8
Thread	Tightening torques [Nm]		
M8	-	16	23
M10	-	30	46
M12	40	55	80
M16	100	140	190
M20	190	200	380
M24	330	455	660

3) For unlubricated bolts/screws at room temperature

4) After repeated tightening of the threads and in case of good lubrication reduce the values by 15 to 20 %.

6 Operation

6.1 Safety instructions for operation

	<p style="background-color: #FFD700; margin: 0;">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 style="background-color: #FFD700; margin: 0;">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 machinery cools down or during standstill of the machinery, 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 style="background-color: #FFD700; margin: 0;">CAUTION</p> <p>Excessive rise in temperature Damage to the mechanical seal! Dry running or damage to the elastomers, incrustations at the seal faces, etc.</p> <ul style="list-style-type: none"> ▷ Shut down the pump for safety reasons.
	<p style="background-color: #0070C0; color: white; margin: 0;">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

- 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.

	<p style="background-color: #0070C0; color: white; margin: 0;">NOTE</p> <p>If a reduction in leakage cannot be observed or if other failures occur, the mechanical seal must be stopped for safety reasons, removed from the system and sent to KSB for inspection.</p>
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	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.
	WARNING
	<p>Incorrect handling of the fluid to be sealed off</p> <p>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.

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 7: Operating limits (nominal diameter, sliding velocity, maximum pressure to be sealed off, and temperature limits)

Type series	Nominal diameter		v ⁵⁾	Max. pressure to be sealed off	T ⁶⁾	
	Min.	Max.			Min.	Max.
	[mm]	[mm]	[m/s]	[bar]	[°C]	[°C]
4K	40	120	20	25	-20	+150
4KD 040, 050, 060	40	120	20	10 ⁷⁾	-20	+150
4KD 070, 080, 100	40	120	20	8 ⁷⁾	-20	+150
4KD 120	40	120	20	16 ⁷⁾	-20	+150

5) Sliding velocity
 6) Fluid temperature
 7) Refers to the maximum barrier fluid pressure

7 Maintenance

7.1 Maintenance/inspection

- If the mechanical seal is operated properly, it requires very little maintenance. Wear parts must be replaced as required.
- Proper operation includes regular checks of temperature and leakage (drainage) of the mechanical seal.
- When a system 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.

8 Trouble-shooting

	<p>⚠ WARNING</p> <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.
	<p>NOTE</p> <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>
	<p>NOTE</p> <p>For any failures you cannot remedy or whose cause cannot be identified, contact the responsible KSB service centre.</p>
	<p>NOTE</p> <p>Maintenance work, servicing work and installation work can be carried out by KSB Service or authorised workshops.</p> <p>KSB Service GmbH Service Centre Pegnitz E-mail: service-center.sued@ksb.com</p> <p>KSB Service LLC Service Centre Abu Dhabi E-mail: ksb@ksb.ae</p> <p>Contact for general queries: E-mail: TSS_PE_Mechanical.Seals@ksb.com</p> <p>Further contacts see: www.ksb.com/contact.</p>

What to do in the event of a failure

- Determine and document the nature of the fault/malfunction.
- Monitor the development of leakage quantity. Stop the pump if necessary. Consistent, flowing leakage indicates a mechanical seal damage.

