Standardised Chemical Pump

Magnochem

With Magnetic Drive
Seal-less

Installation/Operating Manual

KSB

Legal information/Copyright

Installation/Operating Manual Magnochem

Original operating manual

KSB Aktiengesellschaft

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Contents

Glossary

Back pull-out design

The complete back pull-out unit can be pulled out without having to remove the pump casing from the piping.

Back pull-out unit

Pump without pump casing; partly completed machinery

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 line which is connected to the discharge nozzle

Pool of pumps

Pumps which are purchased and stored independently 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

Suction lift line/suction head line

The line which is connected to the suction nozzle

1 General

1.1 Principles

This operating manual is supplied as an integral part of the type series and variants indicated on the front cover. The manual describes the proper and safe use of this equipment in all phases of operation.

The 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 uniquely identify the pump (set) and serve as identification for all further business processes.

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

Noise characteristics (⇨ Section 4.6 Page 20)

1.2 Installation of partly completed machinery

To install partly completed machinery supplied by KSB, refer to the sub-sections under Servicing/Maintenance.(⇨ Section 7.5.10 Page 67)

1.3 Target group

This manual is aimed at the target group of trained and qualified specialist technical personnel.(⇨ Section 2.4 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
Drawing for assembly	Sectional drawing for fitting the 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

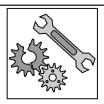
2 Safety

DANGER

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

2.1 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 EC Directive 94/9/EC (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.
	**Warning: Strong magnetic field** In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies information about protection against magnetic fields.

2.2 General

This manual contains general installation, operating and maintenance instructions that must be observed to ensure safe pump operation and prevent personal injury and damage to property.

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

This manual must be read and completely understood by the specialist personnel/ operators responsible prior to installation and commissioning.

The contents of this manual must be available to the specialist personnel at the site at all times.

Information attached directly to the pump must always be complied with and be 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 in this manual.

2.3 Intended use

The pump (set) must only be operated within the operating limits described in the other applicable documents.(⇨ Section 1.4 Page 6)

- 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 to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the pump without the fluid handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- Observe the maximum flow rates indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- 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.

Prevention of foreseeable misuse

- Never open discharge-side shut-off elements further than permitted.
  - The maximum flow rate specified in the data sheet or product literature would be exceeded.
  - Risk of cavitation damage
- Never exceed the permissible operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.

2.4 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.

2.5 Consequences and risks caused by non-compliance with these operating instructions

- 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

2.6 Safety awareness

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

- Accident prevention, health and safety regulations
- Explosion protection regulations

- Safety regulations for handling hazardous substances
- Applicable standards and laws

2.7 Safety information for the operator/user

- The operator shall fit contact guards for hot, cold and moving parts and check that the guards function properly.
- Do not remove any 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 shutting down 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.

2.8 Safety information for maintenance, inspection and installation work

- Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that all maintenance, inspection and installation work is 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.
- The pump casing must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual.(⇨ Section 6.1.8 Page 37)(⇨ Section 6.3 Page 41)
- Decontaminate pumps which handle fluids posing a health hazard.(⇨ Section 7.3 Page 50)
- As soon as the work is completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning.(⇨ Section 6.1 Page 33)

2.9 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 2.3 Page 8)

2.10 Explosion protection

DANGER

Always observe the information on explosion protection given in this section when operating the pump 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 EC Directive 94/9/EC (ATEX).
Especially adhere to the sections in this manual marked with the Ex symbol and the following sections(⇨ Section 2.10.1 Page 11) to(⇨ Section 2.10.4 Page 13) .
The explosion-proof status of the pump set is only assured if the pump set is used in accordance with its intended use.
Never operate the pump set outside the limits stated in the data sheet and on the name plate.
Prevent impermissible modes of operation at all times.

2.10.1 Marking

Pump

The marking on the pump refers to the pump part only.
Example of such marking: II 2 G c TX
Refer to the Temperature Limits table for the temperatures permitted for the individual pump variants.

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.

2.10.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected at the surface of the pump casing, in the area of the magnetic coupling and in the area of the rolling element bearings. The surface temperature at the pump casing corresponds to the temperature of the fluid handled.
If the pump is heated, the operator of the system is responsible for observing the specified temperature class.
The surfaces in the bearing bracket area must be freely exposed to the atmosphere.
The table below lists the temperature classes and the resulting theoretical temperature limits of the fluid handled.

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	Maximum permissible fluid temperature
T1	Maximum 300 °C
T2	275 °C
T3	175 °C
T4	110 °C
T5	on request only
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.

On models with leakage barrier, a shaft seal is fitted upstream of the pump-end rolling element bearing. Based on an ambient temperature of 40 °C, grease and oil lubrication and proper maintenance and operation (without any damage to the containment shroud), compliance with temperature class T4 is warranted.

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

Temperature class T5

Oil lubrication (without leakage barrier) is required for compliance with temperature class T5.

Temperature class T6

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.

2.10.3 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.

Take into account the following risks when selecting suitable monitoring equipment:

Cooling flow interrupted

In the standard version, the inner (fluid-filled) part of the magnetic coupling is cooled by a partial flow bypassed from the main product flow. Should cooling flow be interrupted owing to the properties of the fluid handled (gumming, clogging), this may lead to an impermissible temperature rise.

Cooling flow interrupted

In the standard version, the inner (fluid-filled) part of the magnetic coupling is cooled by a partial flow bypassed from the main product flow. Should cooling flow be interrupted owing to the properties of the fluid handled (gumming, clogging), this may lead to an impermissible temperature rise.

In operation with external fluid supply, the inner section of the magnetic coupling is cooled by barrier fluid via auxiliary connections. If fluid supply from the barrier fluid system is interrupted (e.g. as a result of insufficient barrier pressure or clogged auxiliary feed lines), insuffient cooling flow or failure of the cooling flow supply can result in an inadmissible temperature rise.

Inner and outer rotor out of synchronisation

Overloading, overheating or non-compliance with the design data may cause the inner and the outer rotor to drop out of synchronisation. Thermal energy produced inside the containment shroud or at the outer rotor may also result in an impermissible temperature rise.

Leakage of fluid handled

If a defect in the containment shroud (rare defect) will result in leakage of a fluid whose critical properties might pose a hazard to staff and the environment, leakage monitoring must be provided in combination with a pump version with leakage barrier. Any interaction of the fluid handled with the pump materials shall be taken into consideration, if necessary.

On request, the following equipment can be supplied by KSB:

- Temperature monitoring of containment shroud
  - PT100
  - Mineral-insulated thermocouple
- Fill level monitoring to protect against dry running
  - Liquiphant level transmitter
- Monitoring for containment shroud leakage
  - Liquiphant level transmitter
  - Contact pressure gauge
  - Pressure switch
  - Pressure transducer
- Monitoring of pump power to detect dry running and/or asynchronous operation of the magnetic coupling and to protect against overload operation
  - Motor load monitor
- Other accessories on request
  - Temperature monitoring of rolling element bearings by means of PT100 sensor

2.10.4 Operating limits

The minimum flows indicated in (⇨ Section 6.2.3.1 Page 39) refer to water and water-like fluids. 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 39) can be used to check whether an additional heat build-up may lead to a hazardous temperature increase at the pump surface.

2.11 Magnetic coupling

⚠ DANGER

Strong magnetic field in the area of the magnetic coupling or the individual magnets
Danger of death for persons with pacemaker!
Interference with magnetic data carriers, electronic devices, components and instruments!
Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- ▹ Keep a safety distance of at least 0.3 m.

Distance to assembled pumps:

The safety distance refers to magnet-equipped rotors not yet installed in pumps as well as to loose magnets.

In installed condition the magnetic field is fully shielded so that an assembled pump does not pose a hazard as a result of magnetic fields (even to persons with pacemaker), neither during standstill nor during operation.

3 Transport/Temporary Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer (as applicable) 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.
- ▷ Give due attention to the weight data and the centre of gravity.
- ▷ Observe the applicable local health and safety regulations.
- ▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

CAUTION

Improper transport of complete back pull-out unit (with or without impeller)
Damage to the plain bearings!

- ▷ Use a suitable transport lock to prevent axial movement of the pump shaft during transport.

To transport the pump/pump set or back pull-out unit suspend it from the lifting tackle as shown.

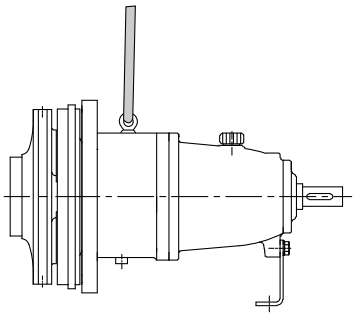


Fig. 1: Transporting the back pull-out unit

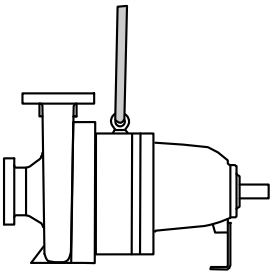


Fig. 2: Transporting the pump

NOTE

To transport the pump attach lifting tackle to the eyebolt (900.26) at the bearing bracket lantern.

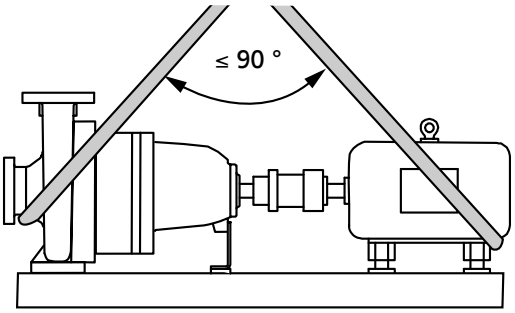


Fig. 3: Transporting the complete pump set

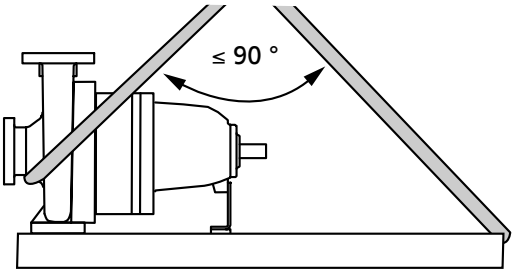


Fig. 4: Transporting the pump on the baseplate

3.3 Storage/preservation

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

CAUTION

Damage during storage by humidity, dirt, or vermin
Corrosion/contamination of the pump (set)!

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

CAUTION

Wet, contaminated or damaged openings and connections
Leakage or damage to the pump set!

- Only remove caps/covers from the openings of the pump set at the time of installation.

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 a maximum of 12 months. New pumps/pump sets are supplied by our factory duly prepared for storage.

For storing a pump (set) which has already been operated, observe the instructions in(⇨ Section 6.3.1 Page 41) .

3.4 Return to supplier

1. Drain the pump as per operating instructions.(⇨ Section 7.3 Page 50)

2. Always flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the fluids handled by the pump set leave residues which might lead to corrosion damage when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the pump set must also be neutralised, and anhydrous inert gas must be blown through the pump for drying purposes.
4. Always complete and enclose a certificate of decontamination when returning the pump (set).
   Always indicate any safety and decontamination measures taken.(⇨ Section 11 Page 81)

NOTE

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

3.5 Disposal

⚠ WARNING

Fluids, consumables and supplies which are hot or pose a health hazard
Hazard to persons and the environment!

- ▹ Collect and properly dispose of flushing fluid and any residues of the fluid handled.
- ▹ 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.

4 Description of the Pump (Set)

4.1 General description

- Standardised chemical mag-drive pump

Pump for handling aggressive, toxic, explosive, valuable, flammable, malodorous or harmful fluids in the chemical, petrochemical and general industries.

4.2 Designation

Example: Magnochem-C H 40-200/110-40

Table 5: Key to the designation

Code	Description
Magnochem (short: MAC)	Type series
C	Material of wetted components, e.g. C = stainless steel
H	Additional code, e.g. H = heatable version
40	Nominal discharge nozzle diameter [mm]
200	Nominal impeller diameter [mm]
110	Nominal diameter of magnetic coupling [mm]
40	Effective length of magnetic coupling [mm]

4.3 Name plate

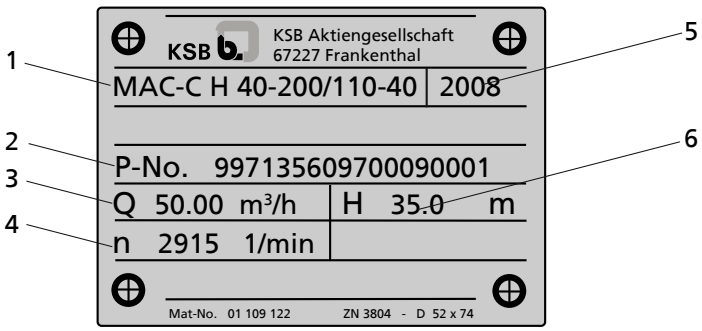


Fig. 5: Name plate (example)

1	Type series, size (⇨ Section 4.2 Page 17)	2	KSB order number
3	Flow rate	4	Speed
5	Year of construction	6	Head

4.4 Design details

Design

- Volute casing pump
- Horizontal installation
- Back pull-out design
- Single-stage
- Meets the technical requirements to ISO 5199
- Dimensions and ratings to EN 22858/ISO 2858,
  complemented by pumps of nominal diameters DN 25, DN 200 and above
- Hydraulic system components identical with those of standardised chemical pump

Pump casing

- Single or double volute, depending on the pump size
- Radially split volute casing
- Volute casing with integrally cast pump feet
- Replaceable casing wear rings

Impeller type

- Closed radial impeller with multiply curved vanes
- Back vanes or discharge-side sealing gap reduce axial thrust

Shaft seal

- Seal-less, with magnetic coupling
- Containment shroud as sealing element
- **Optional**: with leakage barrier

Casing cover variants

- Internal circulation (standard; flushing connection possible)
- External liquid feed (barrier fluid)
- Version with filter (flushing connection possible)
- Heatable

Bearings

- Grease-packed for life
  A theoretical bearing life Lh10 of 25,000 h can be achieved at an operating temperature of 90 °C. At temperatures below 80 °C, Lh10 values of 30,000 h are possible. However, bearing life may be reduced by vibrations, aggressive gases, moisture, etc.

- Drive-end bearings:

- Radial ball bearings with internal clearance C3
- Grease-packed for life (high melting point grease)
- **Optional:** oil lubrication

- Pump-end bearing:

- Hydrodynamic plain bearings
- Product-lubricated

Table 6: Bearings used

Type of lubrication	Variant	Magnetic coupling size	Rolling element bearings	
			Pump end	Drive end
Grease lubrication	Standard	110 / 165	6209-2RS C3	6209-2RS C3
		220	6016-2Z C3	6016-2Z C3
Grease lubrication	Leakage barrier	110 / 165	6209-2Z C3	6209-2Z C3
		220	6016-2Z C3	6016-2Z C3
Oil lubrication	Standard	110 / 165	6209 C3	6209 C3
Oil lubrication	Leakage barrier	110 / 165	6209-Z C3	6209-Z C3

4.5 Configuration and function

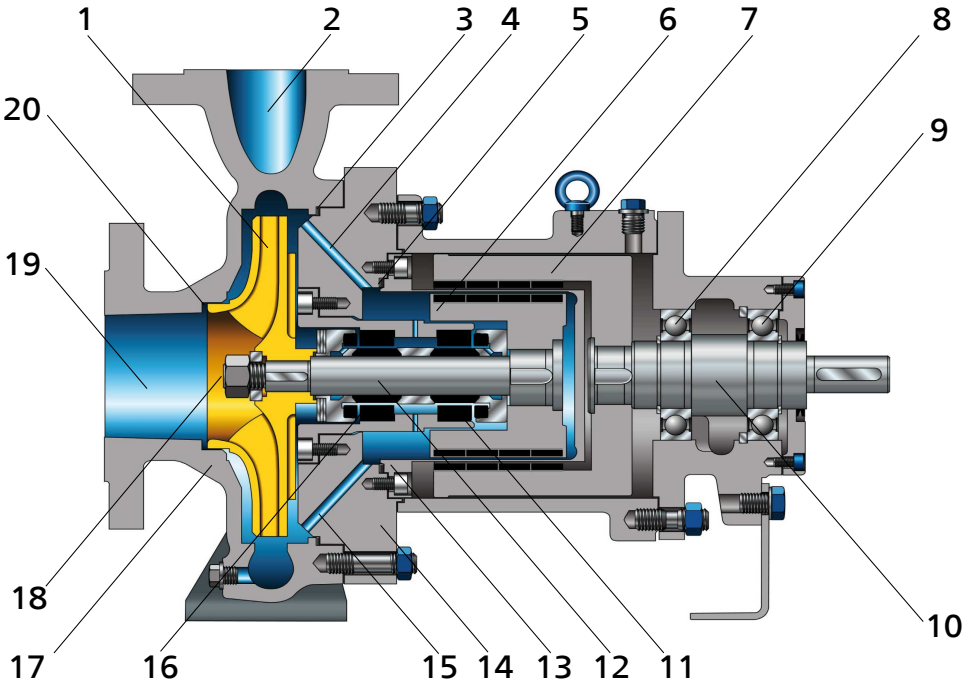


Fig. 6: Sectional drawing

1	Impeller	2	Discharge nozzle
3	Casing gasket	4,15	Bore
5	Shroud gasket	6	Inner rotor
7	Outer rotor	8, 9	Rolling element bearings
10	Drive-end shaft	11, 16	Hydrodynamic plain bearings
12	Pump-end shaft	13	Containment shroud
14	Casing cover	17	Pump casing
18	Shaft bore	19	Suction nozzle
20	Clearance gap		

Function

The fluid enters the pump axially via the suction nozzle (19) and is accelerated outward by the rotating impeller (1). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (20) prevents any fluid from flowing back from the casing to the suction nozzle.

