Standardised Water Pump

Etaseco/ Etaseco-I

Motor Sizes DS 90, DS 112, DS 132
Plain Bearings (SSiC)
Three-phase Motor
Thermistor

Installation/Operating Manual

KSB

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Installation/Operating Manual Etaseco/ Etaseco-I

Original operating manual

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Glossary

(Spare) motor unit

Stator with motor housing, can and electrical connection elements for the stator; without rotor, main bearing and hydraulic system

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 (canned motor pump)

Drive unit with impeller but without pump casing and possibly without baseplate; 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 pipeline which is connected to the discharge nozzle

Pool of pumps

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

Pump

Machine without drive, additional components or accessories

Pump set

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

Shut-off head H_0

The pump is running at nominal speed against a closed shut-off element, producing maximum pump pressure.

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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1 General

1.1 Principles

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

The name plate indicates the type series and size, the main operating data, the order number and the order item number. The order number and order item number 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 see (⇨ Section 4.6, Page 18)

1.2 Installation of partly completed machinery

To install partly completed machinery supplied by KSB refer to the sub-sections under Servicing/Maintenance. (⇨ Section 7.5.2.1, Page 56) (⇨ Section 7.5.6, Page 59)

1.3 Target group

This operating 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/ dimensional 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 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[1)]	Sectional drawing of the installed shaft seal

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

1.5 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇨	Result of an action
⇨	Cross-references

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1 If agreed upon in 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 Directive 2014/34/EU (ATEX).
	**General hazard** In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	**Electrical hazard** In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	**Machine damage** In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

2.2 General

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

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

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

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

Information attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:

- Arrow indicating the direction of rotation
- Markings for connections
- Name plate

The operator is responsible for ensuring compliance with all local regulations not taken into account in this instruction manual.

2.3 Intended use

- The product must not be used in potentially explosive atmospheres.
- The pump (set) must not be operated on a frequency inverter.
- 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.

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- 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 or variant.
- Never operate the pump without the fluid to be 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 the discharge-side shut-off elements further than permitted.
  - The maximum flow rates specified in the product literature or data sheet 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 this manual

- Non-compliance with this operating manual 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, directives and laws

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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

- 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 maintenance, inspection and installation 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.
- Any work on the pump set shall only be performed when it has been disconnected from the power supply (de-energised).
- 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 6.3, Page 42)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been 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 35)

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.

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3 Transport/Temporary Storage/Disposal

CAUTION

Exceeding the permissible power cable bending radius

Damage to the power cable!

- Observe the permissible minimum bending radius indicated in the data sheet provided by the cable manufacturer or stated on the order-specific outline drawing; if required, contact KSB.

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 of the motor.
- 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.

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

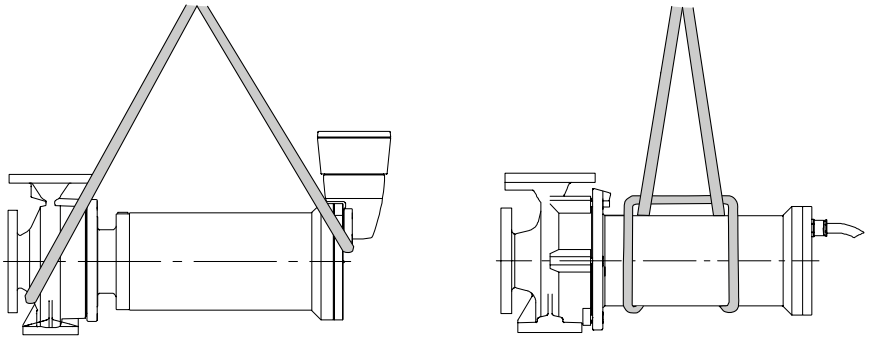

Fig. 1: Transporting the pump set

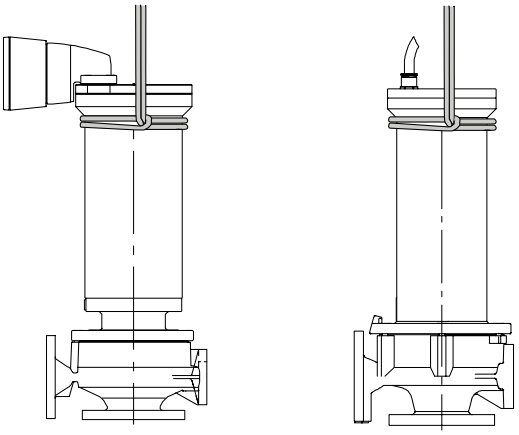

Fig. 2: Transporting the pump set (motor on top)

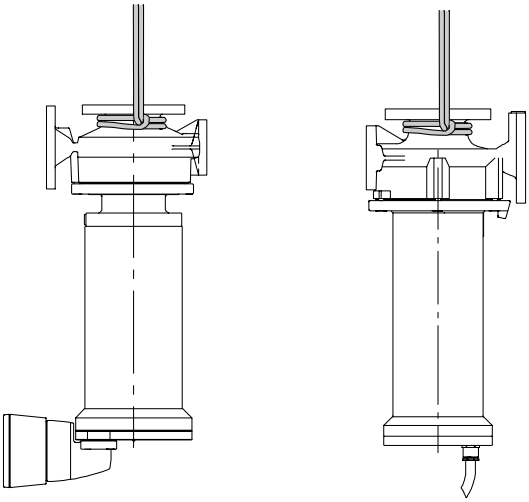

Fig. 3: Transporting the pump set (motor below)

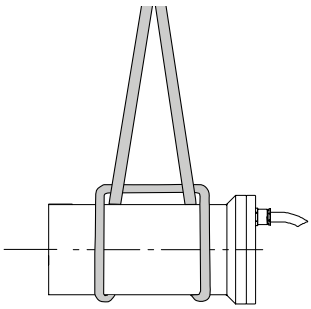

Fig. 4: Transporting the spare motor unit

	NOTE
	For shipment, the spare motor unit is protected by the manufacturer with a transport lock (wooden cover with sealing element). This has to be removed before the unit is used.

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.

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CAUTION

Damage during storage due to 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!

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

Store the pump (set) in a dry, protected room where the atmospheric humidity is as constant as possible.

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, Page 42) .

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇨ Section 7.3, Page 48)
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 pump set has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump set must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
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 74)

NOTE

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

3.5 Disposal

⚠ WARNING

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

Hazard to persons and the environment!

- ▷ Collect and properly dispose of flushing fluid and any 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.

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4 Description of the Pump (Set)

4.1 General description

- Standardised water pump with canned motor

Pump for handling toxic, volatile or valuable liquids in environmental engineering and industrial applications.

4.2 Designation

Example: Etaseco G X - I 32 - 125.1 / 1 2

Table 4: Designation key

Code	Description
Etaseco (abbreviation: ESO)	Type series
G	Pump casing material
X	Special design
I	Nozzle position on pump casing[2)]
32	Nominal discharge nozzle diameter [mm]
125	Nominal impeller diameter [mm]
.1	Hydraulic system optimised for part-load operation
1	Motor rating in kW (rounded off to full kW)
2	Number of motor poles

Motor designation (last two digits of the designation), e.g. "1 2":

Table 5: Key to the motor designation

Motor code	Complete motor designation
12	DS 90.2-1,1
22	DS 90.2-2,2
42	DS 112.2-4
52	DS 112.2-5,5
72	DS 132.2-7,5
112	DS 132.2-11
152	DS 132.2-15

4.3 Name plate

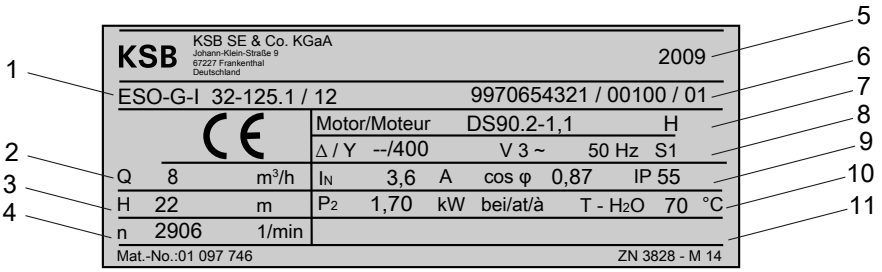

Fig. 5: Name plate (example) Etaseco

1	Type series, size, version	2	Flow rate
3	Head	4	Speed
5	Year of construction	6	Order number/item number/pump number

2 Without letter: 90° (axial suction nozzle, radial discharge nozzle); - I: 180° (suction nozzle and discharge nozzle arranged opposite to each other)

7	Motor size and thermal class	8	Voltage, frequency, duty cycle
9	Rated current, cos φ, enclosure	10	Motor rating at defined fluid temperature
11	Further required information		

4.4 Design details

Design

- Volute casing pump
- Back pull-out design
- Horizontal/vertical installation
- Single-stage

Pump casing

- Radially split volute casing
- Main dimensions to EN 733

Impeller type

- Closed radial impeller with multiply curved vanes
- Axial thrust balancing by sealing clearance

Bearings

- Plain bearings
- Product-lubricated

Shaft seal

- Seal-less (canned motor)

Drive

- Three-phase asynchronous motor
- Fully enclosed canned motor
- IP55 enclosure
- Duty cycle: continuous duty S1
- Thermal class H
- Thermal motor protection by PTC thermistors
- To IEC 60034-7
- DOL starting
- Star-delta starting[3)]

Automation

Automation options:

- PumpMeter

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[3] Can be used for 400 V; motor 42, 52, 72, 112, 152