9 Related Documents

9.1 General assembly drawings with list of components

9.1.1 4K

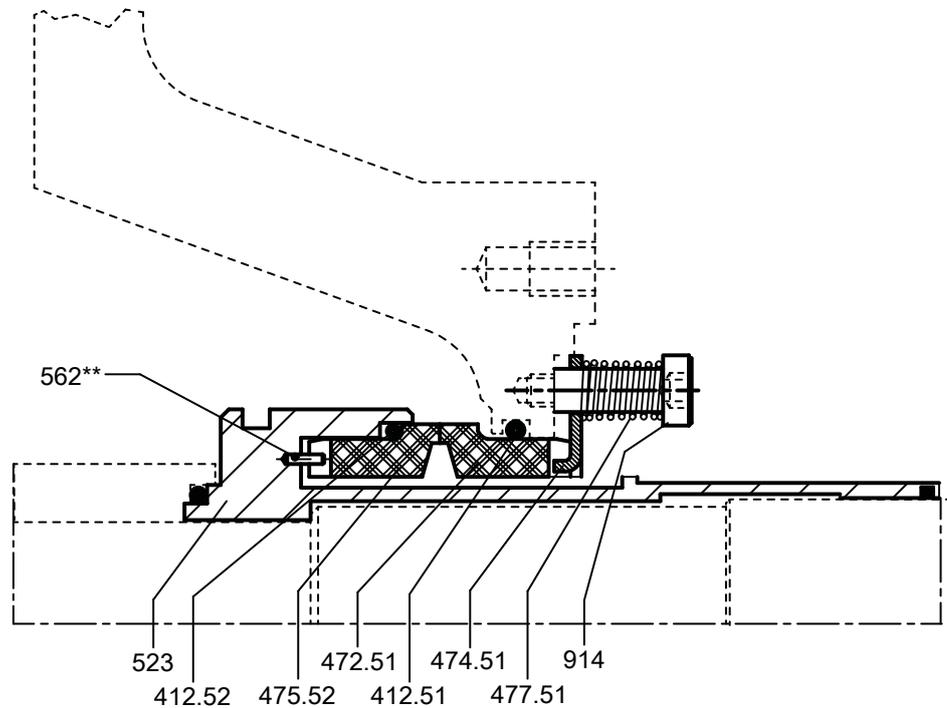


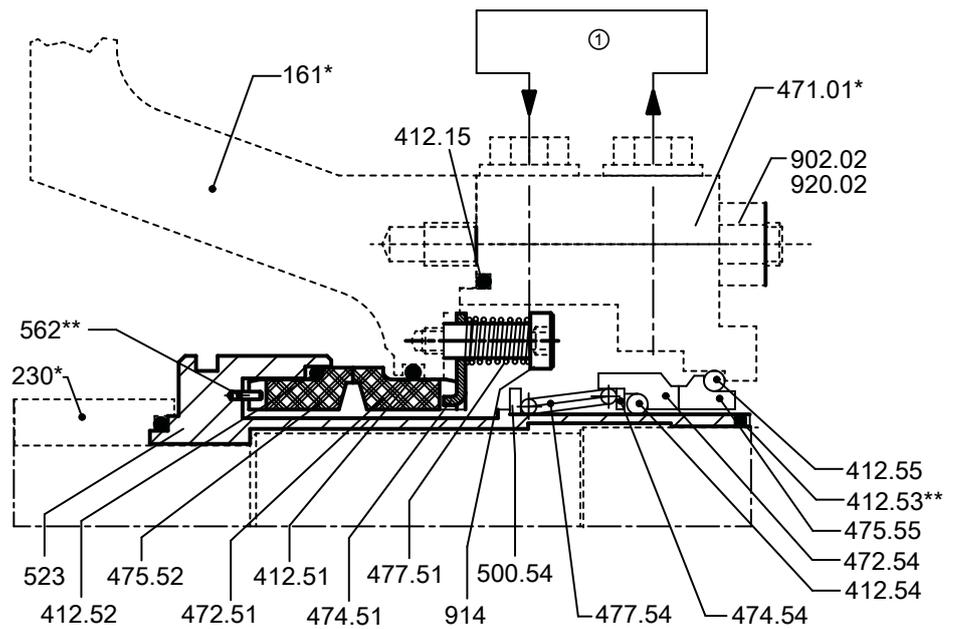
Fig. 4: General assembly drawing of a 4K

** : Not for nominal diameters 040, 050, 060, 070

Table 8: List of components

Part No.	Description	Part No.	Description
412.51/52	O-ring	477.51	Spring for mechanical seal
472.51	Primary ring	523	Shaft sleeve
474.51	Thrust ring	562	Parallel pin
475.52	Mating ring	914	Hexagon socket head cap screw

9.1.2 4K, tandem arrangement


Fig. 5: General assembly drawing of a 4K, tandem arrangement

①: Quench inlet/outlet

*: Required for the mechanical seal to function but not part of the KSB mechanical seal

