High-pressure Pump

Multitec / Multitec-RO

High-pressure Ring-section Pump

Installation/Operating Manual

KSB

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Installation/Operating Manual Multitec / Multitec-RO

Original operating manual

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Glossary

Certificate of decontamination

A certificate of decontamination is enclosed by the customer when returning the product to the manufacturer to certify that the product has been properly drained to eliminate any environmental and health hazards arising from components in contact with the fluid handled.

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

The part of the pump in which the kinetic energy is converted into pressure energy

Pool of pumps

Customers/operators' pumps which are purchased and stored regardless of their later use.

Pump

Machine without drive, additional components or accessories

Pump set

Complete pump set consisting of pump, drive, additional components and accessories

Rotor

Fully assembled unit of all rotating parts, without mechanical seal, rolling element bearings or plain bearings

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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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 name plate indicates the type series and size, the main operating data, the order number and the order item number. The order number and order item number clearly identify the pump set 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.

1.2 Installation of partly completed machinery

To install partly completed machinery supplied by KSB refer to the sub-sections under Servicing/Maintenance.

1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇨ Section 2.3, Page 9)

1.4 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
General arrangement drawing/ outline drawing	Description of mating and installation dimensions for the pump (set), weights
Drawing of auxiliary connections	Description of auxiliary connections
Hydraulic characteristic curve	Characteristic curves showing head, NPSH required, efficiency and power input
General assembly drawing[1)]	Sectional drawing of the pump
Sub-supplier product literature[1)]	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists[1)]	Description of spare parts
Piping layout[1)]	Description of auxiliary piping
List of components[1)]	Description of all pump components
Assembly drawing[1)]	Sectional drawing of the installed shaft seal

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

1.5 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 If agreed to be included in the scope of supply

Symbol	Description
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.6 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.

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2 Safety

DANGER

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
  - Name plate
- The operator is responsible for ensuring compliance with all local regulations not taken into account.

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents. (⇨ Section 1.4, Page 7)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump (set) to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the pump (set) without the fluid to be handled.
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Always operate the pump (set) in the direction of rotation it is intended for.
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

2.3 Personnel qualification and training

All personnel involved must be fully qualified to transport, install, operate, maintain and inspect the machinery 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 pump (set) must always be supervised by technical specialist personnel.

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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 operator/user

- 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 (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If stopping the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with 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 pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.

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- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.1.8, Page 48) (⇨ Section 6.3, Page 52)
- 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. (⇨ Section 6.1, Page 40)

2.8 Unauthorised modes of operation

Never operate the pump (set) outside the limits stated in the data sheet and in this manual.

The warranty relating to the operating reliability and safety of the supplied pump (set) is only valid if the equipment is used in accordance with its intended use. (⇨ Section 2.2, Page 9)

2.9 Explosion protection

DANGER

Always observe the information on explosion protection given in this section when operating the product in potentially explosive atmospheres.

Only pumps/pump sets marked as explosion-proof **and** identified as such in the data sheet may be used in potentially explosive atmospheres.

Special conditions apply to the operation of explosion-proof pump sets to EU Directive 2014/34/EU (ATEX).

Special conditions apply to the operation of explosion-proof pump sets in accordance with the Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016.

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇨ Section 2.9.1, Page 11) to (⇨ Section 2.9.4, Page 12)
The explosion-proof status is only assured if the product is used in accordance with its intended use.
Never operate the product outside the limits stated in the data sheet and on the name plate.
Prevent impermissible modes of operation at all times.

2.9.1 Marking

Pump The marking on the pump refers to the pump part only.

Example of such marking:
II 2G Ex h IIC T5-T1 Gb

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants.

The pump complies with the requirements of type of protection constructional safety "c" to ISO 80079-37.

Shaft coupling An EC manufacturer's declaration is required for the shaft coupling; the shaft coupling must be marked accordingly.

Motor The motor must be considered separately.

2.9.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected at the surface of the pump casing, at the shaft seal and in the bearing areas.
The surface temperature at the pump casing corresponds to the temperature of the fluid handled. If the pump is heated in addition, the operator of the system is responsible for observing the specified temperature class and fluid temperature (operating temperature).

The table (⇨ Table 4) lists the temperature classes and the resulting maximum permissible fluid temperatures. The values shown correspond to the theoretical limits. They include only a general safety margin for the mechanical seal. For single mechanical seals, the safety margin required for specific operating conditions and mechanical seal designs may be substantially higher. If operating conditions differ

from those stated on the data sheet, or if different mechanical seals are used, the actual safety margin required needs to be determined individually. If in doubt please contact the manufacturer.

The temperature class specifies the maximum permissible temperature at the surface of the pump set during operation.

For the permissible operating temperature of the pump in question refer to the data sheet.

Table 4: Temperature limits

Temperature class to EN 13463-1	Max. permissible fluid temperature[2)]
T1	200 °C
T2	200 °C
T3	185 °C
T4	120 °C
T5	85 °C
T6	On request only

Temperature class T4

Based on an ambient temperature of 40 °C, grease lubrication and proper maintenance and operation, compliance with temperature class T4 is warranted in the area of the rolling element bearings.

In the cases listed below, and if ambient temperatures exceed 40 °C, contact the manufacturer.

Temperature classes T5 and T6

If temperature classes T5 and T6 have to be complied with, special measures may have to be taken with regard to bearing temperature.

Misuse, malfunctions or non-compliance with the instructions may result in substantially higher temperatures.

A special design is required for compliance with temperature class T6.

If the pump is to be operated at a higher temperature, if there is no data sheet or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

2.9.3 Monitoring equipment

The pump (set) must only be operated within the limits specified in the data sheet and on the name plate.
If the system operator cannot warrant compliance with these operating limits, appropriate monitoring devices must be used.
Check whether monitoring equipment is required to ensure that the pump set functions properly.

Contact KSB for further information about monitoring equipment.

2.9.4 Operating limits

The minimum flow rates indicated in (⇨ Section 6.2.3.1, Page 50) refer to water and water-like fluids handled. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures at the pump surface. However, if the physical properties of the fluids handled are different from water, it is essential to check whether an additional heat build-up may occur and if the minimum flow rate must therefore be increased. The calculation formula in (⇨ Section 6.2.3.1, Page 50) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

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2 Depending on the material variant

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

DANGER

The pump (set) could slip out of the suspension arrangement

Danger to life from falling parts!

- Always transport the pump (set) in the specified position.
- Never attach the suspension arrangement to the free shaft end or the motor eyebolt and/or the pump.
- Observe the information on weights, centre of gravity and fastening points.
- Observe the applicable local accident prevention regulations.
- Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

To transport the pump/pump set suspend it from the lifting tackle as shown.

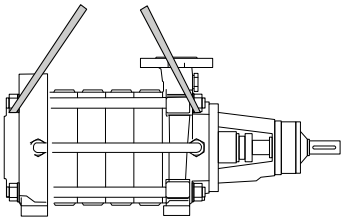


Fig. 1: Transporting the pump

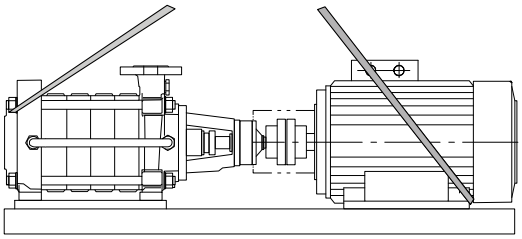


Fig. 2: Transporting the pump set

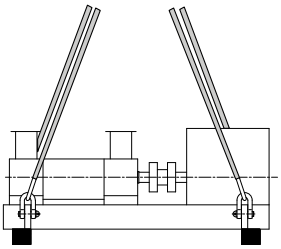


Fig. 3: Transporting the pump set (baseplate with lifting lugs)

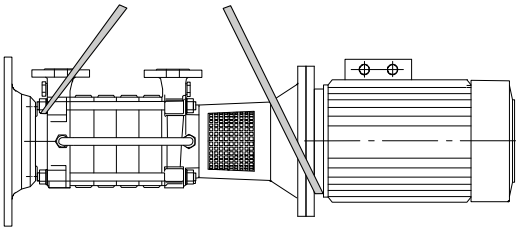
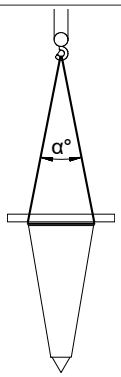
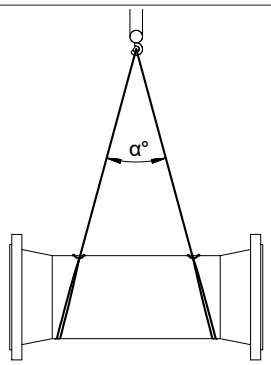
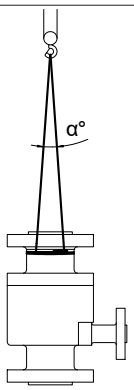
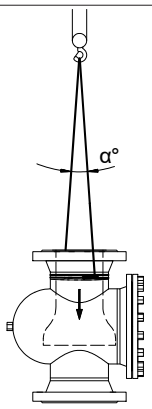
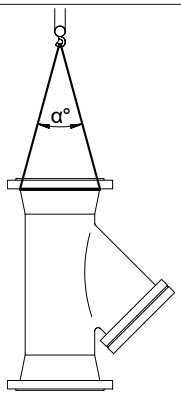
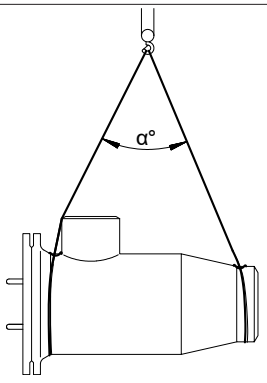


Fig. 4: Transporting close-coupled and vertical pumps

3.2.1 Transporting the accessories

	**CAUTION** **Improper transport of strainer/filter** Damage to the strainer/filter caused by lifting tackle! ▷ Do not exert pressure on the screen and screen mesh or damage them. ▷ Transport accessories by hand. If transporting by hand is not possible due to the weight, observe the applicable regulations.

Attach the lifting accessories as illustrated or as instructed in the product literature of the respective manufacturer.

 α° < 120 °	 α° < 120 °
Transporting the strainer insert (conical strainer)	Transporting the strainer body/spacer
 α° < 120 °	 α° < 120 °
Transporting the minimum flow valve	Transporting the basket strainer
 α° < 120 °	 α° < 120 °
Transporting the Y-strainer	Transporting the cylindrical strainer

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3.3 Storage/preservation

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of the pump (set)!

- ▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

- ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

If commissioning is to take place some time after delivery, we recommend that the following measures be taken for pump (set) storage.

- Store the pump (set) in a dry, protected room where the atmospheric humidity is as constant as possible.
- Rotate the shaft by hand once a month, e.g. via the motor fan.

If properly stored indoors, the pump set is protected for three months (please refer to order or order confirmation).
New pumps/pump sets are supplied by our factory duly prepared for storage.

For storage periods exceeding three months, the pump set is preserved as specified in the purchase order (please refer to order or order confirmation).

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇨ Section 7.3, Page 62)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
   Indicate any safety measures and decontamination measures taken.
   (⇨ Section 11, Page 109)

NOTE

If required, a blank certificate of decontamination can be downloaded from the following web site: www.ksb.com/certificate_of_decontamination

3.5 Disposal

⚠ WARNING

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Hazard to persons and the environment!

- ▷ 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 pump (set).
   Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
   - Metals
   - Plastics
   - Electronic waste
   - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

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4 Description of the Pump (Set)

4.1 General description

- Multistage centrifugal pump in ring-section design with suction impeller (exception: Multitec 32) for low NPSH value.

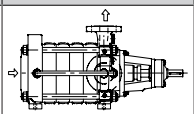
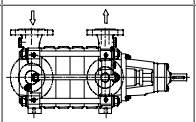
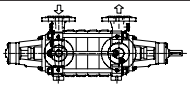
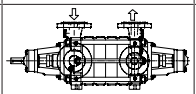
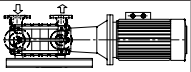
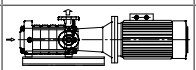
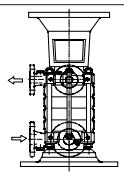
Multitec:

- Handling clean or aggressive fluids not chemically and mechanically aggressive to the pump materials.

Multitec-RO:

Material code: 31 and 33

Pump for water desalination systems (reverse osmosis applications)

Installation type	Illustration	Description
A		Horizontal design, long-coupled, one casing entry (drive end), rolling element bearing (drive end) and plain bearing (suction end), axial suction nozzle for the entire H/Q range
B		Same as installation type A, but radial suction nozzle
C		Horizontal design, long-coupled, with two casing entries, rolling element bearings at suction and drive end drive on discharge side for the entire H/Q range
D		Same as installation type C, but drive on suction side
E		Horizontal close-coupled pump, common bearing for pump and motor, rigid coupling, radial suction nozzle H/Q range: 100 m^3/h, 250 m
F		Same as installation type E, but axial suction nozzle
V		Vertical close-coupled pump H/Q range: up to 400 kW

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: Multitec[3] A 32/8E-2.1 12.167 (SP)

Table 5: Designation key

Code	Description
Multitec	Type series
A	Installation type
32	Nominal discharge nozzle diameter [mm]
8E	No. of stages / impeller combination
2.1	Hydraulic system
12	Material code
167	Seal code
SP	Code for special variants (optional)

4.4 Name plate

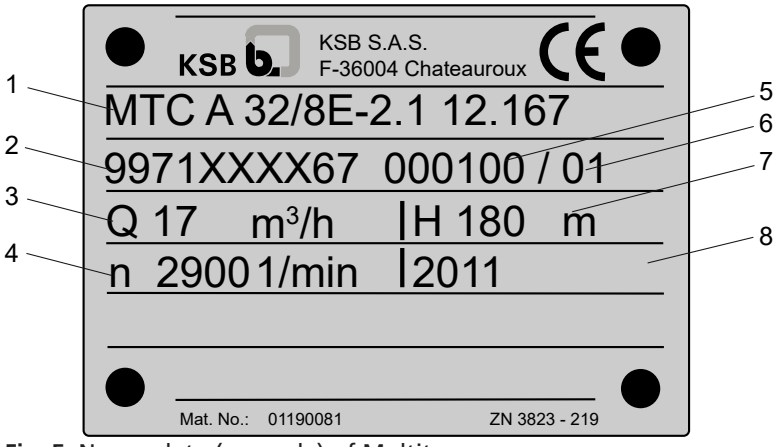


Fig. 5: Name plate (example) of Multitec

1	Type series, size and version	2	KSB order number (ten digits)
3	Flow rate	4	Speed
5	Order item number (six digits)	6	Consecutive number (two digits)
7	Head	8	Year of construction

4.5 Design details

Design

- Multistage centrifugal pump in ring-section design
- Horizontal installation in long-coupled or close-coupled design
- Vertical installation in close-coupled design or with universal joint shaft

Pump casing

- Suction casing: axial or radial
- Radial suction casing and discharge casing: nozzles can be turned in steps of 90°
- Flanges to EN and ASME (holes and flange facing)
- Identical seal housing for gland packing and mechanical seal
- Stage casings, discharge casings and seal housing sealed by confined O-rings

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3 Code: MTC

Drive

- 50 Hz and 60 Hz electric motor
- Can be driven by diesel engine or turbine

Impeller type

- Closed radial impeller with multiply curved vanes

Bearings

- Fixed bearing, drive end, rolling element bearing
- Radial bearing, non-drive end, either plain bearing or rolling element bearing, depending on the type of installation
- Rolling element bearing grease or oil lubricated
- Plain bearing lubricated by fluid handled
- Self-aligning

Coupling

- Long-coupled design, flexible coupling with or without spacer
- Close-coupled design up to DN 65 with rigid coupling, larger designs with flexible coupling without spacer

Coupling guard

Standard:

- Coupling guard, cylindrical

Optional:

- Coupling guard, tread-proof

Shaft seal

- Uncooled gland packing, with or without barrier fluid
- Standardised mechanical seal to EN 12756
- Cartridge seal

4.6 Configuration and function

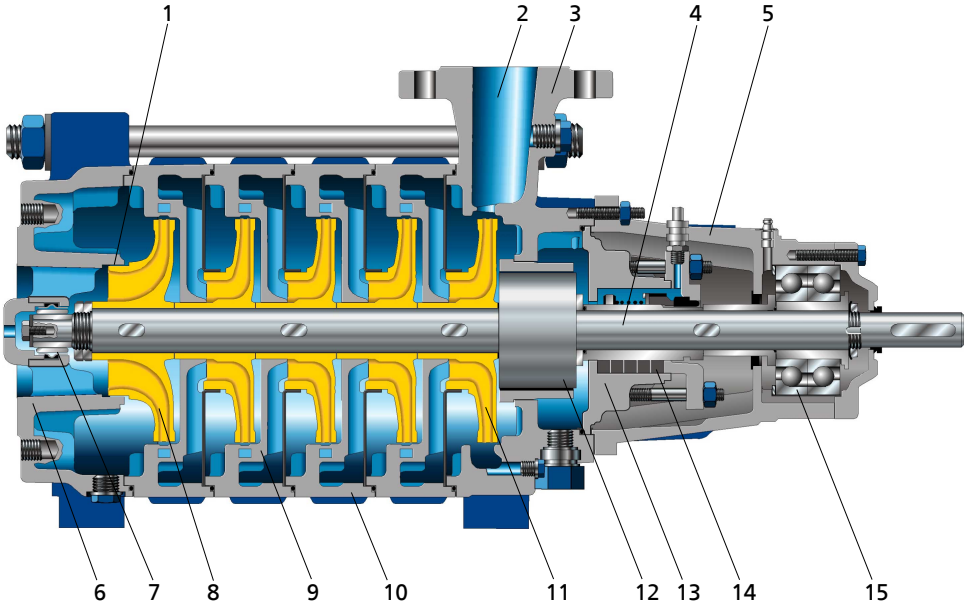

Fig. 6: Sectional drawing

1	Clearance gap	2	Discharge nozzle
3	Discharge casing	4	Shaft
5	Bearing housing	6	Suction casing
7	Plain bearing	8	(Suction) impeller
9	Diffuser	10	Stage casing
11	Impeller	12	Balance drum
13	Shaft seal housing	14	Shaft seal
15	Rolling element bearing		

Design The pump is designed with an axial or radial fluid inlet and a radial outlet. The hydraulic system runs in its own bearings and is connected to the motor via a shaft coupling.

Function The fluid enters the pump via the suction casing (6) and is accelerated outward by the rotating (suction) impeller (8). At the flow contour of the stage casing (10) the kinetic energy of the fluid is converted into pressure energy and the fluid is routed to the next impeller (11) via the diffuser (9). This process is repeated in all stages until the fluid has passed the last impeller (11). It then passes through the discharge casing (3) to the discharge nozzle (2), from where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the stage casing (10) into the suction range of the previous impeller. If required, a balance drum (12) is fitted behind the last impeller, providing axial thrust balancing by means of hydraulic forces. Behind the last impeller (11) and the balancing drum (12), the hydraulic system is closed off by a seal housing (13) through which the drive shaft (4) passes. The shaft passage through the shaft seal housing (13) is sealed to atmosphere by a dynamic shaft seal (14). The drive shaft (4) is supported by rolling element bearings (15) and a plain bearing (7) located in a bearing housing (5) and the suction casing (6), respectively. The bearing housing (5) is connected with the suction casing (6) and/or discharge casing (3).

Sealing The pump is sealed by a shaft seal (standardised mechanical seal or gland packing).

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4.7 Noise characteristics

Table 6: Surface sound pressure level L_{pA} [4) 5)]

Rated power input P_N [kW]	Pump		Pump with electric motor	
	1450 rpm [dB]	2900 rpm [dB]	1450 rpm [dB]	2900 rpm [dB]
2,2	56	57	60	65
3,0	58	60	62	67
4,0	59	61	63	68
5,5	61	63	65	70
7,5	63	65	66	71
9	64	66	68	73
11	65	67	68	73
15	66	68	70	75
18,5	67	69	71	76
22	68	70	72	77
30	69	71	73	78
37	70	72	74	79
45	71	73	75	79
55	71	74	75	80
75	72	74	77	82
90	72	75	77	82
110	73	75	78	83
132	73	76	78	83
160	74	76	79	84
200	75	77	80	85
250	75	78	80,5	-
315	76	78	81	-
355	78	80	81	-
400	79	81	82	-
500	80	82	82	-
560	80	82	82	-
630	82	83	84	-
710	82,5	84	84	-
800	82,5	-	84	-
900	82,5	-	84	-
1000	82,5	-	84	-
1120	82,5	-	84	-
1200	82,5	-	84	-
Up to 1400	83	-	84	-

Noise characteristics for other ratings/speeds on request.
Noise characteristics can only be guaranteed after consultation with the design/engineering department.

4.8 Scope of supply

Depending on the model, the following items are included in the scope of supply:

- Pump

4 Measured at a distance of 1 m from the pump outline (as per DIN 45635 Parts 1 and 24)

5 Increase for 60 Hz operation: 3500 rpm +3 dB, 1750 rpm +1 dB

Drive

- Electric motor
- Diesel engine
- Hydraulic motor
- Turbine up to 4000 rpm maximum

Coupling

- Flexible coupling with or without spacer

Contact guard

- Coupling guard

Baseplate

- Channel section steel

Accessories

- As required

4.9 Dimensions and weights

For dimensions and weights please refer to the general arrangement drawing/outline drawing of the pump/pump set.

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5 Installation at Site

5.1 Safety regulations

DANGER

Improper installation in potentially explosive atmospheres

Explosion hazard!

Damage to the pump set!

- Comply with the applicable local explosion protection regulations.
- Observe the information in the data sheet and on the name plates of pump and motor.

WARNING

Health hazard from preservatives for long-term preservation of pumps

Danger of poisoning!

- Prior to commissioning / start-up, flush the system and pump set.
- Dismantle the pump and thoroughly remove the preservative from all wetted components.
- Observe the data given in the order confirmation.

5.2 Checks to be carried out prior to installation

Place of installation

WARNING

Installation on a mounting surface which is unsecured and cannot support the load

Personal injury and damage to property!

- Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1.
- The mounting surface must be set, flat, and level.
- Observe the weights indicated.

1. Check the structural requirements.
   All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

5.3 Setting up the pump set

DANGER

Electrostatic charging due to insufficient potential equalisation

Explosion hazard!

- Make sure that the connection between pump and baseplate is electrically conductive.

CAUTION

Warped baseplate or pump

Damage to the pump!

- Align the baseplate and the pump accurately and carefully when installing the pump set.

5.3.1 Installation on the foundation

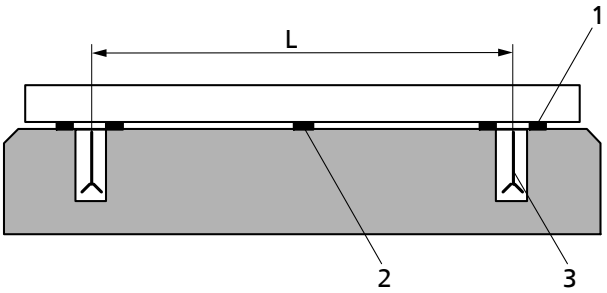

Fig. 7: Fitting the shims

L	Bolt-to-bolt distance	1	Shim
2	Shim for bolt-to-bolt distance > 800 mm	3	Foundation bolt

Installation types A, B, C and D

✓ The foundation has the required strength and characteristics.

✓ The foundation has been prepared in accordance with the dimensions given in the outline drawing / general arrangement drawing.

1. Position the pump set on the foundation and level it with the help of a spirit level placed on the shaft and discharge nozzle.
   Permissible deviation: 0.2 mm/m
2. Use shims (1) for height compensation.
   Always fit shims, if any, immediately to the left and right of the foundation bolts (3) between the baseplate/foundation frame and the foundation.
   For a bolt-to-bolt distance (L) > 800 mm fit additional shims (2) halfway between the bolt holes.
   All shims must lie perfectly flush.
3. Insert the foundation bolts (3) into the holes provided.
4. Use concrete to set the foundation bolts (3) into the foundation.
5. Wait until the concrete has set firmly, then level the baseplate.
6. Tighten the foundation bolts (3) evenly and firmly.
7. Grout baseplates with a width > 400 mm using low-shrinkage concrete with a standard particle size and a water/cement ratio ≤ 0.5.
   Produce flowability with the help of a solvent.
   Perform secondary treatment of the concrete to EN 206-1 .
   Make sure that no cavities remain.

NOTE

Baseplates made of U channel steel sections are torsion-resistant in their own right; they need not be grouted.

NOTE

For low-noise operation contact KSB to check whether the pump set can be installed on anti-vibration mounts. In this case, the baseplate should not be grouted.

NOTE

Expansion joints can be fitted between the pump and the suction line or discharge line.

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Installation types E, F, V,

1. Set the pump on the foundation and level it with the help of a spirit level placed on the upper flange of the motor lantern.
2. Use shims to level the pump (see above).
3. Insert the foundation bolts (3) into the holes provided.
4. Use concrete to set the foundation bolts (3) into the foundation.

5.4 Piping

5.4.1 Connecting the piping

DANGER

Impermissible loads acting on the pump nozzles

Danger to life from escaping hot, toxic, corrosive or flammable fluids!

- ▷ Do not use the pump as an anchorage point for the piping.
- ▷ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains.
- ▷ Observe the permissible forces and moments at the pump nozzles.
- ▷ Take appropriate measures to compensate for thermal expansion of the piping.

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

- ▷ Never earth the electric welding equipment on the pump or baseplate.
- ▷ Prevent current flowing through the rolling element bearings.

NOTE

Installing check and shut-off elements in the system is recommended, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least three times the diameter of the suction flange has been provided upstream of the suction flange.
- ✓ The nominal sizes of the pipelines are equal to or greater than the nominal sizes of the pump nozzles.
- ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
- ✓ The pipelines have been supported in close proximity to the pump and connected without transmitting any stresses or strains.

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Before installing the pump in the piping, remove the flange covers on the suction nozzle and discharge nozzle of the pump.
   For variant Multitec A: Leave the hole of the plain bearing cover open.

CAUTION

Welding beads, scale and other impurities in the piping

Damage to the pump!

- ▷ Remove any impurities from the piping.
- ▷ If necessary, install a filter.
- ▷ Observe the information in (⇨ Section 7.2.2.3, Page 58) .

3. If required, install a filter in the piping (see drawing: Filter in the piping).

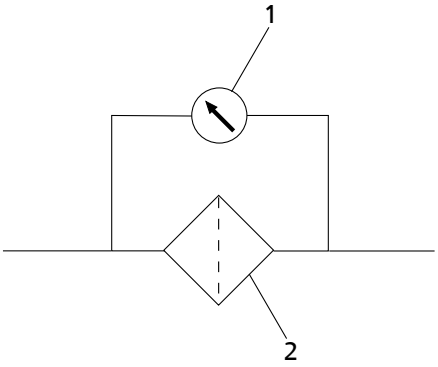

Fig. 8: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

Use a filter with laid-in wire mesh (mesh width 0.5 mm, wire diameter 0.25 mm) of corrosion-resistant material.
Use a filter with a filter area three times the cross-section of the piping.
Conical filters have proved suitable.