4.5 Configuration and function

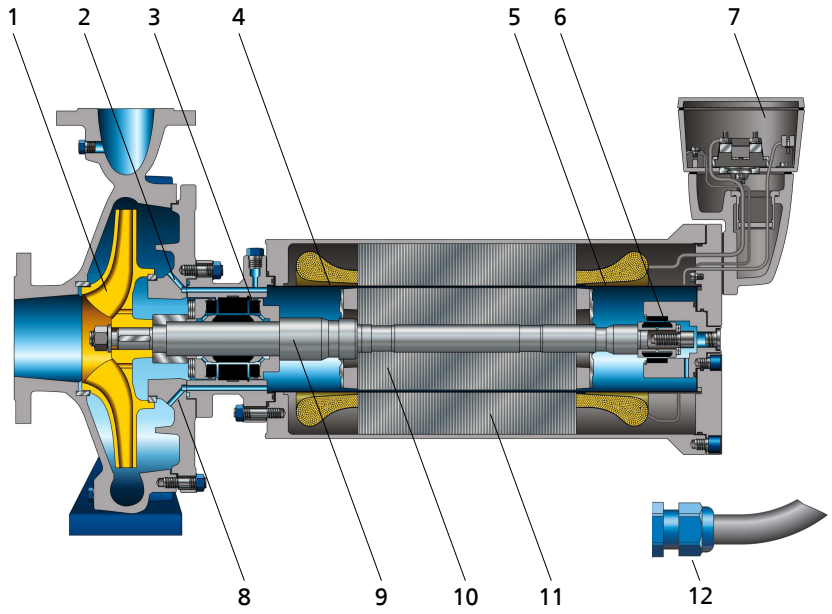

Fig. 6: Sectional drawing of Etaseco

1	Impeller	2	Bore
3	Plain bearing (impeller end)	4	Can
5	Support sleeve	6	Plain bearing (motor end)
7	Terminal box	8	Bore
9	Shaft	10	Rotor
11	Stator	12	Integrated power cable

Design The hydraulic system and the motor are firmly connected and form a close-coupled unit.
Both impeller (1) and rotor (10) are arranged on a common shaft (9).

Function The shaft runs in product-lubricated plain bearings (3 and 6). The rotor space is sealed off towards the stator space by the can (4). The can, which is made of corrosion-resistant material, rests on the stator (11) and the support sleeves (5) to compensate for the forces resulting from the pressure within the rotor space.

The bearings are lubricated by the pumped fluid in the rotor space. When the pump set is started up, the fluid enters the rotor space through the bores (2 and 8) and vents the rotor space through a bore in the shaft. The partial flow tapped from the product flow through the bores (2 and 8) surrounds the rotor during pump operation and enters an axial bore provided at the rear end of the rotor shaft. The axial bore ends at the front face of the impeller-side shaft end.

The pressure difference between the bores (2 and 8) and the outlet of the axial bore through the shaft at the impeller-side shaft end results in a continuous partial flow of fluid handled. As this partial flow passes through the circular clearance between the rotor and the can, it dissipates the heat generated in the motor. The intensive exchange of liquid from the hydraulic space to the rotor space and back to the suction side of the hydraulic system at the same time ensures sufficient lubrication of the plain bearings.

Depending on the pump model, the pump set is connected to the power supply either via a terminal box (7) or an integrated power cable (12) which is firmly connected to the motor. Depending on the technical version, additional equipment such as temperature sensors for monitoring the rotor space temperature (Pt100) can be provided in the motor.

PTC thermistors for monitoring the winding temperature can optionally be fitted. On pump models with "integrated power cable" the temperature sensors can optionally be connected via an additional power cable.

Sealing The pump is a seal-less canned motor pump.

It is sealed by static O-rings. It is not fitted with any dynamic sealing elements.

4.6 Noise characteristics

Table 6: Surface sound pressure level L_{pA}

Motor code	Motor size DS	Surface sound pressure level[4] L_{pA} [dB]
12	90.2-1,1	49
22	90.2-2,2	49
42	112.2-4	52
52	112.2-5,5	53
72	132.2-7,5	55
112	132.2-11	58
152	132.2-15	60

4.7 Dimensions and weights

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

4.8 Scope of supply

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

- Pump set

Special accessories

- Dry running protection
- Motor standstill heater
- Thermistor tripping unit (if thermal motor protection is used)
- Main flow filter

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4 Spatial average; as per ISO 3744 and EN 12639; valid for pump operation in the Q/Qopt = 0.8 - 1.1 range and for non-cavitating operation. If noise levels are to be guaranteed, add +3 dB for measuring and constructional tolerance.

5 Installation at Site

5.1 Safety regulations

DANGER

Installation in potentially explosive atmospheres

Explosion hazard!

- Never install the pump in potentially explosive atmospheres.
- Observe the information given in the data sheet and on the name plates of the pump system.

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.

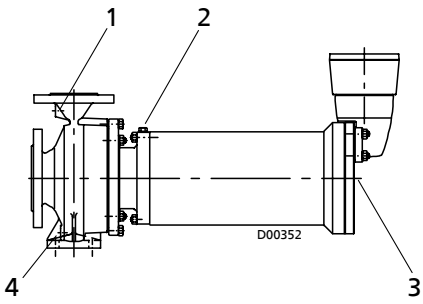
CAUTION

Exceeding the permissible power cable bending radius

Damage to the power cable!

- Observe the permissible minimum bending radius indicated in the data sheet provided by the cable manufacturer or stated on the order-specific outline drawing; if required, contact KSB.

1. Check structural requirements.
   All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.
2. When selecting the place of installation make sure that connections 6B, 10E and 11E can easily be accessed during pump operation.



1	Connection 1M (pressure gauge) / 6D (vent connection, if required)	2	Connection 10E (barrier fluid) / 11E.3 (flushing liquid)
3	Connection 6B.4 (motor drain) / 11E (flushing liquid)	4	Connection 6B (casing drain)

5.3 Installing the pump set

The pump set can be installed either in a horizontal position or vertical position (with the motor on top or below).

Other installation types only after consultation with KSB.

5.3.1 Horizontal installation

5.3.1.1 Installation without baseplate

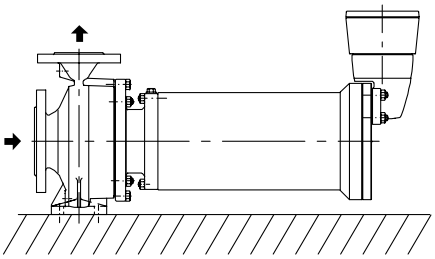


Fig. 7: Horizontal installation

- ✓ The installation surface has the required strength and characteristics.
- ✓ The installation surface has been prepared in accordance with the dimensions given in the outline drawing/general arrangement drawing.
- ✓ The plug fixings used are suitable for the pump weight.

1. Remove the covers from the suction and discharge flanges.
2. Position the pump set on the installation surface and support the motor end in such a way that the discharge nozzle flange is in horizontal position.
3. Use shims for height compensation, if necessary.
   All shims must lie perfectly flush.
4. Insert the fastening bolts into the casing foot and tighten them lightly.
5. Align the pump set with the help of a spirit level placed on the motor housing and the discharge nozzle.
6. To prevent any stresses and strains when tightening the bolts completely, remove any supports from underneath the pump set.
7. Tighten the fastening bolts completely.

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5.3.1.2 Installation with baseplate (optional)

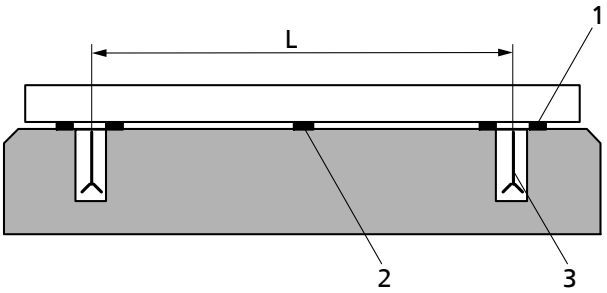

Fig. 8: Fitting the shims

1	Bolt-to-bolt clearance	2	Shim
3	Shim for bolt-to-bolt clearance > 800 mm	4	Foundation bolt

✓ The installation surface has the required strength and characteristics.

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

✓ The plug fixings used are suitable for the pump weight.

1. Remove the covers from the suction and discharge flanges.
2. Position the pump set on the foundation and align it with the help of a spirit level placed on the shaft and discharge nozzle.
   Permissible deviation: 0.2 mm/m.
3. Use shims (2) for height compensation, if necessary.
   Always fit shims between the baseplate/foundation frame and the foundation itself; always insert them to the left and right of the foundation bolts (4) and in close proximity to these bolts.
   For a bolt-to-bolt clearance > 800 mm, fit additional shims (3) halfway between the adjoining holes.
   All shims must lie perfectly flush.
4. Insert the foundation bolts (4) into the holes provided.
5. Use concrete to set the foundation bolts (4) into the foundation.
6. Wait until the concrete has set firmly, then align the baseplate.
7. Tighten the foundation bolts (4) evenly and firmly.

5.3.2 Vertical installation

CAUTION

Viscosity of fluid handled > 15mm²/s and installation with "motor on top"

Pump damage during start-up!

▷ Manually prime/vent the motor space during start-up (pump set will not be self-venting).