Sealing

Mag-drive pumps are characterised by the absence of a dynamic shaft seal (mechanical seal, gland packing). The fluid handled is sealed off towards the atmosphere exclusively by means of static sealing elements: a gasket (3) between the casing (17) and the casing cover (14), and a joint ring (5) between the casing cover (14) and the containment shroud (13). The driving torque is transmitted indirectly from the motor to the pump shaft (12) via the magnetic coupling. The magnetic coupling basically consists of the outer rotor (outer magnet assembly, 7) and the inner rotor (inner magnet assembly, 6). The containment shroud (13) forms the shaft seal separating the wetted from the dry pump section.

Magnetic drive

Magnetic couplings with permanent magnets transmit the driving torque without slip, i.e. the motor and the pump run at the same rotational speed. The driving torque generated by the motor is transmitted from the outer rotor (7) to the inner rotor (6) via the magnetic field. The inner rotor is a component part of the pump rotor, which runs in product-lubricated bearings. The directly product-lubricated radial and axial plain bearings (11, 16) are made of wear-resistant and chemically resistant silicon carbide. The flow circulated through the magnetic coupling not only lubricates the bearings but also dissipates heat losses caused by eddy currents in the metal containment shroud wall. If a ceramic containment shroud is used, no eddy current losses will be induced in the containment shroud wall. In this case, the flow circulated through the magnetic coupling only lubricates the plain bearings.

4.6 Noise characteristics

Table 7: Surface sound pressure level L_{pA} [2) 3)]

Rated power input P_N [kW]	Pump			Pump set		
	2900 rpm [dB]	1450 rpm [dB]	960/760 rpm [dB]	2900 rpm [dB]	1450 rpm [dB]	960/760 rpm [dB]
1	54	53	52	63	58	56
2	56	55	53	66	60	58
3	57	56	55	68	62	60
4	59	58	56	69	63	61
6	61	59	58	71	65	62
8	62	61	59	72	66	64
11	64	63	61	74	68	65
15	66	65	63	75	69	67
19	67	66	64	76	70	68
22	68	67	65	77	71	68
30	70	68	66	78	72	70
37	71	70	67	79	73	70
45	72	71	68	80	74	71
55	73	72	69	80	74	72
75	75	73	71	81	76	73
90	76	74	71	82	76	73
110	77	75	72	82	77	74
132	78	76	73	83	77	75
160	79	77	74	84	78	75
200	80	78	75	84	79	76
250	81	79	-	85	80	-

4.7 Scope of supply

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

- Pump
- KSB surface-cooled IEC frame three-phase current squirrel-cage motor
- Flexible coupling with or without spacer
- Coupling guard
- Baseplate (to ISO 3661), cast or welded, for pump and motor, in torsion-resistant design

4.8 Dimensions and weights

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

2) Spatial average; as per ISO 3744 and EN 12639; valid for operating range Q/Qopt = 0.8 - 1.1 and non-cavitating pump operation. If noise levels are to be guaranteed: Add +3 dB for measuring and manufacturing tolerances.

3) Increase for 60 Hz operation: 3500 rpm +3dB; 1750 rpm +1dB

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.

⚠ DANGER

Strong magnetic field in the area of the magnetic coupling or the individual magnets
Danger of death for persons with pacemaker!
Interference with magnetic data carriers, electronic devices, components and instruments!
Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- ▹ Keep a safety distance of at least 0.3 m.
- ▹ Also observe the additional instructions.(⇨ Section 2.11 Page 13)

5.2 Checks to be carried out prior to installation

Place of installation

⚠ WARNING

Installation on 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 have set and must be completely horizontal and even.
- ▹ 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 Installing the pump set

⚠ DANGER

Excessive temperatures due to improper installation
Explosion hazard!

- ▹ Install the pump in horizontal position to ensure self-venting of the pump.
- ▹ If the pump is operated with an external liquid supply, vent the rotor space separately via the auxiliary connections in the casing cover.

5.3.1 Installation on the foundation

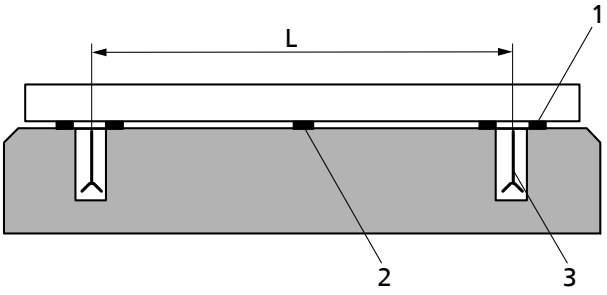


Fig. 7: Fitting the shims

L	Bolt-to-bolt distance	1	Shim
2	Shim if (L) > 800 mm	3	Foundation bolt

✓ 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, if necessary.
   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 the baseplate using low-shrinkage concrete with a standard particle size and a water/cement ratio of ≤ 0.5.
   Produce flowability with the help of a solvent.
   Perform secondary treatment of the concrete to DIN 1045.

NOTE

For low-noise operation contact KSB to check whether the pump set can be installed on anti-vibration mounts.

NOTE

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

5.3.2 Installation without foundation

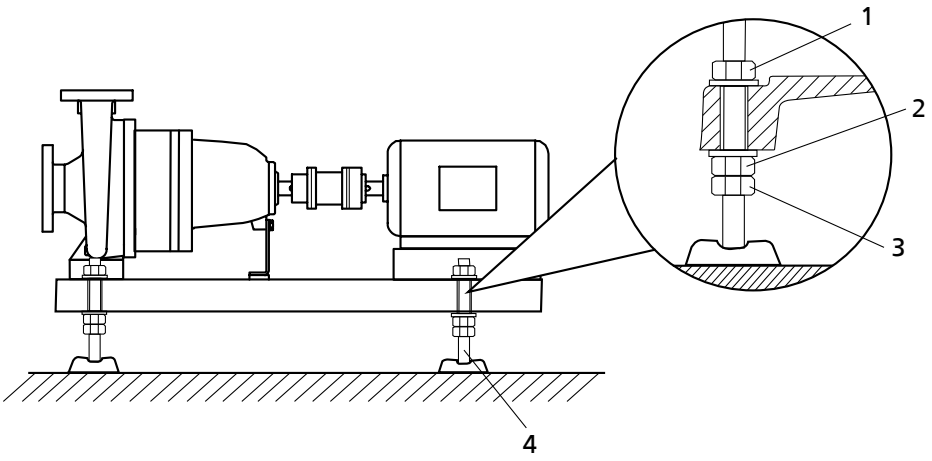


Fig. 8: Adjusting the levelling elements

1, 3	Locknut	2	Levelling nut
4	Levelling element		

✓ The installation surface has the required strength and characteristics.

1. Position the pump set on the levelling elements (4) and level it with the help of a spirit level (on the shaft/discharge nozzle).
2. To adjust any differences in height, loosen the bolts and locknuts (1, 3) of the levelling elements (4).
3. Turn the levelling nut (2) until any differences in height have been compensated.
4. Re-tighten the locknuts (1, 3) at the levelling elements (4).

5.4 Piping

5.4.1 Connecting the piping

⚠ DANGER

Impermissible loads acting on the pump nozzles
Danger to life from leakage of hot, toxic, corrosive or flammable fluids!

- ▹ Do not use the pump as an anchorage point for the piping.
- ▹ Anchor the pipelines in close proximity to the pump and connect them without transmitting any stresses or strains.
- ▹ Observe the permissible forces and moments at the pump nozzles.(⇨ Section 5.4.2 Page 25)
- ▹ Take appropriate measures to compensate 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

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

- ✓ The suction lift line has been laid with a rising slope, the suction head line with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
- ✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.
- ✓ Adapters to larger diameters have a diffuser angle of approximately 8° to prevent excessive pressure losses.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

CAUTION

Welding beads, scale and other impurities in the piping
Damage to the pump!

- ▷ Free the piping from any impurities.
- ▷ If necessary, install a filter.
- ▷ Comply with the instructions set out in (⇨ Section 7.2.2.3 Page 46).

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 and discharge nozzles of the pump.
3. Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
4. If required, install a filter in the piping (see figure: Filter in the piping).

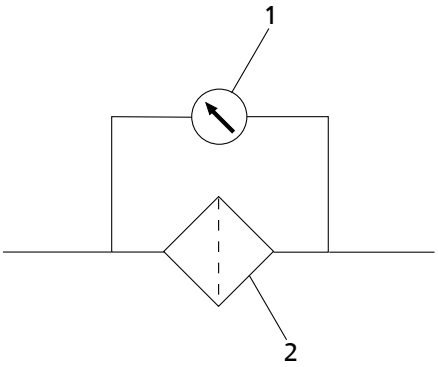


Fig. 9: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

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

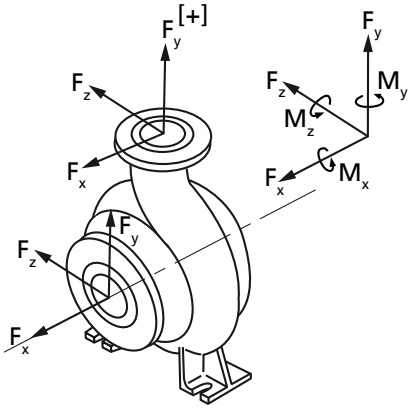
5. Connect the pump nozzles to the piping.

CAUTION

Aggressive flushing and pickling agents
Damage to the pump!

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

5.4.2 Permissible forces and moments at the pump nozzles



Forces and moments at the pump nozzles

The resulting permissible forces have been determined according to

$$F_{res\ D} \leq \sqrt{F_x^2 + F_z^2}$$

$$F_{res\ S} \leq \sqrt{F_y^2 + F_z^2}$$

The data on forces and moments apply to static piping loads only. If the limits are exceeded, they must be checked and verified.
If a computerised strength analysis is required, values are available on request only.
The values are only applicable if the pump is installed on a completely grouted baseplate and bolted to a rigid and level foundation.

Table 8: Forces and moments at the pump nozzles

Sizes	Suction nozzle [N]				Discharge nozzle [N]					Suction nozzle [Nm]			Discharge nozzle [Nm]		
	F_x	F_y	F_z	F_{res}	F_x	F_{yTens} +	F_{yCompr} –	F_z	F_{res}	M_x	M_y	M_z	M_x	M_y	M_z
25–160 25–200	1050	700	850	1100	500	350	650	450	700	550	450	300	400	300	200
32–160 32–200 32–250	1350	900	1100	1400	700	450	850	550	900	700	550	350	450	350	250
40–160 40–200 40–250 40–315	1750	1150	1400	1800	850	550	1100	700	1100	1150	850	600	550	450	300
50–160 50–200 50–250 50–315	2150	1400	1700	2200	1100	700	1350	900	1400	1450	1100	750	700	550	350
65–160 65–200 65–250 65–315	2700	1750	2150	2750	1400	900	1750	1150	1800	2000	1500	1000	1150	850	600
80–160 80–200 80–250 80–315 80–400	3700	2400	2950	3800	1700	1100	2150	1400	2200	2750	2100	1400	1450	1100	750
100–200 100–250 100–315 100–400	3700	2400	2950	3800	2150	1350	2700	1750	2800	2750	2100	1400	2000	1500	1000
125–250 125–315 125–400	4700	3100	3750	4750	2950	1850	3700	2400	3800	3450	2650	1750	2750	2100	1400
150–250 150–315 150–400 150–500	7350	4700	5700	7400	3750	2350	4700	3100	4850	5300	3850	2650	3450	2650	1750
200–250	7350	4700	5700	7400	5700	3550	7350	4700	7400	5300	3850	2650	5300	3850	2650

Sizes	Suction nozzle [N]				Discharge nozzle [N]					Suction nozzle [Nm]			Discharge nozzle [Nm]		
	F_x	F_y	F_z	F_{res}	F_x	F_{yTens} +	F_{yCompr} –	F_z	F_{res}	M_x	M_y	M_z	M_x	M_y	M_z
200–315 200–400 200–500	10000	6700	8000	10450	5700	3550	7350	4700	7400	7500	5700	3650	5300	3850	2650
250–315	12000	8000	10000	12800	8000	5000	10000	6700	10450	9150	6900	4500	7500	5700	3650

Correction coefficients depending on material and temperature (see diagram below).

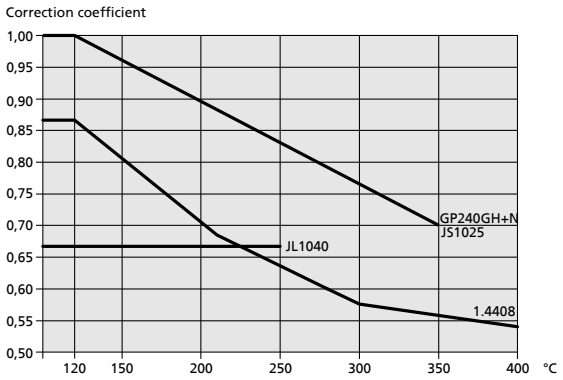


Fig. 10: Temperature correction diagram

5.4.3 Auxiliary connections

⚠ DANGER

Formation of a potentially explosive atmosphere as a result of incompatible fluids mixing in auxiliary feed lines
Risk of burns!
Explosion hazard!

- ▷ Verify compatibility of barrier fluid/quench liquid with fluid 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.

5.5 Enclosure/insulation

⚠ WARNING

The volute casing and casing/discharge cover take on the same temperature as the fluid handled
Risk of burns!

- ▷ Insulate the volute casing.
- ▷ Fit protective equipment.

CAUTION

Heat build-up in the bearing bracket
Damage to the bearings!

- Bearing brackets must not be insulated.
- The bearing temperature must **not** exceed 90 °C (measured on the outside of the bearing bracket).

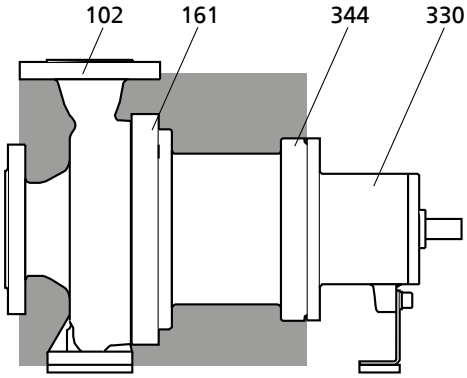


Fig. 11: Area where insulation is permitted

102	Volute casing	161	Casing cover
344	Bearing bracket lantern	330	Bearing bracket
	Area where insulation is permitted[4)]		

NOTE

Monitoring systems can be connected to bearing bracket lantern 344. When insulating the bearing bracket lantern make sure that the sensor connections and displays remain accessible. Also observe the sensor manufacturer's specifications regarding permissible ambient temperature.

5.6 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.

4) Identifies components where insulation is permitted but does not indicate a specific insulation type or design.