4. Connect the pump nozzles to the piping.

CAUTION

Aggressive flushing liquid and pickling agent

Damage to the pump!

- ▷ Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.

5.4.2 Permissible forces and moments at the pump nozzles

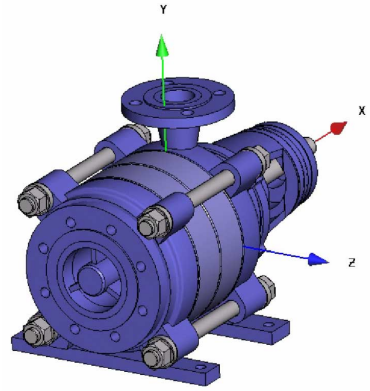

Fig. 9: Forces and moments at the pump nozzles

Direction of forces	
F_X	Horizontal, parallel to the pump axis

F_Y	Vertical to the pump axis
F_Z	Horizontal, at a right angle to the pump axis
Direction of moments	
M_X	Around the horizontal axis, parallel to the pump axis
M_Y	Around the vertical nozzle axis
M_Z	Around the horizontal axis, at a right angle to the pump axis

Suction and discharge nozzles must be regarded separately. Refer to the data sheet for the relevant suction and discharge nozzle diameters.

Forces and moments at the pump nozzles

Table 7:
Forces and moments at the pump nozzles (suction and discharge nozzles made of grey cast iron); material codes 10, 11, 12, 13, 14

DN	Vertical nozzle at a right angle to the shaft			Horizontal nozzle at a right angle to the shaft			Axial nozzle parallel to the shaft			Moments for all nozzles		
	F_x [N]	F_y [N]	F_z [N]	F_x [N]	F_y [N]	F_z [N]	F_x [N]	F_y [N]	F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
32	245	410	265	245	265	410	--	--	--	260	160	190
50	510	635	415	510	415	635	--	--	--	330	250	170
65	640	800	520	640	520	800	800	520	640	460	350	240
80	800	970	625	800	625	970	--	--	--	680	520	340
100	1015	1270	830	1015	830	1270	1270	830	1015	950	715	490
125	1470	1850	1220	1470	1220	1850	1850	1220	1470	1235	930	660
150	1780	2220	1465	1780	1465	2220	2220	1465	1780	1640	1260	840
200	2700	3490	2220	2700	2220	3490	3490	2220	2700	2520	1840	1260
250	3810	4760	3180	3810	3180	4760	4760	3180	3810	3580	1740	2710
300	4765	3815	5715	4765	5715	3815	-	-	-	4360	2130	3295

Table 8: Forces and moments at the pump nozzles (suction and discharge nozzles made of steel, stainless steel, duplex or super duplex stainless steel);
material codes 15, 16, 17, 20, 21, 22, 23, 25, 26, 27, 28, 30, 31, 33

DN	Vertical nozzle at a right angle to the shaft			Horizontal nozzle at a right angle to the shaft			Axial nozzle parallel to the shaft			Moments for all nozzles		
	F_x [N]	F_y [N]	F_z [N]	F_x [N]	F_y [N]	F_z [N]	F_x [N]	F_y [N]	F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
32	345	575	370	345	370	575	--	--	--	365	225	265
50	715	890	580	715	580	890	--	--	--	460	350	240
65	895	1120	730	895	730	1120	1120	730	895	645	490	335
80	1120	1360	875	1120	875	1360	--	--	--	950	730	475
100	1420	1780	1160	1420	1160	1780	1780	1160	1420	1330	1000	685
125	2060	2590	1710	2060	1710	2590	2590	1710	2060	1730	1300	925
150	2490	3110	2050	2490	2050	3110	3110	2050	2490	2295	1765	1175
200	3780	4885	3110	3780	3110	4885	4885	3110	3780	3530	2575	1765
250	--	--	--	--	--	--	6665	4450	5335	5010	3795	2435

5.4.3 Vacuum balance line

NOTE

Where fluid has to be pumped out of a vessel under vacuum, installing a vacuum balance line is recommended.

The following rules apply to vacuum balance lines:

- Minimum nominal line diameter 25 mm.
- The line extends above the highest permissible fluid level in the vessel.

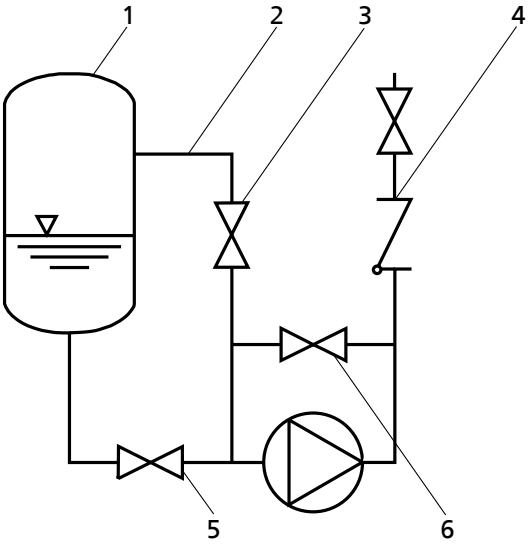

Fig. 10: Vacuum balance system

1	Vessel under vacuum	2	Vacuum balance line
3	Shut-off element	4	Swing check valve
5	Main shut-off element	6	Vacuum-tight shut-off element

NOTE

An additional line fitted with a shut-off valve (from the pump discharge nozzle to the balance line) facilitates venting of the pump before start-up.

5.4.4 Auxiliary connections

DANGER

Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping

Risk of burns!

Explosion hazard!

▷ Make sure that the barrier fluid, quench liquid and/or cooling liquid and fluid handled are compatible.

DANGER

Risk of overheating if the maximum permissible temperature of auxiliary fluids is not complied with

Explosion hazard!

▷ Observe a maximum temperature of 60 °C for the barrier fluid and flushing liquid.

▷ Observe a maximum temperature of 30 °C for water-cooled mechanical seals.

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DANGER

Shaft seal failure caused by insufficient lubrication

Hot or toxic fluid could escape!

Damage to the pump!

- ▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.

WARNING

Failure to use or incorrect use of auxiliary connections (e.g. barrier fluid, flushing liquid, etc.)

Risk of injury from escaping fluid!

Risk of burns!

Malfunction of the pump!

- ▷ Refer to the general arrangement drawing, the piping layout and pump markings (if any) for the quantity, dimensions and locations of auxiliary connections.
- ▷ Use the auxiliary connections provided.

Water-cooled mechanical seal

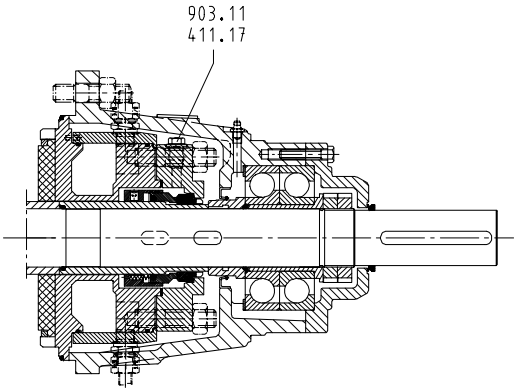

Fig. 11: Water-cooled mechanical seal

On variants with water-cooled mechanical seals the cooling chamber must always be connected to a cooling circuit. Cooling water circulation must be provided regardless of the temperature of the fluid handled.

5.5 Checking the coupling alignment

DANGER

Inadmissible temperatures at the coupling or bearings due to misalignment of the coupling

Explosion hazard!

Risk of burns!

- ▷ Make sure that the coupling is correctly aligned at all times.

	CAUTION
	Misalignment of pump and motor shafts Damage to pump, motor and coupling! ▷ Always check the coupling after the pump has been installed and connected to the piping. ▷ Also check the coupling of pump sets supplied with pump and motor mounted on the same baseplate.

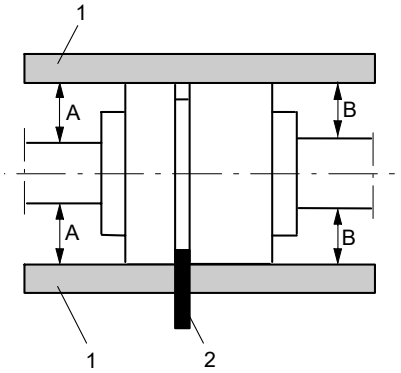

Fig. 12: Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

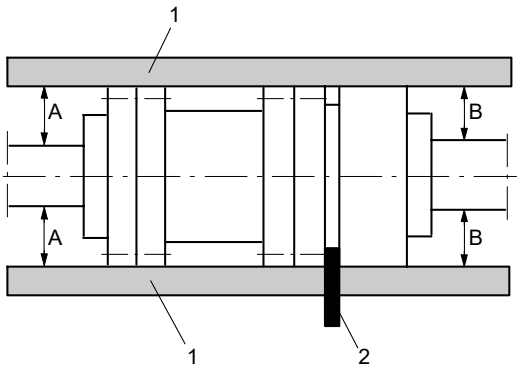

Fig. 13: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

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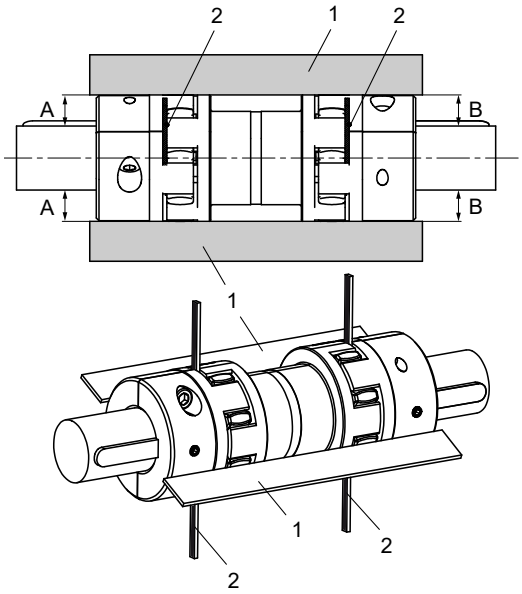

Fig. 14: Double Cardan spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

Table 9: Permissible alignment offset of coupling halves

Coupling type	Radial offset[6)]	Axial offset[6)]
	[mm]	[mm]
Non-spacer-type coupling (⇨ Fig. 12)	≤ 0,1	≤ 0,1
Spacer-type coupling (⇨ Fig. 13)	≤ 0,1	≤ 0,1
Double Cardan coupling (⇨ Fig. 14)	≤ 0,5	≤ 0,5

✓ The coupling guard and its footboard, if any, have been removed.

1. Place the straight edge axially on both coupling halves.
2. Leave the straight edge in this position and turn the coupling by hand.
   The coupling is aligned correctly if the distances A and B to the respective shafts are the same at all points around the circumference.
   Observe the permissible radial offset in coupling half alignment both during standstill and at operating temperature as well as under inlet pressure.
3. Check the distance (dimension see general arrangement drawing) between the two coupling halves around the circumference.
   The coupling is correctly aligned if the distance between the two coupling halves is the same at all points around the circumference.
   Observe the permissible axial offset in coupling half alignment both during standstill and at operating temperature as well as under inlet pressure.
4. If alignment is correct, re-install the coupling guard and its footboard, if any.

6 If lower values are specified by the motor manufacturer they must be complied with.

5.6 Aligning the pump and motor

5.6.1 Thermal expansion

CAUTION

Increase in length and height at fluid temperatures > 100 °C

Warping and deformation of the pump (set)!

- ▷ Tighten the foot bolts holding the pump on the baseplate to the bolt tightening torques given in the table below (to prevent length increase).
- ▷ Note different height increases of pump and drive.
  The equation given below serves as a guide to estimate the increase in height.
- ▷ Verify the correct alignment of pump and motor at operating temperature and re-align, if necessary.

CAUTION

Excessive forces and moments acting on the pump nozzles due to thermal expansion of piping and pump

Warping and malfunction of the pump!

- ▷ Observe the permissible forces and moments at the pump nozzles at any operating temperature. (⇨ Section 5.4.2, Page 26)

Thermal length expansion

To prevent thermal length expansion, the following torques must be complied with:

Table 10: Tightening torques for fastening the pump on the baseplate

Size	Thread	Property class	Tightening torque	
			Drive end [Nm]	Non-drive end [Nm]
32	M12	4.6	30	15
50	M12	4.6	30	15
65	M16	4.6	60	30
100	M20	4.6	120	60
125	M20	4.6	120	60
150	M30	4.6	450	200
200	M30	4.6	450	200
250	M36	4.6	780	390

Thermal height increase

When aligning the coupling, bear in mind that the increase in height of pump and drive due to thermal expansion may differ.

The following equation can serve as a guide to estimate by how much the motor has to be elevated in relation to the pump:

$$\Delta H[mm] = 1/100000 * (\Delta T_p * H_p - \Delta T_m * H_m)$$

ΔT_p	=	Temperature difference pump - ambient [°C]
H_p	=	Height of pump axis [mm]
ΔT_m	=	Temperature difference motor - ambient [°C]
H_m	=	Height of motor axis [mm]

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5.6.2 Motor with adjusting screw

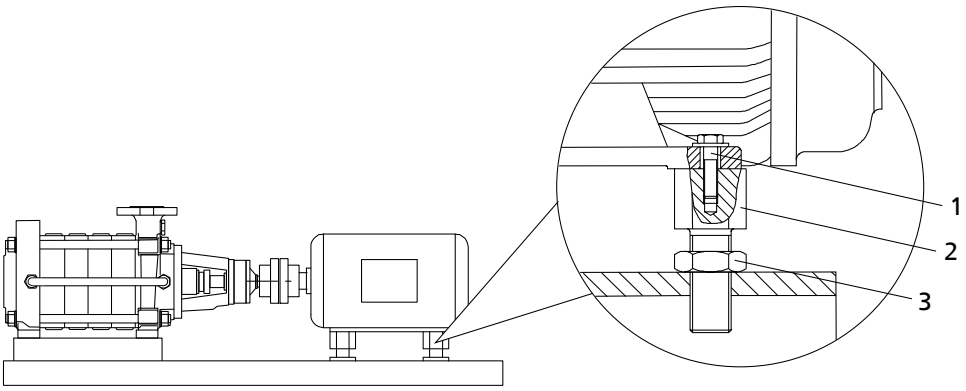

Fig. 15: Motor with adjusting screw

1	Hexagon head bolt	2	Adjusting screw
3	Lock nut		

✓ The coupling guard and its footboard, if any, have been removed.

1. Check the coupling alignment.
2. Unscrew the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
3. Turn the adjusting screws (2) by hand or by means of an open-end wrench until the coupling alignment is correct and all motor feet rest squarely on the baseplate.
4. Re-tighten the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
5. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can easily be rotated by hand.

⚠ WARNING

Unprotected rotating coupling

Risk of injury by rotating shafts!

- ▹ Always operate the pump set with a coupling guard.
  If the customer specifically requests not to include a coupling guard in KSB's delivery, then the operator must supply one!
- ▹ Observe all relevant regulations for selecting a coupling guard.

⚠ DANGER

Risk of ignition by frictional sparks

Explosion hazard!!

- ▹ Choose a coupling guard material that is non-sparking in the event of mechanical contact.

6. Fit the coupling guard and its footboard, if any.
7. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

5.6.3 Motor without adjusting screw

Any differences in shaft centre height between the pump and the motor are compensated by means of shims.

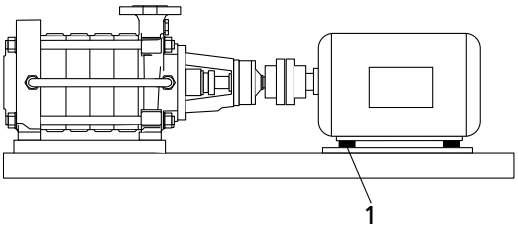

Fig. 16: Pump set with shims

1	Shim		

✓ The coupling guard and its footboard, if any, have been removed.

1. Check the coupling alignment.
2. Loosen the hexagon head bolts at the motor.
3. Insert shims underneath the motor feet until the difference in shaft centreline height has been compensated.
4. Re-tighten the hexagon head bolts.
5. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can easily be rotated by hand.

⚠ WARNING

Unprotected rotating coupling

Risk of injury by rotating shafts!

- ▹ Always operate the pump set with a coupling guard.
  If the customer specifically requests not to include a coupling guard in KSB's delivery, then the operator must supply one!
- ▹ Observe all relevant regulations for selecting a coupling guard.

⚠ DANGER

Risk of ignition by frictional sparks

Explosion hazard!!

- ▹ Choose a coupling guard material that is non-sparking in the event of mechanical contact.

6. Fit the coupling guard and its footboard, if any.
7. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

5.6.4 Aligning close-coupled and vertical pumps

Alignment between the motor and the pump is ensured by the centering effect between the motor flange and the drive lantern flange. It must be easy to rotate the shaft.

For pump sizes Multitec V 32 to Multitec V 65 please observe the adjusting dimensions for coupling alignment.

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Adjusting dimensions for coupling alignment on sizes 32 to 65, installation types E, F, V,

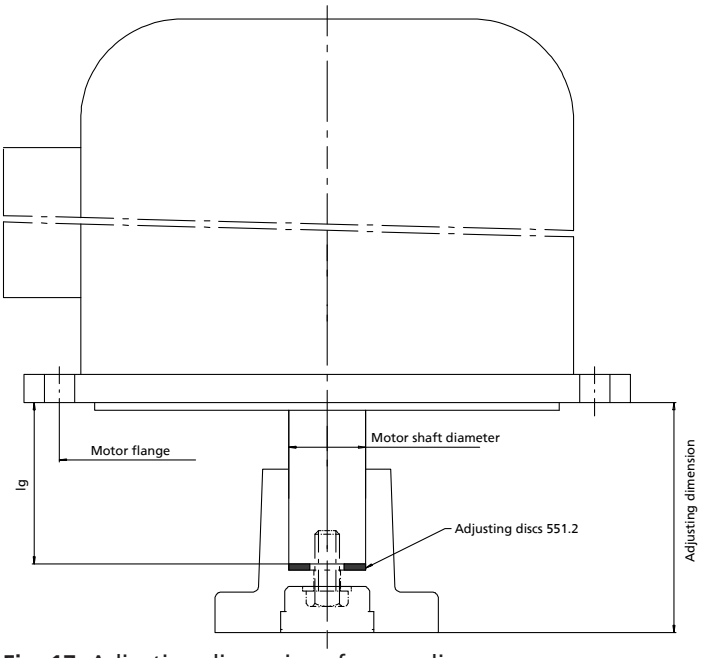

Fig. 17: Adjusting dimensions for coupling

Table 11: Adjusting dimension for coupling alignment

Diameter of motor flange	Size	Motor shaft		Adjusting dimension ±0.25 [mm]
		Diameter [mm]	lg [mm]	
F165	32-50	24	50	90
F215	32-50-65	28	60	100
F265	32-50-65	38	80	120
F300	32-50-65	42/48	110	150
F350	65	48/55	110	150
F350	32-50	48/55	110	153
F400	32-50-65	55	110	153
F400/F500	32-50-65	60	140	183
F500/600	65	65	140	183
F600	65	80	170	213

5.7 Electrical connection

DANGER

Electrical connection work by unqualified personnel

Risk of fatal injury due to electric shock!

- Always have the electrical connections installed by a trained and qualified electrician.
- Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.

⚠ WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

▷ Observe the technical specifications of the local energy supply companies.

1. Check the available mains voltage against the data on the motor name plate.
2. Select an appropriate starting method.

NOTE

Installing a motor protection device is recommended.

5.7.1 Information for electrical connection

Asynchronous motor

Pump sets with asynchronous motors by KSB must only be used for DOL starting. During start-up and run-up the voltage must not fall below the value specified in the order documentation. If this starting method is not permitted for the power supply network used, starting devices to reduce starting currents must be provided (e.g. star-delta contactors (Y-Δ), autotransformers, starting resistors, soft starters, etc).

Synchronous motor

Pump sets with synchronous motors must only be operated on a frequency inverter. They must not be operated directly on the power supply network.

5.7.2 Operation with star-delta contactor, autotransformers and starting resistors

CAUTION

Switchover between star and delta on three-phase motors with star-delta starting takes too long.

Damage to the pump (set)!

▷ Keep switch-over intervals between star and delta as short as possible.

Star-delta contactor

Table 12: Time relay settings for star-delta starting:

Motor rating	Y time to be set
[kW]	[s]
≤ 30	< 3
> 30	< 5

The switchover interval from Y to D must not be longer than 60 ms **(additional delays are not permitted)**.

Starting devices

Set up the starting devices for automatic operation, i.e. switchover from partial to full voltage must be automatic. The partial voltage period shall not exceed the values given in the below table. To operate the pump set with a starting transformer or starting resistor, choose a closed-transition switchover method (Korndorfer connection).

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Table 13: Setting the starting device

Motor rating	Y time to be set
[kW]	[s]
≤ 30	< 3
> 30	< 5

5.7.3 Operation with soft starter

NOTE

For pump sets in VdS-approved sprinkler installations
For pump sets in VdS-approved sprinkler installations, also observe VdS guideline VdS CEA 4001!

The following reference values, based on our experience, ensure safe operation of pump sets. The operator is responsible for checking with the manufacturer of the soft starter that the particular features of pump sets have been taken into account. Depending on the make, the reference values provided might be exceeded.

Table 14: Reference values for soft starters

Parameter / function	Setting
Minimum starting voltage	50 % of the motor's rated voltage
Ramp time / acceleration (run-up) time	t_H < 5 seconds
Current limitation	I_A / I_N approx. 3.5
Deceleration (run-down) time / stop ramp	t_A < 5 seconds
All special functions, e.g. ▪ Delayed starting ▪ Current control ▪ Speed control ▪ Kick-start / boost function	AUS

1. After run-up, the soft starter must be bypassed by a contactor.
2. Always observe the manufacturer's operating instructions.

NOTE

Conspicuous noises or vibrations during run-up and run-down could indicate incorrect parameter settings on the soft starter, such as excessive ramp times, incorrect operating mode (control) or enabled special functions.

5.7.4 Operation on a frequency inverter

NOTE

For pump sets in VdS-approved sprinkler installations
For pump sets in VdS-approved sprinkler installations, also observe VdS guideline VdS CEA 4001!

Control principle of the frequency inverter

- For asynchronous motors the control principle must correspond with a linear V/f characteristic.
- For synchronous motors frequency inverters must be used which have a sensorless control principle suitable for motors with buried magnets.

Maximum permissible run-up time and run-down time

The run-up time from standstill to the minimum frequency f_{min} must not exceed 5 seconds.

Minimum frequency

The minimum frequency for continuous operation is 30 Hz.

The speed must never be less than 900 rpm in continuous operation.

Maximum operating frequency

- For asynchronous motors:
  Do not exceed the maximum operating frequency of 50 Hz or 60 Hz respectively.
- For synchronous motors:
  Do not exceed the maximum operating frequency of 100 Hz.
- For pumps:
  Do not exceed the maximum permissible operating frequency.

5.7.5 Earthing

⚠ DANGER

Electrostatic charging

Explosion hazard!

Fire hazard!

Damage to the pump set!

▷ Connect the PE conductor to the earthing terminal provided.

5.7.6 Connecting the motor

NOTE

In compliance with IEC 60034-8, three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub).

The pump's direction of rotation is indicated by an arrow on the pump.

1. Match the motor's direction of rotation to that of the pump.
2. Observe the manufacturer's product literature supplied with the motor.

5.8 Checking the direction of rotation

⚠ DANGER

Temperature increase resulting from contact between rotating and stationary components

Explosion hazard!

Damage to the pump set!

▷ Never check the direction of rotation by starting up the unfilled pump set.

▷ Separate the pump from the motor to check the direction of rotation.

⚠ WARNING

Hands inside the pump casing

Risk of injuries, damage to the pump!

▷ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

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CAUTION

Drive and pump running in the wrong direction of rotation

Damage to the pump!

- ▷ Refer to the arrow indicating the direction of rotation on the pump.
- ▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.

The correct direction of rotation of the motor and pump is clockwise (seen from the motor end).

Exception: Installation type D - Anti-clockwise rotation

1. Start the drive and stop it again immediately to determine the drive's direction of rotation.
2. Check the direction of rotation.
   The motor's direction of rotation must match the arrow indicating the direction of rotation on the pump.
3. If the motor is running in the wrong direction of rotation, check the electrical connection of the motor and the control system, if any.

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

Before commissioning/starting up the pump set, make sure that the following conditions are met:

- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇨ Section 5.7, Page 35)
- The fluid has been degassed.
- The pump has been primed with the fluid to be handled. The pump has been vented. (⇨ Section 6.1.3, Page 42)
- The direction of rotation has been checked.
- All auxiliary connections required are connected and operational.
- The lubricants have been checked.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇨ Section 6.4, Page 53)
- The pipelines have been connected without transmitting any stresses and strains on the pump nozzles.
- Contact guards for hot, cold and moving parts have been fitted.
- The quality of the concrete foundation complies with the regulations.
- The pump set has been installed and aligned in accordance with the tolerances specified.

CAUTION

Poor boiler feed water and condensate quality

Loss in component strength due to localised corrosion (graphitisation)!

- ▷ The limits given below must be complied with under any operating conditions.
- ▷ Water treatment must be in accordance with the VdTÜV guidelines for feed and boiler water in steam plants of up to 64 bar.
- ▷ The penetration of air into the system must be avoided.

Table 15: Limits for boiler feed water and condensate when using cast iron pump parts

	Limits
pH	≥ 9.0 (target ≥ 9.3)
O_2content	≤ 0.02 ppm
Percentage of fresh water	≤ 25 %

6.1.2 Filling in lubricants

Grease-lubricated bearings

Grease-lubricated bearings have been packed with grease.

Oil-lubricated bearings

Fill the bearing bracket with lubricating oil.
Oil quality see (⇨ Section 7.2.3.1.2, Page 59)
Oil quantity see (⇨ Section 7.2.3.1.3, Page 59)

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Filling the constant level oiler with lubricating oil (oil-lubricated bearings only)

NOTE

If no constant level oiler is provided on the bearing bracket, the oil level can be read in the middle of the oil level gauge arranged at the side of the bearing bracket.

CAUTION

Insufficient quantity of lubricating oil in the reservoir of the constant level oiler

Damage to the bearings!

- Regularly check the oil level.
- Always fill the oil reservoir completely.