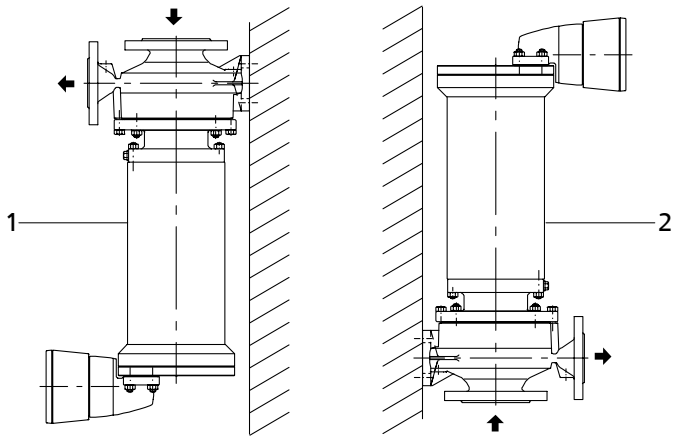

Fig. 9: Vertical installation

1	Installation type "Motor below"	2	Installation type "Motor on top"

✓ The wall has the required strength and characteristics.

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

✓ The plug fixings used are suitable for the pump weight.

1. Remove the covers from the suction and discharge flanges.
2. Position the pump in the required place of installation with a floor-mounted support or crane.
3. Insert the fastening bolts into the casing foot and tighten them sufficiently to make sure the pump set cannot tilt.
4. To prevent any stresses and strains when tightening the bolts completely, remove any floor-mounted supports from underneath the pump set.
5. Align the pump set with the help of a spirit level placed on the suction nozzle and the motor housing in such a way that the discharge nozzle flange is in vertical position.
6. Use shims for height compensation, if necessary.
   All shims must lie perfectly flush.
7. Tighten the fastening bolts at the pump foot completely.
8. Tighten the support foot (if any) at the motor without transmitting any stresses or strains.
   Use shims for height compensation, if necessary. All shims must lie perfectly flush.

5.4 Piping

5.4.1 Protecting flange faces against corrosion

Protect uncoated flange faces with a suitable anti-corrosive before connecting the piping.
Verify that the anti-corrosive is compatible with the material of the flange seal and the O-ring fitted in the mating flange, if applicable.

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5.4.2 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 properly without transmitting any stresses or strains.
- Observe the permissible forces and moments at the pump nozzles.
- Take appropriate measures to compensate for thermal expansion of the piping.

NOTE

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

NOTE

Installing a filter in the suction line is recommended, depending on the type of plant. Monitor contamination of the filter with suitable means.

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

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.

CAUTION

Welding beads, scale and other impurities in the piping

Damage to the pump!

- ▷ Remove any impurities from the piping.
- ▷ If necessary, install a filter.
- ▷ Observe the information in .

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

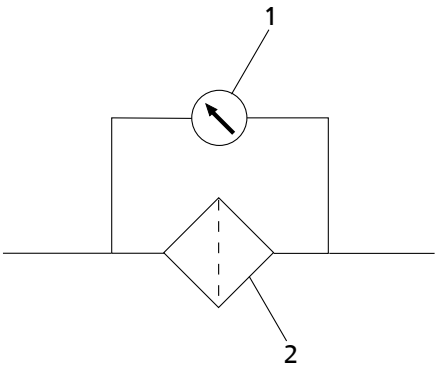

Fig. 10: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

Use a filter with laid-in wire mesh (mesh size max. 0.1 mm) 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.

4. Connect the pump nozzles to the piping.

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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.

5.4.3 Permissible forces and moments at the pump nozzles

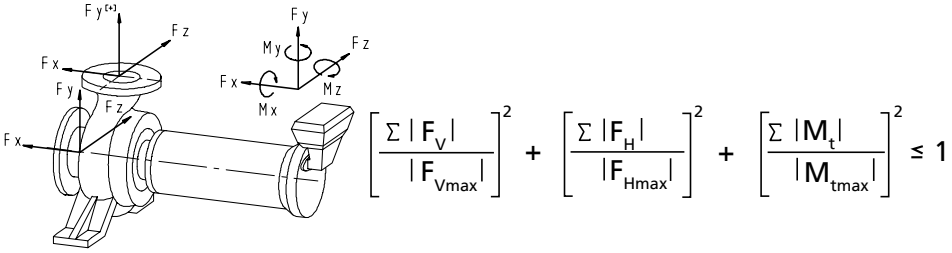

Fig. 11: Forces and moments at the pump nozzles

The following condition must be met:

$\sum|F_V|$, $\sum|F_H|$, and $\sum|M_t|$ are the sums of the absolute values of the respective loads acting on the nozzles. Neither the load direction nor the load distribution among the nozzles are taken into account in these sums.

Table 7: Permissible forces and moments at the pump nozzles

Size	Etaseco G			Etaseco S			Etaseco C		
	F_{Vmax} [kN]	F_{Hmax} [kN]	M_{tmax} [kNm]	F_{Vmax} [kN]	F_{Hmax} [kN]	M_{tmax} [kNm]	F_{Vmax} [kN]	F_{Hmax} [kN]	M_{tmax} [kNm]
32-125.1	2.6	1.8	0.55	3.65	2.59	0.58	4.16	2.95	0.85
32-160.1	2.5	1.7	0.5	3.56	2.51	0.51	4.10	2.87	0.80
32-200.1	2.5	1.7	0.5	3.60	2.43	0.51	4.10	2.78	0.80
32-250.1	2.5	1.7	0.5	--	--	--	4.25	2.96	0.95
32-125	2.6	1.8	0.55	--	--	--	4.16	2.95	0.85
32-160	2.5	1.7	0.5	3.56	2.51	0.51	4.10	2.87	0.80
32-200	2.5	1.7	0.5	3.65	2.43	0.51	4.10	2.78	0.80
32-250	2.5	1.7	0.5	3.73	2.59	0.58	4.25	2.96	0.95
40-125	2.6	1.8	0.6	--	--	--	4.34	3.04	1.26
40-160	2.6	1.8	0.6	3.81	2.67	0.81	4.34	3.04	1.26
40-200	2.6	1.8	0.6	3.81	2.67	0.81	4.46	3.04	1.26
40-250	2.6	1.8	0.6	4.21	2.92	0.58	4.70	3.33	0.90
50-125	2.7	2.0	0.75	--	--	--	4.53	3.15	1.35
50-160	2.7	1.9	0.7	3.97	2.67	1.11	4.53	3.05	1.27
50-200	2.7	1.9	0.7	4.21	2.92	1.11	4.81	3.33	1.27
65-125	3.0	2.2	0.85	--	--	--	5.04	3.47	1.34
65-160	3.0	2.2	0.85	4.42	3.04	1.16	5.04	3.47	1.34
65-200	3.0	2.2	0.85	5.27	3.89	1.79	6.00	4.44	2.08
80-160	3.5	2.8	1.2	5.43	4.05	1.91	6.19	4.62	2.18

5.4.4 Auxiliary connections

DANGER

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

Risk of burns!

Explosion hazard!

- ▷ Make sure that the barrier fluid or quench liquid are compatible with the 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 Electrical system

5.5.1 Information for planning the control system

For the electrical connection of the pump set observe the wiring diagram.
The pump set is supplied with a connection cable; it is wired for DOL starting.

The motors can be connected to electrical low-voltage grids with mains voltages and voltage tolerances to IEC 60038 or to other grids or power supply facilities with a maximum mains voltage tolerance of ±10 %.

For use with other grids and power supply facilities with different tolerances of the mains voltage a prior written approval by the manufacturer is required.

Protective equipment for electric cables

The power cable must be protected against short circuit. Fuses, automatic circuit breakers or motor protection switches can be used for this purpose.

NOTE

In low temperatures the fluid properties change; the fluid density increases. If the pump set is started up in lower temperatures, the motor load and motor current will exceed the values indicated on the name plate.
If protective equipment is installed that monitors the motor current, it will cause the pump to stop. To be able to continue pump operation in such cases, one of the following measures can be implemented: heat up the pump set or use an intelligent motor current monitoring system.

5.5.1.1 Cable gland

DANGER

Excessive strain of cables

Damage at the electrical contact points!

- ▷ Prevent strain of the cables.
- ▷ Take suitable measures at the site to prevent strain.

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Cable glands supplied with the equipment (if applicable) are designed without strain relief.

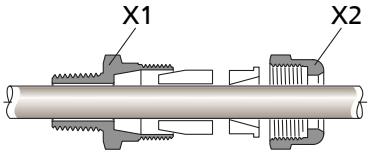

Fig. 12: Cable gland

X1	Cable gland fitting	X2	Union nut

Fire protection

In compliance with the fire protection requirements only cable glands made of metals (e.g. brass or stainless steel) must be used.

5.5.1.2 Motor power cables

The type of connection cable you choose depends on various factors such as, for example, the type of connection, the ambient conditions and the type of system.

Connection cables must not be routed across or near hot surfaces unless they have been designed for this kind of application.

As standard[5)], the power cable connected is a shielded cable of 4 × 1.5 mm².

The use of the power cable shield is left to the customer's discretion.

5.5.1.3 Potential equalisation

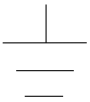

Fig. 13: Earth symbol

For the potential equalisation of the pump set a PE terminal stud is connected at the outside of the motor housing or motor housing cover.
The PE terminal stud comprises an M6 fully threaded stud, an M6 nut and a detent-edged washer.