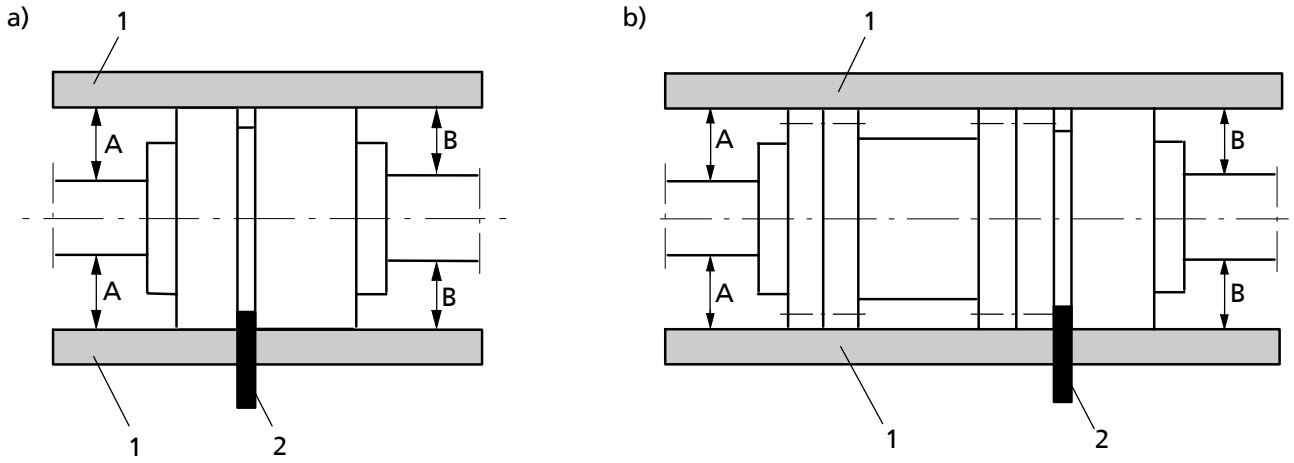


Fig. 12: Checking the coupling alignment: Coupling without spacer sleeve (a) or Coupling with spacer sleeve (b)

1	Straight-edge	2	Gauge

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

1. Loosen the support foot and re-tighten it without transmitting any stresses and strains.
2. Place the straight-edge axially on both coupling halves.
3. 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.
   The radial and axial deviation between the two coupling halves must not exceed 0.1 mm, during standstill as well as at operating temperature and under inlet pressure.
4. 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.
   The radial and axial deviation between the two coupling halves must not exceed 0.1 mm, during standstill as well as at operating temperature and under inlet pressure.
5. If alignment is correct, re-install the coupling guard and its footboard, if any.

5.7 Aligning the pump and motor

After having installed the pump set and connected the piping, check the coupling alignment and, if required, re-align the pump set (at the motor).

5.7.1 Motors with levelling screw

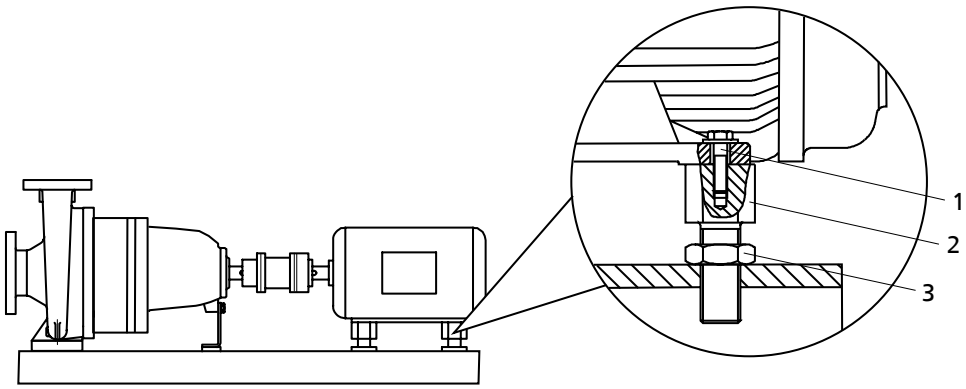


Fig. 13: Motor with levelling screw

1	Hexagon head bolt	2	Levelling screw
3	Locknut		

✓ The coupling guard and the footboard for the coupling guard, 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 levelling screws (2) by hand or by means of an open-jawed 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 that the coupling and 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 (see DIN EN 13463-1).

6. Re-install the coupling guard and the footboard for the coupling guard, if any.
7. Check the distance between coupling and coupling guard.
   The coupling and coupling guard must not come into contact.

5.7.2 Motors without levelling screw

Any differences in the centreline heights of the pump and motor shafts are compensated by means of shims.

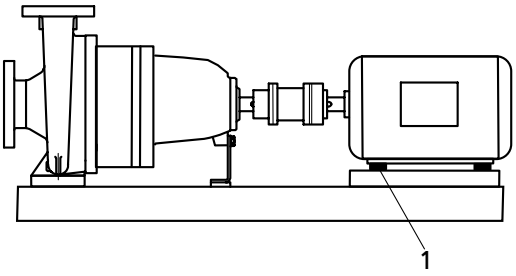


Fig. 14: Pump set with shim

1	Shim

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

1. Check the coupling alignment.
2. Unscrew 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 that the coupling and 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 (see DIN EN 13463-1).

6. Re-install the coupling guard and the footboard for the coupling guard, if any.
7. Check the distance between coupling and coupling guard.
   The coupling and coupling guard must not come into contact.

5.8 Electrical connection

⚠ DANGER

Incorrect electrical installation
Explosion hazard!

- ▹ For electrical installation, also observe the requirements of IEC 60079-14.
- ▹ Always connect explosion-proof motors via a motor protection switch.

⚠ DANGER

Work on the pump set by unqualified personnel
Danger of death from 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 mains network, short circuit!

- ▹ Observe the technical specifications of the local energy supply companies.

Table 9: Selection table of suitable starting methods

Information specified in data sheet	Starting method			
	DOL starting	Star-delta starting	Starting via frequency inverter	Starting via soft starter
Magnetic coupling selected for DOL starting only	✗	○	✗	✗
Magnetic coupling selected for both DOL and star-delta starting	✗	✗	✗	✗
✗ = Suitable, ○ = Not suitable				

1. Check the available mains voltage against the data on the motor name plate.

CAUTION

Using a star-delta configuration if magnetic coupling was selected for DOL starting only
Damage to the pump (set)!

- ▷ Observe the information provided in the data sheet.

2. Select a suitable starting method (see selection table of suitable starting methods).

NOTE

A motor protection device is recommended.

5.8.1 Setting the time relay

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.

Table 10: Time relay settings for star-delta starting:

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

5.8.2 Earthing

⚠ DANGER

Electrostatic charging
Explosion hazard!
Damage to the pump set!

- ▷ Connect the PE conductor to the earthing terminal provided.
- ▷ Provide for potential equalisation between the pump set and foundation.

5.8.3 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.

5.9 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.

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 drive end).

1. Start the motor and stop it again immediately to determine the motor'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 runs in the wrong direction of rotation, check the electrical connection of the motor and the control system, if applicable.

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 electric power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled.(⇨ Section 6.1.3 Page 34)
- The direction of rotation has been checked.(⇨ Section 5.9 Page 32)
- All auxiliary connections required are connected and operational.
- The lubricants have been checked.
- After prolonged shutdown of the pump (set), the activities described in (⇨ Section 6.4 Page 41) have been carried out.

6.1.2 Filling in the lubricant

⚠ WARNING

Mixing greases and oils
Damage to the bearing!

- ▷ Never top up grease-packed bearings with oil.

Grease-lubricated bearings have been packed with grease at the factory.
Grease quality(⇨ Section 7.2.3.2 Page 49)

Oil-lubricated bearings

Fill the bearing bracket with lubricating oil.
Oil quality see(⇨ Section 7.2.3.1.2 Page 48)
Oil quantity see(⇨ Section 7.2.3.1.3 Page 48)

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

✓ The constant-level oiler has been fitted.

CAUTION

Insufficient 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.
- ▷ Keep the oil reservoir properly filled at all times.

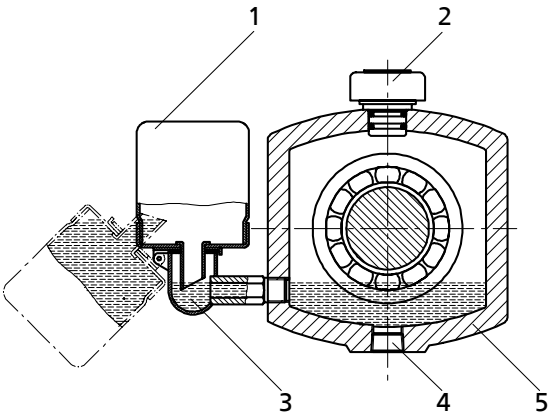


Fig. 15: Bearing bracket with constant-level oiler

1	Constant-level oiler	2	Vent plug
3	Connection elbow of the constant-level oiler	4	Screw plug
5	Bearing bracket		

1. Pull out the vent plug (2).
2. Hinge down the reservoir of the constant-level oiler (1) from the bearing bracket (5) and hold it in this position.
3. Fill in 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 (4) until air bubbles can be seen in the oil reservoir.

NOTE

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

6.1.3 Priming and venting the pump

⚠ DANGER

Formation of a potentially explosive atmosphere as a result of incompatible fluids mixing in auxiliary feed lines
Risk of burns!
Explosion hazard!

▷ Verify compatibility of barrier fluid/quench liquid with 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.

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 Final check

1. Remove the coupling guard and the footboard for the coupling guard, if any.
2. Check the coupling alignment; re-align the coupling if required.(⇨ Section 5.6 Page 27)
3. Check that the coupling and shaft can easily be rotated by hand.
4. Re-install the coupling guard and the footboard for the coupling guard, if any.
5. Check the distance between the coupling and coupling guard.
   The coupling and coupling guard must not come into contact.

6.1.5 Heating

The pump casing, rotor space and bearing bracket lantern can be heated either individually or in combination.

Permissible heating media:

- High-temperature hot water
- Steam
- Thermal oil

CAUTION

Lack of heating medium
Damage to the pump!

- ▷ Provide sufficient quantities of a suitable heating medium.

CAUTION

Time for warming up the pump too short
Damage to the pump!

- ▷ Check that the pump is sufficiently warmed up throughout.

CAUTION

Impermissibly high temperature of the heating medium
Fluid or heating medium could escape!

- ▷ Observe the application limits of the heating media.

⚠ DANGER

Excessive surface temperature
Explosion hazard!
Risk of burns!

- ▷ Observe the permissible temperature classes.

Table 11: Pressure and temperature limits for heated casing and rotor space

Hot water/steam		Thermal oil	
t_{max}	p_{max}	t_{max}	p_{max}
250 °C	20 bar	300 °C	6 bar

Table 12: Pressure and temperature limits for heated lantern

t_{max}	p_{max}
120 °C	10 bar

6.1.6 Heating up the pump (set) and keeping it warm

CAUTION

Pump blockage
Damage to the pump!
- ▷ Prior to pump start-up, heat up the pump as described in the manual.

Observe the following when heating up the pump (set) and keeping it warm:
- Make sure that the temperature is increased continuously.
- Max. heating speed: 10 °C/min (10 K/min)

Fluid temperatures above 150 °C
When the pump is used for handling fluids at temperatures above 150 °C make sure that the pump has been heated throughout before starting it up.

Temperature difference
The temperature difference between the pump's surface and the fluid handled must not exceed 100 °C (100 K) when the pump is started up.

Solidifying fluids
Take the melting point of the fluid handled into account if the pump is used for handling solidifying fluids.
Do not start up the pump set until the pump temperature is higher than the melting point of the fluid handled.

6.1.7 Start-up

⚠ DANGER

Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and discharge lines closed.
Explosion hazard!
Leakage of hot or toxic fluids!
- ▷ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.
- ▷ Only start up the pump set against a slightly open discharge-side shut-off element.

⚠ 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 specified.
- ▷ Always operate the pump within the permissible operating range.

Synchronous operation

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.

✓ 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.

✓ Any auxiliary connections have been opened.

1. Fully open the shut-off element in the suction head/suction lift line.
2. Close or slightly open the shut-off element in the discharge line.

⚠ DANGER

Excessive temperatures due to asynchronous operation of the magnetic coupling
Explosion hazard!

- ▹ Switch off the pump set immediately.
- ▹ Eliminate the cause.
- ▹ Adhere to the starting method indicated in the data sheet.(⇨ Section 5.8 Page 30)

NOTE

Pump run-up and motor run-up must be synchronous. Overloading, overheating or non-compliance with the design data may cause the inner and the outer rotor to drop out of synchronisation. Signs of asynchronous operation:
- Insufficient discharge head
- Noises inside the drive

NOTE

The pump must deliver fluid immediately after start-up. If fluid is not delivered immediately, switch off the pump and repeat the venting procedure.

3. Start up the motor.
   Verify synchronous operation of pump and electric motor.
4. **For vertical installation and bearing brackets P03/P04:** Shut off the external fluid supply, if any.
5. When there is a pressure reading on the pressure gauge, open the gate valve in the discharge line until the correct duty point is reached.

Retarded pump start-up

In some cases, the maximum torque of the magnetic coupling could be exceeded in practice. Accessories are available for limiting the start-up current and thus retarding the run-up of the motor.
Contact KSB to request particulars.

6.1.8 Shutdown

✓ 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 in the discharge line may remain open, provided the site's requirements and regulations are taken into account and observed.

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Drain all fluids which tend to polymerise, crystallise, solidify, etc. from the pump and the magnetic coupling.
3. Flush the pump set with a suitable liquid, if necessary.
   If the pump was used for handling fluids posing a health hazard, observe the information for draining the pump set(⇨ Section 7.3 Page 50).
4. Close the auxiliary feed lines but do not turn off the cooling liquid supply, if any, until the pump has cooled down.

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.

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 indicated 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.

6.2.1 Ambient temperature

CAUTION

Operation outside the permissible ambient temperature
Damage to the pump (set)!

- ▷ Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 13: Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	40 °C
Minimum	See data sheet.

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.

The frequency of starts is usually determined by the maximum temperature increase of the motor. This largely depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL, star-delta, 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 gate valve slightly open:

Table 14: Frequency of starts

Motor rating [kW]	Maximum number of start-ups [Start-ups/hour]
up to 12	15
up to 100	10
more than 100	5

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.

6.2.3 Fluid handled

6.2.3.1 Flow rate

Unless specified otherwise in the characteristic curves or in the data sheets, the following applies:

- Short-time operation: Q_{min} [5] = 0.1 × Q_{opt} [6]
- Continuous operation: Q_{min} [5] = 0.3 × Q_{opt} [6]
- 2-pole operation: Q_{max} [7] = 1.1 × Q_{opt} [6]
- 4-pole operation: Q_{max} [7] = 1.25 × Q_{opt} [6]

The data refer to water and water-like fluids. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures on the pump surface. However, if the physical properties of the fluids handled are different from water, the calculation formula below must be used to check if an additional heat build-up may lead to a dangerous temperature increase at the pump surface. If necessary, the minimum flow must be increased.

5) Minimum permissible flow rate
6) Flow rate at best efficiency point
7) Maximum permissible flow rate

$$T_O = T_f + \Delta\vartheta$$

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

Table 15: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Gravitational constant	m/s²
H	Pump head	m
T_f	Temperature of the fluid handled	°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 increases in proportion to the density of the fluid handled.

CAUTION

Impermissibly high density of the fluid handled
Motor overload!

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

6.2.3.3 Abrasive fluids

When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system and the magnetic coupling are to be expected. In this case, reduce the intervals commonly recommended for servicing and maintenance.

CAUTION

Magnetic particles in the fluid handled
Damage to the magnetic coupling!

- ▷ Take appropriate measures (e.g. magnetic filter) to prevent magnetic particles from entering the rotor space.
- ▷ To ensure sufficient throughflow in the rotor space, monitor the magnetic filter by measuring the differential pressure.

6.2.4 Leakage barrier (optional)

In the event of a defective containment shroud, the leakage barrier largely prevents the fluid handled from escaping into the atmosphere. Some minor leakage has to be expected.

⚠ DANGER

Excessive temperature rise in the shaft seal area in the event of a defective containment shroud
Explosion hazard!
Leakage of hot or toxic fluid handled!

- ▷ Monitor for leakage (fit monitoring equipment).
- ▷ If fluid leakage is detected as a result of a defective containment shroud, make sure that the pump set is switched off as quickly as possible.

The leakage barrier has been designed for the following operating limits:

- Max. permissible fluid temperature: 100 °C

- Max. permissible pressure p = 20 bar
- Max. permissible operating period with a defective containment shroud (leakage barrier subjected to pressure load during pump operation): 1 h

NOTE

If fluid temperatures exceed 100 °C, the maximum permissible operating period will be reduced. Leakage monitoring is mandatory to minimise the pump's period of operation with a defective containment shroud. In addition, increased leakage has to be expected. In a special version, the leakage barrier can be used for fluid temperatures up to 200°C (max.). In this case, contact KSB for particulars.

NOTE

For low inlet pressures and low heads, KSB recommends that leakage be monitored by means of a level transmitter (Liquiphant). In the case of higher inlet pressures and heads, containment shroud leakage can also be monitored by means of a pressure gauge.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

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

1. Start up the pump (set) regularly between once a month and once every three months for approximately five minutes during prolonged shutdown periods. This will prevent the formation of deposits within the pump and the pump intake area.