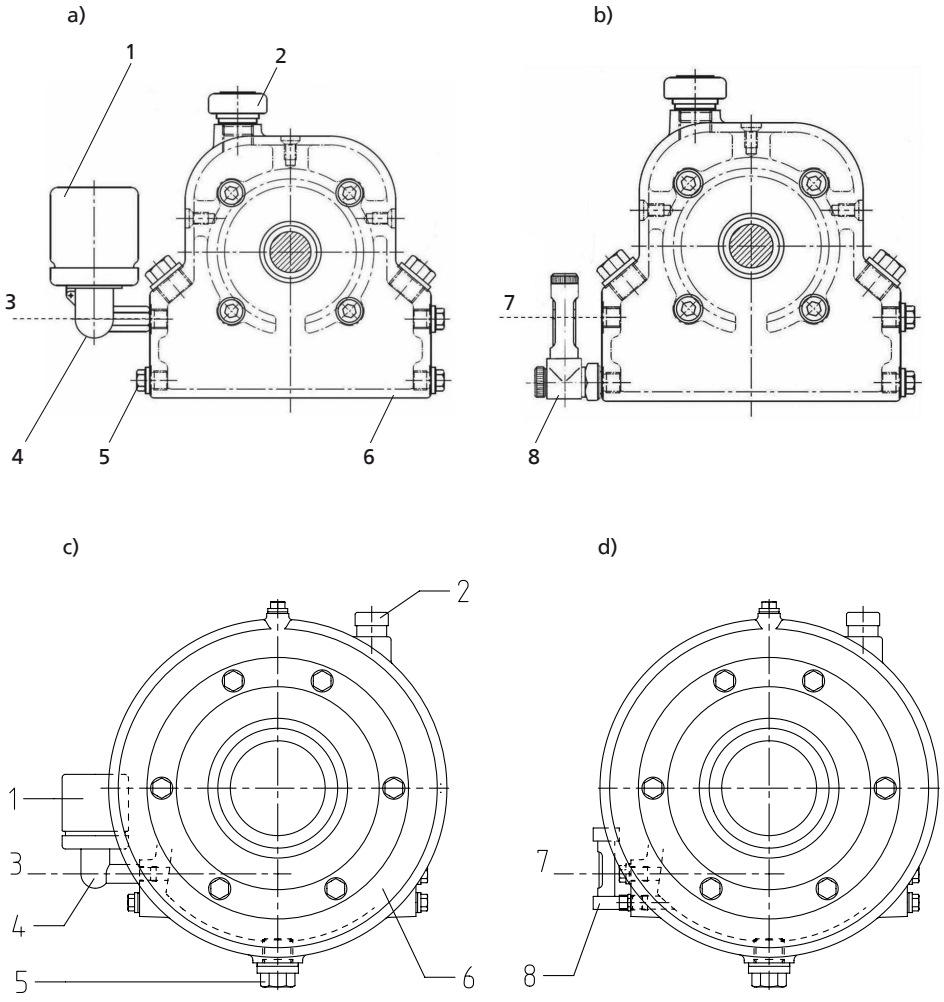

Fig. 18: a) Bearing bracket with constant level oiler – b) Bearing bracket with oil level gauge –
c) Bearing bracket with constant level oiler (size 250) – d) Bearing bracket with oil level gauge (size 250)

1	Constant level oiler	2	Vent plug
3	Oil level Constant level oiler	4	Connection elbow of the constant level oiler
5	Screw plug	6	Bearing cover
7	Oil level Oil level gauge	8	Oil level gauge

NOTE

An excessively high oil level can lead to a temperature rise and to leakage of the fluid handled or oil.

Bearing bracket with constant level oiler

✓ The constant level oiler has been fitted.

✓ Screw plug has been fitted.

1. Pull out the vent plug (2).
2. Pull the constant level oiler (1) down away from the bearing cover (6) and hold it in this position.
3. Fill oil through the hole for the vent plug until the oil reaches the connection elbow of the constant level oiler (3).
4. Completely fill the reservoir of the constant level oiler (1).
5. Snap the constant level oiler (1) back into its operating position.
6. Fit the vent plug (2) again.
7. After approximately 5 minutes, check the oil level in the glass reservoir of the constant level oiler (1).
   The oil reservoir must be properly filled at all times to provide a constant oil level. Repeat steps 1 - 6, if necessary.
8. To check the function of the constant level oiler (1), slowly drain some oil via the screw plug (6) until air bubbles can be seen in the oil reservoir.

Bearing bracket with oil level gauge

Oil-lubricated pumps are standard supplied with a constant level oiler mounted at the bearing cover. Alternatively, an oil level gauge can be connected to the lower connection hole in the bearing cover.

On pumps with oil level gauge the oil level must be visible between the two red marks on the oil level gauge. Remove the vent plug and top up oil, if necessary.

6.1.3 Priming and venting the pump

DANGER

Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping

Risk of burns!

Explosion hazard!

▹ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.

DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

▹ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.

▹ Provide sufficient inlet pressure.

▹ Provide an appropriate monitoring system.

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DANGER

Shaft seal failure caused by insufficient lubrication

Hot or toxic fluid could escape!

Damage to the pump!

- ▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.

1. Vent the pump and suction line and prime both with the fluid to be handled.
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary connections (barrier fluid, flushing liquid, etc).

6.1.4 Priming and venting the pump

DANGER

Formation of a potentially explosive atmosphere inside the pump

Explosion hazard!

- ▷ Before starting up the pump set, vent the pump, mechanical seal housing and suction line, and prime them with the fluid to be handled.

DANGER

Shaft seal failure caused by insufficient lubrication

Hot or toxic fluid could escape!

Damage to the pump!

- ▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.

CAUTION

Increased wear due to dry running

Damage to the pump set!

- ▷ Never operate the pump set without liquid fill.
- ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.

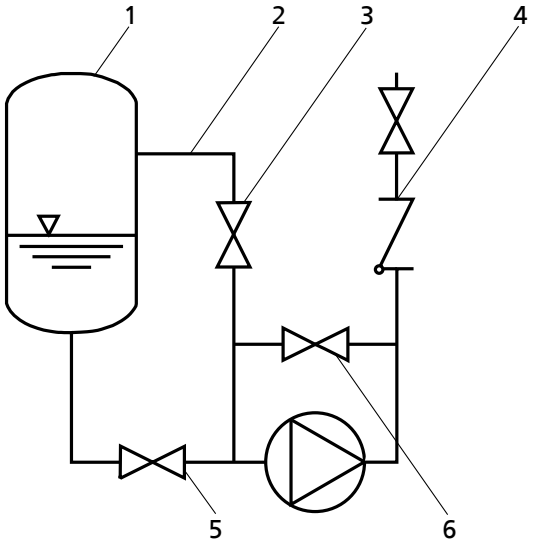

Fig. 19: Vacuum balance line

1	Vessel under vacuum	2	Vacuum balance line
3	Shut-off element	4	Swing check valve
5	Main shut-off element	6	Vacuum-tight shut-off element

1. Vent the pump and suction line and prime both with the fluid to be handled. For venting use the various plugged drain holes provided on the pump and any venting devices provided in the pipelines.
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc), if applicable.
4. Open the shut-off element (3), if any, in the vacuum balance line (2) and close the vacuum-tight shut-off element (6), if any.

NOTE

For design-inherent reasons some unfilled volume in the hydraulic system cannot be excluded after the pump has been primed for commissioning/start-up. However, once the motor is started up the pumping effect will immediately fill this volume with the fluid handled.

Venting the seal chamber of a cooled mechanical seal (seal code 64)

⚠ WARNING

Venting the seal chamber in hot condition

Danger of scalding by hot steam escaping!

- ▷ Only vent the seal chamber in cold condition if possible.
- ▷ If venting in hot condition cannot be avoided, connect a pipe fitted with a shut-off valve to the vent hole in order to divert the steam to a place where there is no danger of scalding.
  (Not included in KSB's scope of supply.)
- ▷ Make sure that the valve cannot be opened during operation.

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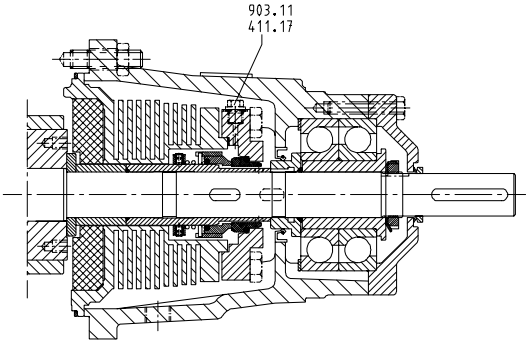

Fig. 20: Vent plug for seal chamber (air-cooled seal housing) – Sizes 32 to 100

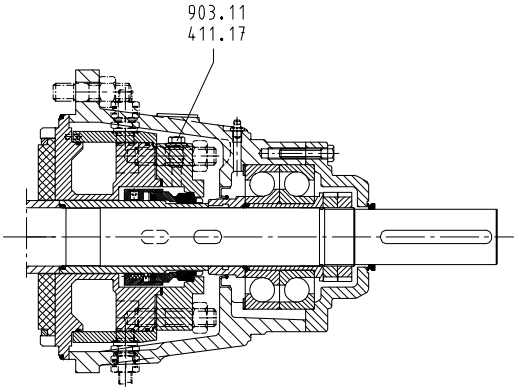

Fig. 21: Vent plug for seal chamber (water-cooled seal housing) – Sizes 125 to 150 (and 32-100 as special version if applicable)

1. Unscrew vent plug 903.11 by a quarter turn.
   ⇨ The seal chamber is vented.
2. Re-tighten vent plug 903.11.

6.1.5 Final check

1. Remove the coupling guard and its footboard, if any.
2. Check the coupling alignment; re-align the coupling, if required.
   (⇨ Section 5.5, Page 29)
3. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can be easily rotated by hand.
4. Fit the coupling guard and its footboard, if any.
5. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

6.1.6 Start-up

⚠ DANGER

Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed.

Explosion hazard!

Hot or toxic fluids escaping!

- ▹ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.
- ▹ Only start up the pump set with the discharge-side shut-off element slightly or fully open.

DANGER

Excessive temperatures due to dry running or excessive gas content in the fluid handled

Explosion hazard!

Damage to the pump set!

- Never operate the pump set without liquid fill.
- Prime the pump as per operating instructions. (⇨ Section 6.1.3, Page 42) (⇨ Section 6.1.4, Page 43)
- Always operate the pump within the permissible operating range.

WARNING

Suction casing, discharge casing, stage casing, seal housing and seal cover take on the temperature of the fluid handled

Risk of burns!

- Do not touch hot parts.

WARNING

Bearing bracket temperature during operation above 60 °C

Risk of burns!

- Do not touch hot parts.

CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

- Switch off the pump (set) immediately.
- Eliminate the causes before returning the pump set to service.

✓ The system piping has been cleaned.

✓ The pump, suction line and inlet tank (if any) have been vented and primed with the fluid to be handled.

✓ The lines for priming and venting have been closed.

CAUTION

Start-up against open discharge line

Motor overload!

- Make sure the motor has sufficient power reserves.
- Use a soft starter.
- Use speed control.

1. Fully open the shut-off element in the suction head line / suction lift line.
2. Close or slightly open the shut-off element in the discharge line.
3. Start up the motor.
   Start-up must proceed without abnormal vibrations or noises.
4. Immediately after the pump has reached full rotational speed, slowly open the shut-off element in the discharge line and adjust it to comply with the duty point.
   If an automatic check valve has been installed, it has to open continuously – without abnormal noise, vibrations or increased current input of the pump set – when the operating speed has been reached.

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5. Once the duty point has been reached, check the drive input power and bearing temperature.
6. Check the coupling alignment and re-align the coupling if required.
7. If unusual noises are detected at grease-lubricated bearings during start-up, some grease can be added (up to 1/3 of the permissible quantity).
(⇨ Section 7.2.3.2.3, Page 61)

6.1.7 Checking the shaft seal

Mechanical seal

The mechanical seal only leaks slightly or invisibly (as vapour) during operation. Mechanical seals are maintenance-free.

Double mechanical seal

⚠ DANGER

Excessive temperature of barrier fluid, with double mechanical seal

Explosion hazard!

Excessive surface temperature

- ▹ For pumps with double mechanical seal, make sure that the barrier fluid's temperature does not exceed 60 °C.

Gland packing

The gland packing must drip slightly during operation.

(approx. 20 drops per minute)

NOTE

On variable speed pumps, the necessary gland packing leakage must be set for the minimum fluid pressure; higher leakage rates are to be expected for other operating conditions.

Preparations

1. Remove the contact guards from the openings in bearing housing 350.1.

Adjusting the leakage

Prior to commissioning

1. Only lightly tighten the nuts of the gland follower by hand.
2. Use a feeler gauge to verify that the gland follower is mounted centred and at a right angle to the shaft.

⇨ The gland must leak after the pump has been primed.

After five minutes of operation

⚠ WARNING

Unprotected rotating parts

Risk of personal injury!

- ▹ Do not touch rotating parts.
- ▹ When the pump is running, perform any work with utmost caution.

The leakage can be reduced.

1. Tighten the nuts on the gland follower by 1/6 turn.
2. Monitor the leakage for another five minutes.

Excessive leakage:
Repeat steps 1 and 2 until the minimum value has been reached.

Not enough leakage:
Slightly loosen the nuts at the gland follower.

No leakage:
Immediately switch off pump set!
Loosen the gland follower and repeat commissioning.

Checking the leakage

After the leakage has been adjusted, monitor the leakage for about two hours at maximum fluid temperature.
Check that enough leakage occurs at the gland packing at minimum fluid pressure.

After work is complete, fit the contact guards to the openings in bearing housing 350.1 again.

6.1.8 Shutdown

CAUTION

Heat build-up inside the pump

Damage to the shaft seal!

- ▷ Depending on the type of installation, the pump set requires sufficient after-run time – with the heat source switched off – until the fluid handled has cooled down.

CAUTION

Backflow of fluid handled is not permitted

Motor or winding damage! Mechanical seal damage!

- ▷ Close the shut-off elements.

✓ The shut-off element in the suction line is and remains open.

1. Close the shut-off element in the discharge line.
2. Switch off the motor and make sure the pump set runs down smoothly to a standstill.

NOTE

If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open provided that the system conditions and system regulations are considered and observed.

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Close any auxiliary lines.
   If the fluid to be handled is fed in under vacuum, also supply the shaft seal with barrier fluid during standstill.

CAUTION

Risk of freezing during prolonged pump shutdown periods

Damage to the pump!

- ▷ Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.

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6.2 Operating limits

DANGER

Non-compliance with operating limits for pressure, temperature, fluid handled and speed

Explosion hazard!

Hot or toxic fluid could escape!

- Comply with the operating data specified in the data sheet.
- Never use the pump for handling fluids it is not designed for.
- Avoid prolonged operation against a closed shut-off element.
- Never operate the pump at temperatures, pressures or rotational speeds exceeding those specified in the data sheet or on the name plate unless the written consent of the manufacturer has been obtained.

DANGER

Formation of a potentially explosive atmosphere inside the pump

Explosion hazard!

- When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring).

DANGER

Excessive temperatures in the shaft seal area

Explosion hazard!

- Never operate a pump (set) with gland packing in potentially explosive atmospheres.

6.2.1 Ambient temperature

Observe the following parameters and values during operation:

Table 16: Permissible ambient temperatures

Permissible ambient temperature	Value[7)]
Maximum	40 °C
Minimum	-10 °C

CAUTION

Operation outside the permissible ambient temperature

Damage to the pump (set)!

- Observe the specified limits for permissible ambient temperatures.

6.2.2 Frequency of starts

DANGER

Excessive surface temperature of the motor

Explosion hazard!

Damage to the motor!

- In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.

7 For other temperatures contact KSB.

CAUTION

Re-starting while motor is still running down

Damage to the pump (set)!

▷ Do not re-start the pump set before the pump rotor has come to a standstill.

The frequency of starts is determined by the maximum temperature increase of the motor. The frequency of starts depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL starting, star-delta starting, moments of inertia, etc). If the start-ups are evenly spaced over the period indicated, the following limits serve as orientation for start-up with the discharge-side shut-off valve slightly open:

Table 17: Frequency of starts

Motor rating	Maximum frequency of starts
[kW]	[Starts/hour]
≤ 3	20
4 - 11	15
12 - 45	10
> 45	5

NOTE

For pumps with shafts fitted with two keys at the coupling the max. frequency of starts is 30 starts/month, regardless of the power input, unless a soft starter or a frequency inverter is used.

Overloading of the motor may generally result in:

- An abnormal increase in motor temperature exceeding the temperature limit of the winding or bearing grease
- Premature coupling wear
- Reduced service life of the pump components
- Irregularities or malfunctions in the system

6.2.3 Fluid handled

6.2.3.1 Flow rate

The minimum flow rates indicated below are for single-pump operation and will prevent thermal or mechanical overloading of the pump. In case of parallel operation with pumps of identical or different design, higher flow rates may be required to guarantee a stable operating behaviour.

Table 18: Flow rate

Size	Temperature range (t)	Minimum flow rate	Maximum flow rate
32	-10 to +100 °C	≈ 15 % of Q_{opt} [8)]	See hydraulic characteristic curves and data sheet
50	> 100 to +140 °C	≈ 20 % of Q_{opt} [8)]	
65	> 140 to +200 °C	≈ 25 % of Q_{opt} [8)]	
100	Independent of temperature	≈ 35 % of Q_{opt} [8)]	
125			
150			
200			
250			

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8 Best efficiency point

In addition, a temporary minimum flow of 25 % of Q has been defined for sizes 100, 125, 150, 200 and 250_{opt}[8)] . This temporary flow shall be limited to one hour's uninterrupted operation and approx. 200 hours/year.

The calculation formula below can be used to check if an additional heat build-up could lead to a dangerous temperature increase at the pump surface.

$T_O = T_f + \Delta\vartheta$

$$\Delta\vartheta = \frac{g \times H}{c \times \eta} \times (1 - \eta)$$

Table 19: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Acceleration due to gravity	m/s^2
H	Pump discharge head	m
T_f	Fluid temperature	°C
T_O	Temperature at the casing surface	°C
η	Pump efficiency at duty point	-
$\Delta\vartheta$	Temperature difference	K

6.2.3.2 Density of the fluid handled

The power input of the pump set will change in proportion to the density of the fluid handled.

CAUTION

Impermissibly high density of the fluid handled

Motor overload!

- Observe the information about fluid density in the data sheet.
- Make sure the motor has sufficient power reserves.

6.2.3.3 Abrasive fluids

Do not exceed the maximum permissible solids content specified in the data sheet. When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system and shaft seal are to be expected. In this case, reduce the commonly recommended inspection intervals.

The pump set must not be used for mixing products added for fluid treatment. If such products are to be added, this has to be done at a distance of at least 5 m from the suction flange to ensure complete mixing. If applicable, check if the pump material is suitable for the intended use. KSB must be contacted in this case.

6.2.4 Speed

The minimum speed is 900 rpm. This speed must be reached within 5 seconds during start-up, depending on the power rating. The maximum speed depends on the materials and pump sizes.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

Multitec:

✓ Sufficient fluid is supplied for the functional check run of the pump.

1. During prolonged shutdown periods, start up the pump (set) regularly once a month for approximately five minutes.
   This will prevent the formation of deposits within the pump and the pump intake area.

NOTE

Prolonged shutdown periods should be avoided in the case of pumps in material variants 10, 13, 17, 20, 21, 27 and 28 (cast-iron hydraulics), particularly if the pumps are handling aggressive water qualities (high oxygen content). In such cases, the pump should remain filled, and the functional check run should be performed at least every other day.

NOTE

The stage casings of horizontal pumps can only be drained completely through the drain plugs provided on the stage casings (optional). If this is not possible we recommend proceeding as described in the following section.

Multitec-RO:

✓ Sufficient fluid is supplied for the functional check run of the pump.

1. The pump is filled with a fluid handled containing salt:
   Max. shutdown period: 48 hours.
   After this time the pump must be operated for at least 30 minutes.
   We recommend flushing the pump with a fluid which does not contain salt.
2. The pump is not filled with a fluid handled containing salt:
   No further preservation or other measures required.
   It is necessary to operate the pump for a short period or to turn the rotor every 30 days.

The pump (set) is removed from the pipe and stored

✓ The pump has been properly drained (⇨ Section 7.3, Page 62) and the safety instructions for dismantling the pump have been observed.
(⇨ Section 7.4.1, Page 63)

1. Fill the pump with a water-repellent preservative (e.g. RUSTELO DEWATERING 924 made by CASTROL, OSYRIS DW made by TOTAL, or equivalent).
2. Turn the pump rotor by hand several times to ensure even distribution of the preservative.

CAUTION

Glycol-base preservatives (e.g. KLÜBERTOP K 01-601)

Corrosion damage on surfaces not treated with preservative

- ▹ Do not drain the preservative if the pump is stored for a longer period.
- ▹ Completely fill the pump with preservative for storage.
- ▹ Do not drain the preservative until immediately before the pump is returned to service.
  (The preservative can be re-used if water content < 20%.)

3. Drain the pump and close the suction and discharge nozzle.

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4. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil or grease) to protect them against corrosion.
   Observe any additional instructions and information provided.
   (⇨ Section 3.3, Page 15)
5. Turn the pump shaft by hand once a month to avoid damage to the bearings. If this is not possible, replace the bearings prior to returning the pump into service.

6.4 Returning to service

For returning the equipment to service observe the sections on commissioning/start-up and the operating limits. (⇨ Section 6.1, Page 40) (⇨ Section 6.2, Page 49)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 54)

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

- ▹ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.

NOTE

If the equipment has been out of service for more than one year, replace all elastomer seals.

7 Servicing/Maintenance

7.1 Safety regulations

⚠ DANGER

Improper cleaning of coated pump surfaces

Explosion hazard by electrostatic discharge!

- ▷ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.

⚠ DANGER

Sparks produced during servicing work

Explosion hazard!

- ▷ Observe the safety regulations in force at the place of installation!
- ▷ Always perform maintenance work at an explosion-proof pump (set) outside of potentially explosive atmospheres.

⚠ DANGER

Improperly serviced pump set

Explosion hazard!

Damage to the pump set!

- ▷ Service the pump set regularly.
- ▷ Prepare a maintenance schedule with special emphasis on lubricants, shaft seal and coupling.

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

- ▷ Ensure that the pump set cannot be started unintentionally.
- ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

⚠ WARNING

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Risk of injury!

- ▷ Observe all relevant laws.
- ▷ When draining the fluid take appropriate measures to protect persons and the environment.
- ▷ Decontaminate pumps which handle fluids posing a health hazard.

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⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

- ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump, pump set and pump parts with a minimum of servicing/maintenance expenditure and work.

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/Inspection

7.2.1 Supervision of operation

⚠ DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

- ▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.
- ▷ Provide sufficient inlet pressure.
- ▷ Provide an appropriate monitoring system.

⚠ DANGER

Incorrectly serviced shaft seal

Explosion hazard!

Hot, toxic fluid escaping!

Damage to the pump set!

Risk of burns!

Fire hazard!

- ▷ Regularly service the shaft seal.

⚠ DANGER

Excessive temperatures as a result of bearings running hot or defective bearing seals

Explosion hazard!

Fire hazard!

Damage to the pump set!

Risk of burns!

- ▷ Regularly check the lubricant level.
- ▷ Regularly check the rolling element bearings for running noises.

CAUTION

Increased wear due to dry running

Damage to the pump set!

- ▷ Never operate the pump set without liquid fill.
- ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.

CAUTION

Impermissibly high temperature of fluid handled

Damage to the pump!

- ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- ▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇨ Section 6.2, Page 49)

While the system is in operation, observe and check the following:

- The pump must run quietly and free from vibrations at all times.
- In case of oil lubrication, ensure the oil level is correct. (⇨ Section 6.1.2, Page 40)
- Check the shaft seal. (⇨ Section 6.1.7, Page 47)
- Check the static sealing elements for leakage.
- Check the rolling element bearings for running noises.
  Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
  To make sure that the stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.
  The bearing temperature must not exceed 90 °C (measured on the outside of the bearing bracket).
- On oil-lubricated models the bearing temperature can be measured in the oil sump. The alert limit is 100 °C. Never exceed 110 °C (pump trip).

CAUTION

Operation outside the permissible bearing temperature

Damage to the pump!

- ▷ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the bearing bracket).

NOTE

After commissioning, increased temperatures may occur at grease-lubricated rolling element bearings due to the running-in process. The final bearing temperature is only reached after a certain period of operation (up to 48 hours depending on the conditions).

Please note the following when checking the bearing temperature:

- **Manual temperature checks are not sufficient!**
- A temperature rise may also occur after replacement of the bearings or dismantling of the hydraulic system, or after lubricant change.
- If the bearing temperature exceeds 100 °C during start-up, switch off the pump and check the following:

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- Check the alignment of the pump set.
- Verify bearing type and arrangement. (⇨ Section 7.5.4, Page 86)
- Remove the rolling element bearings.
- Check the grease quantity in the rolling element bearings (grease-lubricated bearings only).
  Excessive amounts of grease will cause increased temperatures.
- After reassembly, ensure a tight press fit of the outer bearing ring via the cover (fixed bearing).

7.2.2 Inspection work

DANGER

Excessive temperatures caused by friction, impact or frictional sparks

Explosion hazard!

Fire hazard!

Damage to the pump set!

▷ Regularly check the coupling guard, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.

DANGER

Electrostatic charging due to insufficient potential equalisation

Explosion hazard!

▷ Make sure that the connection between pump and baseplate is electrically conductive.

7.2.2.1 Checking the coupling

Check the flexible elements of the coupling. Replace the relevant parts in due time if there is any sign of wear and check the alignment.

7.2.2.2 Checking the clearances

Excessive clearances will affect pump performance. Losses in efficiency and discharge head will occur.

Maximum permissible clearances

The clearances given refer to the diameter.

Table 20: Max. permissible clearances

Diameter	Clearance [mm]
Impellers 230 and 231	
Suction-side clearance	0,8
Clearance at the hub	0,8
Balance drum 59.4	0,8
Suction casing 106.1 and spacer sleeve 525.2 (installation types C and D only)	1.0 if the fluid is pumped from a vessel under vacuum conditions 2.5 for all other operating conditions

Exceptions from the above clearances for specific sizes and versions are given in the table below:

Table 21: Maximum permissible clearances for material codes 31 and 33

Size	Hydraulic system	Frequency	Number of stages with limited clearances	Clearance [mm]		
				Suction-side clearance	Clearance at the hub	Balance drum 59.4
65	5.1	50 Hz-2p	12-16	0,6	0,7	0,6
		60 Hz-2P	9-12			
	6.1	50 Hz-2p	12-13			
		60 Hz-2P	8-9			
100	7.1	50 Hz-2p	10			
		60 Hz-2P	7			
	8.1	50 Hz-2p	10			
		60 Hz-2P	6-7			

NOTE

If the maximum clearances given are exceeded, replace the affected components or restore the original clearance by means of a casing wear ring.
Contact KSB.

7.2.2.3 Cleaning filters

CAUTION

Insufficient inlet pressure due to clogged filter in the suction line

Damage to the pump!

- ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge).
- ▷ Clean filter at appropriate intervals.

7.2.2.4 Checking the bearing seals

DANGER

Excessive temperatures caused by mechanical contact

Risk of explosion!

Damage to the pump set!

- ▷ Check correct seating of axial seal rings mounted on the shaft.
  Only gentle contact of the sealing lip shall be established.

7.2.3 Lubrication and lubricant change of rolling element bearings

DANGER

Excessive temperatures as a result of bearings running hot or defective bearing seals

Explosion hazard!

Fire hazard!

Damage to the pump set!