**: Not for nominal diameters 040, 050, 060, 070

Table 9: List of components

Part No.	Description	Part No.	Description
161	Casing cover	477.51/.54	Spring for mechanical seal
230	Impeller	500.54	Ring
412.15/.51/.52/.53/.54/.55	O-ring	523	Shaft sleeve
471.01	Seal cover	562	Parallel pin
472.51/.54	Primary ring	902	Stud
474.51/.54	Thrust ring	914	Hexagon socket head cap screw
475.52/.55	Mating ring	920.02	Nut

9.1.3 4KXW

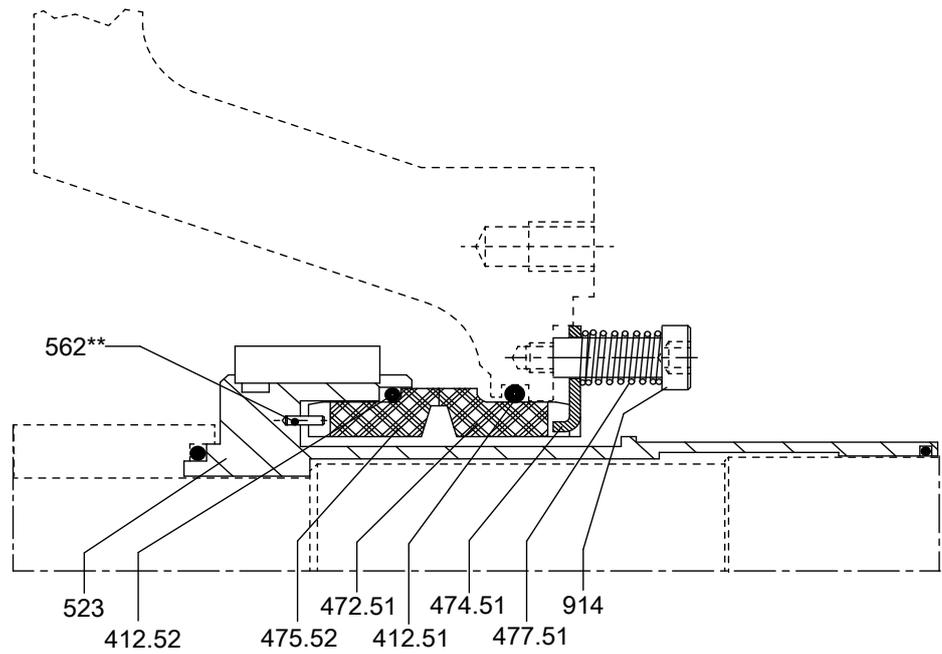


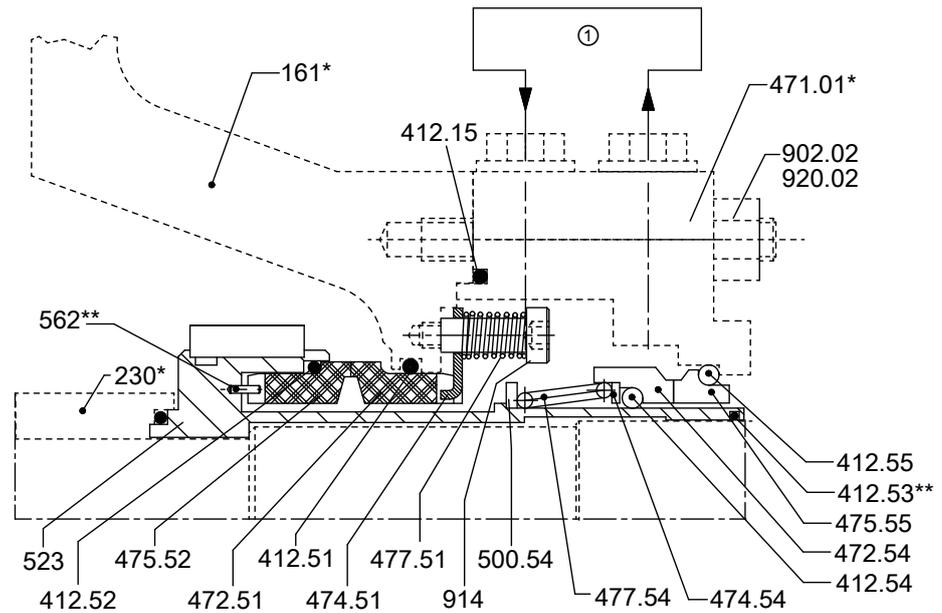
Fig. 6: General assembly drawing of a 4KXW