The pump (set) is removed and stored

✓ The pump has been properly drained (⇨ Section 7.3 Page 50) and the safety instructions for dismantling the pump have been observed.(⇨ Section 7.4.1 Page 51)

1. Spray-coat the inside wall of the pump casing, and in particular the impeller clearance areas, with a preservative.
2. Spray the preservative through the suction and discharge nozzles.
   It is advisable to then close the pump nozzles (e.g. with plastic caps or similar).
3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil or grease, food-approved, if required) to protect them against corrosion.
   Observe the additional instructions.(⇨ Section 3.3 Page 15)

If the pump set is to be stored temporarily, only preserve the wetted components made of low-alloy materials. Commercially available preservatives can be used for this purpose. Observe the manufacturer's instructions for application/removal.

Observe any additional instructions and information provided.(⇨ Section 3 Page 14)

6.4 Returning to service

For returning the pump to service observe the sections on commissioning/start-up (⇨ Section 6.1 Page 33) and the operating limits.(⇨ Section 6.2 Page 38)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service.(⇨ Section 7 Page 43)

⚠ WARNING

Failure to re-install or re-activate protective devices
Risk of personal injury from moving parts or escaping fluid!

- ▷ As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.

NOTE

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

7 Servicing/Maintenance

7.1 Safety regulations

⚠ DANGER

Sparks produced during servicing work
Explosion hazard!

- Observe the safety regulations in force at the place of installation!
- Always perform maintenance work on explosion-proof pump sets outside 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.

⚠ DANGER

Strong magnetic field in the area of the magnetic coupling or the individual magnets
Danger of death for persons with pacemaker!
Interference with magnetic data carriers, electronic devices, components and instruments!
Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- Keep a safety distance of at least 0.3 m.
- Also observe the additional instructions.(⇨ Section 2.11 Page 13)

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

⚠ WARNING

Unintentional starting of pump set
Risk of injury by moving parts!

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

⚠ WARNING

Fluids and supplies posing a health hazard and/or hot fluids or supplies
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.

⚠ WARNING

Insufficient stability
Risk of crushing hands and feet!

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

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

NOTE

All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached "Addresses" booklet or on the Internet at "www.ksb.com/contact".

Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

7.2.1 Supervision of operation

⚠ 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.

⚠ DANGER

Incorrectly serviced barrier fluid system
Explosion hazard!
Fire hazard!
Damage to the pump set!
Hot and/or toxic fluids could escape!

- ▷ Service the barrier fluid system regularly.
- ▷ Monitor the barrier fluid pressure.

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 38)

While the pump 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.
- 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 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).

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 as well as at grease or oil lubricated rolling element bearings with shaft seal (model with leakage barrier) 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).

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.

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 clearance gaps

For checking the clearance gaps, remove the back pull-out unit and the impeller (if necessary).(⇨ Section 7.4.5 Page 52).
If the clearance gap is larger than permitted (see the following table), replace casing wear ring 502.1 with a new one.

Clearances between impeller and casing

The clearances given refer to the diameter:

Table 16: Clearances between impeller and casing

	Material variants	
	S [mm]	C / E [mm]
up to and including DN 65	$0.4^{+0.1}$	$0.6^{+0.1}$
DN 80 to DN 200	$0.5^{+0.1}$	$0.6^{+0.1}$
DN 200 and above	$0.65^{+0.1}$	$0.75^{+0.1}$

NOTE

If the clearances given are exceeded by more than 1 mm (referring to the diameter) replace the affected components or restore the original clearance by means of a casing wear ring.
Contact KSB.

Plain bearing clearances

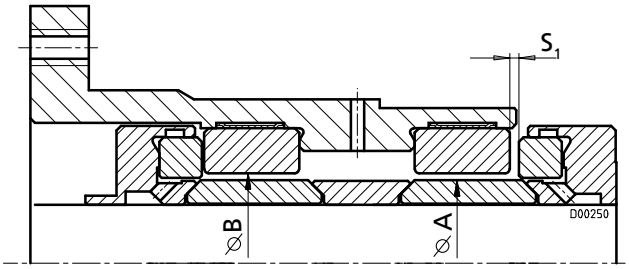


Fig. 16: Plain bearing clearances

Table 17: Plain bearing clearances

Bearing bracket	Axial clearance S_1[8)] [mm]	Ø A [mm]	Ø B [mm]
P02	0.5±0.3	$36.97_{-0.02}$	$37^{+0.025}$
P03/P04	0.5±0.3	$49.95_{-0.02}$	$50^{+0.025}$
P05	0.5±0.3	$61.95_{-0.02}$	$62^{+0.03}$

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 Lubrication of plain bearings

The hydrodynamic plain bearings are lubricated by the pumped product itself during pump operation. Bearings shall be checked for wear in the following cases:

- When the pump has been operated under dry running or cavitation conditions, the bearings should be checked immediately, if possible.
- Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear at the bearings (insufficient lubrication). Also check the bearings.

8) Can be measured between the back vanes of impeller 230 and casing cover 161 in assembled condition

7.2.2.5 Checking the shaft seal (for models with leakage barrier only)

If a defect in the containment shroud (rare defect) results in leakage of a fluid whose critical properties might pose a hazard to staff and the environment, the shaft seal of the leakage barrier must be checked regularly.

Example of functional test

To test the correct function of the shaft seal, proceed as follows, for instance:

Before commissioning the pump, prepare it by fitting an additional connection for the test fluid.

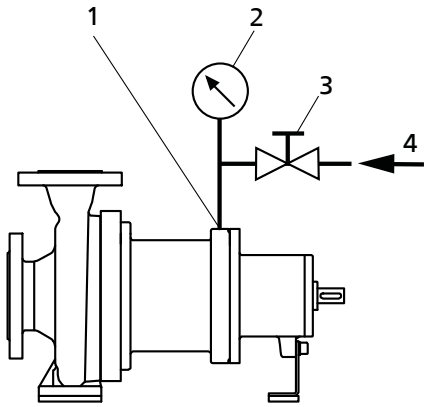


Fig. 17: Schematic of test set-up

1	Connection 8 M.1	2	Pressure gauge
3	Shut-off element	4	Inert gas (e.g. nitrogen)

1. Fit pipework with shut-off element at connection 8 M.1 (see illustration).
2. Provide a pressure gauge with display, unless already fitted for leakage monitoring.
3. Shut off the connection for inert gas during pump operation (close the valve).

NOTE

Before testing the shaft seal function, switch off the pump set as stipulated and close the shut-off elements in the suction and discharge lines. Allow the pump set to cool down to ambient temperature. Use inert gas (e.g. nitrogen) as test fluid.

NOTE

If the containment shroud is defective there will be fluid handled in the bearing bracket lantern. Provide a suitable vessel to contain any leakage and wear protective clothing, if necessary.

4. Connect the test fluid supply.
5. Open the shut-off element and fill bearing bracket lantern 344 with test fluid until a pressure of 2-3 bar is reached.
6. Shut off the test fluid supply.
7. Check the pressure gauge reading: The pressure must not drop by more than 1 bar during a test period of 1 minute.

   ⇨ If the pressure drops more quickly, replace the shaft seal.

The following must be observed when repairing a pump with a defective containment shroud:

- Always replace all sealing elements, i.e. sealing lip, elastomers and O-rings.
- Also check all components of the leakage barrier for corrosion: If corrosion damage is found, replace the bearing bracket lantern, bearing bracket with shaft seal, outer rotor and the rolling element bearings (leakage barrier components (⇨ Section 9.1 Page 73))

7.2.3 Lubrication and lubricant change at 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!
Risk of burns!

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

7.2.3.1 Oil lubrication

The rolling element bearings are usually lubricated with mineral oil.

7.2.3.1.1 Intervals

Table 18: Oil change intervals

Temperature at the bearing	First oil change	All subsequent oil changes[9)]
up to 70 °C	After 300 operating hours	Every 8500 operating hours
70 °C - 80 °C	After 300 operating hours	Every 4200 operating hours
80 °C - 90 °C	After 300 operating hours	Every 2000 operating hours

7.2.3.1.2 Oil quality

Table 19: Oil quality

Designation	Symbol to DIN 51502	Properties	
CLP46 lubricating oil to DIN 51517 or HD 20W/20 SAE	□	Kinematic viscosity at 40 °C	46±4 mm²/s
		Flash point (to Cleveland)	+175 °C
		Solidification point (pour point)	-15 °C
		Application temperature[10)]	Higher than permissible bearing temperature

7.2.3.1.3 Oil quantity

Table 20: Oil quantity

Bearing bracket	Oil quantity [l]
P02	0.1
P03	0.15
P04	0.15

9) At least once a year
10) For ambient temperatures below -10 °C use a different suitable type of lubricating oil. Contact KSB.

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.

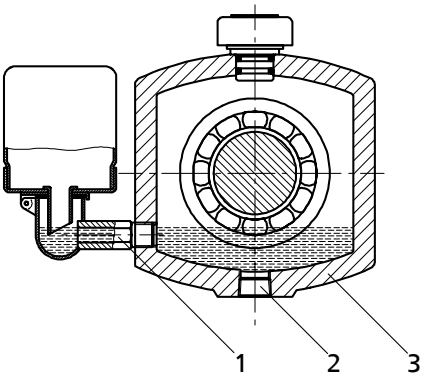


Fig. 18: Bearing bracket with constant-level oiler

1	Constant-level oiler	2	Screw plug
3	Bearing bracket		

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

1. Place the container underneath the screw plug.
2. Undo the screw plug (2) at the bearing bracket (3) and drain the oil.
3. Once the bearing bracket (3) has been drained, re-insert and re-tighten the screw plug (2).
4. Re-fill with oil.

7.2.3.2 Grease lubrication

The bearings are packed with high-quality lithium-soap grease at the factory.

7.2.3.2.1 Intervals

The bearings are grease-packed for life.
A theoretical bearing life Lh10 of 25,000 h can be achieved at an operating temperature of 90 °C. At temperatures below 80 °C, Lh10 values of 30,000 h are possible.
However, bearing life may be reduced by vibrations, aggressive gases, moisture, etc.

7.2.3.2.2 Grease quality

Optimum grease properties for rolling element bearings

- High melting point lithium soap base grease
- Free of resin and acid
- Not liable to crumble
- Rust-preventive characteristics

7.3 Drainage/cleaning

⚠ DANGER

Insufficient preparation of work on the pump (set)
Risk of injury!

- Properly shut down the pump set.(⇨ Section 6.1.8 Page 37)
- Close the shut-off elements in the suction and discharge line.
- Release pump pressure. (⇨ Section 7.3 Page 50)
- Shut off any auxiliary feed lines.
- Allow the pump set to cool down to ambient temperature.

⚠ WARNING

Fluids, consumables and supplies which are hot or pose a health hazard
Hazard to persons and the environment!

- Collect and properly dispose of flushing fluid and any residues of the fluid handled.
- Wear safety clothing and a protective mask, if required.
- Observe all legal regulations on the disposal of fluids posing a health hazard.

If the fluids handled by the pump set leave residues which might lead to corrosion damage when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the pump set must be flushed through, neutralised, and then for drying purposes anhydrous inert gas must be blown through the pump.

Use connection 6B or 6B.1 to drain the fluid handled (see drawing of auxiliary connections).
The pump is drained via the drain plugs 903.01 (on the casing) and 903.29 (on the casing cover, if any).

NOTE

Apart from the pump casing itself, the bearing bracket lantern 344, too, could be pressurised (on models fitted with a leakage barrier).

In case of containment shroud damage

To avoid any risk in the event of damage to the containment shroud, also always open screw plugs 903.22 and 903.94 on the lantern (or remove auxiliary pipework, if any), to ensure that the fluid handled is drained completely.

If handling highly toxic fluids

Utmost care must be taken when highly toxic fluids have been handled. In this case, the complete pump set must be thoroughly flushed through.
Always watch out for possible liquid residues even when the pump has been flushed and drained!

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ DANGER

Strong magnetic field in the area of the magnetic coupling or the individual magnets
Danger of death for persons with pacemaker!
Interference with magnetic data carriers, electronic devices, components and instruments!
Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- ▹ Keep a safety distance of at least 0.3 m.
- ▹ Also observe the additional instructions.(⇨ Section 2.11 Page 13)

⚠ WARNING

Hot surface
Risk of injury!

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

⚠ WARNING

Unqualified personnel performing work on the pump (set)
Risk of injury!

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

⚠ 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.

Observe the general safety instructions. (⇨ Section 7.1 Page 43)

For any work on the motor, observe the instructions of the motor manufacturer (refer to manufacturer's technical product literature).

For dismantling and reassembly observe the exploded views and the general assembly drawing.

In case of damage you can always contact our service departments.

⚠ DANGER

Insufficient preparation of work on the pump (set)
Risk of injury!

- ▹ Properly shut down the pump set.(⇨ Section 6.1.8 Page 37)
- ▹ Close the shut-off elements in suction and discharge line.
- ▹ Drain the pump and release the pump pressure. (⇨ Section 7.3 Page 50)
- ▹ Close any auxiliary connections.
- ▹ Allow the pump set to cool down to ambient temperature.

7.4.2 Preparing the pump set

1. Interrupt the power supply and secure the pump against unintentional start-up.
2. Disconnect and remove all auxiliary pipework.

3. Remove the coupling guard.
4. Remove the coupling spacer, if any.
5. Drain the oil fill of oil-lubricated bearings.(⇨ Section 7.2.3.1.4 Page 49)

7.4.3 Dismantling the motor

NOTE

On pump sets with spacer-type couplings, the back pull-out unit 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. Unbolt the motor from the baseplate.
3. Shift the motor to separate it from the pump.

7.4.4 Dismantling the bearing bracket with outer rotor (horizontal dismantling)

✓ The steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.3 Page 52) have been observed/carried out.

1. Undo hexagon socket head cap screw 914.04 with spring washer 930.01.
2. Undo the baseplate fixing bolts at support foot 183 and remove the support foot.
3. Undo hexagon nuts 920.04.

⚠ WARNING

Axial magnetic forces
Risk of bruising injuries on fingers and hands

- ▹ When the pump is dismantled/reassembled in horizontal position, use forcing screws to counteract the magnetic forces acting in axial direction. The forcing screws should be at least as long as the magnets.(⇨ Section 4.2 Page 17)

4. Use forcing screws 901.33 to separate bearing bracket 330 with outer rotor 818.02 from lantern 344.
5. Place the outer rotor with the bearing bracket in a vertical position on a clean and level non-magnetic assembly surface.
6. Proceed with (⇨ Section 7.4.6.3 Page 54) and (⇨ Section 7.4.6.4 Page 54) .

7.4.5 Removing the back pull-out unit

✓ On pump sets without spacer-type coupling, the motor has been removed.

CAUTION

Improper transport of complete back pull-out unit (with or without impeller)
Damage to the plain bearings!

- ▹ Use a suitable transport lock to prevent axial movement of the pump shaft during transport.

1. Undo hexagon socket head cap screw 914.04 with spring washer 930.01.
2. Undo the baseplate fixing bolts at support foot 183 and remove the support foot.
3. Undo hexagon nuts 920.01.

⚠ WARNING

Back pull-out unit tipping over
Risk of squashing hands and feet!

- ▹ Suspend or support the back pull-out unit at the pump end.

4. Use forcing screws 901.74 to push the complete back pull-out unit out of casing 102.
5. Pull the back pull-out unit out of the casing and place it vertically on the impeller.
6. Secure the back pull-out unit against tipping over.

7.4.6 Dismantling the back pull-out unit

7.4.6.1 Dismantling the bearing bracket with the outer rotor (vertical dismantling)

CAUTION

Collision between outer rotor and containment shroud
Damage to containment shroud or outer rotor!

- ▹ Observe the dismantling sequence specified.

✓ The steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.5 Page 52) have been observed/carried out.

✓ The back pull-out unit has been placed vertically on the impeller in a clean and level assembly area.

✓ The back pull-out unit has been secured against tipping over.

1. Undo hexagon nuts 920.04.
2. Use forcing screws 901.33 to separate bearing bracket 330 with outer rotor 818.02 from lantern 344.
3. Screw an eyebolt into the stub of shaft 210.01 and use it to pull out bearing bracket 330, complete with outer rotor 818.02 (e.g. with lifting equipment).
4. Place the outer rotor with the bearing bracket in a vertical position on a clean and level non-magnetic assembly surface.

NOTE

This dismantling sequence ensures that the outer rotor is guided along the inner diameter of the lantern, thus preventing impact on the shroud due to magnetic forces.

7.4.6.2 Dismantling the bearing bracket lantern

CAUTION

Collision between bearing bracket lantern and containment shroud
Damage to containment shroud!