- ▷ Regularly check the condition of the lubricant.

7.2.3.1 Oil lubrication

The rolling element bearings are usually lubricated with mineral oil.

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7.2.3.1.1 Intervals

Table 22: Oil change intervals

Temperature at the bearing	First oil change	All subsequent oil changes[9)]
Up to 70 °C	After 300 operating hours	Every 8,500 operating hours
70 °C - 80 °C	After 300 operating hours	Every 4,200 operating hours
80 °C - 90 °C	After 300 operating hours	Every 2,000 operating hours

7.2.3.1.2 Oil quality

Quality: ISO VG 46

Table 23: Oil quality

Designation	Properties	
ISO VG 46	Kinematic viscosity at 40 °C	46±4.6 mm^2/s
	Flash point (to Cleveland)	+180 °C
	Solidification point (pour point)	-12 °C
	Application temperature[10)]	Higher than permissible bearing temperature

7.2.3.1.3 Oil quantity

Table 24: Oil quantities

Size	Oil quantity (approx.)[11)] [ml]	
	Drive end	Non-drive end
32	330	330
50	500	330
65	490	510
100	880	920
125	880	920
150	1000	1040
200	1000	1040
250	940	1000

7.2.3.1.4 Changing the oil

⚠ WARNING

Lubricants posing a health hazard and/or hot lubricants

Hazard to persons and the environment!

- ▷ When draining the lubricant take appropriate measures to protect persons and the environment.
- ▷ Wear safety clothing and a protective mask if required.
- ▷ Collect and dispose of any lubricants.
- ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

9 At least once a year

10 For ambient temperatures below -10 °C use a different suitable type of lubricating oil. Contact KSB.

11 Oil quantity without oil fill in the reservoir of the constant level oiler

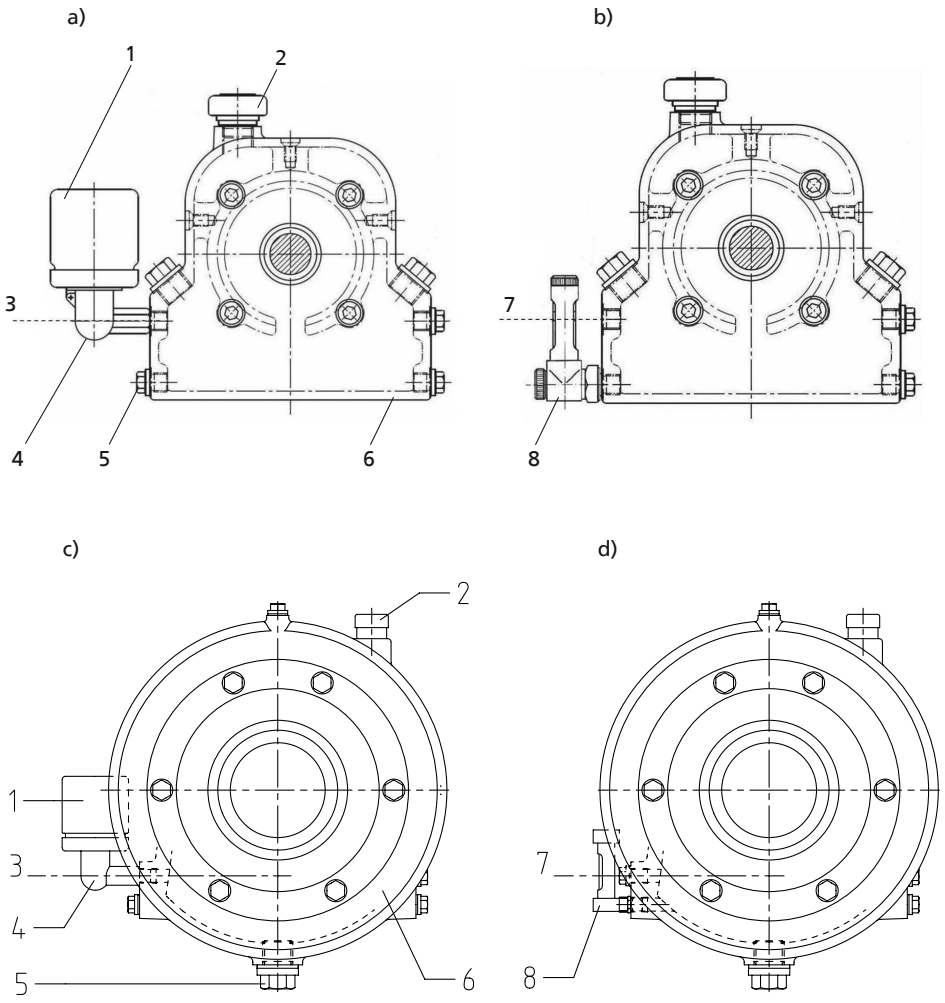

Fig. 22: a) Bearing bracket with constant level oiler – b) Bearing bracket with oil level gauge –
c) Bearing bracket with constant level oiler (size 250) – d) Bearing bracket with oil level gauge (size 250)

1	Constant level oiler	2	Vent plug
3	Oil level Constant level oiler	4	Connection elbow of the constant level oiler
5	Screw plug	6	Bearing cover
7	Oil level Oil level gauge	8	Oil level gauge

✓ A suitable container for the used oil is on hand.

1. Place the container underneath the screw plug.
2. Undo the screw plug (5) at the bearing cover (6) and drain the oil.
3. Once the bearing housing (3) has been drained, re-insert and re-tighten the screw plug (5).
4. Re-fill with oil. (⇨ Section 6.1.2, Page 40)

7.2.3.2 Grease lubrication

The bearings are supplied packed with high-quality lithium-soap grease.

7.2.3.2.1 Intervals

Depending on the pump size and rotational speed, re-lubricate the rolling element bearings or replace the grease at regular intervals.

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Exception: Bearings sealed for life (Multitec 32 and non-drive end rolling element bearings on Multitec 50 and 65)

NOTE

On some pump designs the rolling element bearings are lubricated for life. These pumps are not provided with a lubricating nipple on the bearing bracket.

Table 25: Grease change intervals

Size	Grease change interval		
	< 1800 rpm	≈ 2950 rpm	≈ 3550 rpm
32	10000 h	7200 h	5700 h
50			
65			
100	9000 h	5700 h	3900 h
125			
150	8300 h	4000 h	3100 h
200	8300 h	-	-
250	7100 h	-	-

NOTE

If re-lubrication intervals are short, we recommend that the grease be completely replaced once a year.
Otherwise, the grease fill must be replaced completely every two years. To do so, remove the rolling element bearings, clean and pack with new grease.

7.2.3.2.2 Grease quality

Optimum grease properties for rolling element bearings

Table 26: Grease quality to DIN 51825

Soap basis	NLGI grade	Worked penetration at 25° C in mm/10	Drop point
Lithium	2 to 3	220-295	≥ 175 °C

- Free of resin and acid
- Not liable to crumble
- Rust-preventive characteristics

If required, the bearings may be lubricated with greases of other soap bases. Make sure to remove any old grease and rinse the bearings thoroughly.

7.2.3.2.3 Grease quantity

Table 27: Grease quantity

Size	Quantity per bearing [g]	
	Drive end	Non-drive end
32	-	-
50	46	-
65	46	-
100	94	45
125	94	45
150	162	80

Size	Quantity per bearing [g]	
	Drive end	Non-drive end
200	162	80
250	180	90

7.2.3.2.4 Changing the grease

CAUTION

Mixing greases of differing soap bases

Changed lubricating qualities!

- ▷ Thoroughly clean the bearings.
- ▷ Adjust the re-lubrication intervals to the grease used.

✓ The pump must be dismantled for changing the grease.
(⇨ Section 7.4.4.2, Page 66)

1. Only half-fill the bearing cavities with grease.

7.3 Drainage/disposal

⚠ WARNING

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Hazard to persons and the environment!

- ▷ 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.

Vertical pumps

Remove the drain plugs in the suction casing.

Horizontal pumps

Remove the drain plugs in the stage casing (optional), suction casing (if any) and discharge casing.

Alternative:

1. Use a crane to bring the pump into a vertical position, with the suction nozzle pointing downwards.
2. Turn the rotor by hand.
3. Remove the drain plugs in the seal housing, suction casing (if any) and discharge casing.

If the pump cannot be drained completely, we recommend dismantling it and drying the individual components.

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7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

- ▹ Always have repair work and maintenance work performed by specially trained, qualified personnel.

⚠ WARNING

Hot surface

Risk of injury!

- ▹ Allow the pump set to cool down to ambient temperature.

CAUTION

Protruding plain bearing on sizes 32, 50 and 100

Damage to plain bearing when dismantling the suction line!

- ▹ When separating the suction line from the suction nozzle, make sure to shift the suction line axially away from the pump by at least 20 mm before removing it.

Observe the general safety instructions and information. (⇨ Section 7.1, Page 54)

For any work on the motor, observe the instructions of the relevant motor manufacturer.

For dismantling and reassembly observe the exploded views and the general assembly drawing. (⇨ Section 9.1, Page 99)

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- ▹ Properly shut down the pump set. (⇨ Section 6.1.8, Page 48)
- ▹ Close the shut-off elements in the suction line and discharge line.
- ▹ Drain the pump and release the pump pressure. (⇨ Section 7.3, Page 62)
- ▹ Shut off any auxiliary connections.
- ▹ Allow the pump set to cool down to ambient temperature.

NOTE

After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use a brand name penetrating agent and/or - if possible - an appropriate puller.

7.4.2 Preparing the pump set

1. Interrupt the power supply and make sure it cannot be switched on again unintentionally.
2. Disconnect and remove all auxiliary pipework.
3. Remove the coupling guard. For size 200 vertical and motor > 250 kW the cylindrical coupling guard is composed of two parts. Undo the two screws to remove the coupling guard.
4. Remove the coupling spacer if fitted.
5. Drain the oil fill of oil-lubricated bearings.

7.4.3 Removing the motor

NOTE

On pump sets with spacer-type couplings, the bearing assembly and the shaft seal can be removed while the motor remains bolted to the baseplate.

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

- ▷ Suspend or support the motor to prevent it from tipping over.

1. Disconnect the motor from the power supply.
2. Undo the fastening bolts of the motor at the baseplate or drive lantern.
3. **Installation types E, F and V, size 32-65 only:** Undo hexagon head bolt 901.5.
4. Shift or lift the motor to separate it from the pump.
5. **Installation type V, size 200 and motor size > 250 kW only:** Remove hexagon socket head cap screw 914, shim 554, coupling guard 280 and adapter 145.

7.4.4 Dismantling the bearings

7.4.4.1 Dismantling the plain bearing (non-drive end)

The plain bearing is removed without dismantling the hydraulic section of the pump.

Axial suction nozzle

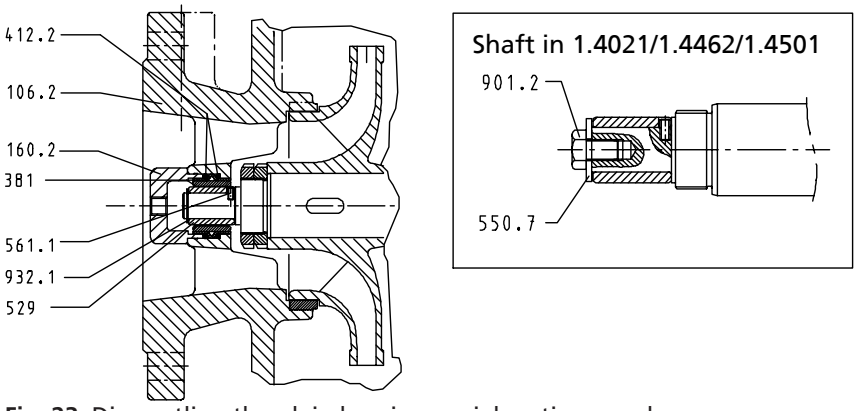

Fig. 23: Dismantling the plain bearing - axial suction nozzle

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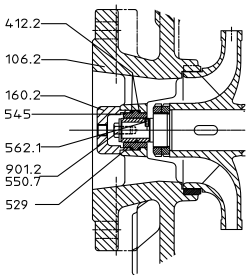

Fig. 24: Dismantling the plain bearing - axial suction nozzle

1. Pull off cover 160.2 using a forcing screw (M10 for Multitec 32 and M12 for Multitec 50-150).
2. **Shaft in C45+N**
   Remove circlip 932.1.
   Shaft in 1.4021/1.4462/1.4501
   Remove bolt 901.2 and disc 550.7.
3. Take out SiC bearing sleeve 529.
4. Pull out bearing cartridge 381 / bearing bush 545 with two O-rings 412.2.

N.B.:
Grooved pin 561.1 / parallel pin 562.1 remains in position.

Radial suction nozzle

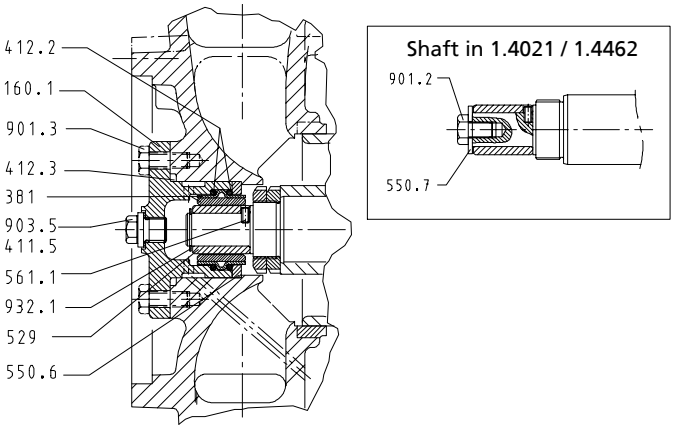

Fig. 25: Dismantling the plain bearing - radial suction nozzle

1. Undo hexagon head bolts 901.3.
2. Remove cover 160.1 with O-ring 412.3.
3. Pull out bearing cartridge 381 with both O-rings 412.2.
4. **Shaft in C45**
   Remove circlip 932.1.
   Shaft in 1.4021/1.4462
   Remove bolt 901.2 and disc 550.7.
5. Take out SiC bearing sleeve 529.
6. Take out disc 550.6.

N.B.:
Grooved pin 561.1 remains in position.

7.4.4.2 Dismantling the rolling element bearings (non-drive end)

a) b)

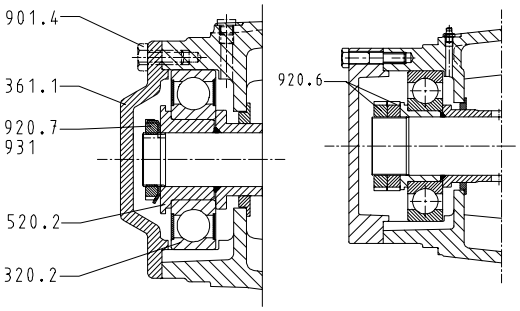

Fig. 26: Grease lubrication with lip seal: a) Multitec 32-125 and b) Multitec 150-200

a) b)

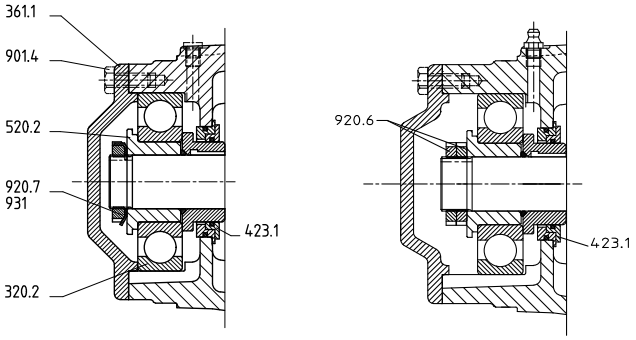

Fig. 27: Grease lubrication with labyrinth seal: a) Multitec 32-125 and b) Multitec 150-200

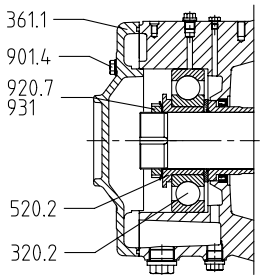

Fig. 28: Grease lubrication with lip seal: Multitec 250

a) b)

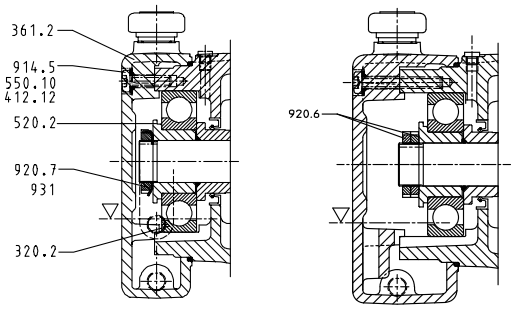

Fig. 29: Oil lubrication with lip seal: a) Multitec 32-125 and b) Multitec 150-200

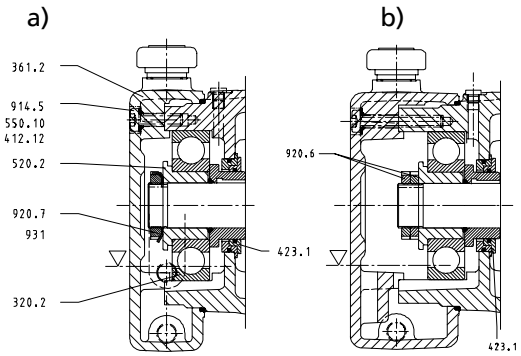

Fig. 30: Oil lubrication with labyrinth seal: a) Multitec 32-125 and b) Multitec 150-200

✓ The oil fill of oil-lubricated bearings has been drained.

1. Unscrew hexagon head bolts 901.4 or hexagon socket head cap screw 914.5.
2. Remove non-drive end bearing cover 361.1 or 361.2.
3. Undo nut 920.7 with lock washer 931 or nuts 920.6.
4. Pull out sleeve 520.2 with rolling element bearing 320.2.

7.4.4.3 Dismantling the rolling element bearings (drive end)

The drive-end rolling element bearing is removed without dismantling the plain bearing located at the opposite end of the shaft.

Removing the coupling half

The coupling half must be removed before the drive-end rolling element bearings can be dismantled.

1. Undo the grub screw in the coupling hub.
2. Pull off the coupling half.
3. Pull out key 940.3.

Preparations for dismantling the rolling element bearings

Grease lubrication

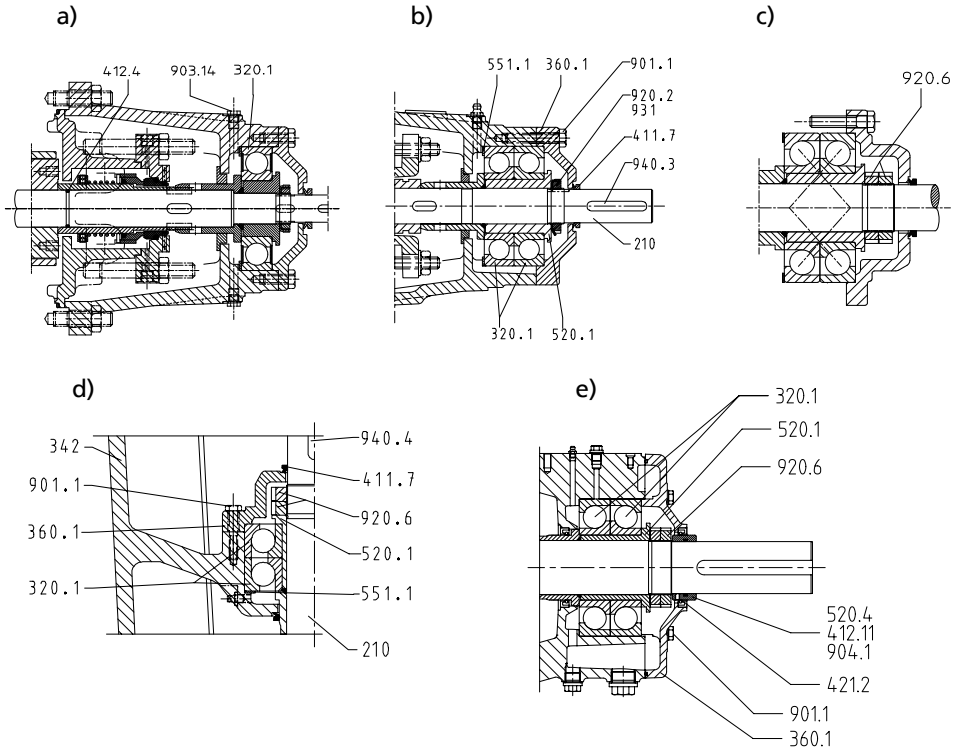

Fig. 31: Grease lubrication: a) size 32 and b) sizes 50-65 and c) sizes 100-200 and d) installation type V sizes 100-150 and e) size 250

1. Remove joint ring 411.7 (V-ring, not on size 250).
2. Undo hexagon head bolts 901.1.
3. Remove bearing cover 360.1.
   On size 250: Remove bearing cover 360.1 with shaft seal ring 421.2.
4. On size 250: Undo grub screws 904.1 and pull off sleeve 520.4.

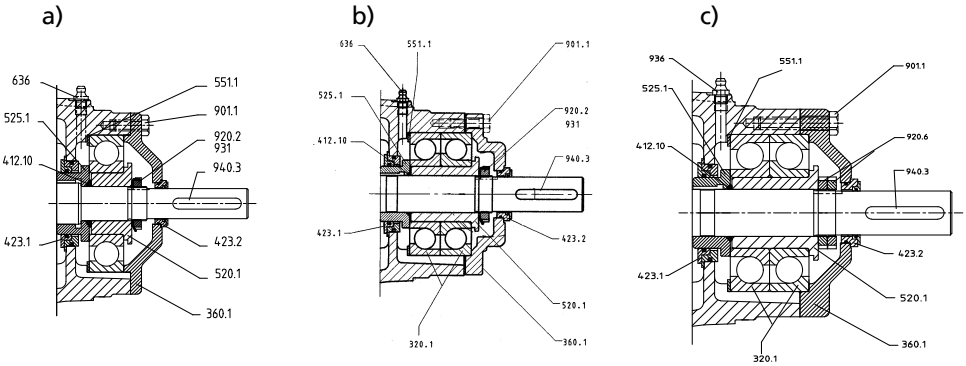

Fig. 32: Grease lubrication with labyrinth seal: a) size 32 and b) sizes 50-65 and c) size 100-200

1. Remove labyrinth ring 423.2.
2. Undo hexagon head bolt 901.1.
3. Remove bearing cover 360.1.

Oil lubrication with lip seal

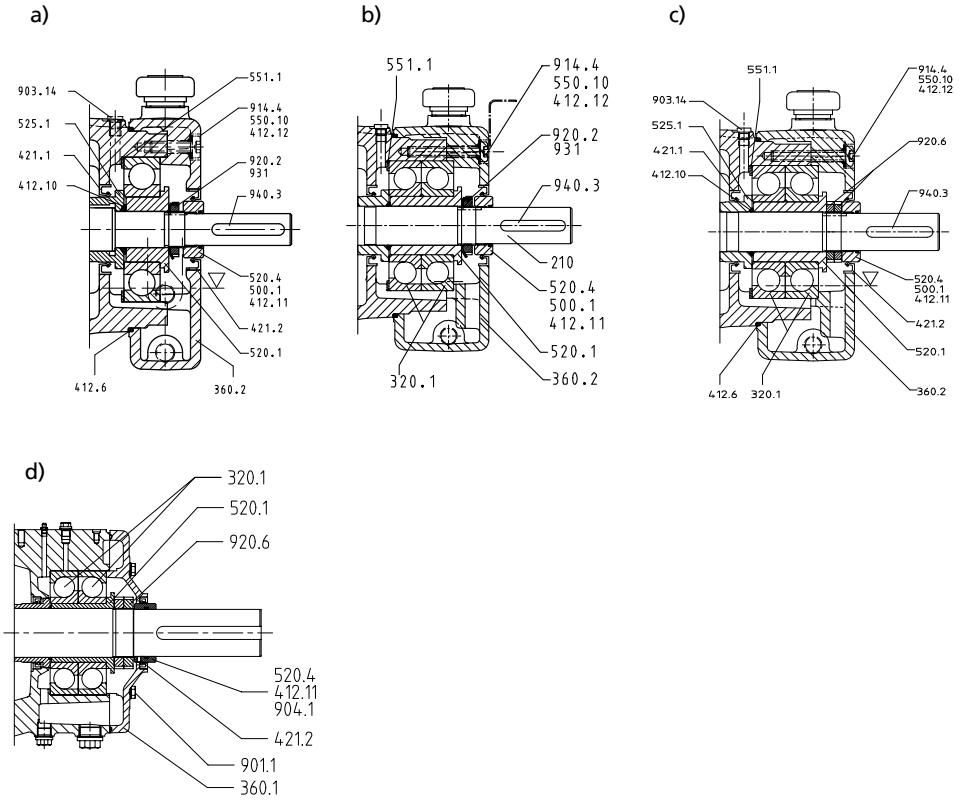

Fig. 33: Oil lubrication with lip seal: a) size 32 and b) sizes 50-65 and c) sizes 100-200 and d) size 250

✓ The oil fill of oil-lubricated bearings has been drained.

1. Undo hexagon socket head cap screws 914.4 and remove together with disc 550.10 and O-ring 412.12, or remove hexagon head bolts 901.1 with joint ring 411.26.
2. Remove bearing cover 360.2.
3. Pull off sleeve 520.4 with ring 500.1 (tolerance ring) and O-ring 412.11.
   On size 250: Undo grub screws 904.1. Pull off sleeve 520.4 with O-ring 412.11.

Oil lubrication with labyrinth seal

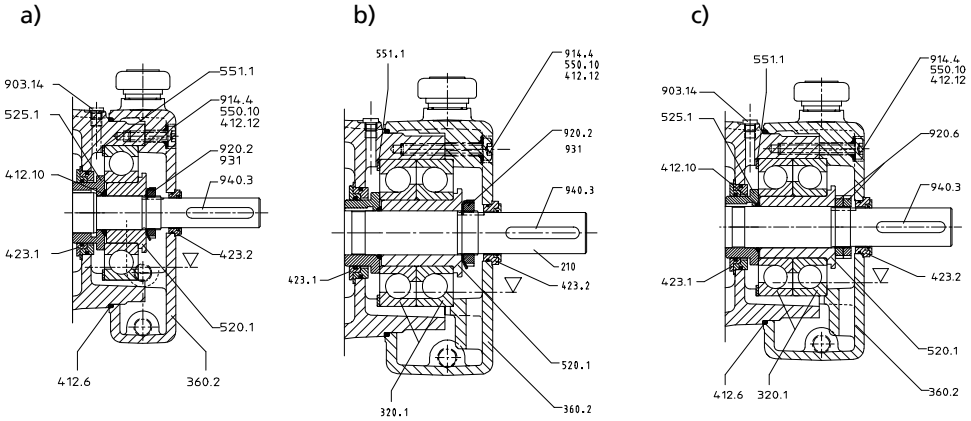

Fig. 34: Oil lubrication with labyrinth seal: a) size 32 and b) size 50-65 and c) size 100-200

✓ Oil fill of oil-lubricated bearings drained

1. Pull out labyrinth ring 423.2.
2. Undo socket head cap screws 914.4 and pull out together with disc 550.10 and O-ring 412.12.
3. Remove bearing cover 360.2.