- Connection cross-section: ≤ 10 mm²
- Maximum tightening torque: 6 Nm to 7 Nm (basis: friction coefficient μ = 0.14)

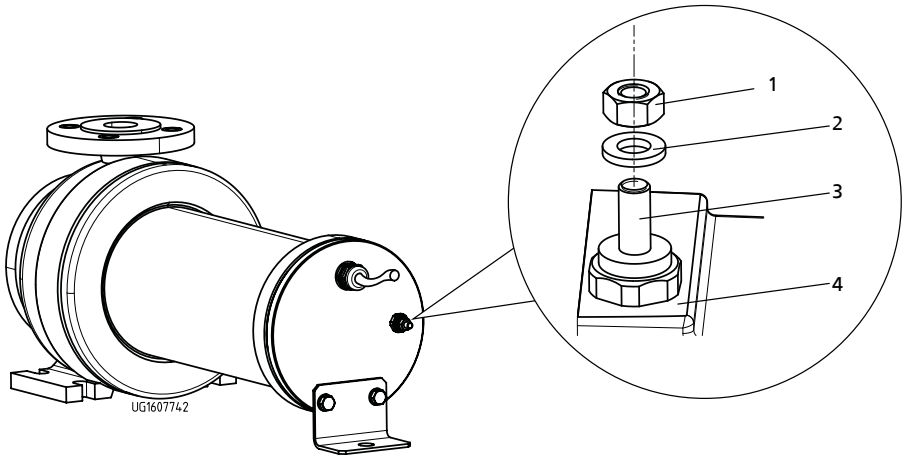

Fig. 14: PE terminal stud for potential equalisation

1	Hexagon nut	2	Detent-edged washer
3	M6 fully threaded stud	4	Motor housing cover 812

5 As an option, unshielded cables or cables of 4 × 2.5 mm² can be used.

5.5.2 Connecting the potential equalisation conductor

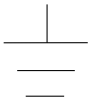

Fig. 15: Earth symbol

Potential equalisation via screw terminal

A screw terminal for the potential equalisation conductor is fitted on the outside of the motor housing.
The terminal consists of a pressed-in square base with fitted clamp and a screw (M5) with spring washer.
The potential equalisation terminal fulfills the requirements of VDE 0170 and is marked with the earth symbol.

- The conductor must be connected in a suitable manner in accordance with EN 60999-1:2000
- Nominal cross-section: 4 mm^2
- Maximum tightening torque: 2 Nm

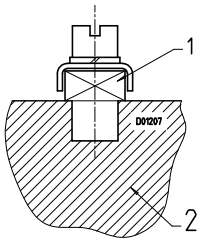

Fig. 16: Screw terminal for potential equalisation

1	Earthing / potential equalisation terminal	2	Motor housing

1. Connecting the potential equalisation optionally provided on the outside of the motor housing is recommended. (⇨ Section 5.5.1.3, Page 27)

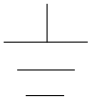

Fig. 17: Earth symbol

Potential equalisation via PE terminal stud

A PE terminal stud for the potential equalisation conductor is fitted on the outside of the motor housing.
The PE terminal stud comprises an M6 fully threaded stud, an M6 nut and a detent-edged washer.

- Connection cross-section: ≤ 10 mm^2
- Maximum tightening torque: 6 Nm to 7 Nm (basis: friction coefficient μ = 0.14)

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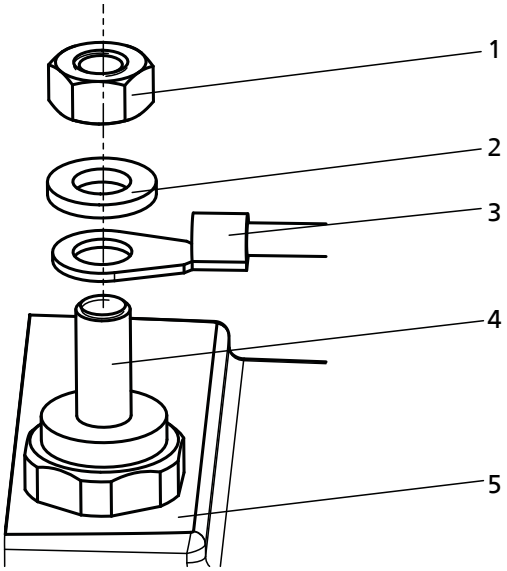

Fig. 18: Potential equalisation connection

1	Hexagon nut	2	Detent-edged washer
3	PE conductor with ring-type terminal	4	M6 fully threaded stud
5	Motor housing cover 812		

1. Connecting the potential equalisation optionally provided on the outside of the motor housing is recommended. (⇨ Section 5.5.1.3, Page 27)

5.5.3 Connection to power supply

⚠ DANGER

Electrical connection work by unqualified personnel

Risk of fatal injury due to electric shock!

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

⚠ WARNING

Incorrect connection to the mains

Damage to the mains network, short circuit!

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

1. Check the available mains voltage against the data on the name plate.
2. Select an appropriate start-up method.

NOTE

A motor protection device is recommended.

5.5.3.1 Connecting the motor to the power supply

5.5.3.1.1 Pump version with terminal box

DANGER

Earth conductor not properly connected

Danger from electric shock!

▷ Connect the earth conductor to the appropriate earthing terminal in the wiring compartment (DIN VDE 0100).

The terminal box is equipped with a terminal block with six terminals.

Effect wiring in accordance with the circuit diagram shown in the cover of the terminal box.

Star configuration (DOL starting)

Star configuration in the terminal box

✓ The pump power cable provides a clockwise rotating field.

✓ The motor is wired for star configuration as indicated on the name plate. Example: Δ/Y --/400 V

✓ Supply voltage from 380 to 420 V

1. Fit bridges as shown below.
2. Connect cores as shown below.

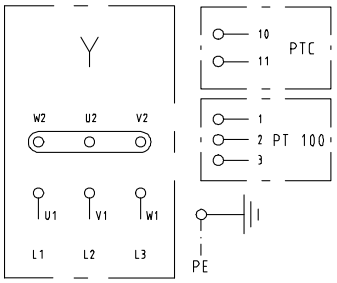

Fig. 19: Star configuration in the terminal box (Pt100 and PTC if fitted)

Factory-supplied star configuration at the stator

✓ The pump power cable provides a clockwise rotating field.

✓ The motor is wired for star configuration as indicated on the name plate. Example: Δ/Y --/400 V

✓ Supply voltage from 380 to 420 V

1. Connect cores as shown below.

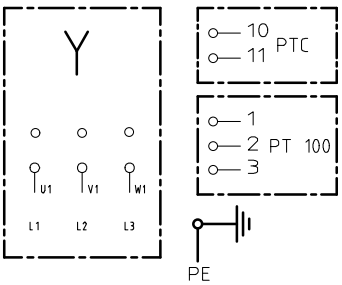

Fig. 20: Factory-supplied star configuration at the stator (special version, Pt100 and PTC if fitted)

Delta configuration (DOL starting)

✓ The pump power cable provides a clockwise rotating field.

✓ The motor is wired for delta configuration as indicated on the name plate. Example: Δ/Y 400 V/--

✓ Supply voltage from 380 to 420 V

1. Fit bridges as shown below.
2. Connect conductors as shown below.

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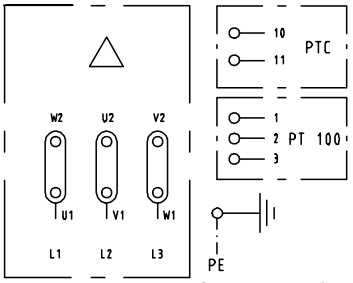

Fig. 21: Delta configuration (PT 100 optional)

Star-delta configuration

Motors connected in delta configuration during operation may be started up in star-delta configuration with the corresponding supply voltage.

- ✓ The pump power cable provides a clockwise rotating field.
- ✓ The motor is wired for delta configuration as indicated on the name plate. Example: Δ/Y 400 V/--
- ✓ Supply voltage from 380 to 420 V

1. Remove all bridges from the terminal block.
2. On terminal blocks with U-shaped terminal clamps bend the conductors in U-shape before placing them under the clamps.

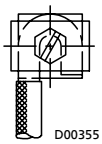

Fig. 22: U-shaped terminal clamp

3. Connect conductors as shown below.

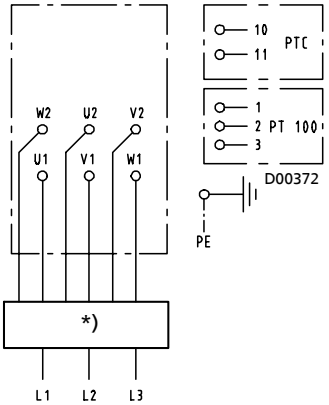

Fig. 23: Star-delta configuration (PT 100 optional)

*)	Y/Δ combination and monitoring device, e.g. motor protection switch

5.5.3.1.2 Version with integrated power cable

DANGER

Earth conductor not properly connected

Danger from electric shock!

- ▷ Connect the earth conductor to the marked PE terminal in the control cabinet.

	CAUTION
	Exceeding the permissible power cable bending radius Damage to the power cable! ▷ Observe the permissible minimum bending radius indicated in the data sheet provided by the cable manufacturer or stated on the order-specific outline drawing; if required, contact KSB.

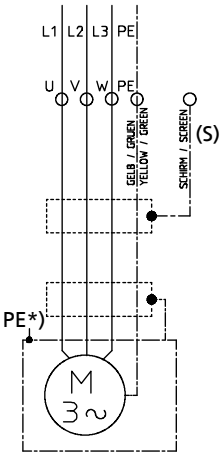

Fig. 24: Electrical connection with integrated power cable

*)	Optional connection of earthing / potential equalisation conductor

The cable end consists of:

- Three cores U/V/W
- Earth conductor (marking: yellow/green)
- EMC braided shield (S) if required

For motors with integrated power cable:

- Only use DOL starting.
- Make sure that no moisture can penetrate into the motor via the free cable end.

5.5.3.2 Operation on a frequency inverter

Limits Depending on the conditions of the electric connection (e.g. cable length) differences could occur between the output values (frequency inverter) and the input values (pump).