** : Not for nominal diameters 040, 050, 060, 070

Table 10: List of components

Part No.	Description	Part No.	Description
412.51./52	O-ring	477.51	Spring for mechanical seal
472.51	Primary ring	523	Shaft sleeve
474.51	Thrust ring	562	Parallel pin
475.52	Mating ring	914	Hexagon socket head cap screw

9.1.4 4KXW, tandem arrangement


Fig. 7: General assembly drawing of a 4KXW, tandem arrangement

①: Quench inlet/outlet

*: Required for the mechanical seal to function but not part of the KSB mechanical seal

**: Not for nominal diameters 040, 050, 060, 070

Table 11: List of components

Part No.	Description	Part No.	Description
161	Casing cover	477.51/.54	Spring for mechanical seal
230	Impeller	500.54	Ring
412.15/.51/.52/.53/.54/.55	O-ring	523	Shaft sleeve
471.01	Seal cover	562	Parallel pin
472.51/.54	Primary ring	902	Stud
474.51/.54	Thrust ring	914	Hexagon socket head cap screw
475.52/.55	Mating ring	920.02	Nut

9.1.5 4KD, tandem arrangement

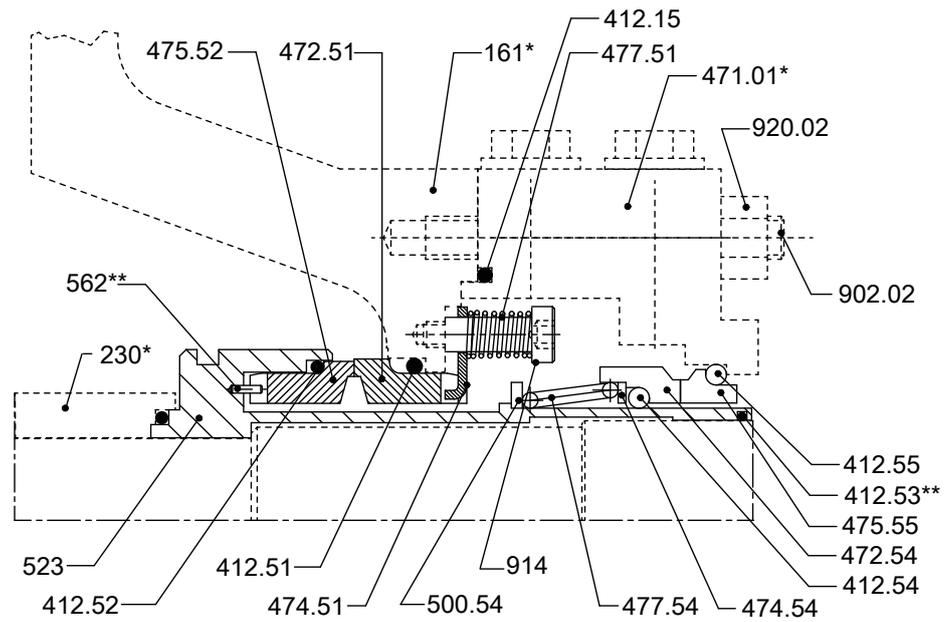


Fig. 8: General assembly drawing of a 4KD, tandem arrangement

*: Required for the mechanical seal to function but not part of the KSB mechanical seal

** : Not for nominal diameters 040, 050, 060, 070

Table 12: List of components

Part No.	Description	Part No.	Description
161	Casing cover	477.51/.54	Spring for mechanical seal
230	Impeller	500.54	Ring
412.15/.51/.52/.53/.54/.55	O-ring	523	Shaft sleeve
471.01	Seal cover	562	Parallel pin
472.51/.54	Primary ring	902	Stud
474.51/.54	Thrust ring	914	Hexagon socket head cap screw
475.52/.55	Mating ring	920.02	Nut

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