Removing the rolling element bearings

	**NOTE** When removing slotted round nut 920.6, mark all relevant positions such as the sequence and the orientation of the contact face to ensure identical reassembly.

1. Undo nut 920.2 with lock washer 931 or nuts 920.6. Hold shaft 210 in position during this step.
2. Pull off sleeve 520.1 with rolling element bearing(s) 320.1.
   The shaft is centred in the sleeve without locking device.

	**CAUTION** **Incorrect axial adjustment of rotor** ▷ After bearing or seal replacement, fit the same spacer discs on the bearing side. ▷ Always reproduce the original rotor adjustment.

3. Remove spacer disc 551.1 (not fitted on size 250).

	**NOTE** Sizes 32, 50, 65 in installation types V, E, F do not have a fixed bearing as this function is taken over by the motor bearings. On sizes 100, 125 and 150 in installation type V, the fixed bearing is located in thrust bearing lantern 342. Dismantle and reassemble in analogy with the horizontal installation types.

7.4.5 Removing the shaft seal

7.4.5.1 Removing the mechanical seal

7.4.5.1.1 Removing the standard mechanical seal

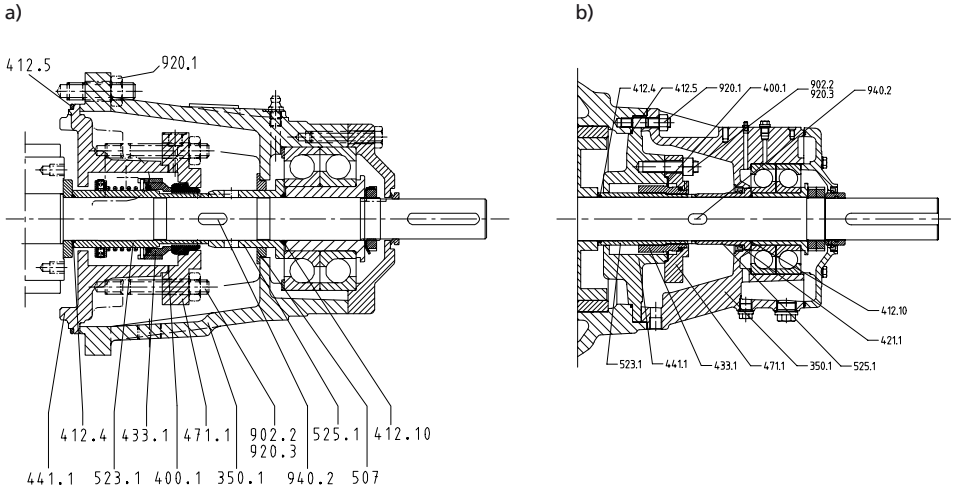

Fig. 35: Removing the mechanical seal: a) sizes 32-200 and b) size 250

✓ The pump has been drained.

✓ The bearings have been removed. (⇨ Section 7.4.4.3, Page 67)

1. Remove the contact guards from the openings in bearing housing 350.1.
2. Remove O-ring 412.10.
3. Pull off spacer sleeve 525.1.
4. Remove the circulation line (depending on the model).
5. Loosen nut 920.3 on seal cover 471 until the spring of the mechanical seal is relaxed.
6. Undo nut 920.1 and remove bearing housing 350.1 with the associated sealing element.
7. Remove seal cover 471.1 with the stationary ring and gasket 400.1.
8. Remove key 940.2.
9. Pull off shaft sleeve 523.1 with the rotating components of mechanical seal 433.1 or 523.2 with 433.2 (depending on seal code).
   Two holes are provided in the shaft sleeve for engaging a puller.
10. Take off seal housing 441.1 with O-ring 412.5 and two studs 902.2.
11. Remove O-ring 412.4.

7.4.5.1.2 Removing an air-cooled mechanical seal (seal code 64)

Application range

Operating temperature:	140-200 °C
Sizes:	Multitec 32 to 100

The pump must only be coupled to a motor with IP 55 enclosure.

Additional dismantling steps for installation types C and D

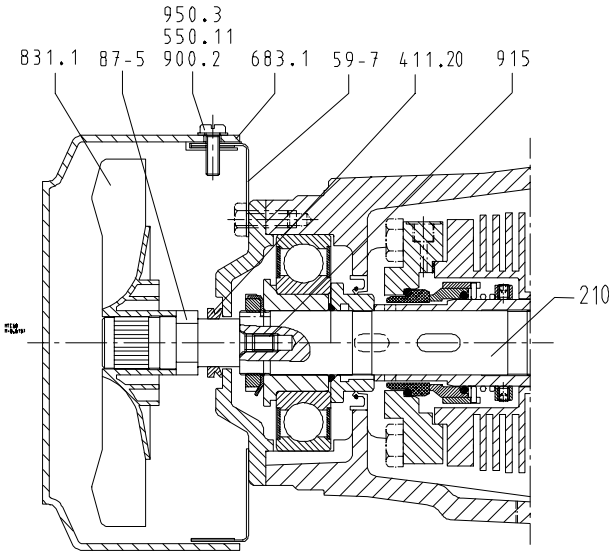

Fig. 36: Removing an air-cooled mechanical seal - additional dismantling steps

Installation types C and D

1. Undo screw 900.2 and remove hood 683.1.
2. Undo axis 87-5 with fan impeller 831.1.
   Threaded insert 915 remains in shaft 210.
3. Remove support 59-7.

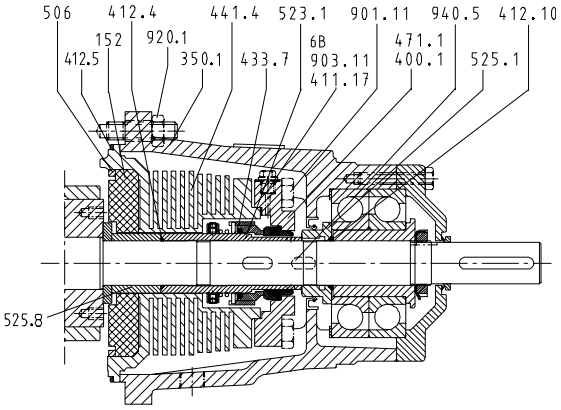

Fig. 37: Removing an air-cooled mechanical seal

Dismantling sequence for mechanical seal

✓ The pump has been drained.

✓ The bearings have been removed. (⇨ Section 7.4.4.3, Page 67)

1. Remove O-ring 412.10.
2. Pull off spacer sleeve 525.1.
3. Undo hexagon head bolt 901.11.
4. Undo nut 920.1 and remove bearing housing 350.1 with the associated sealing element.
5. Remove seal cover 471.1 with the stationary ring and gasket 400.1.
6. Remove key 940.5.
7. Pull shaft sleeve 523.1 with the rotating components of mechanical seal 433.7 off the shaft.
   Two holes are provided in the shaft sleeve for engaging a puller.
8. Take off seal housing 441.4 with heat barrier 152, O-ring 412.5 and two studs 902.2.
9. Remove O-ring 412.4.
10. Remove spacer sleeve 525.8.

7.4.5.1.3 Removing a water-cooled mechanical seal (seal code 64)

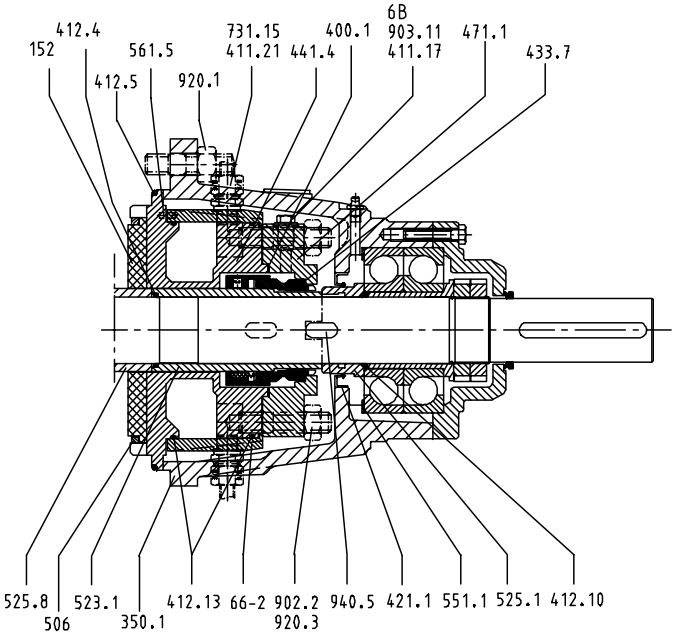

Fig. 38: Removing a water-cooled mechanical seal

Application range

Operating temperature:	140-200 °C
Sizes:	Multitec 125 to 150 (optional for Multitec sizes 32 to 100)

✓ The pump has been drained.

✓ The cooling chamber has been drained.

✓ The bearings have been removed. (⇨ Section 7.4.4.3, Page 67)

1. Undo pipe union 731.15 and dismantle the cooling lines.
2. Remove O-ring 412.10.
3. Pull off spacer sleeve 525.1.
4. Undo nut 920.3 on seal cover 471.
5. Undo nut 920.1 and remove bearing housing 350.1 with the associated sealing element.
6. Remove seal cover 471.1 with the stationary ring and gasket 400.1.
7. Remove key 940.5.
8. Pull shaft sleeve 523.1 with the rotating components of mechanical seal 433.7 off the shaft.
   Two holes are provided in the shaft sleeve for engaging a puller.
9. Take off cooling jacket 66-2.
10. Take off seal housing 441.4 with heat barrier 152, O-ring 412.5 and two studs 902.2.
11. Remove O-ring 412.4.
12. Remove spacer sleeve 525.8.

7.4.5.1.4 Removing a cartridge seal

Cartridge seals are fitted in the seal arrangements specified by the customer. There is a wide variety of variants, types and brands. Please refer to the general assembly drawing and the product literature supplied with the pump when dismantling these mechanical seal variants. If in doubt please contact the manufacturer.

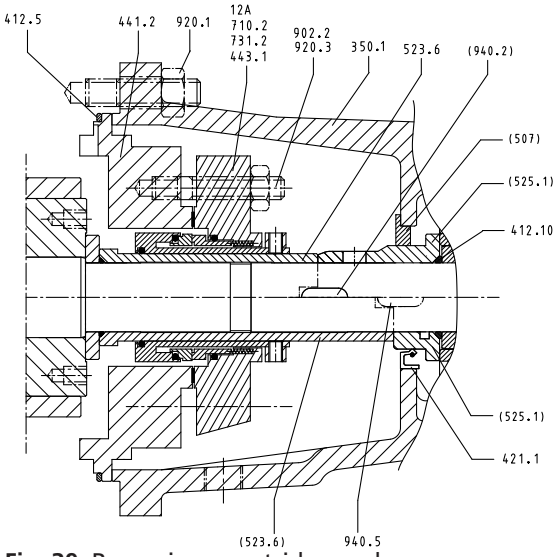

Fig. 39: Removing a cartridge seal

The general procedure is as follows:

✓ The pump has been drained.

✓ The bearings have been removed. (⇨ Section 7.4.4.3, Page 67)

1. Remove the contact guards from the openings in bearing housing 350.1.
2. Remove O-ring 412.10.
3. Pull off spacer sleeve 525.1.
4. Dismantle any auxiliary piping (circulation, etc., depending on model).
5. Undo nuts 920.3 at the cartridge.
6. Undo nut 920.1 and remove bearing housing 350.1 with the associated sealing element.
7. Take off cartridge 443.1 and gasket 400.1.
8. Remove circlips 940.2 / 940.5.
9. Pull off shaft sleeve 523.6.
   Two holes are provided in the shaft sleeve for engaging a puller.
10. Take off seal housing 441.2 with O-ring 412.5 and two studs 902.2.
11. Remove O-ring 412.4.

7.4.5.1.5 Removing a double mechanical seal

Mechanical seals in tandem or back-to-back arrangement are fitted as per customer specifications. There is a wide variety of variants, types and brands. Please refer to the general assembly drawing and the product literature supplied with the pump when dismantling these mechanical seal variants. If in doubt please contact the manufacturer.

The general procedure is as follows:

Back-to-back arrangement

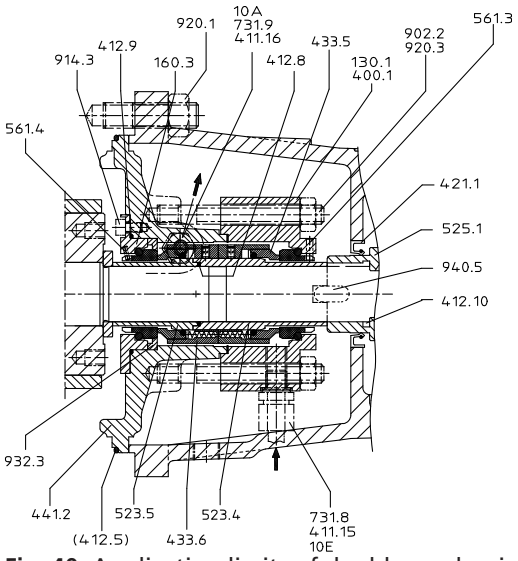

Fig. 40: Application limits of double mechanical seal in back-to-back arrangement

✓ The pump has been drained.

✓ The bearings have been removed. (⇨ Section 7.4.4.3, Page 67)

1. Remove the contact guards from the openings in bearing housing 350.1.
2. Remove O-ring 412.10.
3. Pull off spacer sleeve 525.1.
4. Dismantle the auxiliary piping (of thermosyphon system).
5. Undo pipe unions 731.8 and 731.9.
6. Loosen nuts 920.3 on seal cover 130.1 until the spring of the mechanical seal is relaxed.
7. Undo nut 920.1 and remove bearing housing 350.1 with the associated sealing element.
8. Take off seal cover 130.1 with gasket 400.1 and remove mating ring of second mechanical seal 433.5.
9. Remove key 940.5.
10. Pull off shaft sleeve 523.4 with the primary ring of second mechanical seal 433.5 and with the torque-transmitting element of mechanical seal 433.6.
11. Remove O-ring 412.8 (on Multitec 32: O-ring 412.4).
12. Pull off shaft sleeve 523.5 (on Multitec 32: shaft sleeve 523.4) with primary ring of first mechanical seal 433.6.
13. Take off seal housing 441.2 with O-ring 412.5, mating ring of first mechanical seal 433.6 and two studs 902.2.
14. Remove O-ring 412.4.

Tandem or quench design

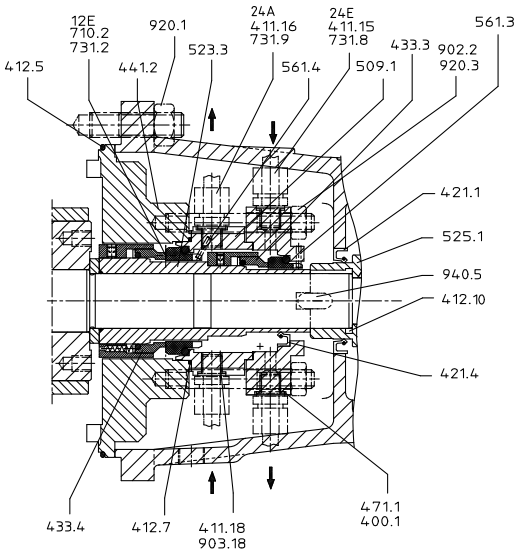

Fig. 41: Removing a mechanical seal in tandem or quench design

✓ The pump has been drained.

✓ The bearings have been removed. (⇨ Section 7.4.4.3, Page 67)

1. Remove the contact guards from the openings in bearing housing 350.1.
2. Remove O-ring 412.10.
3. Pull off spacer sleeve 525.1.
4. Dismantle any auxiliary piping (circulation, etc., depending on model).
5. Remove pipe unions 731.8 and 731.9.
6. Loosen nuts 920.3 on seal cover 130.1 until the spring of the mechanical seal is relaxed.
7. Undo nut 920.1 and remove bearing housing 350.1 with the associated sealing element.
8. Take off seal cover 130.1 with gasket 400.1 and the stationary ring of second mechanical seal 433.3 (tandem arrangement) or lip seal 421.4 (seals with quench supply).
9. Remove key 940.5.
10. Remove screw plug 903.18.
11. Unscrew the grub screw of the rotating components of second mechanical seal 433.5 through the opening of the intermediate rings (except on models with quench supply). Rotate the shaft until the grub screw can be accessed, if necessary.
12. Remove the rotating components of second mechanical seal 433.3 (except on models with quench supply).
13. Remove intermediate ring 509.1 and O-ring 412.7.
14. Remove the stationary ring of first mechanical seal 433.4.
15. Pull shaft sleeve 523.3 with the rotating components of first mechanical seal 433.4 off the shaft.
16. Take off seal housing 441.2 with O-ring 412.5 and two studs 902.2.
17. Remove O-ring 412.4.

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7.4.5.2 Dismantling the gland packing

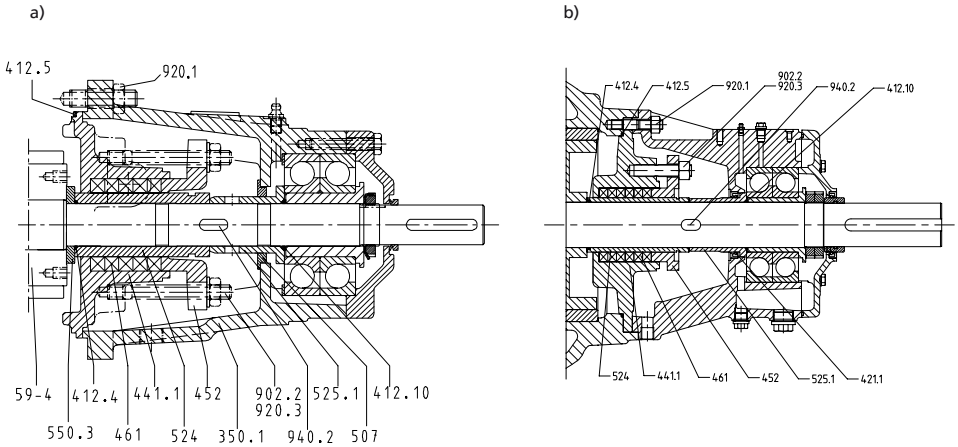

Fig. 42: Removing the gland packing: a) sizes 32-200 and b) size 250

Removing the packing rings

The packing rings can be removed without dismantling the bearing section.

✓ Remove the contact guards from the openings in bearing housing 350.1.

1. Unscrew nuts 920.3.
2. Pull gland follower 452 out of seal housing 441.1.
3. If applicable, remove the barrier fluid line.
4. Remove packing rings 461 and lantern ring (if any).

Dismantling the seal housing

✓ The bearings have been removed. (⇨ Section 7.4.4.3, Page 67)

✓ The packing rings 461 have been removed.

1. Remove O-ring 412.10.
2. Pull off spacer sleeve 525.1.
3. Undo nut 920.1. Remove bearing housing 350.1 with the associated sealing element.
4. Pull out seal housing 441.1 with gland follower 452.
5. Remove key 940.2.
6. Use a puller to remove shaft protecting sleeve 524. Use the groove provided in the shaft protecting sleeve for this purpose.
7. Remove O-ring 412.4.

Please note:

If shaft protecting sleeve 524 is hard to remove, balance drum 59-4 (if fitted) can be used for leverage.

1. The puller can be engaged in the threaded holes provided in the balance drum.
2. Pull out balance drum 59-4, disc 550.3 and shaft protecting sleeve 524.

7.4.6 Dismantling the hydraulic system

Removing the discharge casing

✓ Rolling element bearings 320.1 have been removed.

✓ The shaft seal has been removed.

✓ The hydraulic system is in a vertical position (if possible).

1. Only with installation types A and B: Remove the plain bearing. (⇨ Section 7.4.4.1, Page 64)
2. Place the pump in a vertical position, with the bare shaft end pointing upwards.

3. Support the opposite pump end (suction side).
4. Start dismantling from the top (discharge side).
5. Number and match-mark the casing faces to ensure identical reassembly.
6. Remove balancing line (pipe) 710.1 (if fitted).
7. Attach discharge casing 107 to lifting equipment to hold it safely in position.
8. Undo the four or eight tie bolts 905.
9. Lift discharge casing 107 slightly and separate it by gently tapping the last stage of the suction casing with a mallet.
10. Pull off discharge casing 107.
11. Remove balance drum 59-4 (or spacer sleeve 525.4) and disc 550.3 (not fitted on size 250).
12. Remove key 420.2.
13. Pull off impeller 230.3 or 230.1 and remove the respective key.
14. Remove and dispose of O-ring 412.1.

Dismantling the individual stages

Removing the stage casings

1. Remove disc 550.1 (not fitted on sizes 125-250).
2. Pull off stage casing 108.1 and (integrated or separate) diffuser 171.1.
   Use the raised areas at the outside diameter or the groove provided for this purpose. If necessary, separate them by tapping gently.
3. Pull off impeller 230.1 and remove the respective key.
4. Remove and dispose of O-ring 412.1.
5. Hold the shaft in a vertical position if possible.
6. Repeat steps 1-5 up to suction impeller 231.

NOTE! Versions A, B, C and D in material variants 22, 23, 30, 31 and 33 with sizes 32-150 are equipped with an intermediate bearing in the middle stage. Please refer to the table below for the pump sizes and number of stages concerned:

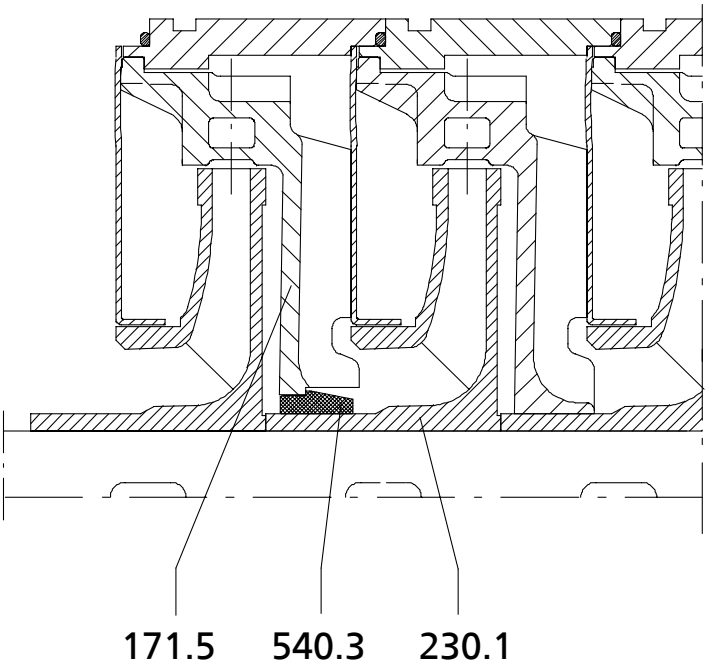

Fig. 43: Bush (intermediate bearing)

171.5	Diffuser (intermediate bearing)	230.1	Impeller
540.3	Bush (intermediate bearing)		

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Table 28: Sizes and number of stages with intermediate bearing

Size	Number of stages
32	8
50	7
65	6
100	6
125	5
150	6

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

- ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

CAUTION

Improper reassembly

Damage to the pump!

- ▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.
- ▷ Use original spare parts only.

CAUTION

Elastomers in contact with oil/grease

Shaft seal failure!

- ▷ Use water as assembly lubricant.
- ▷ Never use oil or grease as assembly lubricant.

Sequence

Always reassemble the pump in accordance with the corresponding general assembly drawing.

Replace any damaged components by original spare parts.

Sealing elements

- **Gaskets**
  - Always use new gaskets, making sure that they have the same thickness as the old ones.
  - Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).
- **O-rings**
  - Never use O-rings that have been made by cutting an O-ring cord to size and gluing the ends together.
  - Always use new O-rings.
- **Assembly adhesives**
  - For gaskets, avoid the use of assembly adhesives, if possible.
  - If assembly adhesives are required, use a commercially available contact adhesive (e.g. "Pattex").
  - Only apply adhesive at selected points and in thin layers.
  - Never use quick-setting adhesives (cyanoacrylate adhesives).

– Coat the locating surfaces of the individual components and screwed connections with graphite or similar before reassembly.

Tightening torques

For reassembly, tighten all screws and bolts as specified in this manual.
(⇨ Section 7.6, Page 91)

7.5.2 Reassembly of hydraulic system

- ✓ Start reassembly from the suction end.
- ✓ Reassemble the pump in a vertical position if possible.
- ✓ The clearance between the last impeller 230.1 or 230.3 and balance drum 59-4 (or spacer sleeve 525.4) is between 0.7 and 1.2 mm. On size 200 the clearance is between 1.3 and 2.9 mm, and on size 250 it is between 1.7 and 2.6 mm.
- ✓ Use assembling aids for components made of stainless steel (impellers, drum). Verify suitability for drinking water applications.
- ✓ Assembly consisting of suction casing 106.1 or 106.2 with casing wear ring 502.1 and foot (if any) is on hand.
- ✓ **Installation types A, B, V:**
  The assembly consisting of shaft 210, grooved pin 561.1 or parallel pin 562.1 and shaft nuts 920.5 has been installed.
- ✓ **Installation types C, D:**
  The assembly consisting of shaft 210 and spacer sleeve 525.2 is on hand.

1. Fit key 940.1 and suction impeller 231 on the shaft.
2. Fit shaft/suction impeller assembly into suction casing 106.1 or 106.2.
3. Fit key 940.1.
4. Mount stage casing 108.1 with (integrated or separate) diffuser 171.1 and O-ring 412.1 on the shaft.
   On sizes 125-250: casing wear rings in stage casings
   On sizes 200-250: casing wear rings in diffusers
5. Fit disc 550.1 (not fitted on sizes 125-250).
6. Fit stage impeller 230.1 on the shaft.
7. Repeat steps 3-6 up to the last impeller.
8. If an intermediate bearing 540.3 is fitted, the intermediate bearing is located in diffuser 171.1. Make sure to re-install the stages in the correct order as indicated by the stage numbers applied during dismantling.
   On the 9.2, 10.2, 11.1, 12.1, 13.1, 14.1 and 15.2 hydraulic systems, impeller 230.3 is the last impeller.
9. Fit key 940.2, balance drum 59-4 (or spacer sleeve 525.4) and disc 550.3 on the shaft.
10. Fit discharge casing 107 (with O-ring 412.1, foot (if any), drum bush 540.1 (if any) and four studs 902.1).
11. Insert tie bolts 905 with discs 550.4 and nuts 920.4.
12. Slightly tighten tie bolts 905.
13. Move the pump into a horizontal position, setting the pump feet down on a level surface (e.g. workbench).
14. Tighten tie bolts 905 in two steps.
    First step: tighten to 50 % of tightening torque, second step: tighten to 100 % of tightening torque. (⇨ Section 7.6.1, Page 91)
    Observe the tightening sequence given.
15. Connect balancing line 710.1 (if a balance drum is fitted).