- ▹ Suitably protect the containment shroud (see table for manufacturing dimensions of shroud guard).

NOTE

A suitable containment shroud guard can be manufactured to the following dimensions.

Table 21: Manufacturing dimensions of containment shroud guard

Containment shroud diameter (nominal diameter of magnetic coupling [mm])	Inside/outside diameter x length [mm]
110	115/156 x 100
165	170/220 x 120
220	225/270 x 220

✓ The steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.1 Page 53) have been observed/carried out.

1. Place the containment shroud guard onto the containment shroud.
2. Remove hexagon nuts 920.15.
3. Take lantern 344 off casing cover 161.
4. On models with leakage barrier, pull O-ring 412.98 off the containment shroud flange.
5. Remove the containment shroud guard.

7.4.6.3 Dismantling the bearing bracket with the outer rotor

✓ The steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6 Page 53) have been observed/carried out.

✓ The bearing bracket with the outer rotor is kept in a clean and level, non-magnetic assembly area.

1. Protect the magnets in outer rotor 818.02 with a suitable non-metallic cover.
2. Remove screw 900.08 with a pin wrench (included in KSB's scope of supply) and pull outer rotor 818.02 off shaft 210.01.

7.4.6.4 Dismantling the rolling element bearings

Dismantling the rolling element bearings - standard design

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.3 Page 54) have been observed/carried out.

✓ The bearing bracket is kept in a clean and level assembly area.

1. Pull the coupling half off the pump shaft with a puller.
2. Remove keys 940.02 and 940.32.
3. Undo screws 914.02 and remove drive-end bearing cover 360.02 and joint ring 411.78.
   Oil-lubricated models: Also remove thrower 507.12, O-ring 412.21 and gasket 400.02. Undo screws 914.01 and remove pump-end bearing cover 360.01 with thrower 507.11, O-ring 412.36, gasket 400.01 and joint ring 411.77.
4. Remove circlip 932.80.
5. Push the shaft out of the bearing bracket from the drive end.
6. Pull rolling element bearing 321.02 out of bearing bracket 330 from the drive end.
7. Remove circlip 932.02 from the bearing bracket.
8. Remove circlip 932.20.
9. Pull rolling element bearing 321.01 off the drive shaft.

Dismantling the rolling element bearings - design with leakage barrier (optional)
Magnetic coupling 110/165

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.3 Page 54) have been observed/carried out.

✓ The bearing bracket is kept in a clean and level assembly area.

1. Pull the coupling half off the pump shaft with a puller.
2. Remove keys 940.02 and 940.32.
3. Undo screws 914.02 and remove drive-end bearing cover 360.02, shaft spring 950.24 and joint ring 411.78.
   Oil-lubricated models: Also remove gasket 400.02.
4. Undo screws 914.01 and gently pull bearing cover 360.01 including backing ring 50-3.97 and shaft seal 430.77 off shaft protecting sleeve 524.09.
5. Take O-ring 412.36 out of bearing cover 360.01.
6. Place bearing cover 360.01 with backing ring 50-3.97 on top in a clean and level assembly area.
7. Undo screws 914.78. Use forcing screws (e.g. 2xM5x20) to remove backing ring 50-3.97 from bearing cover 360.01.
8. Remove sealing lip 420.97 and elastomer 400.97.
9. Pull shaft protecting sleeve 524.09 off shaft 210.01.
10. Remove O-ring 412.28 from shaft 210.01.
11. Remove circlip 932.20.
12. Push shaft 210.01 out of bearing bracket 330 from the pump end.
13. Pull rolling element bearing 321.02 out of bearing bracket 330 from the pump end.
14. Remove O-ring 412.97 from the groove in bearing bracket 330.
15. Remove circlip 932.80.
16. Pull rolling element bearing 321.02 off the drive shaft.

Dismantling the rolling element bearing - design with leakage barrier (optional) Magnetic coupling 220

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.3 Page 54) have been observed/carried out.

✓ The bearing bracket is kept in a clean and level assembly area.

1. Pull the coupling half off the pump shaft with a puller.
2. Remove keys 940.02 and 940.32.
3. Undo screws 914.02 and remove drive-end bearing cover 360.02 and joint ring 411.78.
4. Undo screws 914.01. Use forcing screws (M8x20) to gently pull bearing cover 360.01 including backing ring 50-3.97 and shaft seal 430.77 off shaft protecting sleeve 524.09.
5. Remove O-ring 412.36 from bearing cover 360.01. Place bearing cover 360.01 with backing ring 50-3.97 on top in a clean and level assembly area.
6. Undo screws 914.78. Use forcing screws (e.g. 3xM5x20) to remove backing ring 50-3.97 from bearing cover 360.01.
7. Remove sealing lip 420.97 and elastomer 400.97.
8. Pull shaft protecting sleeve 524.09 off shaft 210.01.
9. Remove O-ring 412.28 from the groove in shaft protecting sleeve 524.09.
10. Remove circlip 932.80.
11. Push the shaft out of bearing bracket 330 from the drive end.
12. Pull rolling element bearing 321.02 out of bearing bracket 330 from the drive end.
13. Remove circlip 932.02 from bearing bracket 330.
14. Remove O-ring 412.97 from the groove in bearing bracket 330.
15. Pull rolling element bearing 321.01 off the drive shaft.

7.4.6.5 Removing the containment shroud

Removing the containment shroud - metallic materials

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.4 Page 54) have been observed/carried out.

✓ The parts are kept in a clean and level assembly area.

⚠ WARNING

Possible fluid residues
Hazard to persons and the environment!

▹ Wear protective clothing.

1. Undo socket head cap screws 914.03.
2. Carefully separate containment shroud 82-15 from casing cover 161 using forcing screws.
3. Take out joint ring 411.08.
4. Clean containment shroud 82-15, if necessary, and place it on a non-magnetic assembly surface (e.g. wood, plastic).
5. Place a non-magnetic spacer (wood, plastic, at least 15 mm high) in the bottom of the containment shroud.
6. Place the entire assembly (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) into the containment shroud or guard.

NOTE

The non-magnetic containment shroud 82-15 protects the magnetic inner rotor from damage and above all from contamination (metal particles). It is also possible to use a non-magnetic guard made of wood or plastic (see table: manufacturing dimensions of guard).

Removing the containment shroud - ceramic materials, bearing bracket P02

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.4 Page 54) have been observed/carried out.

✓ The parts are kept in a clean and level assembly area.

⚠ WARNING

Possible fluid residues
Hazard to persons and the environment!

▹ Wear protective clothing.

1. Undo socket head cap screws 914.03.
2. Carefully separate containment shroud flange 723.11 from casing cover 161 using forcing screws.
3. Carefully take off containment shroud 82-15.
4. Take out joint ring 411.08.

CAUTION

Hidden damage to ceramic containment shroud
Destruction of containment shroud upon pump start-up!

▹ Never use a ceramic containment shroud as guard.

▹ Use a guard made of plastic or wood (see table: manufacturing dimensions of guard).

5. Place the entire assembly (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) into the guard.

NOTE

The magnetic inner rotor must be protected from damage and above all from contamination (metal particles). Use a non-magnetic guard made of wood or plastic for this purpose (see table: manufacturing dimensions of guard).

Removing the containment shroud - ceramic materials, bearing brackets P03/ P04

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.4 Page 54) have been observed/carried out.

✓ The parts are kept in a clean and level assembly area.

⚠ WARNING

Possible fluid residues
Hazard to persons and the environment!

▹ Wear protective clothing.

1. Undo socket head cap screws 914.03.
2. Carefully separate containment shroud flange 723.11 from casing cover 161 using forcing screws.
3. Carefully take off the containment shroud assembly (containment shroud flange 723.11, containment shroud flange 723.12, containment shroud 82-15).
4. Take out joint ring 411.08.
5. Undo socket head cap screws 914.06.
6. Carefully separate containment shroud flange 723.12 from containment shroud flange 723.11 using forcing screws.
7. Carefully take off containment shroud 82-15.
8. Take out joint ring 411.30.

CAUTION

Hidden damage to ceramic containment shroud
Destruction of containment shroud upon pump start-up!

▹ Never use a ceramic containment shroud as guard.

▹ Use a guard made of plastic or wood (see table: manufacturing dimensions of guard).

9. Place the entire assembly (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) into the guard.

NOTE

The magnetic inner rotor must be protected from damage and above all from contamination (metal particles). Use a non-magnetic guard made of wood or plastic for this purpose (see table: manufacturing dimensions of guard).

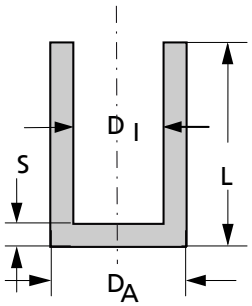


Fig. 19: Dimensions of shroud guard

Table 22: Manufacturing dimensions of the shroud guard

Containment shroud diameter (nominal diameter of magnetic coupling [mm])	D_I [mm]	D_A [mm]	L [mm]	S [mm]
110	110	130	110	10
165	164	184	140	10
220	218	238	240	10

7.4.6.6 Dismantling the impeller

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.5 Page 56) have been observed/carried out.

✓ The parts are kept in a clean and level assembly area.

1. Undo hexagon nut 920.95 and take disc 550.87 off shaft 210.03.
2. Pull impeller 230 off shaft 210.03.
3. Remove key 940.01.

7.4.6.7 Dismantling the rotor

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 51) to (⇨ Section 7.4.6.6 Page 58) have been observed/carried out.

✓ The parts are kept in a clean and level assembly area.

1. Lift casing cover 161 with bearing ring carrier 391.01, disc springs 950.23, bush 540.01 (P05) and thrust bearing 314.01 off shaft 210.03.

NOTE

If thrust bearing 314.01 is stuck on the shaft, remove disc springs 950.23 and extract thrust bearing 314.01 by means of the threads in thrust bearing 314.01 (bearing bracket P05: push out thrust bearing 314.01 with bearing ring carrier 391.01).

2. Lift shaft 210.03 with inner rotor 818.01 out of the guard.
3. Take bearing sleeve 529.21, intermediate ring 509.21, bearing sleeve 529.22, thrust bearing 314.02, inner rotor 818.01 and key 940.31 off shaft 210.03.
4. Undo socket head cap screws 914.07.
5. Use forcing screws to separate bearing ring carrier 391.01 from casing cover 161.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ WARNING

Leaks and/or corrosion damage on monitoring systems
No fault indications!
Leakage of fluid handled!

- ▹ Never install damaged or corroded monitoring systems in the pump.
- ▹ Check monitoring systems for damage and correct function prior to installation.

⚠ 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.

⚠ WARNING

Collision between lantern and containment shroud or lantern and bearing bracket/ intermediate piece due to magnetic forces
Damage to magnets and bearings!
Risk of personal injury!

- ▹ Strictly follow the instructions for reassembly.

	**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.

Sequence

Always reassemble the pump in accordance with the corresponding general assembly drawing or exploded view.(⇨ Section 9.1 Page 73)

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**
  - Always use new O-rings.
  - Never use O-rings that have been glued together from material sold by the metre.

	**CAUTION** **Contact of O-ring with graphite or similar material** Fluid could escape! ▷ Do not coat O-ring with graphite or similar material. ▷ Use animal fats or lubricants based on silicone or PTFE.

Assembly adhesives

For gaskets, avoid the use of assembly adhesives, if possible.

- **Adhesives**
  - Should assembly adhesives be required after all, 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).
  - If in certain cases mounting aids or anti-adhesives other than described herein are required, please contact the sealing material manufacturer.
- **Locating surfaces**
  - Coat the locating surfaces of the individual components and screwed connections with graphite or similar before reassembly.
    Make sure the lubricant is compatible with the fluid handled.

Tightening torques

For reassembly, tighten all screws and bolts as specified in this manual.(⇨ Section 7.6 Page 68)

Dimensions check

During reassembly, verify and observe the specified dimensions.(⇨ Section 7.2.2.2 Page 45)

7.5.2 Pre-assembling the rotor

✓ It has been checked whether the bearing components and impeller can be easily mounted on the shaft.

✓ The individual parts are kept in a clean and level assembly area.

✓ All disassembled 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.

CAUTION

Improper reassembly
Damage to plain bearings or magnetic coupling!

- ▷ Casing cover 161 and bearing ring carrier 391.01 must always be re-assembled with the dotting marks pointing upwards.

1. Fit bearing ring carrier 391.01 in casing cover 161 with the dotting marks in casing cover 161 and in bearing ring carrier 391.01 pointing upwards.
2. Tighten socket head cap screws 914.07 to the torques given in this manual.(⇨ Section 7.6 Page 68)
3. Insert key 940.31 into shaft 210.03.

CAUTION

Dirt particles between conical surfaces of bearing components
Damage to the plain bearings!

- ▷ Thoroughly clean the bearing components prior to reassembly.

4. Fit inner rotor 818.01 (Caution: magnetic!), spacer ring 504.02 (if any), thrust bearing 314.02, bearing sleeve 529.22, intermediate ring 509.21 and bearing sleeve 529.21 in this order. (Note: bearing sleeves 529.21 and .22 are identical.) The conical surfaces of the thrust bearing, the bearing sleeves and the intermediate ring have a pre-centring effect.
5. Place containment shroud 82-15 on a non-magnetic assembly surface (wood, plastic).
6. To hold the shaft in position, place a non-magnetic spacer (e.g. made of wood or plastic, at least 15 mm high) on the bottom inside the containment shroud.
7. Place the shaft with the pre-assembled components (inner rotor, spacer, thrust bearing, bearing sleeves, intermediate ring) into the containment shroud.
8. Slip casing cover 161 with bearing ring carrier 391.01 over the bearing sleeves and carefully rest it on thrust bearing 314.02.
9. Slip on thrust bearing 314.01.

CAUTION

Incorrect installation of disc springs
Damage to the plain bearings!

- ▷ Fit the disc springs in such a way that the outside diameter rests against thrust bearing 314.01.

10. Slip disc springs 950.23 onto thrust bearing 314.01.
11. Bearing bracket P05: Slide bush 540.01 onto shaft 210.03.
12. Insert key 940.01 into shaft 210.03.
13. Fit impeller 230.
14. Insert disc 550.87.
15. Tighten hexagon nut 920.95 with a torque wrench.
    Hold impeller 230 with a suitable tool (belt wrench).

NOTE

Repeatedly rotate the casing cover by hand while tightening the nuts. Make sure the casing cover is easy to rotate. Stop the tightening procedure if the casing cover seems to be blocked. Loosen the nut and repeat the tightening procedure.
If the casing cover is blocked repeatedly, dismantle the components again and check for cleanliness and correct dimensions.

7.5.3 Fitting the containment shroud

Fitting the containment shroud - metallic materials

✓ The notes and steps stated in(⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.2 Page 59) have been observed/carried out.

✓ The individual parts have been placed 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. Take the rotor out of the containment shroud or assembly fixture and place it vertically onto the impeller in a clean and level assembly area.
2. Check the inner rotor for contamination (e.g. metal particles) and clean, if necessary.
3. Place joint ring 411.08 into the casing cover.
4. Place containment shroud 82-15 onto the casing cover.
5. Tighten hexagon socket head cap screws 914.03 to the torques given in this manual.(⇨ Section 7.6 Page 68)

Fitting the containment shroud - ceramic materials, bearing bracket P02

1. Take the rotor out of the guard and place it vertically onto the impeller in a clean and level assembly area.
2. Check the inner rotor for contamination (e.g. metal particles) and clean, if necessary.
3. Insert joint ring 411.08 into casing cover 161.
4. Place containment shroud 82-15 onto casing cover 161.
5. Carefully guide containment shroud flange 723.11 over containment shroud 82-15 and place it onto casing cover 161.
6. Tighten hexagon socket head cap screws 914.03 to the torques given in this manual.(⇨ Section 7.6 Page 68)

Fitting the containment shroud - ceramic materials, bearing brackets P03/ P04

1. Take the rotor out of the guard and place it vertically onto the impeller in a clean and level assembly area.
2. Check the inner rotor for contamination (e.g. metal particles) and clean, if necessary.
3. Position containment shroud flange 723.11 nearby with the bolt hole circle with 8 pocket holes pointing upwards.
4. Place joint ring 411.30 in containment shroud flange 723.11.
5. Place containment shroud 82-15 onto containment shroud flange 723.11.
6. Carefully guide containment shroud flange 723.12 over containment shroud 82-15 and place it onto containment shroud flange 723.11.
7. Tighten hexagon socket head cap screws 914.06 to the torques given in this manual.
8. Insert joint ring 411.08 into casing cover 161.
9. Place the containment shroud assembly (containment shroud flange 723.11, containment shroud flange 723.12, containment shroud 82-15) onto casing cover 161.
10. Tighten hexagon socket head cap screws 914.03 to the torques given in this manual.(⇨ Section 7.6 Page 68)

7.5.4 Fitting the bearing bracket lantern

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.3 Page 61) have been observed/carried out.