Do not exceed the following pump input values:

Table 8: Limits for operation on a frequency inverter

Variable	Value
Motor rating	See data sheet of the pump
Frequency range	Constant V/f ratio[6)]
Voltage ramp-up time	Maximum: d_u/d_t < 1000 V/µs
Peak voltage at the motor	$\hat{U}$ < 1000 V
Maximum frequency	Nominal frequency see data sheet
Minimum frequency	50 % of the nominal frequency[7)]

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6 Nominal values: see data sheet
7 Lower values on request

Pump with terminal box

DANGER

Improper electrical connection

Transmission of interference signals!

- ▹ Only use shielded cables with concentric copper braiding.
- ▹ Make sure that the shield ends of the connection cable have contact over a large area of the wiring compartments of motor and frequency inverter.

Pump with integrated power cable

As standard, shielded connection cables with EMC-compliant cable gland are used at the motor.
Connecting the EMC shield at the control cabinet, etc., is recommended.
Connection cables without EMC shield will only be fitted upon the customer's express request.

Pump with bulkhead housing

The size 6B bulkhead housing fitted at the motor meets the industry standard. Using a customer-supplied shielded connection cable and connecting the EMC shield at the mating connector as well as at the control cabinet, etc., is recommended. (For tougher EMC requirements an EMC-compliant bulkhead housing is available as an option.)

5.5.3.3 Checking the direction of rotation

1. Make sure that the power cable for the pump provides a clockwise rotary field.
2. Make sure that the motor is properly connected to the power supply.
   (⇨ Section 5.5.3.1, Page 30) .

⇨ When terminals U1, V1 and W1 or cores U, V and W are connected to phases L1, L2 and L3 in the order shown, the pump will run in the correct direction of rotation.
Correct direction of rotation: The pump runs in anti-clockwise rotation, looking at the suction flange (see arrow on the pump casing).

⇨ Owing to the special design features of this pump set, in installed condition, the direction of rotation cannot be checked directly; we urgently recommend determining the mains phase sequence with a measuring instrument.

5.5.3.4 Motor monitoring

CAUTION

Insufficient motor monitoring

Increased wear! Damage to the pump!

- ▹ The use of overload protection is imperative.
- ▹ Use temperature monitoring and dry running monitoring if required.

Overload protection

1. Protect the motor against overloading by a thermal time-lag overload protection device in accordance with EN 60439 (VDE 0660) and local regulations (motor protection switch).
2. Set the overload protection device to the nominal current specified on the name plate (⇨ Section 4.3, Page 15) .

Temperature monitoring[8)]

Thermal motor protection by means of thermistor tripping unit (thermistor relay):

1. Use a thermistor relay which interrupts the power supply to the contactor in the event of a thermal hazard to the winding.
2. Connect the thermistor relay cable to terminals 10 and 11 in the terminal box.

NOTE

PTC resistors for monitoring the winding temperature are fitted as an option.

Dry running monitoring

If system conditions are such that the pump could run dry due to a lack of fluid, provide an appropriate monitoring device.

Proven monitoring systems:

- Pressure switch
- Flow control device
- Level control unit
- cos φ control unit
- Current control unit

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8 If PTCs are installed in the stator.

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 mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked. (⇨ Section 6.1.4, Page 37)
- All auxiliary connections required are connected and operational.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇨ Section 6.4, Page 42)

I

6.1.2 Priming and venting the pump

CAUTION

Increased wear due to dry running

Damage to the pump set!

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

Pump without barrier fluid (standard version)

1. Open the shut-off elements in suction and discharge line.
2. Vent the pump and suction line and prime both with the fluid to be handled (for at least 5 minutes).
3. Close the shut-off element in the discharge line.
4. Make sure that the pump does not drain through the suction line.

Pump with barrier fluid (option)

1. Open the shut-off element in the discharge line (suction line closed).
2. Fill the pump with barrier fluid through connection 10E (for at least five minutes).
3. Close connection 10E.
4. Close the shut-off element in the discharge line.
5. Open the suction head/suction lift line.
6. For suction head operation: Vent the system up to the discharge-side shut-off element.
7. For suction lift operation: Evacuate the pump and the suction line.
   The min. permissible pressure is 0.1 bar (absolute).
8. Close all auxiliary connections (barrier fluid, flushing liquid, etc).

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Vertically installed pump (motor on top) / Viscosity of fluid handled > 15mm²/s

⚠ WARNING

Hot/corrosive fluid may escape

Scalding/Chemical burns!

- ▷ Wear appropriate protective clothing (e.g. safety gloves, safety goggles) when venting the pump set.
- ▷ Protect the electric components against escaping fluid.

CAUTION

Viscosity of fluid handled > 15mm²/s and installation with "motor on top"

Pump damage during start-up!

- ▷ Manually prime/vent the motor space during start-up (pump set will not be self-venting).

In vertical installation (with the motor on top) and if the fluid handled has a viscosity > 15mm²/s, the pump will not be self-venting. Prime/vent the pump as follows:

1. Open the shut-off elements in suction and discharge line.
2. Open connection 6B.4/11E.
3. Prime the motor space until the fluid handled escapes from connection 6B.4/11E.
4. Close connection 6B.4/11E.
5. Close the shut-off element in the discharge line.
6. Make sure that the pump does not drain through the suction line.

6.1.3 Start-up

CAUTION

Increased wear due to dry running

Damage to the pump set!

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

CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

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

✓ The system piping has been cleaned.

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

✓ The filling and venting lines have been closed.

1. Fully open the shut-off element in the suction head/suction lift line.
2. Slightly open the shut-off element in the discharge line.
3. Start up the motor.
4. Immediately after the pump has reached full rotational speed, slowly open the shut-off element in the discharge line and adjust it to the duty point.

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5. Adjust barrier fluid supply, if any, in accordance with the data sheet.
6. Verify the actual values of flow rate, head and pump input power against the values in the data sheet.
7. If the pump cannot reach its duty point, find out the cause.
(⇨ Section 6.1.5, Page 38)

CAUTION

Wrong direction of rotation

Vibrations during pump operation! Damage to the pump!

- ▹ If the pump cannot reach its duty point, check the characteristic curve. If required, change the direction of rotation. (⇨ Section 6.1.5, Page 38)

6.1.4 Checking/changing the direction of rotation

CAUTION

Drive and pump running in the wrong direction of rotation

Damage to the pump!

- ▹ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.

Owing to the special design features of this pump set, the direction of rotation cannot be checked directly in installed condition as no rotating parts of the pump sets are visible from the outside.

6.1.4.1 Checking the characteristic curve

✓ The pump set has been switched on.

1. Close the shut-off element in the discharge line.
2. Switch off the pump set.
3. Prime the pump set.
4. Vent the system.
5. Slightly open the shut-off element in the discharge line.
6. Start up the pump set.
7. Check if the pump set reaches the duty point.

6.1.4.2 Checking the shut-off head

✓ The pump set has been switched on.

CAUTION

Pump operation against closed discharge line

Damage to the stator and bearings due to overheating or dry running!

- ▹ Only operate the pump set against a closed discharge line for the test described in this section.
- ▹ Never operate the pump set against a closed discharge line for longer than 1 minute.

1. When the pump has reached its nominal speed, close the discharge-side shut-off element and check (e.g. with a pressure sensor) whether the head equals the shut-off head in the characteristic curve.
2. If the value reached by the pump is more than 10 % below the shut-off head in the characteristic curve, the direction of rotation of the pump set might be incorrect.

6.1.4.3 Changing the direction of rotation

✓ The shut-off head of the pump at full rotational speed is more than 10 % below the corresponding value in the characteristic curve.

1. Switch off the pump set. (⇨ Section 6.1.6, Page 39)

⚠ DANGER

Electrical connection work 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.

2. Take safety precautions for work on electric installations. (⇨ Section 5.5.3, Page 29)
3. To change the direction of rotation, interchange two phases of the power supply. (⇨ Section 5.5.3.1, Page 30)
4. Check the shut-off head again. (⇨ Section 6.1.4.2, Page 37)

6.1.5 Checking the characteristic curve/changing the direction of rotation

Checking the characteristic curve

✓ The pump has been started up but cannot reach its duty point.

1. Switch off the pump. (⇨ Section 6.1.6, Page 39)
2. Prime and vent the pump (⇨ Section 6.1.2, Page 35) .
3. Slightly open the shut-off element in the discharge line.

CAUTION

Pump operation against closed discharge line

Damage to the stator and bearings due to overheating or dry running!

- ▹ Only operate the pump set against a closed discharge line for the test described in this section.
- ▹ Never operate the pump set against a closed discharge line for longer than 1 minute.

4. Start up the pump.
5. When the pump has reached full rotational speed, close the discharge-side shut-off element and check whether the head equals the shut-off head in the characteristic curve.
6. If the value reached by the pump is more than 10 % below the shut-off head in the characteristic curve, change the direction of rotation.

✓ The shut-off head of the pump at full rotational speed is more than 10 % below the corresponding value in the characteristic curve.

1. Switch off the pump set. (⇨ Section 6.1.6, Page 39)

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DANGER

Electrical connection work 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.

2. Take safety precautions for work on electric installations. (⇨ Section 5.5.3, Page 29)
3. To change the direction of rotation, interchange two phases of the power supply. (⇨ Section 5.5.3.1, Page 30)
4. Check the shut-off head again. (⇨ Section 6.1.4.2, Page 37)

6.1.6 Shut-off between two operating periods

Pump set on stand-by

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

✓ The equipment remains energised.

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.
3. Close the auxiliary connections (e.g. connections for barrier fluid) immediately after switching off the motor.

NOTE

If the discharge line is equipped with a 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.

NOTE

If shut-off is not possible, the pump will run in reverse direction.
The reverse runaway speed must be lower than the rated speed.