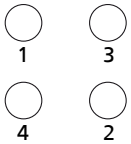

Fig. 44: Sizes 32-150:
Tie bolts – tightening sequence

7.5.3 Fitting the shaft seal

7.5.3.1 Installing the mechanical seal

For drawings and part numbers refer to the section on the mechanical seal.

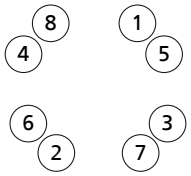

Fig. 45: Sizes 200-250: Tie bolts – tightening sequence

On horizontal, long-coupled (baseplate mounted) pump sets (installation types C and D), the correct direction of rotation must be observed for mechanical seals with uni-directional springs.

Installing the mechanical seal

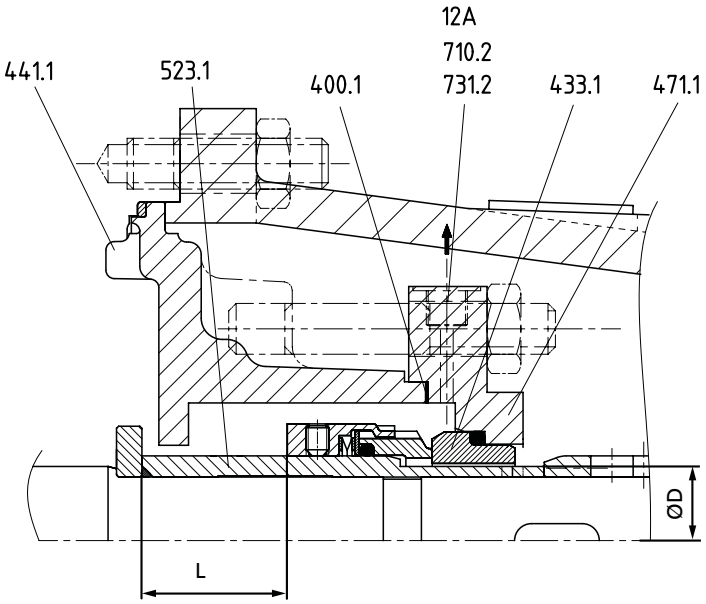

Fig. 46: Adjusting dimension L for mechanical seal

Table 29: Adjusting dimension L for mechanical seals H7N (seal codes 55, 63, 64, 67, 68, 81), 57B (seal codes 42, 43, 45) and 5B (seal codes 155, 163, 164, 167, 168, 181)

Size	Diameter D Mechanical seal [mm]	Adjusting dimension L [mm]
32	35	31
50	35	31
65	40	43,5
100	50	51,5
125	60	58
150	70	70,5
200	70	70,5
250	85	70,5

NOTE

Pumps with seal codes 55, 62, 63, 67 and 68 ordered before 28 February 2011 may be equipped with different mechanical seal types (H12N and H17GN) requiring other adjusting dimensions.
Contact KSB to identify the seal type installed and the adjusting dimensions to be complied with.

For other mechanical seal types contact KSB.

NOTE

Mechanical seals with other seal codes are installed without adjusting dimensions.

The following rules must be observed when installing the mechanical seal:

- For installing the mechanical seal, proceed as shown in the seal installation drawing.
- Work cleanly and accurately.
- Only remove the protective wrapping of the seal faces immediately before installation takes place.
- Prevent any damage to the seal faces or O-rings.
- After inserting the mating ring, check that it is plane-parallel in relation to the casing part.
- The surface of the shaft sleeve must be absolutely clean and smooth, and the sleeve's mounting edge must be chamfered.
- When sliding the rotating assembly onto the shaft sleeve, take appropriate steps to protect the surface of the shaft sleeve from damage.

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 79) to (⇨ Section 7.5.2, Page 80) have been observed/carried out.

✓ The bearing assembly and the individual parts of the mechanical seal are kept in a clean and level assembly area.

✓ All dismantled parts have been cleaned and checked for wear.

✓ Any damaged or worn parts have been replaced by original spare parts.

✓ The sealing surfaces have been cleaned.

1. Depending on the mechanical seal design, proceed as follows:

7.5.3.1.1 Fitting a standard mechanical seal

1. Fit O-ring 412.4 onto the shaft.
2. Fit seal housing 441.1 with O-ring 412.5 and two studs 902.2 onto the shaft.
3. Fit the rotating assembly of mechanical seal 433.1 / 433.2 onto shaft sleeve 523.1 / 523.2 (observing adjusting dimension L).
4. Slide shaft sleeve 523.1 with the pre-assembled rotating assembly of mechanical seal 433.1, or shaft sleeve 523.2 with the rotating assembly of mechanical seal 433.2 (depending on seal code), onto the shaft.
5. Fit key 940.2.
6. Carefully press the stationary ring of mechanical seal 433.1 / 433.2 into seal cover 471.1.
7. Fit seal cover 471.1 with gasket 400.1.
8. Insert nuts 920.3 and tighten.
9. Fit nut 920.1 and bearing housing 350.1 with the associated sealing element, spacer sleeve 525.1 and O-ring 412.10.
10. Connect circulation line 710.2 (depending on seal code).
11. Fit the contact guards to the openings in bearing housing 350.1.

7.5.3.1.2 Installing an air-cooled mechanical seal (seal code 64)

The pump must only be coupled to a motor with IP 55 enclosure.

1. Fit spacer sleeve 525.8 and O-ring 412.4 onto the shaft.
2. Fit seal housing 441.4 with O-ring 412.5 and heat barrier 152 on the shaft.
3. Fit the rotating assembly of mechanical seal 433.7 on shaft sleeve 523.1 (observing adjusting dimension L).
4. Slide shaft sleeve 523.1 onto the shaft.
5. Fit key 940.5.
6. Carefully press the stationary ring of mechanical seal 433.7 into seal cover 471.1.
7. Fit seal cover 471.1 with gasket 400.1.

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8. Insert hexagon head bolts 901.11 and tighten.
9. Fit nut 920.1 and bearing housing 350.1 with the associated sealing element, spacer sleeve 525.1 and O-ring 412.10.

Additional assembly steps for installation types C and D

After the bearing has been fitted, fit the fan impeller as follows:

1. Fit support 59-7 on the bearing cover.
2. Screw axis 87-5 with fan impeller 831.1 into threaded insert 915 (in shaft 210).
3. Fit hood 683.1 and tighten screws 900.2.

7.5.3.1.3 Installing a water-cooled mechanical seal (seal code 64)

1. Fit spacer sleeve 525.8 and O-ring 412.4 onto the shaft.
2. Fit seal housing 441.4 with O-ring 412.5, heat barrier 152, cooling jacket 66-2 with O-rings 412.13 and both studs 902.2 onto the shaft.
3. Fit the rotating assembly of mechanical seal 433.7 onto shaft sleeve 523.1 (observing adjusting dimension L).
4. Slide shaft sleeve 523.1 onto the shaft.
5. Fit key 940.5.
6. Carefully press the stationary ring of mechanical seal 433.7 into seal cover 471.1.
7. Fit seal cover 471.1 with gasket 400.1.
8. Insert nuts 920.3 and tighten.
9. Fit nut 920.1 and bearing housing 350.1 with the associated sealing element, spacer sleeve 525.1 and O-ring 412.10.
10. Insert pipe unions 731.15 with joint rings 411.21.
11. Connect the cooling lines again.

7.5.3.1.4 Installing a cartridge seal

Cartridge seals are fitted in the seal arrangements specified by the customer. There is a wide variety of variants, types and brands. Please refer to the general assembly drawing and the product literature supplied with the pump when installing these mechanical seal variants. If in doubt please contact the manufacturer.

The general procedure is as follows:

1. Fit O-ring 412.4 onto the shaft.
2. Fit seal housing 441.2 with O-ring 412.5 and two studs 902.2 onto the shaft.
3. Slip shaft sleeve 523.6 and cartridge seal 443.1 onto the shaft (observe the manufacturer's instructions).
4. Fit key 940.2.
5. Insert nuts 920.3 and tighten.
6. Fit nut 920.1 and bearing housing 350.1 with the associated sealing element, spacer sleeve 525.1 and O-ring 412.10.
7. Connect circulation line 710.2.
8. Fit the contact guards to the openings in bearing housing 350.1.

7.5.3.1.5 Installing a double mechanical seal

Mechanical seals in tandem or back-to-back arrangement are fitted as per customer specifications. There is a wide variety of variants, types and brands. Please refer to the general assembly drawing and the product literature supplied with the pump when installing these mechanical seal variants. If in doubt please contact the manufacturer.

The general procedure is as follows:

Back-to-back arrangement

1. Fit O-ring 412.4.
2. Fit seal housing 441.2 with O-ring 412.5, mating ring of first mechanical seal 433.6 and two studs 902.2 on the shaft.
3. Fit shaft sleeve 523.5 (on Multitec 32: shaft sleeve 523.4) with first mechanical seal 433.6 onto the shaft.
4. Fit O-ring 412.8 (on Multitec 32: O-ring 412.4).
5. Fit shaft sleeve 523.4 with the torque-transmitting element of first mechanical seal 433.6 and the primary ring of second mechanical seal 433.5 on the shaft.
6. Fit key 940.5.
7. Fit seal cover 130.1 with gasket 400.1 and mating ring of second mechanical seal 433.5.
8. Insert nuts 920.3 and tighten.
9. Fit nut 920.1 and bearing housing 350.1 with the associated sealing element, spacer sleeve 525.1 and O-ring 412.10.
10. Fit pipe unions 731.8 and 731.9 (for thermosyphon system).
11. Fit the contact guards to the openings in bearing housing 350.1.

Tandem or quench design

1. Fit O-ring 412.4 onto the shaft.
2. Fit seal housing 441.2 with O-ring 412.5 and two studs 902.2 onto the shaft.
3. Fit shaft sleeve 523.3 with the rotating assembly of the inboard mechanical seal 433.4 on the shaft.
4. Fit the stationary ring of the inboard mechanical seal 433.4 on intermediate ring 509.1.
5. Fit O-ring 412.7 and slide intermediate ring 509.1 onto seal housing 441.2.
6. Fit the rotating assembly of the outboard mechanical seal 433.3 (tandem arrangement) on shaft sleeve 523.3.
7. Tighten the grub screw of the rotating assembly of the outboard mechanical seal 433.4 through the opening of the intermediate ring (except on models with quench supply).
8. Insert and tighten screw plug 903.18.
9. Fit key 940.5.
10. Slide seal cover 130.1 with gasket 400.1 and the stationary ring of the outboard mechanical seal 433.4 (tandem arrangement) and lip seal 421.4 (seals with quench supply) onto intermediate ring 509.1.
11. Insert nuts 920.3 and tighten.
12. Fit nut 920.1 and bearing housing 350.1 with the associated sealing element, spacer sleeve 525.1 and O-ring 412.10.
13. Fit pipe unions 731.8 and 731.9 (for thermosyphon system or similar).
14. Connect circulation line 710.2.
15. Fit the contact guards to the openings in bearing housing 350.1.

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7.5.3.2 Fitting the gland packing

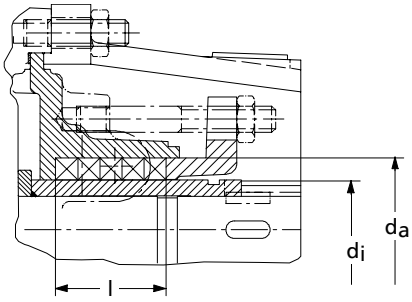

Fig. 47: Gland packing chamber

Table 30: Gland packing dimensions

Size	Gland packing chamber			Packing cross-section	Length of packing cord	Number of packing rings
	Ø d_i	Ø d_a	l			
32	45	65	50	□ 10	≈ 181	5
50	45	65	50			
65	45	65	50			
100	56	80	60	□ 12,5	≈ 223	
125	66	90	72		≈ 254	6
150	78	110	96	□ 16	≈ 306	
200	78	110	96			
250	90	122	96		≈ 346	

If the inlet pressure at the suction nozzle is below 1 bar absolute, the gland packing needs to be fitted with a lantern ring.

The barrier fluid is a clean fluid supplied from an external source.

Requirements:

- Flow rate: 1 l/min
- The barrier fluid pressure must be 0.5 bar higher than the pressure in the seal chamber.
- The barrier fluid pressure must always correspond to at least 0.1 bar relative.

Packing ring cut to size

Pure graphite packings see supplementary operating instructions.

Fig. 48: Packing ring cut to size

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 79) to (⇨ Section 7.5.2, Page 80) have been observed/carried out.

✓ The bearing assembly as well as the individual parts are kept in a clean and level assembly area.

✓ All dismantled parts have been cleaned and checked for wear.

✓ Any damaged or worn parts have been replaced by original spare parts.

✓ The sealing surfaces have been cleaned.

1. Clean the packing chamber.
2. Insert O-ring 412.4.
3. Fit shaft protecting sleeve 524 on the shaft.
4. Fit key 940.2.
5. Slide on seal housing 441.1.
6. Fit nut 920.1 and bearing housing 350.1 with the associated sealing element, spacer sleeve 525.1 and O-ring 412.10.
7. Slip the pre-stressed packing ring onto shaft protecting sleeve 524 and press it home with the help of gland follower 452.
   Insert each subsequent packing ring into the packing chamber with its joint offset by approximately 90° in relation to the previous one. Use gland follower 452 to push each packing ring separately into the packing chamber.

8. On gland packings with lantern ring (for vacuum operation), fit the lantern ring instead of the next to last packing ring. The last packing ring is located in the seal housing on the pump side.
9. Place gland follower 452 on studs 902.2. Tighten it gently and evenly with hexagon nuts 920.2, so that the packing rings are not compressed yet.
10. Use a feeler gauge to verify that gland follower 452 is fitted centred and at a right angle to the shaft.
11. Tighten gland follower 452 lightly and evenly.
    The rotor must be easy to rotate.
12. Fit the contact guards to the openings in bearing housing 350.1.

7.5.4 Fitting the bearings

NOTE

If a cylindrical coupling guard is fitted:
- Grease-lubricated bearings: The adapter is fastened to the bearing cover by means of hexagon head bolt 901.1.
- Oil-lubricated bearings: The bearing cover is fitted using socket head cap screws 914.4. The adapter is fastened to the bearing cover by three additional hexagon head bolts 901.15.

Rolling element bearing sizes

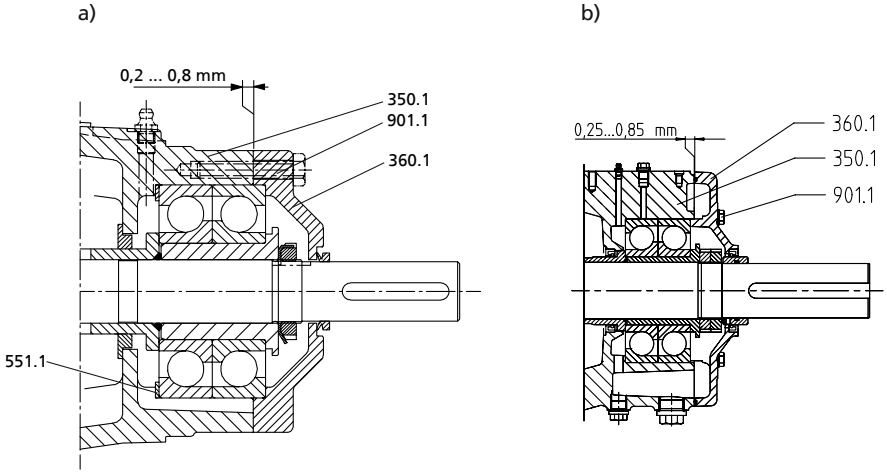

Fig. 49: Grease-lubricated bearings: a) sizes 32-200 and b) size 250

Table 31: Rolling element bearing sizes – grease-lubricated bearings

Size	Fixed bearing 320.1	Radial bearing 320.2
32	6309 ZZ C3-HT	6309 ZZ C3-HT
50	2 x 7309 BUA	6309 ZZ C3-HT
65	2 x 7309 BUA	6309 ZZ C3-HT
100	2 x 7312 BUA	6312 C3
125	2 x 7312 BUA	6312 C3
150	2 x 7315 BUA	6315 C3
200	2 x 7315 BUA	6315 C3
250	2 x 7318 BUA	6318 C3

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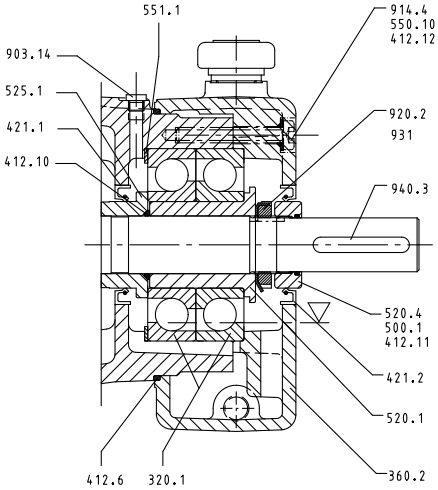

Fig. 50: Oil-lubricated bearings

Table 32: Rolling element bearing sizes – oil-lubricated bearings

Size	Fixed bearing 320.1	Radial bearing 320.2
32	6309 C3	6309 C3
50	2 x 7309 BUA	6309 C3
65	2 x 7309 BUA	6309 C3
100	2 x 7312 BUA	6312 C3
125	2 x 7312 BUA	6312 C3
150	2 x 7315 BUA	6315 C3
200	2 x 7315 BUA	6315 C3
250	2 x 7318 BUA	6318 C3

7.5.4.1 Fitting the fixed bearing

The fixed bearing is located at the drive end.
Size 32 is fitted with deep groove ball bearings. The other sizes are fitted with angular contact ball bearings in face-to-face arrangement.
Close-coupled pump sets of installation types E, F and V in sizes 32, 50 and 65 do not have a fixed bearing. (⇨ Section 7.5.4.2, Page 88)

Spacer discs 551.1 (not fitted on size 250) provide axial positioning of the rotor.

Axial position of rotor

Axial adjustment of the rotor is not required. On sizes 32 to 200 the correct axial position of the rotor is achieved by spacer discs 551.1 on the side of the bearing (or angular contact ball bearings) in bearing housing 350.1. The total thickness of the spacer sleeves is 1.6 mm. On size 250 the correct position of the rotor is achieved directly by the bearing housing.

Cover bolt tightening torque

Cover bolts 901.1 (or 914.4 on oil-lubricated bearings) must be tightened in diagonally opposite sequence to the following torques:

Table 33: Cover bolt tightening torques

Size	Tightening torque [Nm]
32/50/65	30
100/125/150/200/250	40

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 79) to (⇨ Section 7.5.3, Page 80) have been observed/carried out.

1. **Vertical close-coupled pump sets of sizes 100 to 150:**
   Fit thrust bearing lantern 342 with studs 902.1.
2. Apply grease to both sides of grease-lubricated bearings. (Not applicable to type 6309 and oil-lubricated bearings!)

3. Use a press to guide the rolling element bearings onto bearing sleeve 520.1 or 520.2 in face-to-face arrangement.
   If no press is at hand, place the rolling element bearings on a soft surface and insert the bearing sleeve into the bearing bore with a soft striking tool, taking care not to tilt the sleeve.
4. Place spacer discs 551.1 into bearing housing 350.1. (Total thickness of spacer discs = 1.6 mm). Not fitted on size 250.
5. Slide O-ring 412.10 onto the shaft.
6. Slide the pre-assembled bearing assembly into bearing housing 350.1. Lift the shaft slightly if necessary.
7. Secure the rolling element bearings with shaft nuts 920.2/.6/.7.
   On models with two shaft nuts, firmly tighten the inner shaft nut first (⇨ Section 7.6.2, Page 91) , then slightly loosen it again and lock it with the outer shaft nut.
8. Bend over lock washer 931 (if any) to engage it in the groove provided.

Final check After installation of the bearings, check the following:

Grease-lubricated bearings

✓ Hexagon head bolts 901.1 have been tightened.

1. Check the clearance between cover 360.1 and bearing housing 350.1. The cover must not rest against the bearing housing.

   The clearance shall be between 0.2 mm and 0.8 mm.
   On sizes 32 to 200 the clearance must be between 0.2 and 0.8 mm, and on size 250 it must be between 0.25 and 0.85 mm.

Oil-lubricated bearings

1. Check the clearance between cover 360.2 and bearing housing 350.1.

7.5.4.2 Completing reassembly of close-coupled pumps E, F, V, sizes 32, 50 and 65

1. Fit coupling half 861.1.
2. Tighten shaft nut 920.9. (⇨ Section 7.6.2, Page 91)
3. Bend over lockwasher 931.4 to engage it in the groove provided.
4. Fasten drive lantern 341 with studs 902.1.

7.5.4.3 Fitting the radial bearing

Radial bearing

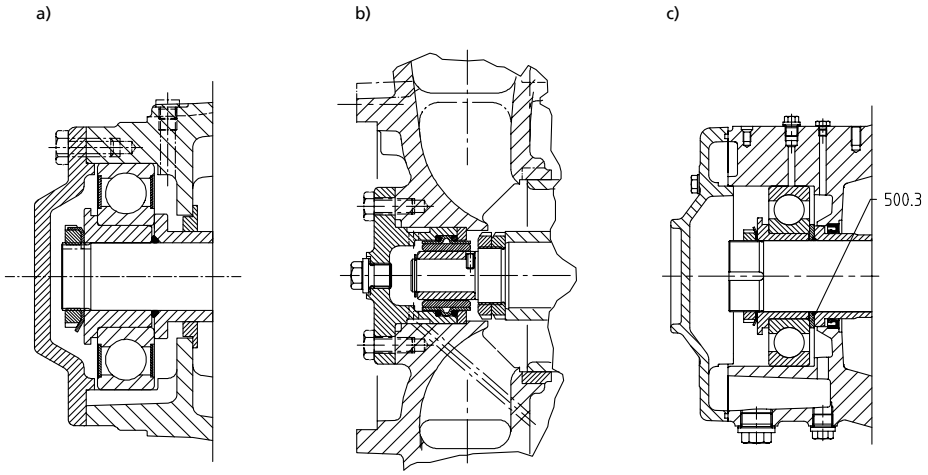

Fig. 51: a) Deep groove ball bearing as radial bearing, sizes 32-200 – b) Plain bearing as radial bearing – c) Deep groove ball bearing as radial bearing, size 250

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Installation types C and D are fitted with a deep groove ball bearing as radial bearing (a) or (c). On all other installation types a plain bearing made of silicon carbide is fitted in the suction casing (b).
The outer ring of the deep groove ball bearing must have axial play. The bearing is installed without spacer discs 551.1.

7.5.4.3.1 Fitting the plain bearing (non-drive end)

Axial suction nozzle

✓ Grooved pin 561.1 or parallel pin 562.1 have been fitted.

1. Fit bearing cartridge 381 or bearing bush 545 with both O-rings 412.2.
2. Slide SiC bearing sleeve 529 onto the shaft.
3. **Shaft in C45+N**
   Fit circlip 932.1.
   Shaft in 1.4021/1.4462/1.4501
   Screw disc 550.7 and bolt 901.2 into the shaft.
4. Fit cover 160.2 by lightly tapping it with a rubber mallet.

Radial suction nozzle

✓ Grooved pin 561.1 or parallel pin 562.1 have been fitted.

1. Insert disc 550.6.
2. Slide SiC bearing sleeve 529 onto the shaft.
3. **Shaft in C45+N**
   Fit circlip 932.1.
   Shaft in 1.4021/1.4462/1.4501
   Screw disc 550.7 and bolt 901.2 into the shaft.
4. Fit bearing cartridge 381 with both O-rings 412.2.
5. Remove cover 160.1 with O-ring 412.3.
6. Tighten hexagon head bolts 901.3.

7.5.4.3.2 Fitting the rolling element bearing (non-drive end)

1. On size 250, insert ring 550.3.
2. Apply grease to grease-lubricated bearings.
   (Not applicable to type 6309 and oil-lubricated bearings!)
3. Use a press to guide the rolling element bearings onto bearing sleeve 520.2. If no press is at hand, place the rolling element bearing on a soft surface and insert the bearing sleeve into the bearing bore with a soft striking tool, taking care not to tilt the sleeve.
4. Fasten nut 920.7 with lock washer 931 or nuts 920.6.
   Observe the tightening torque. (⇨ Section 7.6.2, Page 91)
5. Screw in non-drive end bearing cover 361.1 or 361.2.
6. Tighten hexagon head bolts 901.4 or hexagon socket head cap screw 914.5.

7.5.5 Mounting the coupling hubs

CAUTION

Improper dismantling

Damage to bearings and coupling parts!

- ▷ Remove coupling hubs using a puller.
- ▷ Never strike the coupling hubs.

Mount all coupling hubs which have not been fitted.
Make sure that the markings on all coupling components to be connected are identical.

1. Carefully clean the shaft ends and bores of the coupling hubs and check them for dimensional accuracy.
2. Slightly debur the hub keyways and insert the key.

⚠ WARNING

Hot surfaces due to heating of components for assembly/dismantling

Risk of burns!

- ▷ Wear heat-resistant protective gloves.
- ▷ Remove flammable substances from the danger zone.

3. To facilitate fitting, the coupling hubs may be heated uniformly to a temperature of 80 °C max. Elastomeric parts must be removed before heating. Elastomeric parts which have been heated must not be used any more.
4. Fit the coupling hubs until the shaft end and the hub face are in alignment. For rigid couplings of close-coupled pump sets E, F and V of sizes 32-65: Observe the adjusting dimensions for the rigid coupling. (⇨ Section 5.6.4, Page 34)

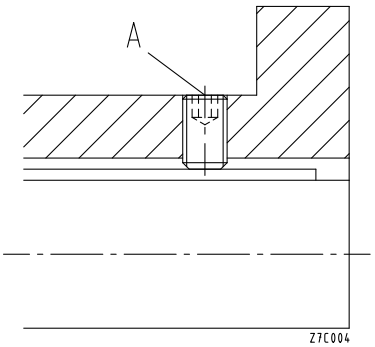

Fig. 52: Coupling hub with grub screw

A	Grub screw

5. Securely tighten the grub screws.
6. Fit the retaining ring (if applicable) on the coupling hub.

NOTE

Some models are equipped with two keys in the shafts or couplings. The two keys must be fitted as described above.

7.5.6 Mounting the motor

7.5.6.1 Mounting the motor (long-coupled pump sets)

NOTE

Steps 1 and 2 do not apply to versions with spacer-type coupling.

1. Shift the motor to connect it to the pump via the coupling.
2. Fasten the motor to the baseplate.
3. Align pump and motor.
4. Connect the motor to the power supply (refer to manufacturer's product literature).

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7.5.6.2 Mounting the motor (close-coupled pump sets)

1. Place the motor in position and fasten with bolts 901.7 and nuts 920.10 on the drive lantern or thrust bearing lantern 341 or 342, as applicable.
2. Align pump and motor. (⇨ Section 5.6.4, Page 34)
3. Connect the motor to the power supply.