✓ The individual parts are kept in a clean and level assembly area.
✓ All disassembled 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.

CAUTION

Collision between bearing bracket lantern and containment shroud
Damage to containment shroud!

▹ Suitably protect the containment shroud (see table for manufacturing dimensions of shroud guard).

1. Screw eyebolt 900.26 into the bearing bracket lantern.
2. On models with leakage barrier, pull O-ring 412.98 onto the containment shroud flange.
3. Place the containment shroud guard onto the containment shroud.

NOTE

On the fully assembled pump, the dotting mark in the casing cover and the eyebolt must point in the same direction (upwards).

4. Place lantern 344 onto the casing cover.
5. Tighten hexagon nuts 920.15 to the torques given in this manual.(⇨ Section 7.6 Page 68)
6. Remove the guard.
7. Fit studs 902.04.

7.5.5 Fitting the rolling element bearings

Fitting the rolling element bearings - standard design

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.4 Page 61) have been observed/carried out.
✓ 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. Push radial ball bearing 321.02 onto shaft 210.01 until it abuts against the shaft shoulder (do not heat up the bearing!) and secure it with circlip 932.80.
2. Place circlip 932.02 into bearing bracket 330.
3. Push shaft 210.01 with radial ball bearing 321.02 into bearing bracket 330 from the drive end.
4. Push radial ball bearing 321.01 onto shaft 210.01 until it abuts against the shaft shoulder (do not heat up the bearing!) and secure it with circlip 932.20.
5. Fit bearing cover 360.02.
   Oil-lubricated models: Fit bearing cover 360.02 with O-ring 412.21, thrower 507.12 and gasket 400.02.
6. Tighten hexagon socket head cap screws 914.02 to the torques given in this manual.(⇨ Section 7.6 Page 68)
7. **Oil-lubricated models:** Fit bearing cover 360.01 with O-ring 412.36, thrower 507.11 and gasket 400.01.
8. **Oil-lubricated models:** Tighten hexagon socket head cap screw 914.01 to the torques given in this manual.(⇨ Section 7.6 Page 68)
9. Fit joint ring 411.78 and, on oil-lubricated models, joint ring 411.77.
10. Check whether the shaft can easily be turned by hand.

Fitting the rolling element bearings - design with leakage barrier (optional) Magnetic coupling 110/ 165

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.4 Page 61) have been observed/carried out.

✓ 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. Push radial ball bearing 321.01 onto shaft 210.01 until it abuts against the shaft shoulder (do not heat up the bearing!) and secure it with circlip 932.20.
2. Push shaft 210.01 with radial ball bearing 321.01 into bearing bracket 330 from the pump end.
3. Push radial ball bearing 321.02 onto shaft 210.01 until it abuts against the shaft shoulder (do not heat up the bearing!) and secure it with circlip 932.80.
4. Fit O-ring 412.97 in the groove of bearing bracket 330.
5. Gently pull O-ring 412.28 over the shaft shoulder and fit it in the groove.
6. Slide shaft protecting sleeve 524.09 onto shaft 210.01 until it abuts against the shaft shoulder.
7. Position bearing cover 360.01 nearby with the bolt hole circle with 5 pocket holes pointing upwards.
8. Insert elastomer 400.97 into bearing cover 360.01.

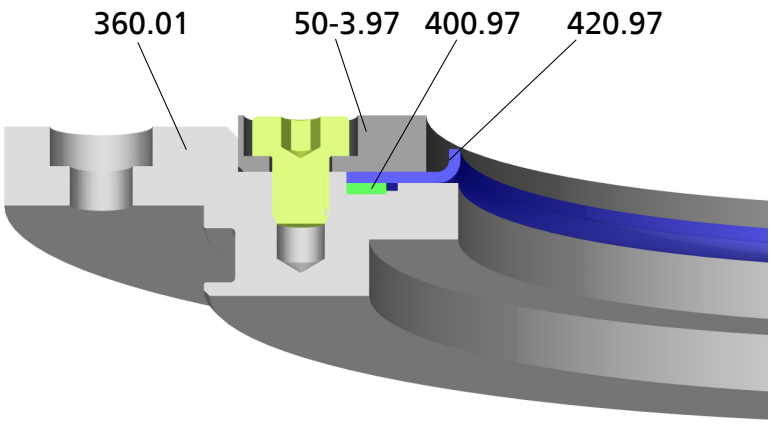


Fig. 20: Inserting the sealing lip

360.01	Bearing cover	50-3.97	Backing ring
400.97	Elastomer	420.97	Sealing lip

NOTE

Insert the sealing lip with the sealing edge (inside diameter of the sealing lip) pointing upwards.

9. Fit sealing lip 420.97 on elastomer 400.97.
10. Place backing ring 50-3.97 on sealing lip 420.97.
11. Slightly tighten hexagon socket head cap screws 914.78.
12. Insert O-ring 412.36 into bearing cover 360.01.
    Verify that the fitted sealing lip faces the side to be sealed (here: the pump's hydraulic system).

NOTE

If the sealing lip is not fitted correctly, the sealing function will not work.

NOTE

The inside diameter of sealing lip 420.97 in as-new condition is smaller than the diameter of shaft protecting sleeve 524.09. Stretch the sealing lip to fit it.

13. Fit bearing cover 360.01 with backing ring 50-3.97, O-ring 412.36 and shaft seal 430.77 on bearing bracket 330. When sliding on bearing cover 360.01 make sure to hold it perpendicular to the shaft axis.
14. Tighten hexagon socket head cap screws 914.02 to the torques given in this manual.(⇨ Section 7.6 Page 68)
15. Loosen hexagon socket head cap screws 914.78 to centre sealing lip 420.97 on shaft protecting sleeve 524.09.
16. Tighten hexagon socket head cap screws 914.78 to the torques given in this manual.
17. Push shaft spring 950.24 into bearing bracket 330 until it abuts radial ball bearing 321.02.
18. Fit bearing cover 360.02. On oil-lubricated models, fit bearing cover 360.02 with gasket 400.02.
19. Tighten hexagon socket head cap screws 914.02 to the torques given in this manual.(⇨ Section 7.6 Page 68)
20. Fit joint ring 411.78.
21. Check whether the shaft can easily be rotated by hand.

Fitting the rolling element bearings - design with leakage barrier (optional) Magnetic coupling 220

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.4 Page 61) have been observed/carried out.

✓ 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. Push radial ball bearing 321.02 onto shaft 210.01 until it abuts against the shaft shoulder (do not heat up the bearing!) and secure it with circlip 932.80.
2. Insert circlip 932.02 into the bearing bracket.
3. Push shaft 210.01 with radial ball bearing 321.02 into bearing bracket 330 from the drive end.
4. Press radial ball bearing 321.01 onto shaft 210.01 until it abuts against the shaft shoulder (do not heat up the bearing!).
5. Fit bearing cover 360.02.
6. Tighten hexagon socket head cap screws 914.02 to the torques given in this manual.
7. Fit O-ring 412.97 in the groove of bearing bracket 330.
8. Insert O-ring 412.28 in shaft protecting sleeve 524.09.

NOTE

Shaft protecting sleeve 524.09 with O-ring 412.28 must be positioned in such a way that - once pump reassembly has been completed - the O-ring will sit on shaft 210.01, not on outer rotor 818.02.(⇨ Section 9.1 Page 73)

9. Slide shaft protecting sleeve 524.09 with O-ring 412.28 onto shaft 210.01 until it abuts against radial ball bearing 321.01.
10. Position bearing cover 360.01 nearby with the bolt hole circle with 12 pocket holes pointing upwards.
11. Insert elastomer 400.97 into bearing cover 360.01.

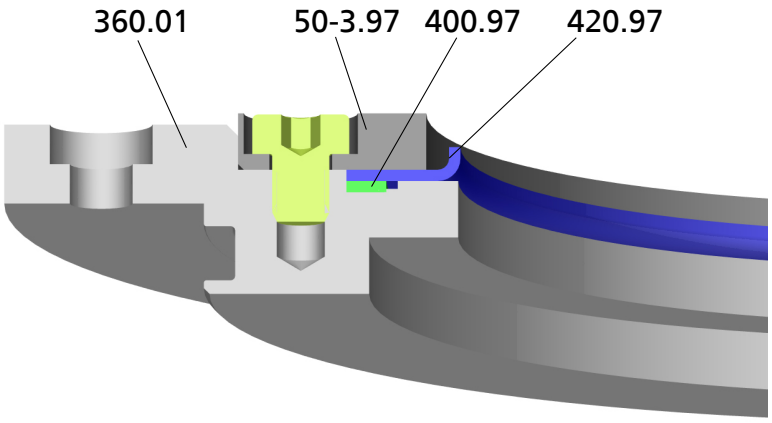


Fig. 21: Inserting the sealing lip

360.01	Bearing cover	50-3.97	Backing ring
400.97	Elastomer	420.97	Sealing lip

NOTE

Insert the sealing lip with the sealing edge (inside diameter of the sealing lip) pointing upwards.

12. Fit sealing lip 420.97 on elastomer 400.97.
13. Place backing ring 50-3.97 on sealing lip 420.97.
14. Slightly tighten hexagon socket head cap screws 914.78.
15. Insert O-ring 412.36 into bearing cover 360.01. Verify that the fitted sealing lip faces the side to be sealed (here: the pump's hydraulic system).

NOTE

If the sealing lip is not fitted correctly, the sealing function will not work.

NOTE

The inside diameter of sealing lip 420.97 in as-new condition is smaller than the diameter of shaft protecting sleeve 524.09. Stretch the sealing lip to fit it.

16. Fit bearing cover 360.01 with backing ring 50-3.97, O-ring 412.36 and shaft seal 430.77 on bearing bracket 330. When sliding on bearing cover 360.01 make sure to hold it perpendicular to the shaft axis.
17. Tighten hexagon socket head cap screws 914.01 to the torques given in this manual.(⇨ Section 7.6 Page 68)
18. Loosen hexagon socket head cap screws 914.78 to centre sealing lip 420.97 on shaft protecting sleeve 524.09.
19. Tighten hexagon socket head cap screws 914.78 to the torques given in this manual.(⇨ Section 7.6 Page 68)
20. Fit joint ring 411.78.
21. Check whether the shaft can easily be rotated by hand.

7.5.6 Mounting the outer rotor on the drive shaft

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to have been observed/ carried out.

✓ 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. Insert key 940.32.
2. Protect the magnets in outer rotor 818.02 with a suitable non-metallic cover. Slide outer rotor 818.02 onto drive shaft 210.01.
3. Tighten screw 900.08 with a pin wrench (included in KSB's scope of supply) to the torque indicated in this manual. (⇨ Section 7.6 Page 68)
4. Remove the protective cover.

7.5.7 Vertical reassembly

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.6 Page 66) have been observed/carried out.

✓ 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. Screw an eyebolt into the stub of shaft 210.01 and attach the drive assembly with the outer rotor to suitable lifting equipment.
2. Guide the drive assembly including outer rotor 818.02 into bearing bracket lantern 344.

NOTE

Make sure that the motor is positioned correctly in relation to the bearing bracket lantern
(with the eyebolt on the bearing bracket lantern pointing upwards and the support foot of the bearing bracket pointing downwards).

3. Tighten nuts 920.04 to the torques given in this manual.(⇨ Section 7.6 Page 68)

7.5.8 Horizontal reassembly

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.7 Page 66) have been observed/carried out.

✓ The individual parts are kept in a clean and level assembly area.

✓ All disassembled 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.

NOTE

Due to high magnetic forces, it is not advisable to dismantle/reassemble magnetic coupling 220 in horizontal position.

	**⚠ WARNING** **Axial magnetic forces** Risk of bruising injuries on fingers and hands ▹ When the pump is dismantled/reassembled in horizontal position, use forcing screws to counteract the magnetic forces acting in axial direction. The forcing screws should be at least as long as the magnets.(⇨ Section 4.2 Page 17)

1. Screw forcing screws (e.g. 2 x M 12 x 100) into bearing bracket 330 up to the screw heads.
2. Evenly screw back the forcing screws in bearing bracket 330, thus pushing the bearing bracket into lantern 344.
3. Use hexagon nuts 920.04 to fasten bearing bracket 330.

7.5.9 Run-out check

After the back pull-out unit has been fitted, check the radial shaft run-out.

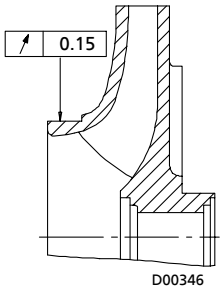


Fig. 22: Checking run-out at the impeller

- ✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.8 Page 66) have been observed/carried out.
- ✓ The individual parts are kept in a clean and level assembly area.
- ✓ All dismantled components 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. Check run-out.
   Maximum permissible run-out: 0.15 mm.

The allowable max. run-out may be exceeded as a result of dirt particles between the conical surfaces or incorrect installation of plain bearing components.

If the maximum run-out is exceeded:

1. Undo the impeller nut.
2. Pull off the impeller.
3. Clean the plain bearing components and check correct assembly.
4. Check run-out again.

7.5.10 Installing the back pull-out unit

	**NOTE** Make sure to fit the back pull-out unit with the dotting marks in the casing cover and the eyebolt in the bearing bracket lantern pointing upwards.

- ✓ The notes and steps stated in (⇨ Section 7.5.1 Page 58) to (⇨ Section 7.5.9 Page 67) have been observed/carried out.
- ✓ All disassembled 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.
- ✓ For back pull-out units without coupling, install the coupling in accordance with the manufacturer's instructions.

	**⚠ WARNING** **Back pull-out unit tipping over** Risk of crushing hands and feet! ▹ Suspend or support the bearing bracket at the pump end.

1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
2. Insert the back pull-out unit into the pump casing.
3. Tighten nuts 920.01 to the torques given in this manual.(⇨ Section 7.6 Page 68)
4. Mount support foot 183 with safety device 930.01 and hexagon head bolt 901.04.
5. Bolt support foot 183 onto the baseplate.
6. Fit keys 940.02.
7. Pull the coupling hub onto the shaft end.
8. Secure the coupling hub with a set screw.

7.5.11 Mounting the motor

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.(⇨ Section 5.7 Page 28)
4. Connect the motor to the power supply (refer to manufacturer's product literature).

7.6 Tightening torques

Table 23: Tightening torques for specific materials

Stud DIN 938 Hexagon nut ISO 4032 Socket head cap screw DIN 912 Hexagon nut ISO 4035/8675	A4-7 0			1.7709+QT		
	Tightening torque [Nm]					
	New threads[11)]	-15%[12)]	-20%[12)]	New threads[11)]	-15%[12)]	-20%[12)]
M5	4,25	3,6	3,4	-	-	-
M6	7,3	6,2	5,8	-	-	-
M8	17,7	15	14,2	-	-	-
M10	34,8	29,6	27,8	-	-	-
M12	59,9	50,9	47,9	55	46,7	44
M12x1,5	62,9	53,5	50,3	-	-	-
M16	148	125,8	118,4	155	131,7	124
M16x1,5	100	85	80	-	-	-
M20x1,5	120	102	96	-	-	-
M24x1,5	150	128	120	-	-	-

Table 24: Tightening torques by part No.

Part No.	Tightening torque [Nm]
914.78	5,2
900.08	80

11) Applicable to the initial tightening of new threads

12) After repeated tightening of the threads and in case of good lubrication the values shall be reduced by 15 to 20%. The values do not apply, if general assembly drawings or other instructions state different values.

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

- Type series
- Size
- KSB order number
- Material variant
- Year of construction

Refer to the name plate for all data. (⇨ Section 4.3 Page 17)

Also specify the following data:

- Description
- Part No.
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

Refer to the general assembly drawing for part numbers and descriptions. (⇨ Section 9.1 Page 73)

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

Table 25: 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
210.01	Shaft	1	1	1	2	2	2	20 %
210.03	Shaft	1	1	1	2	2	2	20 %
230	Impeller	1	1	1	2	2	2	20 %
321.01	Radial ball bearing	1	1	2	2	2	3	25 %
321.02	Radial ball bearing	1	1	2	2	2	3	25 %
330	Bearing bracket	-	-	-	-	-	1	2
411.08	U-ring/Joint ring	4	6	8	8	9	10	100 %
411.10	Joint ring	4	6	8	8	9	10	100 %
412.28/.36/.97/.98	O-ring	4	6	8	8	9	10	100 %
430.77[13)]	Shaft seal	4	6	8	8	9	10	100 %
502.1	Casing wear ring	2	2	2	3	3	4	50 %

7.7.3 Interchangeability of pump components

NOTE! Volute casing 102 and impeller 230 are not interchangeable between different pump sizes.