For prolonged shutdown periods

1. Ensure that the motor cannot be started unintentionally.
2. Close the shut-off element in the suction line and discharge line.
3. Close any auxiliary lines.
4. Drain all fluids which change their physical condition (e.g. by concentration, polymerisation, crystallisation, solidification) from the pump and motor. (⇨ Section 7.3, Page 48)
5. Flush the pump via connection 6B.4/11E if applicable. (⇨ Section 7.3, Page 48)
6. Fit new joint rings. Close connection 6B.4/11E again. Observe the tightening torque for the screw plug.

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6.2 Operating limits

DANGER

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

Leakage of hot or toxic fluid handled!

- ▷ Comply with the operating data indicated on the data sheet.
- ▷ Avoid prolonged operation against a closed shut-off element (5 minutes maximum).
- ▷ Never operate the pump at temperatures 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 Frequency of starts

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 starts are evenly spaced over the period indicated, the following limits can be used for orientation:

Table 9: Frequency of starts

Motor rating	Maximum frequency of starts
[KW]	[Starts/hour]
≤ 15	60

6.2.2 Ambient temperature

Observe the following parameters and values during operation:

Table 10: Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	80 °C
Minimum	-20 °C[9)]

CAUTION

Operation outside the permissible ambient temperature

Damage to the pump (set)!

- ▷ Observe the specified limits for permissible ambient temperatures.

6.2.3 Operation on a frequency inverter

The pump set is suitable for operation on a frequency inverter as per IEC 60034-17.

Selection When selecting a frequency inverter, check the following details:

- Data provided by the manufacturer
- Electrical data of the pump set, particularly the nominal current

Operation Observe the following limits during operation on a frequency inverter:

Table 11: Limits for operation on a frequency inverter

Variable	Value
Motor rating	See data sheet of the pump
Frequency range	Constant V/f ratio[10)]

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9 Lower temperatures on request

10 Nominal values: see data sheet

Variable	Value
Voltage ramp-up time	Maximum: d_u/d_t < 1000 V/µs
Peak voltage at the motor	$\hat{U}$ < 1000 V
Maximum frequency	Nominal frequency see data sheet
Minimum frequency	50 % of the nominal frequency[11)]

6.2.4 Fluid handled

6.2.4.1 Flow rate

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

- Short-time operation: Q_{min}[12)]=0.05xQ_{opt}[13)]
- Continuous operation: Q_{min}=0.3xQ_{opt}
- Continuous operation: Q_{max}[14)]=1.2xQ_{opt}

The data refer to water and water-like fluids.

6.2.4.2 Density of the fluid handled

The pump input power changes in proportion to the density of the fluid handled.

CAUTION

Impermissibly high density of the fluid handled

Motor overload!

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

6.2.4.3 Viscosity of the fluid handled

The discharge head, flow rate and power input of the pump are influenced by the viscosity of the fluid handled.

The pump set can be installed in either a horizontal or a vertical position.

If the values of kinematic viscosity during operation differ from those in the data sheet, check the pump selection.

For vertical installation (motor on top) make sure that the fluid handled has a kinematic viscosity < 15 mm^2/s during commissioning of the pump/system. The pump will then be self-venting.

For fluids with higher viscosities, the motor space must be primed/vented manually (see connections in the general arrangement drawing) and draining of the rotor space must be prevented by appropriate measures at the site.

As long as the pump set / system is vented properly, the pump set can be started up after a stop without any problems also when handling fluids with higher viscosities (see data sheet for the fluid handled).

6.2.4.4 Abrasive fluids

Do not exceed the maximum permissible solids content specified in the data sheet. When the pump handles liquids containing abrasive substances, increased wear of all components in contact with the fluid handled is to be expected. In this case, reduce the intervals commonly recommended for servicing and maintenance.

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11 Lower values on request
12 Minimum permissible flow rate
13 Best efficiency point
14 Maximum permissible flow rate

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.
- ✓ The fluid does not change during pump shutdown (e.g. freeze or polymerise).

1. Start up the pump (set) regularly once a month or 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 from the pipe and stored

- ✓ The pump has been properly drained (⇨ Section 7.3, Page 48) (⇨ Section 7.4.1, Page 49) .
- ✓ The preservative used is compatible with the O-ring materials.

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 blank parts and surfaces of the pump (with silicone-free oil and grease, food-approved if required) to protect them against corrosion.
   Observe any additional information/instructions (⇨ Section 3.3, Page 12) .

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 11)

6.4 Returning to service

For returning the equipment to service, observe the sections on commissioning/start-up (⇨ Section 6.1, Page 35) and the operating limits. (⇨ Section 6.2, Page 40)

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

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7 Servicing/Maintenance

7.1 Safety regulations

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

⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

⚠ WARNING

Fluids handled and supplies posing a health hazard and/or hot fluids handled and 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 tilting or tipping over.

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

NOTE

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

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/inspection

7.2.1 Supervision of operation

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! ▷ Observe the temperature limits in the data sheet and in the section on Operating limits. ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).

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

- Check the flanged connections for integrity.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
  To make sure that stand-by pumps remain ready for instant start-up, start up stand-by pumps regularly between once a month and once every three months for approximately five minutes

7.2.2 Inspection work

7.2.2.1 Checking the clearances

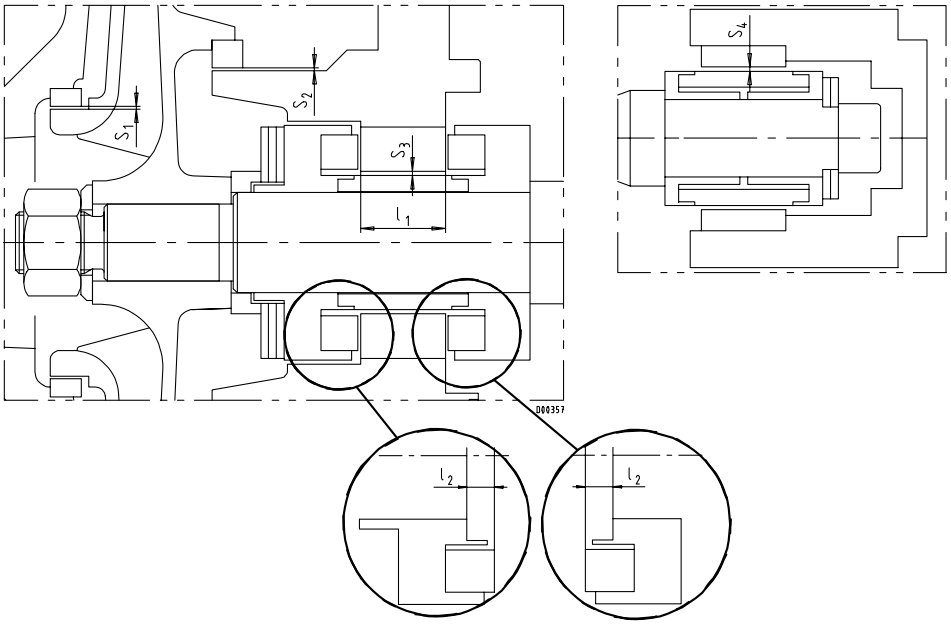

Fig. 25: Clearances

Table 12: Clearances by material

Material	S_1	S_2	S_3	S_4	l_1	l_2
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
G, S	0,15... 0,45	0,15... 0,45	-	-	-	-
C	0,25... 0,75	0,25... 0,75	-	-	-	-

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Table 13: Motor clearances (with ceramic bearing)

Motor	S_1	S_2	S_3	S_4	l_1	l_2
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
DS 90	-	-	0,02... 0,038	0,02... 0,038	$22_{-0,05}$	5,65
DS 112	-	-	0,03... 0,048	0,02... 0,038	$32_{-0,05}$	5,15
DS 132	-	-	0,03... 0,048	0,02... 0,038	$32_{-0,05}$	5,15

✓ The pump set has been disconnected from the power supply in the control cabinet or terminal box.

✓ The pump and bearings have been dismantled.
See steps (⇨ Section 7.4.2, Page 50) to (⇨ Section 7.4.7, Page 52) .

1. Measure the clearances and check them against the table.
2. If the clearances are too large, replace the components with original spare parts.

7.2.2.2 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.

NOTE

When commissioning pump sets, especially pump sets in new systems, check any existing filters shortly after commissioning. Clean them, if necessary, to remove any residues stemming from construction work.

The following filters, if fitted, have to be cleaned:

- Filter in the suction line
- Main flow filter
- Other filters in the piping

7.2.2.3 Lubrication of plain bearings

The hydrodynamic plain bearings are lubricated by the fluid handled or the barrier fluid 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). In this case, checking the bearings is also required. (⇨ Section 7.4.7, Page 52)

7.2.2.4 Checking the motor winding

Measure the insulation resistance of the motor winding during regular maintenance work.

1. Disconnect the pump from the power supply (⇨ Section 7.4.2, Page 50) and, if required, remove it from the piping.
2. Measure the insulation resistance of the motor winding to chassis ground. (⇨ Section 7.2.2.5, Page 46)

⇨ If resistance to chassis ground ≧ 5 MΩ: motor winding in working order. The pump can be re-installed and connected to the power supply (⇨ Section 5.5.3, Page 29) .

⇨ If resistance to chassis ground < 5 MΩ: Measure stator and power cable separately.
To do so, open the stator space and, in addition to the above, measure the motor winding at the winding ends of the stator. (⇨ Section 7.4.10, Page 54)

7.2.2.5 Measuring the insulation resistance of the motor winding

Version with terminal box and PTC

✓ The mains power cable has been disconnected at the terminal box of the pump set. (⇨ Section 7.4.2, Page 50)

✓ Required measuring instrument: insulation resistance measuring device

✓ Measuring voltage 1000 V DC

1. Connect the terminal studs of the three phases on the terminal board.
2. Use this connection point to measure the insulation resistance of the motor winding to chassis ground (1000 V DC). (⇨ Section 7.2.2.5, Page 46)
3. If applicable, connect the cores of the winding temperature sensor.
4. Measure the connection point of the winding temperature sensor to chassis ground (1000 V DC).