7.6 Tightening torques

7.6.1 Tie bolt tightening torques

Table 34: Tie bolt tightening torques (in Nm)[12)]

Size	Material code						
	10-11-12-13-14	15-16-17	20-21-22-23-25-26-30-31-33		27-31-33	28	31-33
			Maximum permissible pressure				
			40 [bar]	63 [bar]	80 [bar]	100 [bar]	100 [bar]
32	85	95	150		-	-	-
50	140	170	240		-	-	-
65	250	330	430		550	-	640
100	400	500	680		865	1060	990
125	600	1070	1370		1620	1950	1650
150	700	1750	1500	2000	-	-	-
200	700	-	-	-	-	-	-
250	1000	-	-	-	-	-	-

7.6.2 Shaft nut tightening torques

Table 35: Shaft nut tightening torques (in Nm) – drive end

Size	A, B, C, D				E,F, V			
	Nut	M1[13)]	M2[14)]	M3[15)16)]	Nut	M1[13)]	M2[14)]	M3[15)16)]
32	M 25x1,5	80	40[17)]	-	M 25x1,5	80	40[17)]	--
50	M 30x1,5	80	40[17)]	-	M 25x1,5	80	40[17)]	--
65	M 35x1,5	100	50[17)]	-	M 30x1,5	80	40[17)]	--
100	M 42x1,5 (2x)	150	75	150	M 42x1,5 (2x)	150	75	150
125	M 52x1,5 (2x)	200	100	200	M 52x1,5 (2x)	200	100	200
150	M 62x1,5 (2x)	250	125	250	M 62x1,5 (2x)	250	125	250
200	M 62x1,5 (2x)	250	125	250	M 62x1,5 (2x)	250	125	250
250	M 75x1,5 (2x)	315	160	315	-	-	-	-

Table 36: Shaft nut tightening torques (in Nm) – non-drive end

Size	A, B, E, F, V				C, D			
	Nut	M1[13)]	M2[14)]	M3[15)16)]	Nut	M1[13)]	M2[14)]	M3[15)16)]
32	M 25x1,5	-	40	100	M 25x1,5	80	40	--
50	M 30x1,5	-	40	120	M 30x1,5	80	40	--
65	M 35x1,5	-	50	150	M 35x1,5	100	50	--
100	M 42x1,5	-	75	150	M 42x1,5	150	75[17)]	--

12 Observe any deviating data on the name plate and in the other applicable documents.
13 Loosen again after first tightening.
14 Final tightening torque of first nut
15 Tightening torque of second nut (if any)
16 Block first nut when tightening.
17 Bend over the lock washer.

Size	A, B, E, F, V				C, D			
	Nut	M1[13)]	M2[14)]	M3[15)16)]	Nut	M1[13)]	M2[14)]	M3[15)16)]
125	M 50x1,5	-	100	200	M 52x1,5	200	100[17)]	--
150	M 60x1,5	-	125	250	M 62x1,5 (2x)	250	125	250
200	M 60x1,5	-	125	250	M 62x1,5 (2x)	250	125	250
250	-	-	-	-	M 75x2,0	315	160	-

Procedure for tightening the shaft nuts with a torque wrench

Secure the shaft nut with a low-strength thread-locking agent (e.g. Loctite 222).

Nut with lock washer – drive end (and non-drive end on installation types C and D)

1. The lock washer has not been fitted yet. Tighten nut to torque M1, then loosen again.
2. Fit the lock washer.
3. Tighten nut to torque M2 and bend over the lock washer.

Nut with locknut – drive end (and non-drive end on installation types C and D)

1. Tighten first nut to torque M1, then loosen again.
2. Tighten first nut to torque M2.
3. Tighten locknut to torque M3 while blocking the first nut.

Nut with locknut – non-drive end (except installation types C and D)

1. Tighten first nut to torque M1.
2. Tighten locknut to torque M2 while blocking the first nut.

Procedure for tightening the shaft nut without a torque wrench

If no suitable torque wrench is available for tightening the shaft nuts, proceed as follows, depending on the pump version:

Nut with lock washer – drive end (or non-drive end on installation types C and D)

1. Tighten shaft nut firmly without lock washer.
2. Loosen the shaft nut again.
3. Fit the lock washer.
4. Tighten the shaft nut firmly but not excessively.
5. Bend over the lock washer.

Nut with locknut – drive end (or non-drive end on installation types C and D)

1. Tighten the first shaft nut firmly.
2. Loosen the first shaft nut again.
3. Tighten the first shaft nut firmly but not excessively.
4. Tighten the locknut firmly against the first shaft nut while blocking the first nut.

Nut with locknut – non-drive end (except installation types C and D)

1. Tighten the first shaft nut firmly but not excessively.
2. Tighten the locknut firmly against the first shaft nut while blocking the first nut.

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7.7 Spare parts stock

7.7.1 Ordering spare parts

Always quote the following data when ordering replacement or spare parts:

- Order number
- Order item number
- Consecutive number
- Type series
- Size
- Material variant
- Seal code
- Year of construction

Refer to the name plate for all data. (⇨ Section 4.4, Page 18)

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 99)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

7.7.2 Recommended spare parts stock for 2 years' operation to DIN 24296

To be able to respond quickly to any failures, keeping spare parts on stock is recommended.
The following options are available:

- Individual selection of spare parts
- Pre-configured repair kits containing the main spare parts

NOTE

We recommend replacing various wear parts such as bearings, sealing elements, circlips, etc. (see spare parts list below) whenever the hydraulic system has been completely dismantled.

Table 37: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
For grease-lubricated pump sets								
210	Shaft (complete with small parts)	1	1	2	2	2	3	30 %
230	Impeller (set)	1	1	1	2	2	3	30 %
231	Suction stage impeller	1	1	1	2	2	3	30 %
412.1	O-ring (set)	4	8	8	8	9	12	150 %
433	Mechanical seal, complete	2	3	4	5	6	7	90 %
461[18)]	Gland packing (set)	4	6	8	8	9	12	150 %
502.1[19)]	Casing wear ring, suction casing (set)	2	2	2	3	3	4	50 %
502.2[20)]	Casing wear ring, stage casing (set)	2	2	2	3	3	4	50 %
502.3[21)]	Casing wear ring, diffuser (set)	2	2	2	3	3	4	50 %

18 For seal codes 65 and 66 (gland packing); parts No. 433 and 523 not fitted
19 On pump sizes 32 to 100 with material codes 15, 16, 17 and 20 to 33; on size 125-200 with any material
20 Size 125-200 only
21 Size 200 only

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
523	Shaft sleeve	2	2	2	3	3	4	50 %
524[18)]	Shaft protecting sleeve	2	2	2	3	3	4	50 %
525	Spacer sleeve	2	2	2	3	3	4	50 %
550.1[22)]	Disc (set)	2	2	2	3	3	4	50 %
99-20.1[23)]	Plain bearing repair kit (incl. part Nos. 381 or 545, 412.2/.3, 529, 550.7, 561.1 or 562.1, 901.2, 931.1)	1	1	2	2	3	4	50 %
99-20.2	Balance drum repair kit (incl. part Nos. 540.1, 59-4, 940.2)	1	1	1	2	2	3	30 %
99-20.4[23)]	Drive-end ball bearing repair kit (incl. part Nos. 320.1, 412.10, 520.1, 551.1)	1	1	2	2	3	4	50 %
99-20.4[24)]	Non-drive-end ball bearing repair kit (incl. part Nos. 320.2, 412.10, 520.1, 520.2)	1	1	2	2	3	4	50 %
99-9.1	Set of sealing elements (incl. part Nos. 400.1, 411.7, 412.2/.3/.4/.5/.10, 507)	4	8	8	8	9	12	150 %
Additional parts required for oil lubrication								
421[25)]	Lip seal	4	8	8	8	9	12	150 %
423[25)]	Labyrinth ring	2	3	4	5	6	7	90 %
99-9.2	Set of sealing elements (incl. part Nos. 411.10/.11, 412.6/.10/.11/.12)	4	8	8	8	9	12	150 %

22 On pump sizes 32 to 100 only
23 On installation types A and B
24 Additional parts on installation types C and D; part No. 99-20.1 not fitted
25 Depending on version

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

- ▷ 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.

If problems occur that are not described in the following table, consultation with the KSB service is required.

Table 38: Trouble-shooting

Fault/malfunction	Possible cause	Remedy
Pump flow rate < specified value	Pump delivers against an excessively high pressure.	Open the shut-off element in the discharge line further until the duty point is reached.
	Excessively high back pressure	Mount larger impeller(s).
		Contact KSB's service centre.
		Increase the speed of the turbine or the combustion engine.
		Check system for impurities.
	Pump and/or piping are not completely vented and/or primed.	Vent and/or prime.
	Inlet line or impeller(s) clogged	Remove deposits in pump and/or piping.
	Formation of air pockets in the piping	Alter piping layout.
		Fit a vent valve.
	$NPSH_{available}$ is too low (inlet)	Check/alter liquid level.
		Fully open shut-off element in suction/inlet line.
		Change the inlet line, if the resistances in the inlet line are too high.
		Check any strainers installed.
	Excessive speed of pressure fall	Observe permissible speed of pressure fall.
	Suction lift is too high.	Clean the strainer element and inlet line.
		Correct/Alter liquid level.
		Alter the inlet line.
		Check any strainers installed.
	Wrong direction of rotation	Interchange two of the phases of the power cable.
	Speed is too low	Increase speed.
		Increase the voltage.
		Contact KSB's service centre.
	Wear of internal components	Replace defective parts.
		Contact KSB's service centre.
	Motor is running on 2 phases only.	Replace defective fuses.
		Check the electrical cable connections.
Pump discharge pressure $_{pd}$ > specified value	Speed is too high.	Alter the impeller diameter.
		Contact KSB's service centre.
Inlet pressure $_{ps}$ < specified value	Damaged measuring instrument	Replace the measuring instrument.
	Differential pressure in the strainer element is too high.	Dismantle and clean the strainer element.
	Shut-off element in the inlet line is not fully open.	Open the shut-off element.

Fault/malfunction	Possible cause	Remedy
Inlet pressure $_{ps}$ < specified value	Pressure in the inlet vessel is too low.	Check the inlet tank and/or increase the pressure.
Pump discharge pressure $_{pd}$ < specified value	Damaged measuring instrument	Replace the measuring instrument.
	Speed is too low.	Check the drive.
	Inlet pressure is too low.	Check the inlet pressure and inlet tank.
	Temperature of the medium pumped is too low or too high.	Increase/reduce the temperature.
	Defective minimum flow system	Check the minimum flow system.
Leakage at the shaft seal	Defective shaft seal	Check; replace, if required.
	Score marks or roughness on shaft protecting sleeve 524 and/ or shaft sleeve 523	Check shaft protecting sleeve 524 and/or shaft sleeve 523. Replace, if required.
	Pump set alignment	Check the coupling; re-align, if required.
	Pump is warped.	Check piping connections and secure fixing of pump.
	Insufficient cooling liquid	Increase cooling liquid quantity.
	Dirty cooling liquid chamber or cooler	Clean the cooling liquid chamber and/or cooler.
		Check the cooling liquid; clean, if required.
	Fault in the circulation line	Increase the free cross-section.
		Check the piping.
	Excessive surface pressure at sealing gap, lack of lubricant/ circulation liquid	Check the installation dimensions.
		Contact KSB's service centre.
Excessive bearing temperature	Defective bearings	Check; replace, if required.
	Oil quantity	Check the oil quantity; top up or replace, if required.
	Oil quality	Check.
	Increased axial thrust	Check the casing wear rings/balancing device; replace, if required.
		Contact KSB's service centre.
	Wear of internal components	Replace defective parts.
		Contact KSB's service centre.
	Unbalance of the pump rotor	Clean the pump rotor.
		Balance the pump rotor.
	Pump set is misaligned.	Check coupling. Replace it, if required.
	Pump is warped.	Check piping connections and secure fixing of pump.
	Coupling hub distance	Check the coupling hub distance for compliance with the general arrangement drawing; correct, if required.
Pump temperature > specified value	Pump and/or piping are not completely vented and/or primed.	Vent and/or prime.
	$NPSH_{available}$ is too low (inlet)	Check/alter liquid level.
		Fully open shut-off element in suction/inlet line.
		Change the inlet line, if the resistances in the inlet line are too high.
		Check any strainers installed.
	Excessive speed of pressure fall	Observe permissible speed of pressure fall.
	Flow rate < specified value	Flow rate ≥ Q_{min}
Pump leakage	Defective O-rings and/or metallic sealing surfaces	Replace the O-rings and/or remachine the metallic sealing surfaces.

Fault/malfunction	Possible cause	Remedy
Pump leakage	Defective O-rings and/or metallic sealing surfaces	Contact KSB's service centre.
	Tie bolts have worked loose.	Re-tighten.
		Contact KSB's service centre.
Vibrations during pump operation	Pump and/or piping are not completely vented and/or primed.	Vent and/or prime.
	$NPSH_{available}$ is too low (inlet)	Check/alter liquid level.
		Fully open shut-off element in suction/inlet line.
		Change the inlet line, if the resistances in the inlet line are too high.
		Check any strainers installed.
	Excessive speed of pressure fall	Observe permissible speed of pressure fall.
	Wear of internal components	Replace defective parts.
		Contact KSB's service centre.
	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point by means of the shut-off valve in the discharge line.
		In the case of persistent overloading, turn down the impeller(s), if necessary.
		Contact KSB's service centre.
	Pump set alignment	Check the coupling; re-align, if required.
	Pump is warped.	Check piping connections and secure fixing of pump.
	Oil quantity	Check the oil quantity; top up or replace, if required.
	Oil quality	Check the oil quality; replace it, if required
	Unbalance of the pump rotor	Clean the pump rotor.
		Balance the pump rotor.
	Defective bearings	Replace.
	Flow rate < specified value	Flow rate ≥ Q_{min}
Cavitation noise in the pump and/or piping	Damaged suction line	Check the inlet line.
	Shut-off element in the inlet line is not fully open.	Open the shut-off element.
	Pressure in the inlet vessel is too low.	Check the inlet tank and/or increase the pressure.
	$NPSH_{available}$//$NPSH_{-required}$ too low	Check the inlet line.
		Alter the inlet line.
	Excessive speed of pressure fall	Observe permissible speed of pressure fall.
	Air intake at seal elements, valves and shaft seal	Check the piping; check shaft seal for leakage.
	Pump and/or piping not completely vented	Vent and/or prime.
	Temperature of fluid handled is too high.	Reduce the temperature.
Pump suddenly blocks.	Rotor is mechanically blocked.	Interrupt the power supply, interlock and depressurise the pump.
		Contact KSB's service centre.
The balancing liquid pressure/quantity varies.	Pump and/or piping are not completely vented and/or primed.	Vent and/or prime.
	$NPSH_{available}$ is too low (inlet)	Check/alter liquid level.

Fault/malfunction	Possible cause	Remedy
The balancing liquid pressure/quantity varies.	$NPSH_{available}$ is too low (inlet)	Fully open shut-off element in suction/inlet line.
		Change the inlet line, if the resistances in the inlet line are too high.
		Check any strainers installed.
	Excessive speed of pressure fall	Observe permissible speed of pressure fall.
	Wear of internal components	Replace defective parts.
		Contact KSB's service centre.
	Increased axial thrust	Check the casing wear rings/balancing device; replace, if required.
		Contact KSB's service centre.
	Change in cross-section of balancing liquid line; excessive losses; joining of several lines near the pump	Check the mode of operation. Check the balancing liquid return line. Check the pump pressures.
	Balance flow leakage at balance disc seat.	Check the rotor clearances and balancing device.
	Wear in balancing device.	Check the rotor clearances and balancing device.
Drive overload	Wear of internal components	Replace defective parts.
		Contact KSB's service centre.
	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point by means of the shut-off valve in the discharge line.
		In the case of persistent overloading, turn down the impeller(s), if necessary.
		Contact KSB's service centre.
	Density or viscosity of the fluid handled is higher than specified in the purchase order.	Contact KSB's service centre.
	Speed is too high.	Alter the impeller diameter.
		Contact KSB's service centre.
		Reduce the speed of the drive.
	Pump is warped.	Check piping connections and secure fixing of pump.
	Operating voltage is too low.	Check the electrical cable connections.
	Motor is running on 2 phases only.	Replace defective fuses.
		Check the electrical cable connections.

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9 Related Documents

9.1 General assembly drawing with list of components

Please note the following information relating to specific part numbers:

1) For pump models with mechanical seal only
2) Except size 32
3) Size 125...150/4-pole only
4) Sizes 65, 100, 125 and 150/4-pole only
5) Multitec 50 ASME
6) Size 150/2-pole only
7) Hydraulic systems 9.2/10.2/11.1/12.1/13.1 and 14.1 only

9.1.1 Axial suction nozzle

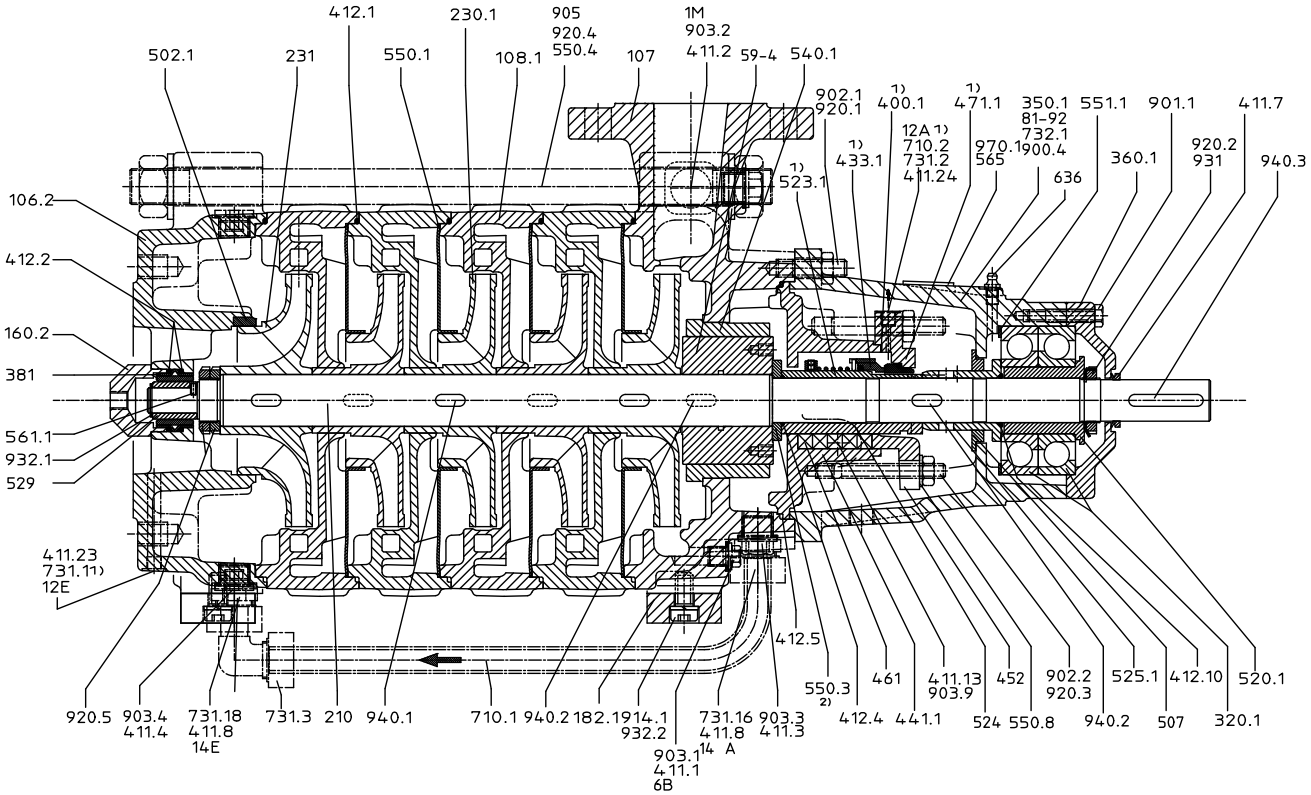

Fig. 53: Multitec - installation type A - size 32-50

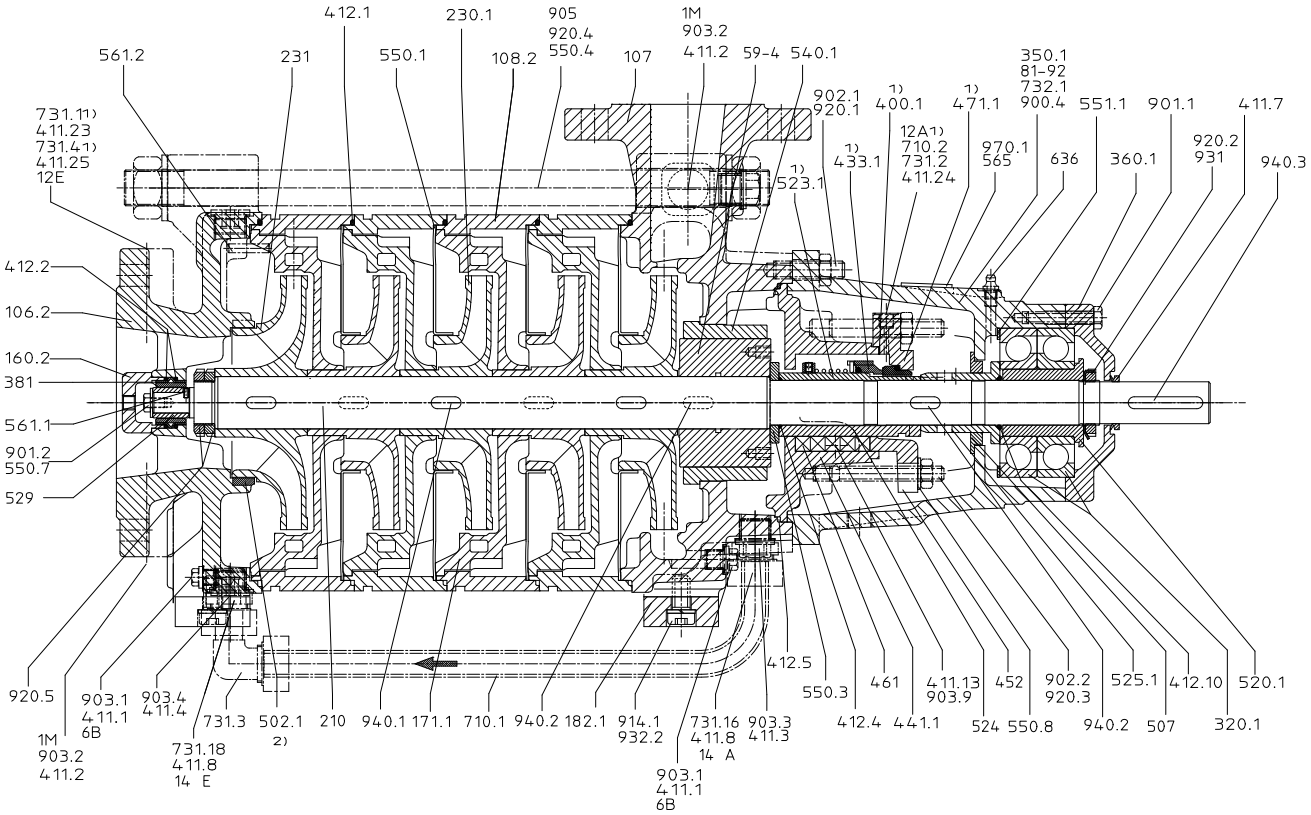

Fig. 54: Multitec - installation type A - size 65-100

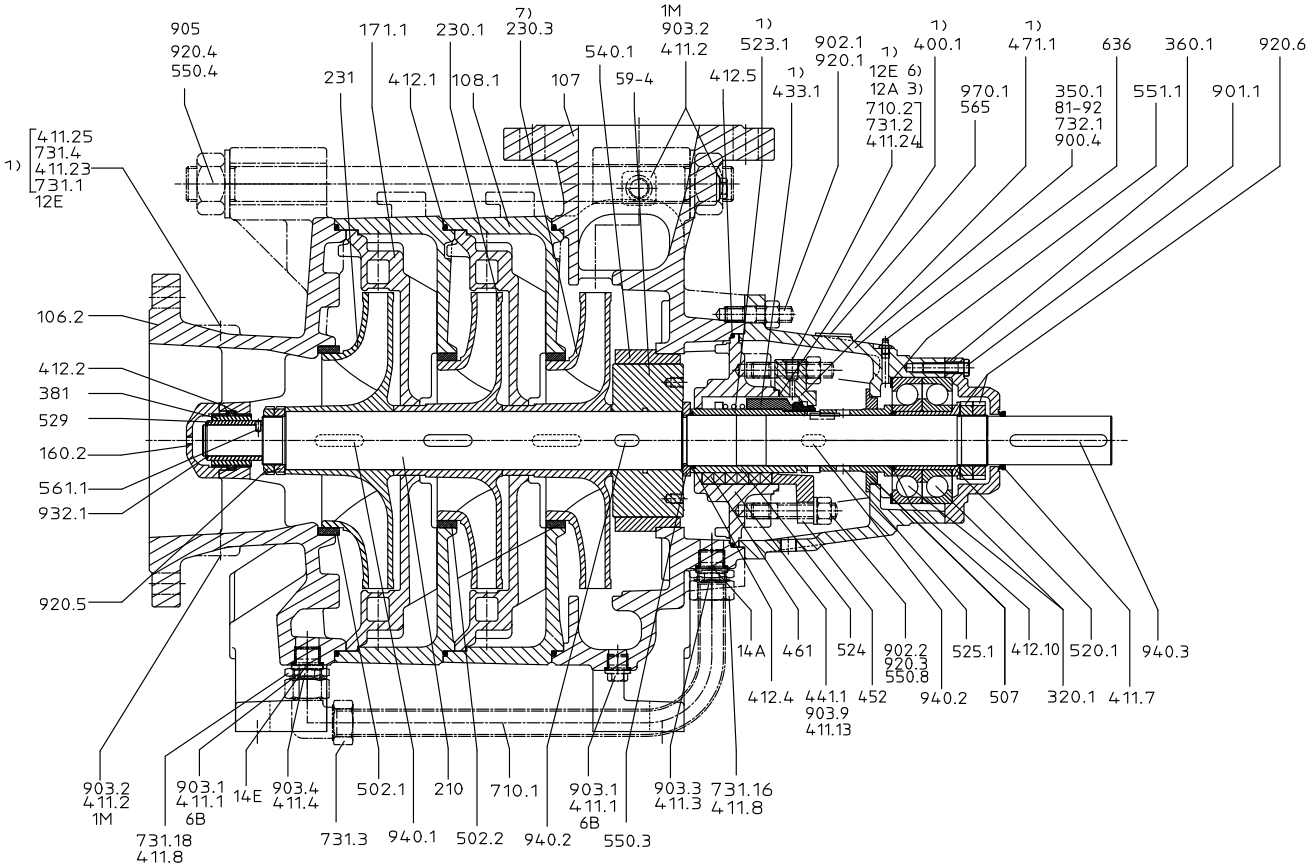

Fig. 55: Multitec - installation type A - size 125-150

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9.1.2 Radial suction nozzle

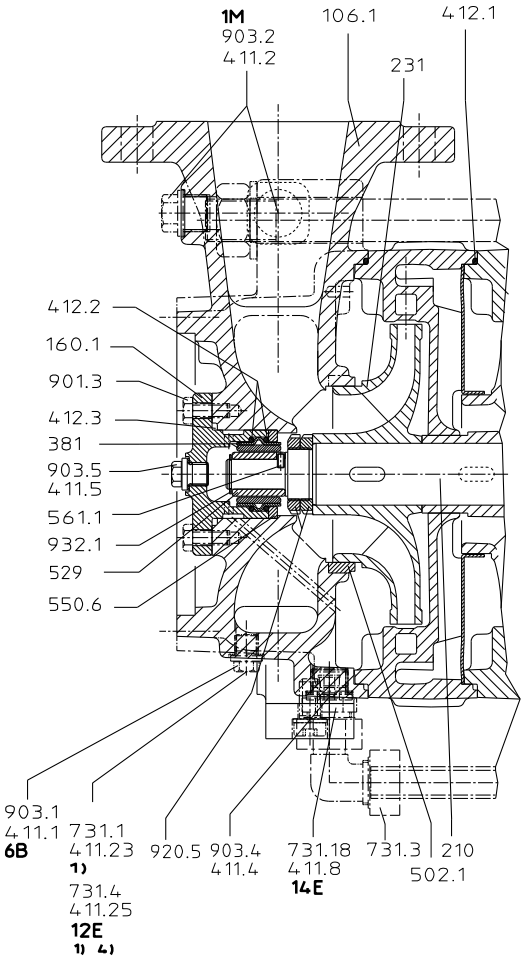


Fig. 56: Installation types B and E

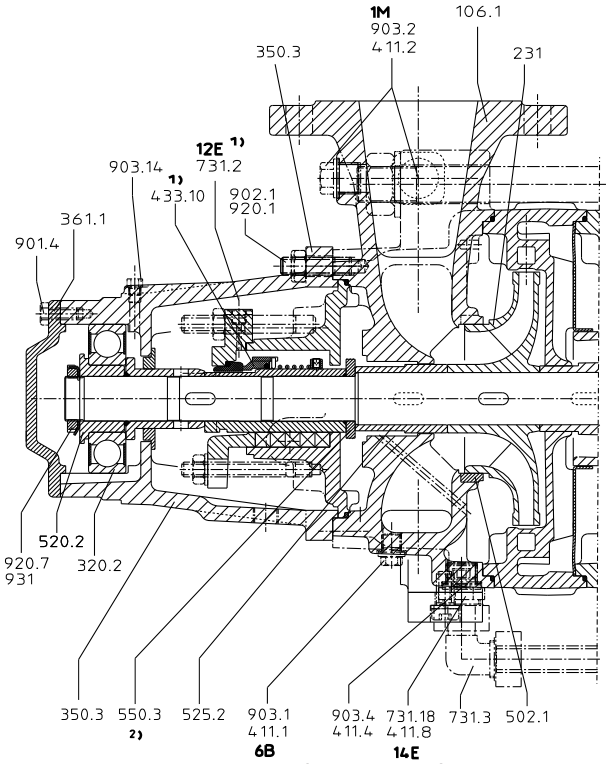


Fig. 57: Installation type C (suction side)