13) On pumps with leakage barrier only

Table 26: Interchangeability of pump components[14)]

Sizes	Bearing bracket	Description															
		Casing cover Magnetic coupling 110/165	Casing cover Magnetic coupling 220	Support foot	Support foot Magnetic coupling 220	Radial ball bearing Magnetic coupling 110/165	Radial ball bearing Magnetic coupling 220	Casing wear ring[15)]	Magnetic coupling 110 + lantern P 02[16)]	Magnetic coupling 110 + lantern P 03/04[16)]	Magnetic coupling 165 + lantern P 03/04[16)]	Magnetic coupling 220 + lantern magnetic coupling 220[16)]	Impeller nut	Disc	Plain bearing assembly P 02	Plain bearing assembly P 03/04	Plain bearing assembly Magnetic coupling 220
		Part No.															
		161	161	183	183	321.01/.02	321.01/.02	502.01					920.95	550.87			
25-160	P02	1	-	1	-	1	-	9	1	-	-	-	1	1	1	-	-
25-200	P02	2	-	2	-	1	-	9	1	-	-	-	1	1	1	-	-
32-160	P02	1	-	1	-	1	-	1	1	-	-	-	1	1	1	-	-
32-200	P02	2	-	2	-	1	-	1	1	-	-	-	1	1	1	-	-
40-160	P02	1	-	1	-	1	-	2	1	-	-	-	1	1	1	-	-
40-200	P02	2	-	2	-	1	-	2	1	-	-	-	1	1	1	-	-
50-160	P02	1	-	2	-	1	-	3	1	-	-	-	1	1	1	-	-
50-200	P02	2	-	2	-	1	-	3	1	-	-	-	1	1	1	-	-
32-250	P03	4	-	4	-	1	-	6	-	1	1	-	2	2	-	1	-
40-250	P03	4	-	3	-	1	-	5	-	1	1	-	2	2	-	1	-
40-315	P03	5	-	5	-	1	-	5	-	1	1	-	2	2	-	1	-
50-250	P03	4	-	3	-	1	-	4	-	1	1	-	2	2	-	1	-
50-315	P03	5	-	6	-	1	-	7	-	1	1	-	2	2	-	1	-
65-160	P03	6	-	2	-	1	-	7	-	1	1	-	2	2	-	1	-
65-200	P03	3	-	3	-	1	-	8	-	1	1	-	2	2	-	1	-
65-250	P03	4	-	5	-	1	-	8	-	1	1	-	2	2	-	1	-
80-160	P03	6	-	3	-	1	-	10	-	1	1	-	2	2	-	1	-
80-200	P03	3	-	3	-	1	-	10	-	1	1	-	2	2	-	1	-
80-250	P03	4	-	6	-	1	-	11	-	1	1	-	2	2	-	1	-
100-200	P03	3	-	5	-	1	-	12	-	1	1	-	2	2	-	1	-
65-315	P04	5	10	6	5	1	2	16	-	1	1	2	3	3	-	1	1
80-315	P04	5	10	7	6	1	2	12	-	1	1	2	3	3	-	1	1
80-400	P04	-	11	-	15	-	2	27	-	-	-	2	3	3	-	-	1
100-250	P04	4	9	6	5	1	2	13	-	1	1	1	3	3	-	1	1
100-315	P04	5	10	7	6	1	2	16	-	1	1	2	3	3	-	1	1
100-400	P04	-	11	-	15	-	2	16	-	-	-	2	3	3	-	-	1
125-250	P04	4	9	7	6	1	2	14	-	1	1	1	3	3	-	1	1
125-315	P04	5	10	8	15	1	2	15	-	1	1	2	3	3	-	1	1
125-400	P04	-	11	-	16	-	2	14	-	-	-	2	3	3	-	-	1
150-250	P04	4	9	8	15	1	2	15	-	1	1	1	3	3	-	1	1
150-315	P05	-	13	-	11	-	2	18	-	-	-	3	4	4	-	-	3
150-400	P05	-	14	-	11	-	2	18	-	-	-	3	4	4	-	-	3
150-500	P05	-	14	-	13	-	2	18	-	-	-	3	4	4	-	-	3
200-250	P05	-	12	-	10	-	2	17	-	-	-	2	4	4	-	-	2
200-315	P05	-	13	-	10	-	2	19	-	-	-	3	4	4	-	-	3
200-400	P05	-	14	-	10	-	2	20	-	-	-	3	4	4	-	-	3
200-500	P05	-	14	-	14	-	2	28	-	-	-	3	4	4	-	-	3
250-315	P05	-	13	-	12	-	2	21	-	-	-	3	4	4	-	-	3

14) Components featuring the same number in a column are interchangeable.
15) For Magnochem-S only.
16) Complete magnetic coupling with containment shroud and identical transmittable torque

8 Trouble-shooting

⚠ WARNING

Improper remedial work on the pump (set)
Risk of injury!

- ▷ For any work performed in order to remedy faults on the pump (set) observe the relevant information given in this operating manual or the product literature provided by the accessories manufacturers.

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

A Pump delivers insufficient flow rate
B Motor is overloaded
C Excessive pump discharge pressure
D Increased bearing temperature
E Leakage at the pump
F Vibrations during pump operation
G Impermissible rise of temperature inside the pump

Table 27: Trouble-shooting

A	B	C	D	E	F	G	Possible cause	Remedy[17]
✗							Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller.[18] Increase the speed (turbine, I.C. engine)
✗					✗	✗	Pump or piping are not completely vented and/or primed.	Vent and/or prime.
✗	✗				✗		Supply line or impeller clogged	Remove deposits in the pump and/or piping.
✗							Formation of air pockets in the piping	Alter piping layout. Fit a vent valve.
✗					✗	✗	$NPSH_{available}$(positive suction head) is too low.	Check/alter fluid level. Fully open the shut-off element in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall.
✗							Increased axial thrust[18]	Correct rotor adjustment.
✗							Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
✗							Speed is too low.[18] ▪ Operation with frequency inverter ▪ Operation without frequency inverter	▪ Increase voltage/frequency at the frequency inverter in the permissible range. ▪ Check voltage.
✗					✗		Suction lift is too high.	Clean suction strainer and suction lines. Correct/alter fluid level. Change suction line.
	✗				✗		Pump back pressure is lower than specified in the purchase order.	Adjust duty point accurately. In the case of persistent overloading, turn down impeller.[18]
	✗					✗	Density or viscosity of fluid handled higher than stated in purchase order	[18]
	✗	✗					Speed is too high.	Reduce speed (turbine, I.C. engine).[18][19]

17) Release pump pressure before attempting to remedy faults on parts which are subjected to pressure.
18) Consult the manufacturer.

A	B	C	D	E	F	G	Possible cause	Remedy[17)]
✗					✗		Wear of internal components	Replace worn components by new ones.
				✗			Use of unsuitable materials.	Change the material combination.
				✗			Connection bolts and screw plugs have loosened.	Re-tighten. Fit new sealing elements.
						✗	Lack of cooling liquid or dirty cooling chamber	Increase cooling liquid quantity. Clean out cooling chamber. Purify/clean cooling liquid.
				✗			Dismantle to find out.	Repair necessary.
			✗		✗		The pump set is misaligned.	Check the coupling alignment; re-align the coupling, if required.
	✗		✗		✗		Pump is warped or sympathetic vibrations in the piping.	Check the piping connections and secure fixing of pump; if required, reduce distances between the pipe clamps. Fix the pipelines using anti-vibration material.
			✗				Insufficient or excessive quantity of lubricant or unsuitable lubricant	Top up, reduce or change lubricant.
			✗				Non-compliance with specified coupling distance	Correct distance according to general arrangement drawing.
✗	✗						Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
	✗						Operating voltage is too low.	Increase voltage; check voltage drop in the power cable.
					✗		Impeller is out of balance.	Clean the impeller. Re-balance the impeller.
	✗				✗		Defective bearing(s)	Fit new bearing(s).
					✗	✗	Flow rate is too low.	Increase the minimum flow rate.
✗					✗	✗	Magnetic coupling has dropped out of synchronisation with motor.	Switch off the motor and re-start. Check motor starting.
		✗					System pressure is too high.	Check system.
			✗				No cooling air flow from the motor to the rolling element bearing	Check system.
				✗			Defective shroud	Repair necessary.
			✗		✗		Magnetic coupling out of balance (inner and outer rotor)	Check balancing.
						✗	Cooling circuit of magnetic coupling interrupted	Repair necessary.

17) Release pump pressure before attempting to remedy faults on parts which are subjected to pressure.

19) The fault can also be remedied by changing the impeller diameter.