⇨ If the electrical resistance to chassis ground ≧ 5 MΩ, the motor winding is in working order.
The pump can be connected to the power supply.

⇨ If the electrical resistance to chassis ground < 5 MΩ, contact KSB Service.

Version with integrated power cable

✓ The integrated power cable of the pump set has been disconnected in the control cabinet. (⇨ Section 7.4.2, Page 50)

✓ Required measuring instrument: insulation resistance measuring device

✓ Measuring voltage 1000 V DC

1. Connect three cores of the cable (e.g. 1-1-1, 2-2-2, 3-3-3) together.
2. Use this connection point to measure the insulation resistance of the motor winding to chassis ground (1000 V DC). (⇨ Section 7.2.2.5, Page 46)

⇨ If the electrical resistance to chassis ground ≧ 5 MΩ, the motor winding is in working order.
The pump can be connected to the power supply.

⇨ If the electrical resistance to chassis ground < 5 MΩ, contact KSB Service.

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7.2.2.6 Checking the power cable (for versions with integrated power cable only)

Visual inspection

✓ The pump set has been removed from the piping if required.

✓ The power cable at the pump set is visible and freely accessible.

1. Visually inspect the power cable for any damage.
2. If any parts are damaged, contact KSB Service.

Earth conductor test

⚠ DANGER

Defective earth conductor

Electric shock!

▹ Never switch on a pump set with a defective earth conductor.

✓ The pump set has been removed from the piping if required.

✓ The power cable at the pump set is visible and freely accessible.

✓ A special earth conductor testing device for measuring the electrical resistance is available.

1. Measure the resistance between the earth conductor and chassis ground. The electrical resistance must be lower than 1 Ω.
2. If any parts are damaged, contact KSB Service.

7.2.2.7 Checking the electrical connection of the pump set (for version with terminal box or bulkhead housing only)

Visual inspection

✓ The pump set has been removed from the piping if required.

✓ **On versions with terminal box only:** The terminal box cover has been removed.

✓ **On versions with bulkhead housing only:** The bulkhead housing has been disconnected.

✓ The electrical connection at the pump set is visible and freely accessible.

1. Visually inspect the electrical connection for any damage.
2. Visually inspect the sealing element for any damage.
3. If any parts are damaged, contact KSB Service.

Earth conductor test

⚠ DANGER

Defective earth conductor

Electric shock!

▹ Never switch on a pump set with a defective earth conductor.

✓ The pump set has been removed from the piping if required.

✓ **On versions with terminal box only:** The terminal box cover has been removed.

✓ **On versions with bulkhead housing only:** The bulkhead housing has been disconnected.

✓ The electrical connection at the pump set is visible and freely accessible.

✓ A special earth conductor testing device for measuring the electrical resistance is available.

1. Measure the electrical resistance between the earth conductor (in the terminal box or bulkhead housing) and chassis ground (e.g. potential equalisation connection on the outside of the motor housing). (⇨ Section 5.5.1.3, Page 27) The electrical resistance must be lower than 1 Ω.
2. If any parts are damaged, contact KSB Service.

7.3 Drainage/cleaning

DANGER

Insufficient preparation of work on the system

Risk of injury!

- Properly shut down the system and secure it against unintentional start-up.
- Close the shut-off elements in the suction line and discharge line.
- Shut off any auxiliary feed lines.
- Allow the system to cool down to ambient temperature.

WARNING

Fluids posing a health hazard

Hazard to persons and the environment!

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

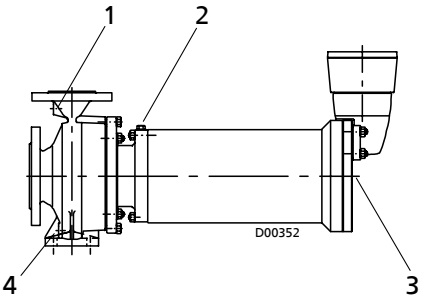
WARNING

Fluid could escape when the flanged connections are opened

Hazard to persons and the environment!

- Wear protective clothing.
- Collect and dispose of any liquid residues.

If the pump set has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump set must also be flushed, neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.



1	Connection 1M (pressure gauge) / 6D (vent connection, if required)	2	Connection 10E (barrier fluid) / 11E.3 (flushing liquid)
3	Connection 6B.4 (motor drain) / 11E (flushing liquid)	4	Connection 6B (casing drain)

Draining

Depending on the installation type, choose one of the following connections for draining:

Table 14: Connections for draining

Installation type	Connection
Horizontal	6B
Vertical (motor on top)	6B
Vertical (motor below)	6B.4

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Flushing

Table 15: Connections for flushing

Installation type	Connection
Horizontal	11E
Vertical (motor on top)	11E
Vertical (motor below)	6B

1. Open connection 6B or connection 11E, depending on the type of installation.
2. Connect the flushing device (e.g. pipe union G 3/8 or G 1/4 with nozzle).
3. Open connection 6B or 11E or the flushing valve in the suction line, depending on the type of installation.
4. Flush the pump set towards the open drain connection.
   The duration of flushing depends on the nature and quantity of the fluid handled inside the pump.
   For information on the quantity refer to the table below.
5. Do not stop the flushing process until the fluid residue inside the pump has been sufficiently diluted (concentration, colour, smell).
   This process will usually take 10 minutes.

Table 16: Quantity of fluid handled in the rotor space

Motor size	Fluid in the rotor space [l]
DS 90.2-1,1	0,3
DS 90.2-2,2	0,3
DS 112.2-4	1,1
DS 112.2-5,5	0,8
DS 132.2-7,5	1,7
DS 132.2-11	1,7
DS 132.2-15	1,2

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

⚠ 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

Hot surface

Risk of personal injury!

- ▷ Allow the pump set to cool down to approx. 35 °C.

⚠ 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.

Always observe the safety instructions and information. (⇨ Section 7.1, Page 43)

For any work on the motor, observe the instructions in this manual.

For dismantling and reassembly observe the general assembly drawing and/or exploded view. (⇨ Section 9.1, Page 65)

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

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- Properly shut down the pump set. (⇨ Section 6.1.6, Page 39)
- Close the shut-off elements in the suction line and discharge line. (⇨ Section 6.1.6, Page 39)
- Depressurise and drain the pump set. (⇨ Section 7.3, Page 48)
- Shut off any auxiliary feed lines. (⇨ Section 6.1.6, Page 39)
- Disconnect the motor at the terminal box or in the control cabinet. (⇨ Section 7.4.2, Page 50)
- Allow the pump set to cool down to approximately 35 °C.

7.4.2 Disconnecting the electrical connections

⚠ DANGER

Power supply not disconnected

Danger to life!

- Disconnect all electrical connections from the power supply and secure against unintentional start-up.

CAUTION

Contamination of the bulkhead housing and/or plug

Reduced dielectric strength of the electrical connections!

- Protect open electrical plug-type connections from contamination.
- Clean or replace contaminated bulkhead housings if possible (for replacement contact KSB Service.)
- Clean or replace contaminated plugs if possible.

Version with integrated power cable

✓ The information in (⇨ Section 7.4.1, Page 49) has been observed.

1. Disconnect the power cables from the system power supply.
2. Remove the routed cable from the cable duct (or similar) if applicable.

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Version with terminal box

✓ The information in (⇨ Section 7.4.1, Page 49) has been observed.

1. Remove the terminal box cover.
2. Disconnect the power cables at the main terminals and, if applicable, at the auxiliary terminals.
3. Unscrew the cable glands at the terminal box and pull out the power cables.

Version with bulkhead housing

✓ The information in (⇨ Section 7.4.1, Page 49) has been observed.

1. Undo the lock.
2. Unplug the system-side power cable with sleeve housing (coupling).
3. Close the bulkhead housing at the motor of the pump set with a suitable cover (protection).

7.4.3 Removing the pump set and dismantling the pump casing

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.2, Page 50) have been observed/carried out.

1. Drain the pump set. Flush it, if required.
2. Fit new joint rings in connections 6B.4/11E and 6B.
3. Close connections 6B.4/11E and 6B. Observe the tightening torque for the screw plugs.
4. Undo the flanged connections.
5. Unbolt the pump foot from the support surface, if applicable.
6. Remove the pump set from the piping and place it down on a clean and level surface.

⚠ WARNING

Pump tilting or tipping over

Risk of injury/crushing!

- ▹ Protect the pump against tilting; use suitable lifting tackle or other equipment.

7. Store the pump as follows:
   Position the motor section vertically (with the impeller on top) on a suitable holder.
   If this is not possible: Place the pump set in a horizontal position so that it sits on the motor without the pump casing resting on the support surface. Secure the pump set against tilting.

⚠ WARNING

Possible fluid residues

Hazard to persons and the environment!

- ▹ Wear safety clothing and a protective mask.
- ▹ Collect and dispose of any fluid residues.

8. Undo nuts 920.01.
9. Remove the pump casing.

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7.4.4 Removing the impeller

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.3, Page 51) have been observed/carried out.

1. Undo impeller nut 920.95 and disc 550.87.
   To undo impeller nut 920.95 hold the impeller with a belt wrench at the impeller eye or, if required, at the outer impeller diameter.
2. Pull off the impeller with a suitable impeller removal device.

7.4.5 Removing the casing cover/bearing bracket

Motor DS 90

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.4, Page 52) have been observed/carried out.