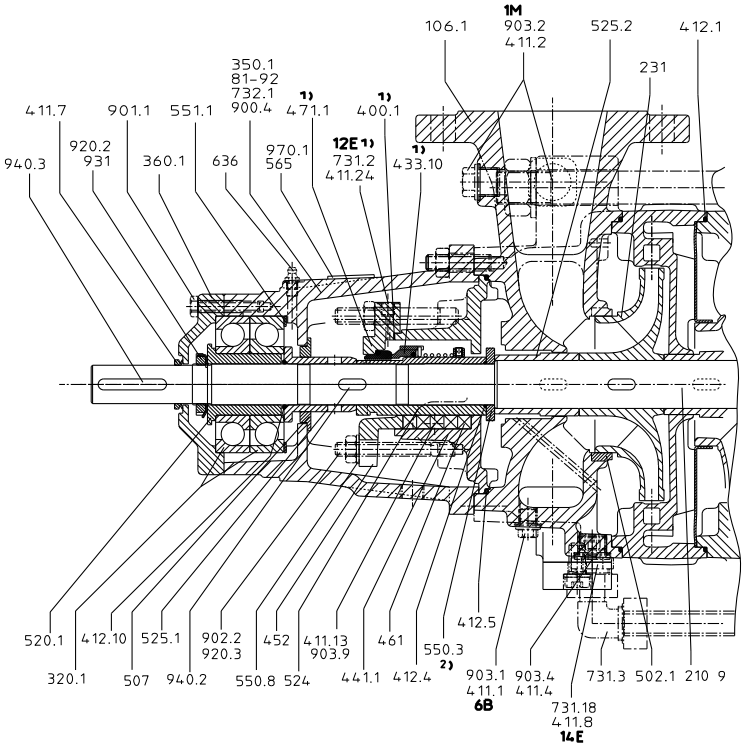


Fig. 58: Installation type D (suction side)

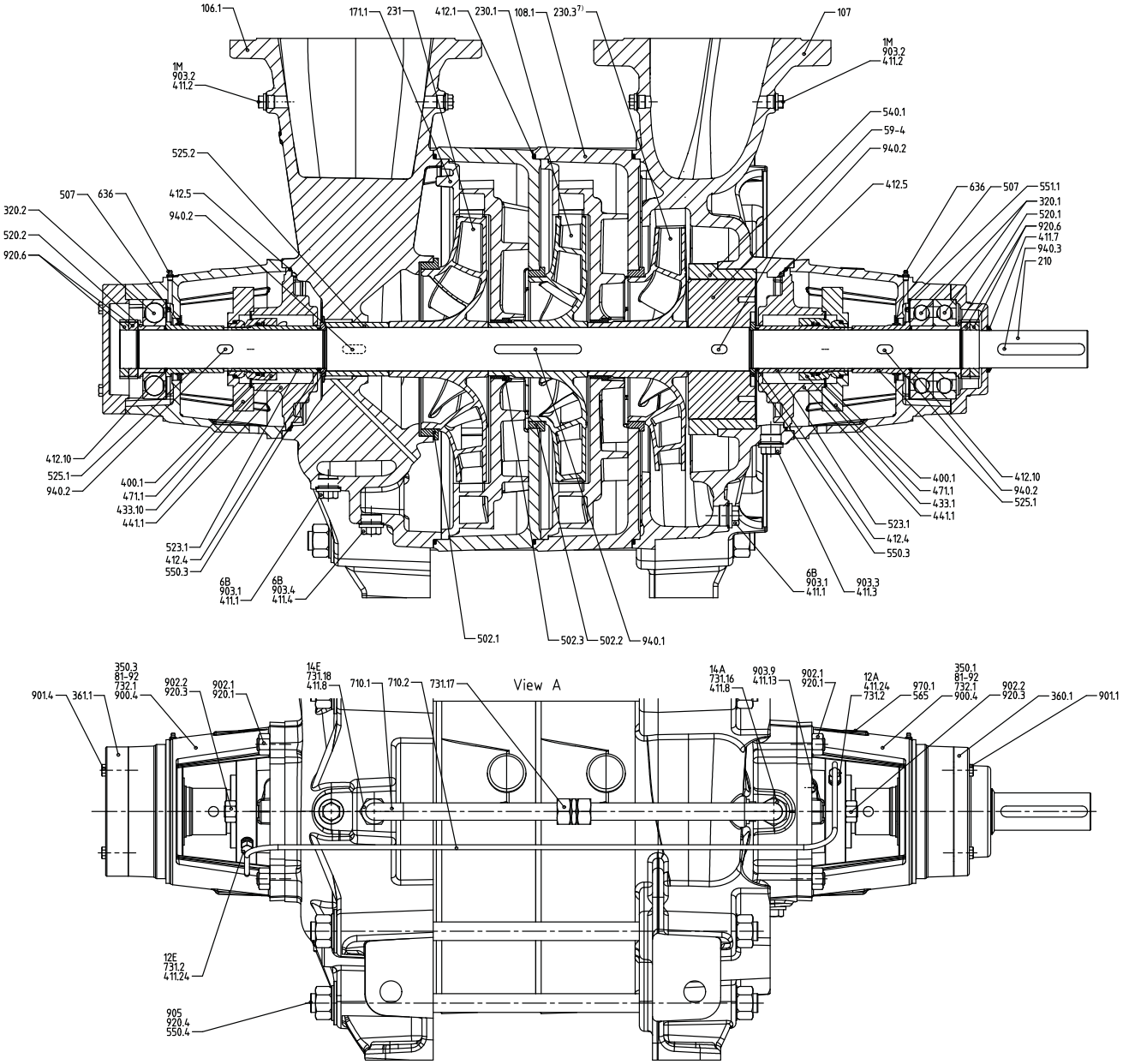


Fig. 59: Installation type C – Multitec 200

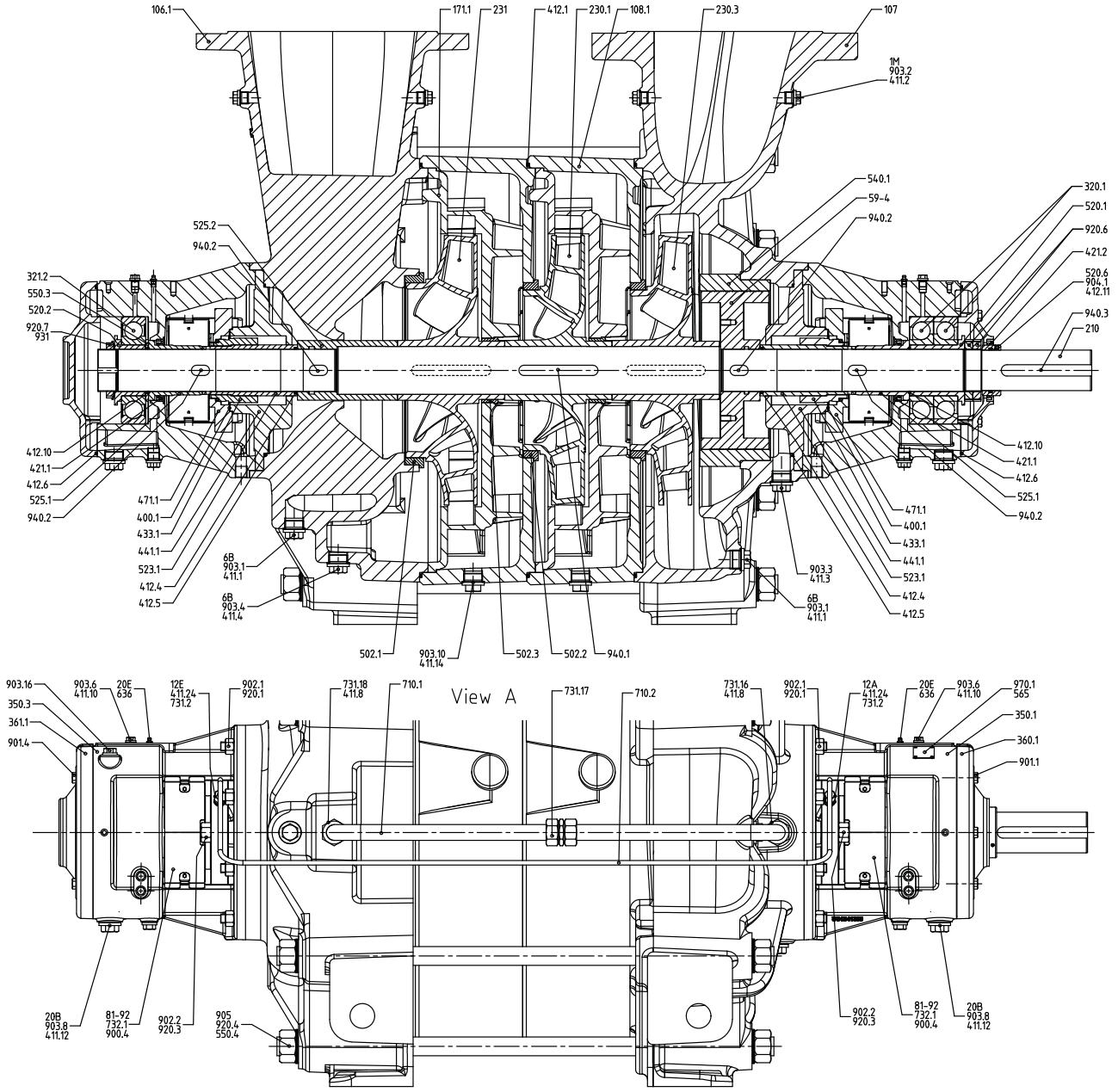


Fig. 60: Installation type C – Multitec 250

9.1.3 Close-coupled pumps

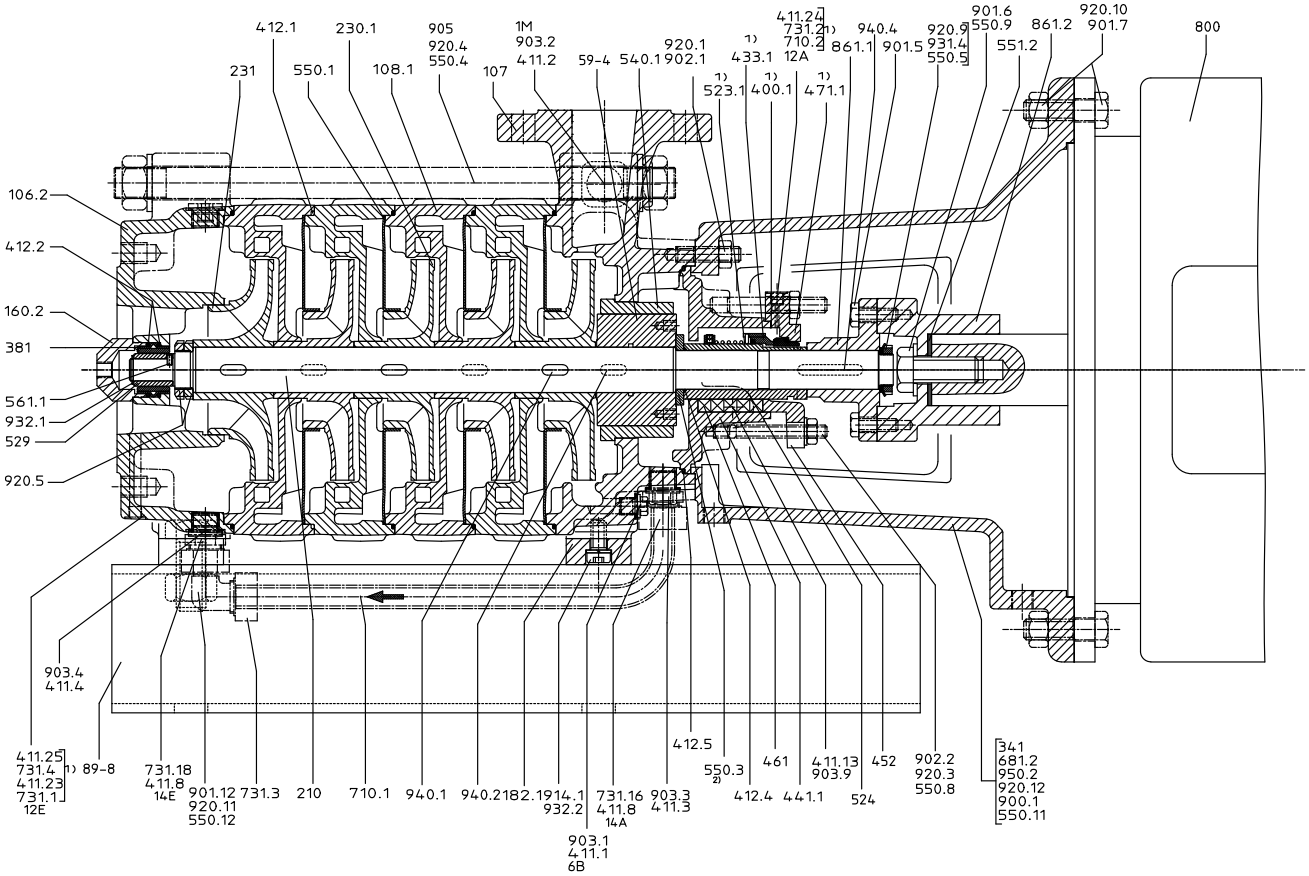
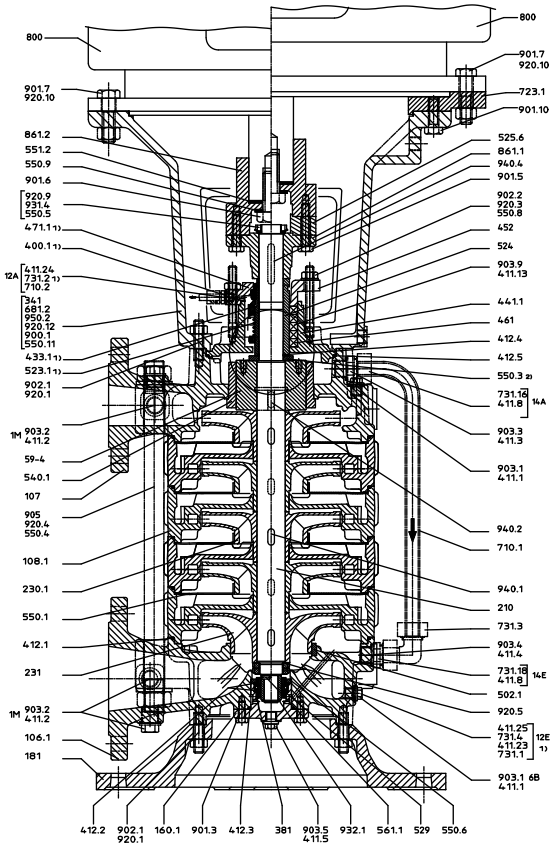


Fig. 61: Installation type F

a)



b)

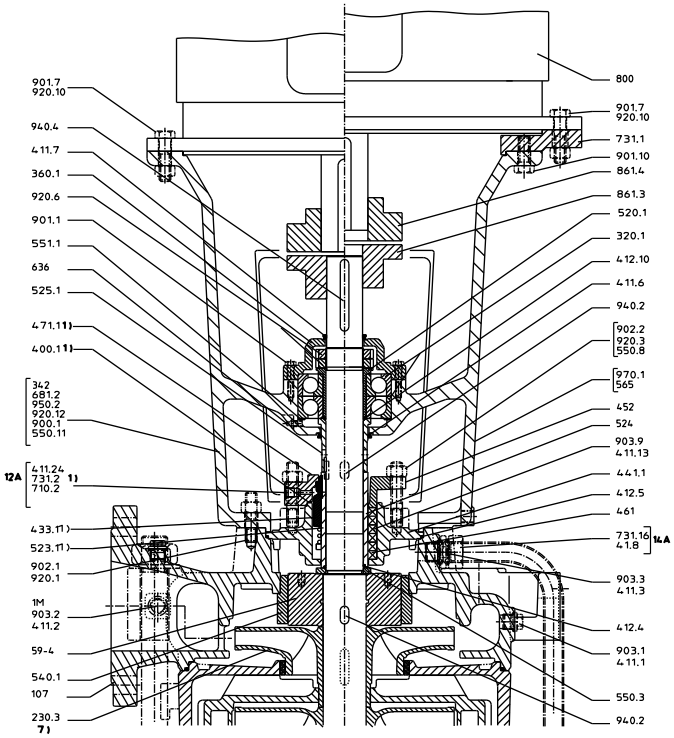


Fig. 62: Installation type V – a) size 32-65 – b) size 100-200

9.1.4 Variants

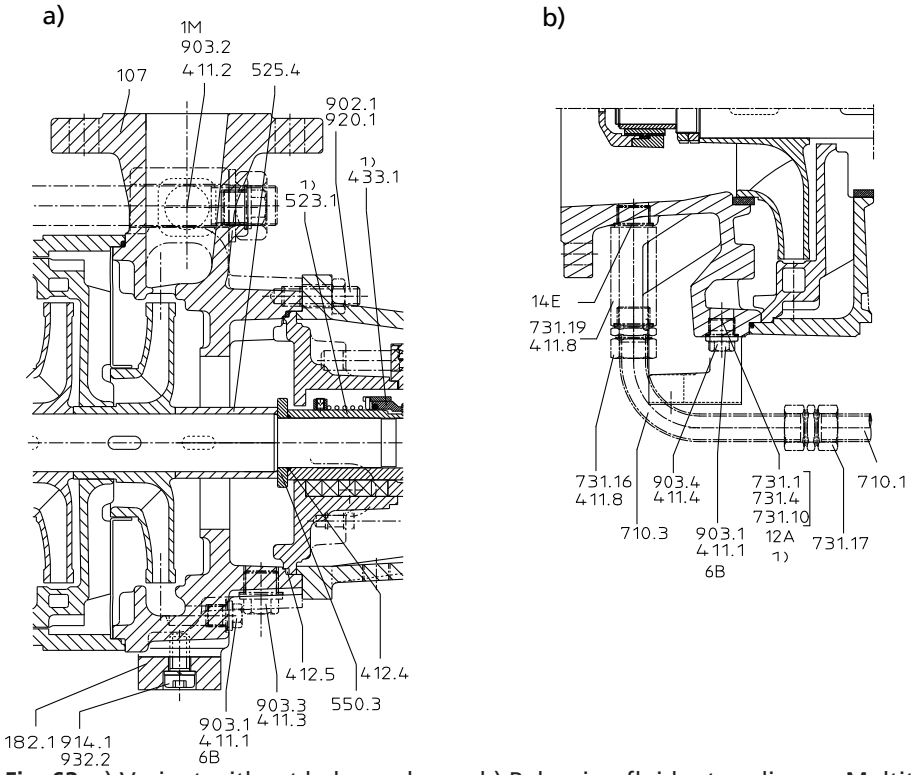


Fig. 63: a) Variant without balance drum - b) Balancing fluid return line on Multitec 150/2-pole

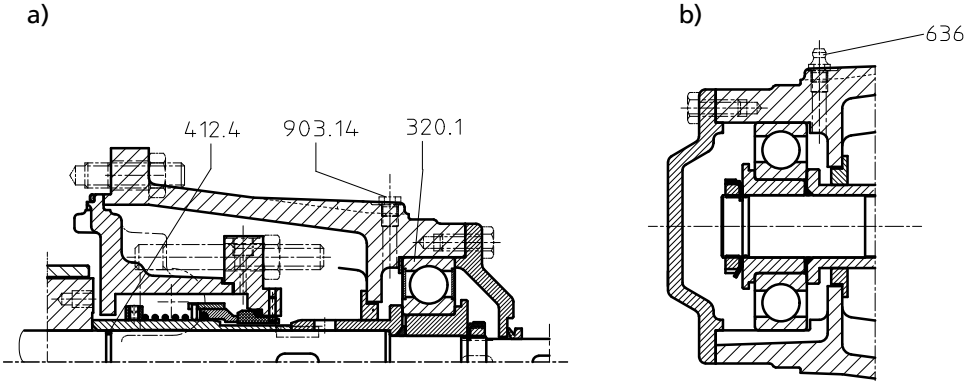


Fig. 64: a) Drive-end bearing on Multitec 32 - b) Grease lubrication with lubricating nipple, non-drive-end, sizes 100 and 125

9.1.5 List of components

Table 39: List of components

Part No.	Description	Part No.	Description
106.1/.2	Suction casing	540.1/.3	Bush
107	Discharge casing	545	Bearing bush
108.1/.2	Stage casing	550.1	Disc
160.1/.2	Cover	550.2/.3/.4/.6/.7/.8/.9/.10/.11	Disc
171.1/.5	Diffuser	551.1/.2	Spacer disc
181	Pump stool	561.1/.2	Grooved pin
182.1	Foot	562.1/.2	Parallel pin
210	Shaft	565	Rivet
230.1/.3	Impeller	59-4	Balance drum
231	Suction stage impeller	59-7	Support
320.1/.2	Rolling element bearing	636	Lubricating nipple
341	Drive lantern	638	Constant level oiler
342	Thrust bearing lantern	681.2	Coupling guard
350.1	Bearing housing	683.1	Hood
360.1/.2	Bearing cover	710.1/.2/.3	Pipe
361.1/.2	Non-drive end bearing cover	723.1	Flange
381	Bearing cartridge	731.1/.2/.3/.4/.16/.17/.18	Pipe union
400.1	Gasket	732.1	Bracket
411.1/.2/.3/.4/.5/.6/.7/.8/.13/.23/.24/.25	Joint ring	800	Motor
412.1/.2/.3/.4/.5/.10/.11/.12	O-ring	81-92	Cover plate
421.1/.2/.3	Lip seal	831.1	Fan impeller
423.1/.2	Labyrinth ring	861.1/.2/.3/.4	Coupling half
433.1/.2/.3/.4/.5/.6/.7/.10	Mechanical seal	87-5	Axle
441.1/.4	Shaft seal housing	89-9	Foundation rail
452	Gland follower	900.2/.4	Screw/bolt
461	Gland packing	901.1/.2/.3/.4/.5/.6/.7/.8/.9/.10/.11/.12	Hexagon head bolt
471.1/.2	Seal cover	902.1/.2	Stud
500.1	Ring	903.1/.2/.3/.4/.5/.9/.10/.11/.14	Screw plug
502.1/.2	Casing wear ring	905	Tie bolt
502.3	Casing wear ring (diffuser)	914.1	Hexagon socket head cap screw
507	Thrower	920.1/.2/.3/.4/.5/.6/.7/.9/.10/.11	Nut
520.1/.2/.3/.4	Sleeve	931	Lock washer
523.1/.2/.3/.5/.6	Shaft sleeve	932.1/.2	Circlip
524	Shaft protecting sleeve	940.1/.2/.3/.4/.5	Key
525.1/.2/.4	Spacer sleeve	950.2/.3	Spring
529	Bearing sleeve SiC	970.1	Plate

10 EU Declaration of Conformity

Manufacturer:

KSB SE & Co. KGaA
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

The manufacturer herewith declares that **the product**:

Multitec, Multitec-RO

KSB order number: .....

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): 2006/42/EC Machinery Directive

The manufacturer also declares that

- the following harmonised international standards[26)] have been applied:
  - ISO 12100
  - EN 809

Person authorised to compile the technical file:

Name
Function
Address (company)
Address (street, No.)
Address (post or ZIP code, city) (country)

The EU Declaration of Conformity was issued in/on:

Place, date

.....[27)].....

Name

Function

Company
Address

26 Apart from the standards listed here referring to the Machinery Directive, further standards are observed for explosion-proof versions (ATEX Directive) as applicable and are listed in the legally binding EU Declaration of Conformity.

27 A signed, legally binding EU Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[28]: .....

Delivery date: .....

Application: .....

Fluid handled[28]: .....

Please tick where applicable[28]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[28]: .....

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

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28 Required field

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