9 Related Documents

9.1 General assembly drawing

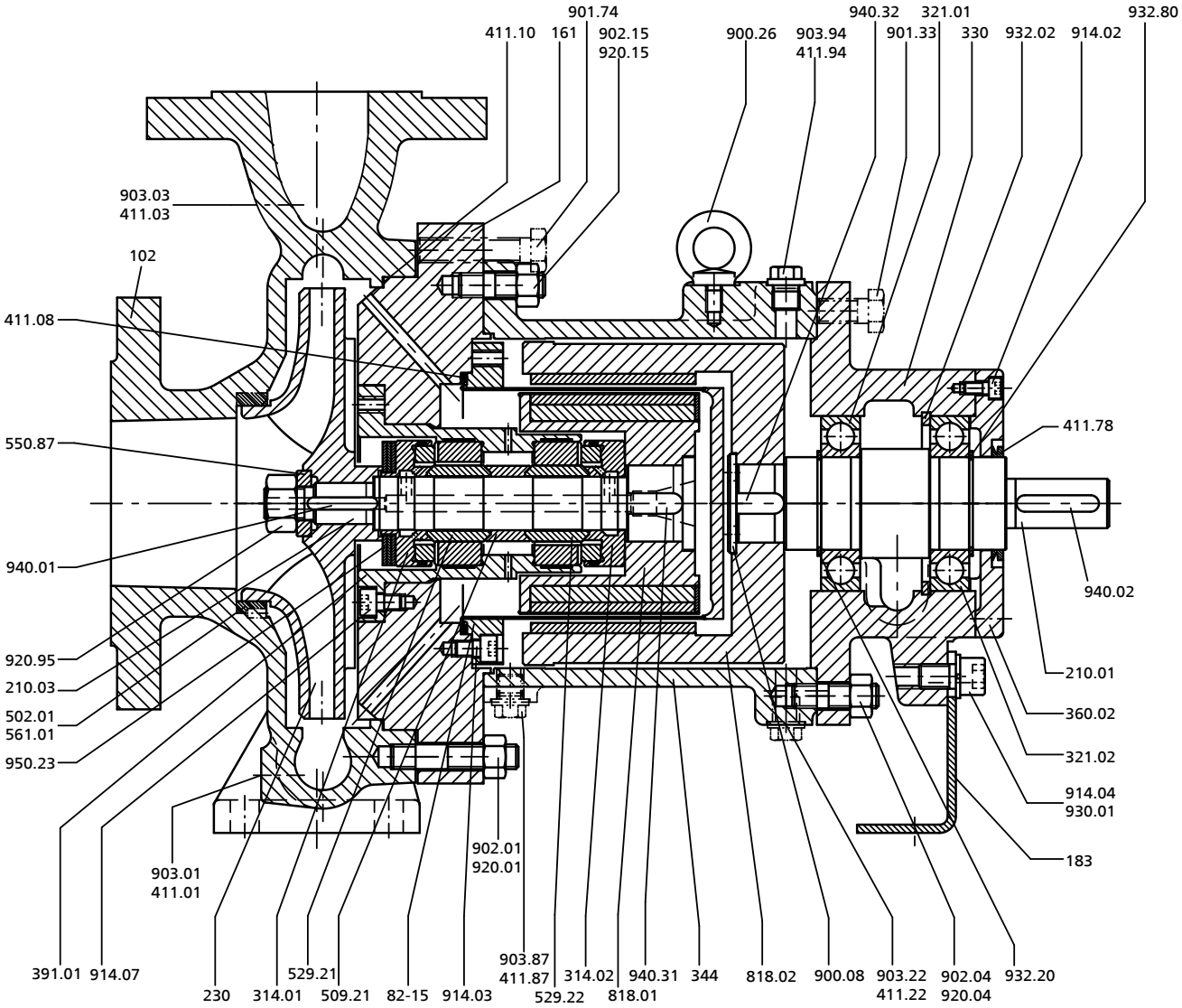


Fig. 23: General assembly drawing of Magnochem

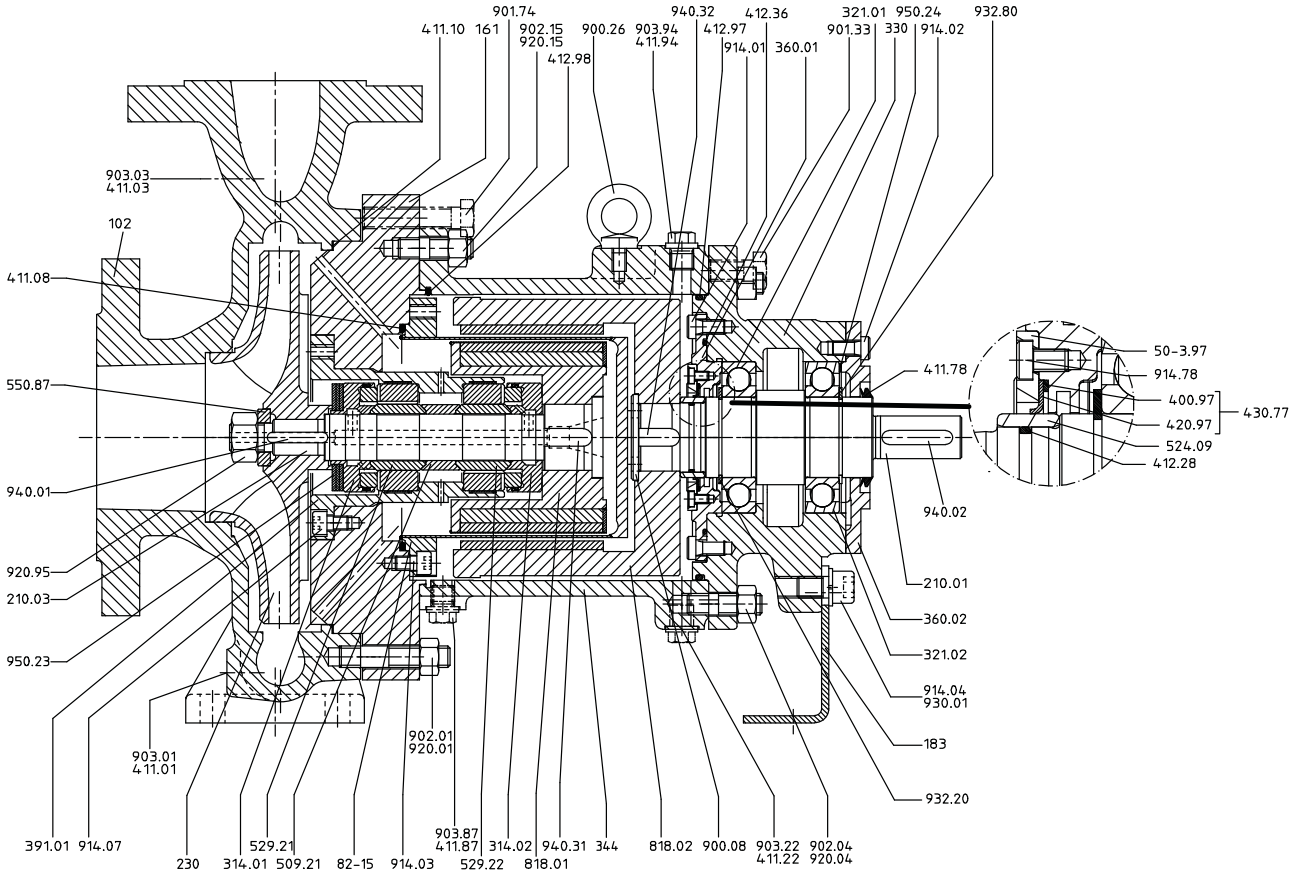


Fig. 24: General assembly drawing of Magnochem with leakage barrier

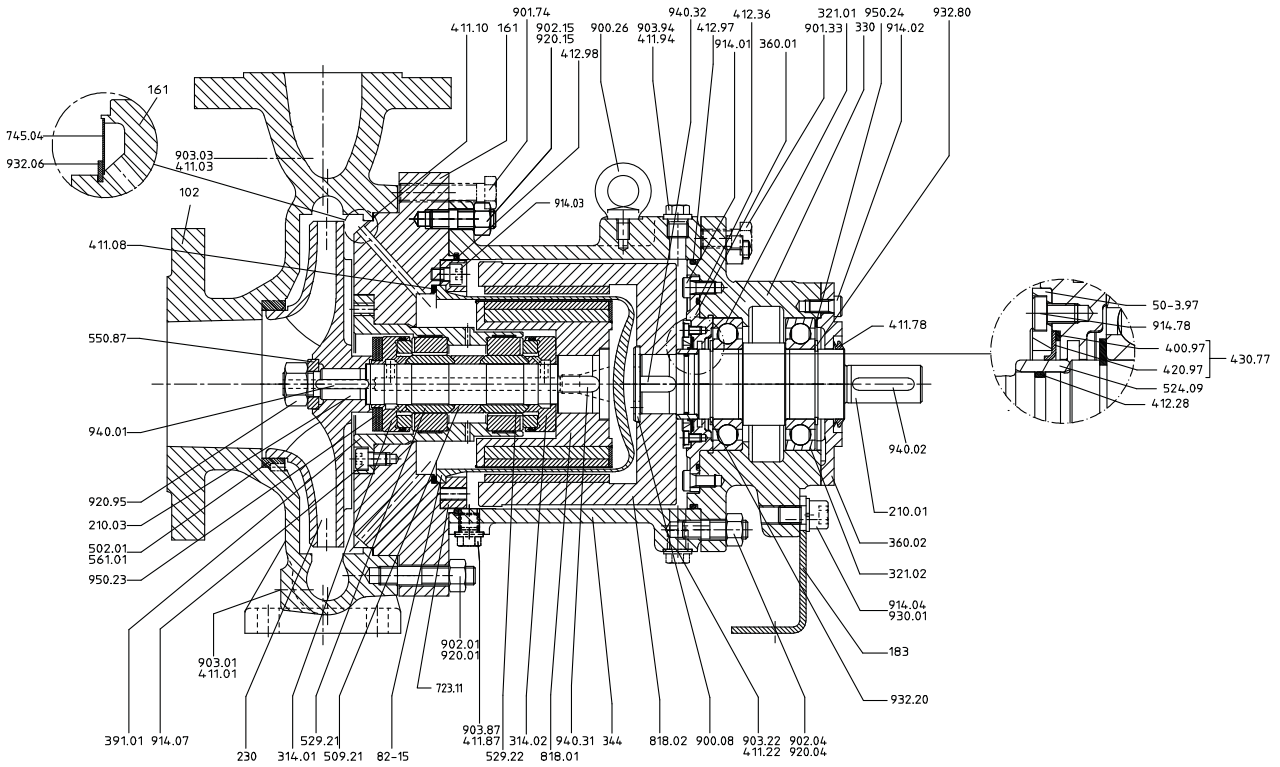


Fig. 25: General assembly drawing of Magnochem with ceramic containment shroud and leakage barrier, bearing bracket P02 MK110

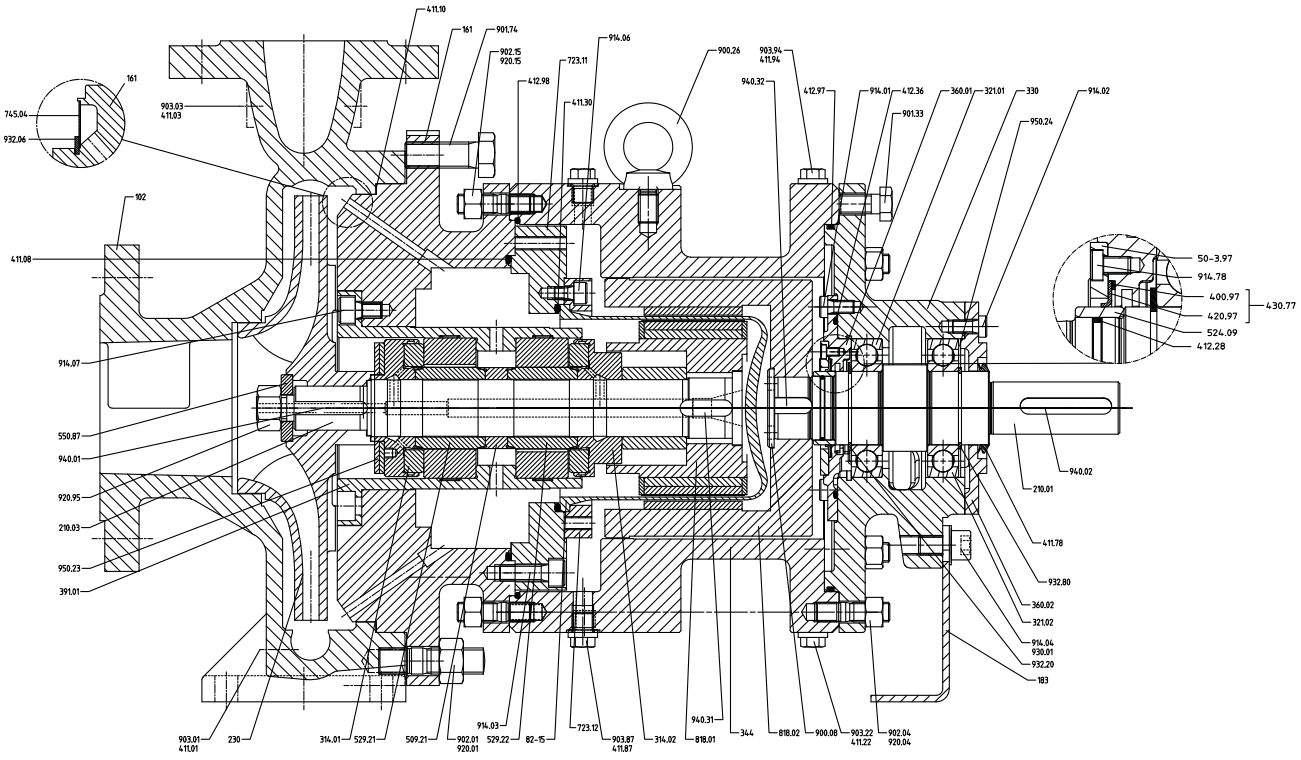
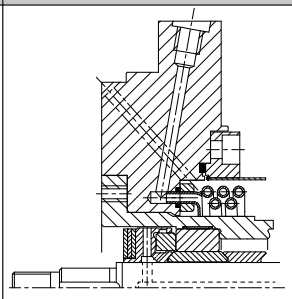
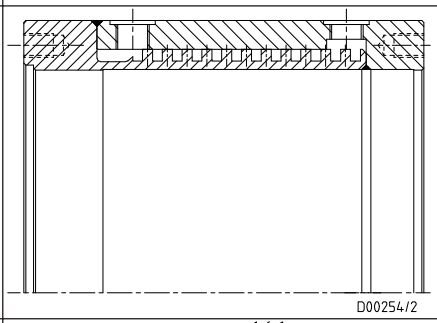
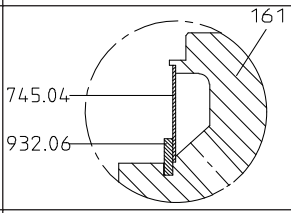
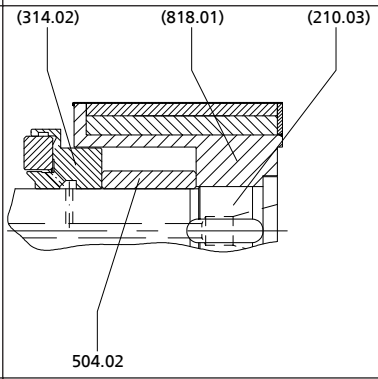
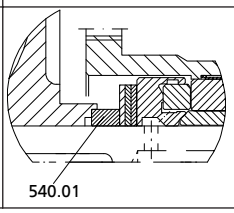
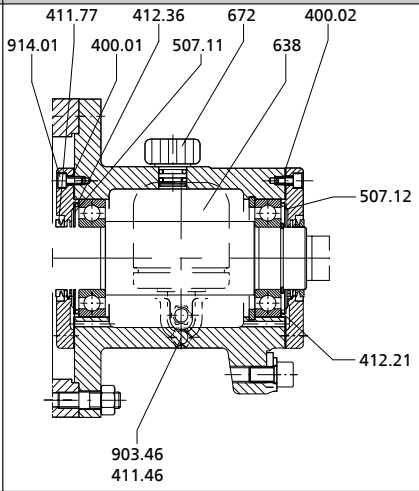
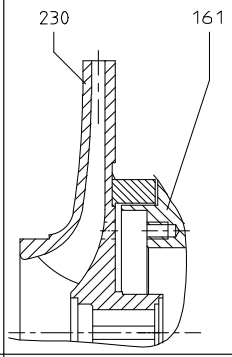
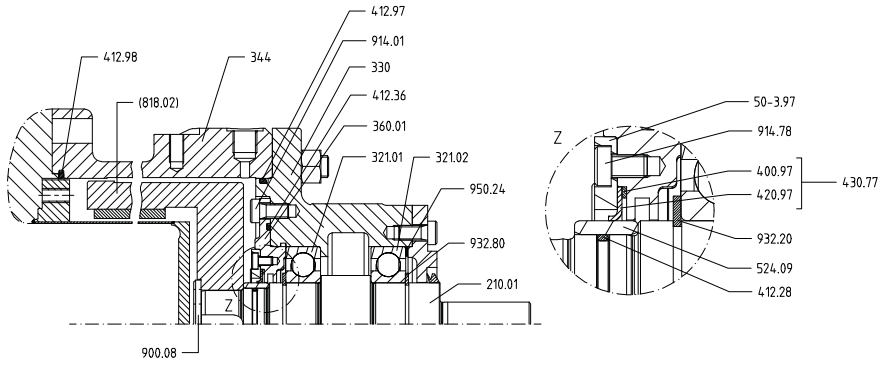


Fig. 26: General assembly drawing of Magnochem with ceramic containment shroud and leakage barrier, bearing brackets P03/P04 MK110

Table 28: Variant details

Design	Detailed view
Heating (rotor space)	
Heating (lantern)	
Filter Mesh width 0.2 × 3 mm	
Bearing brackets P03/P04 with magnetic coupling 110	
Bearing bracket P05	

Design	Detailed view
Bearing bracket with oil-lubricated rolling element bearings	
Discharge-side sealing gap	
Leakage barrier, magnetic coupling 110/165, with grease-lubricated rolling element bearings	

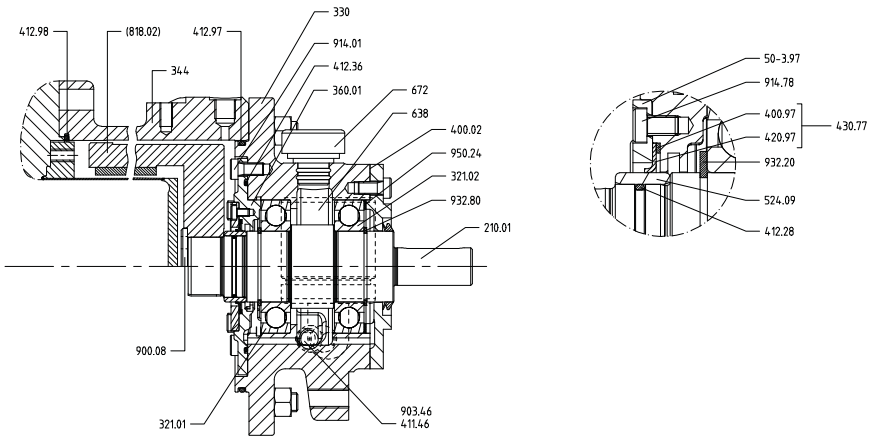
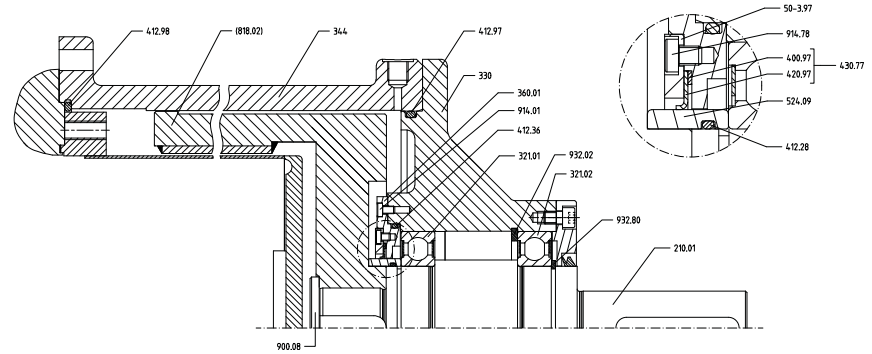
Design	Detailed view
Leakage barrier, magnetic coupling 110/165, with oil-lubricated rolling element bearings	
Leakage barrier, magnetic coupling 220, with grease-lubricated rolling element bearings	

Table 29: List of components

Part No.	Comprising	Description
102	102	Volute casing
	411.01/411.02[20]/411.03[20]/ 411.10[21]	Joint ring
	502.01[22]	Casing wear ring
	561.01[22]	Grooved pin
	902.01	Stud
	903.01/903.02[20]/903.03[20]	Screw plug
	920.01	Hexagon nut
161	161	Casing cover
	901.74	Hexagon head bolt
	902.15[23]	Stud
	920.15[23]	Hexagon nut
183	183	Support foot
	901.04	Hexagon head bolt
	930.01	Safety device
210.01	210.01	Shaft
	900.08	Screw
	932.20/.80	Circlip
	940.02/.32	Key
210.03	210.03	Shaft
	504.02[24]	Spacer ring

20) Not on all versions.

21) Joint ring 411.10 depending on application temperature. To be ordered separately in spare parts order.

22) For Magnochem-S only

23) On pumps with bearing brackets P02 and P04/P05 with magnetic coupling 220 only

Part No.	Comprising	Description
	550.87	Disc
	920.95	Hexagon nut
	940.01/.31	Key
230	230	Impeller
310	310	Bearing assembly
	314.01/.02	Plain thrust bearing
	391.01	Bearing ring carrier
	509.21	Intermediate ring
	529.21/.22	Bearing sleeve
	540.01[25)]	Bush
	914.07	Socket head cap screw
	950.23	Disc spring
321.01/.02	321.01/.02	Deep-groove ball bearing
330	330	Bearing bracket
	360.02	Bearing cover
	411.78	Joint ring
	914.02	Socket head cap screw
	932.02	Circlip
344	344	Bearing bracket lantern
	411.22/.87/.94	Joint ring
	900.26	Eyebolt
	902.04/.15[26)]	Stud
	903.22/.87/.94	Screw plug
	920.04/.15[26)]	Hexagon nut
411.08	411.08	Joint ring
82-15	82-15	Containment shroud
	914.03	with socket head cap screw
818.01	818.01	Inner rotor
818.02	818.02	Outer rotor
On pumps with leakage barrier only		
	50-3.97	Backing ring
	360.01	Bearing cover
	400.97	Gasket
	412.28/.36/.97/.98	O-ring
	420.97	Shaft seal ring
	524.09	Shaft protecting sleeve
	914.01/.78	Socket head cap screw

24) Spacer ring on pumps with bearing brackets P03/P04 with magnetic coupling 110 only

25) On pumps with bearing bracket P05 only

26) On pumps with bearing brackets P03/P04 with magnetic coupling 110/165 only

10 EC Declaration of Conformity

Manufacturer: **KSB Aktiengesellschaft**
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

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

Magnochem (MAC), Magnochem-Bloc (MAC-Bloc)

KSB order number: .....

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

The manufacturer also declares that

- the following harmonised international standards have been applied:
  - ISO 12100,
  - EN 809/A1

Person authorised to compile the technical file:
Name
Function
Address (company)
Address (Street, No.)
Address (post or ZIP code, city) (country)

The EC Declaration of Conformity was issued in/on:

Place, date

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

Name

Function
Company
Address

Address

27) A signed, legally binding declaration of conformity is supplied with the product.

11 Certificate of Decontamination

Type .....
Order number/
Order item number[28)] .....

Delivery date .....

Field of application: .....

Fluid pumped[28)]: .....

Please tick where applicable[28)]:


☐ Radioactive


☐ Explosive


☐ Corrosive


☐ Toxic


☐ Harmful


☐ Bio-hazardous


☐ Highly flammable

☐ 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 hereby declare that this product is free from hazardous chemicals, biological or radioactive substances.

On seal-less pumps, the rotor has been removed from the pump for cleaning.

☐ 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

28) Required fields

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2739.8/13-EN (01317188)

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