1. Pull off bush 540.01, disc springs 950.23 and thrust bearing 314.01.
2. Undo hexagon socket head cap screws 914.04 and pull off casing cover 161.
3. Remove O-rings 412.11, 412.41 and 412.71.

Motors DS 112 and 132

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.4, Page 52) have been observed/carried out.

1. Undo nuts 920.15 and take casing cover 161 off bearing bracket lantern 344.
2. Pull bush 540.01, cup springs 950.23 and thrust bearing 314.01 off the rotor.
3. Undo nuts 920.04 and remove bearing bracket lantern 344.
4. Remove O-rings 412.11/.41/.71.

7.4.6 Dismantling the rotor

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.5, Page 52) have been observed/carried out.

CAUTION

Incorrect dismantling

Damage to rotor and can!

▹ Keep the rotor straight to prevent any rubbing contact with the can when pulling out the rotor.

1. Pull rotor 818 carefully out of the rotor space of the motor unit.
2. Place the rotor and motor unit on a clean and level surface and secure them against rolling off.

7.4.7 Dismantling the bearings

Auxiliary device We recommend fastening the rotor to the support surface at the rotor core pack so that the torque required to undo/fasten motor-end bearing sleeve 529.06 can be applied.

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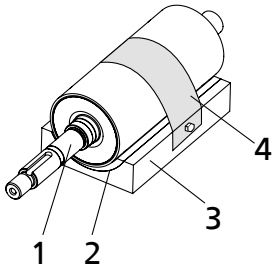

Fig. 26: Auxiliary device for installing/removing the motor-end bearing sleeve

1	Rotor	2	Felt or rubber padding
3	Auxiliary device	4	Strap

Removing the bearing sleeves

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.6, Page 52) have been observed/carried out.

1. Pull pump-end bearing sleeve 529.21 and thrust bearing 314.02 off the rotor.
2. Remove hexagon socket head cap screw 914.80 (left-hand thread!) as well as disc springs 950.11.
3. Pull rings 515.23, 515.24 and motor-end bearing sleeve 529.06 off the shaft end.

Removing the bearing carrier

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.6, Page 52) have been observed/carried out.

1. Undo and remove countersunk head screws 900.72 or hexagon socket head cap screws 914.72 at the motor unit.

CAUTION

Incorrect dismantling

Damage to the can!

▹ Keep the bearing carrier straight to prevent any rubbing contact with the can when pulling the bearing carrier out.

2. Pull out bearing carrier 382.
3. Remove O-ring 412.02.

NOTE

It is impermissible for the motor unit to be dismantled any further by the customer. The motor unit must only be opened for cleaning in the event of damage.
(⇨ Section 7.4.10, Page 54)

7.4.8 Cleaning and checking the components

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.7, Page 52) have been observed/carried out.

1. Clean all dismantled components and inspect them for signs of damage.
2. Replace any damaged components by original spare parts.
3. If the can is damaged:
   - Replace the complete motor unit.
   - For disposal open the stator space and completely dismantle the motor unit, if required.
4. Inspect the bores located in the following components for cleanliness and free passage. Clean them, if necessary.
   - Impeller 230

- Thrust bearing 314.01/.02
- Bearing carrier 382
- Rotor 818 (radial bores; axial bore)
- Casing cover 161
- Bearing bracket lantern 344 (on DS112/DS132 only)
- Hexagon socket head cap screw 914.80

After cleaning and checking the components, proceed with the inspection work.

7.4.9 Checking the motor unit

1. **Only for versions with integrated power cable:** Check the power cable. (⇨ Section 7.2.2.6, Page 47)
2. Check the earth conductor.
3. Clean all dismantled components and check them for signs of wear.
4. Replace any damaged or worn parts by original spare parts.
5. Clean the sealing surfaces.

7.4.10 Completely dismantling the motor unit

NOTE

Only carry out the following dismantling instructions when the product is no longer under warranty. Carrying out the maintenance work described below during the warranty period will result in loss of warranty cover. In the event of damage during the warranty period contact KSB.

For standard maintenance the motor unit does not need to be completely dismantled.

Only dismantle the motor unit completely if:

- The can is defective.
- A motor defect is suspected.

7.4.10.1 Opening the stator space

Version with terminal box

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.8, Page 53) have been observed/carried out.

1. Undo the core connections to the stator in the terminal box.
2. Undo the screws of the terminal box and remove the terminal box.
3. On motor size DS 90 undo hexagon socket head cap screws 914.57; on motor size DS 112 undo hexagon socket head cap screw 914.57 and hexagon socket head cap screw 914.84.
4. Lift off the holder 732.10 of terminal box.
5. Undo countersunk head screws 900.38 or hexagon socket head cap screws 914.38. Remove motor housing cover 812, making sure not to damage the electric wiring to the stator.

Version with integrated power cable

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 49) to (⇨ Section 7.4.8, Page 53) have been observed/carried out.

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NOTE

Do not undo cable gland 826.01 or its union nut, making sure that the cable remains in the motor housing cover.

1. Undo countersunk head screws 900.38 or hexagon socket head cap screws 914.38. Remove motor housing cover 812, making sure not to damage the electric wiring to the stator.

7.4.10.2 Cleaning the stator space

If the can is damaged, clean the stator space.

⚠ WARNING

Possible fluid residues

Hazard to persons and the environment!

- ▹ Wear safety clothing and a protective mask.
- ▹ Collect and dispose of any fluid residues.

✓ The stator space has been opened. (⇨ Section 7.4.10.1, Page 54)

1. Dispose of liquid residues, if any.
2. Clean the stator space. (⇨ Section 7.3, Page 48)
3. Dispose of defective motor unit or return to KSB for repair.

7.4.10.3 Checking the motor winding at the winding ends

✓ An insulation resistance < 5 MΩ has been measured (⇨ Section 7.2.2.4, Page 45) .

✓ The stator space has been opened (⇨ Section 7.4.10.1, Page 54) .

1. On versions with free cable end or terminal box with sealed terminal gland, cut off the electrical cores leading to the stator.
2. Measure the insulation resistance of the motor winding to chassis ground. (⇨ Section 7.2.2.5, Page 46)
   - ⇨ Insulation resistance ≧ 5 MΩ:
     The connection cable is defective. The motor winding is in working order.
   - ⇨ Insulation resistance < 5 MΩ:
     The motor winding is defective. The power cable is in working order.
3. If the power cable is defective, have the power cable replaced by KSB Service and reassemble the pump set.
   Reassembly from step (⇨ Section 7.4.9, Page 54)
4. If the motor winding is defective, replace the complete motor unit 80-1 as per (⇨ Section 9.2, Page 71) .

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

CAUTION

Improper reassembly

Damage to the pump!

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

Sequence Always reassemble the pump in accordance with the corresponding general assembly drawing or list of components.

Sealing elements Check O-rings for any damage and replace by new O-rings if required.

Always use new sealing elements in the materials specified in the list of components, 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).

Assembly adhesives Avoid the use of assembly adhesives if possible.

Should an assembly adhesive be required after all, use a commercially available contact adhesive (e.g. Pattex) or sealant (e.g. HYLOMAR or Epple 33).

Only apply adhesive at selected points and in thin layers.

Never use quick-setting adhesives (cyanoacrylate adhesives).

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

Prior to reassembly, screw back any forcing screws and adjusting screws.

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual.
(⇨ Section 7.6, Page 60)

7.5.2 Installing the bearings

CAUTION

Dry bearing surfaces during assembly

Dry running of the bearings at pump start-up!

- ▷ Before installing the bearings, wet the running surfaces of the bearings with a suitable fluid (e.g. water or oil).

7.5.2.1 Spare motor unit

NOTE

Motor units supplied as spare parts come with the bearing carrier already fitted. For shipment, the spare motor unit is protected by the manufacturer with a transport lock (wooden cover with sealing element). This has to be removed before the unit is used. Proceed with (⇨ Section 7.5.2.3, Page 57) .

7.5.2.2 Fitting the bearing carrier

- ✓ The individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear (bearing bush).
- ✓ Any damaged or worn parts have been replaced by original spare parts.

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✓ The sealing surfaces have been cleaned.

✓ The running surface of the bearing bush has been wetted with a suitable liquid.

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) have been observed and carried out.

1. Insert O-ring 412.22 into the groove in motor housing cover 812. Verify that it is properly positioned and free from any damage.
2. Insert O-ring 412.02 into the groove in bearing carrier 382.
3. Carefully slide bearing carrier 382 with the bearing bush from the open motor housing on the pump end into motor housing cover 812.
   Make sure not to damage the stator can in this process.
4. Fit countersunk head screws 900.72 or hexagon socket head cap screws 914.72. Tighten them with a torque wrench.
   Observe the tightening torque. (⇨ Section 7.6, Page 60)

7.5.2.3 Fitting the motor-end bearing sleeve on the rotor

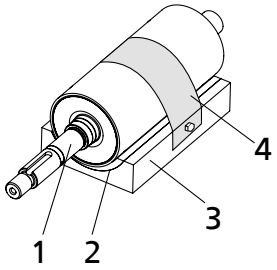

Fig. 27: Auxiliary device for installing/removing the motor-end bearing sleeve

1	Rotor	2	Felt or rubber padding
3	Auxiliary device	4	Strap

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.2.2, Page 56) have been observed and carried out.

1. Slide taper lock ring 515.23, bearing sleeve 529.06, taper lock ring 515.24 and disc springs 950.11 (pointing in the same direction) onto the free shaft end (motor end).
   The highest point of the disc spring pack must point towards the head of hexagon socket head cap screw 914.80.
2. Screw in hexagon socket head cap screw 914.80 (left-hand thread!) and tighten slightly by hand.
3. Slightly turn plain bearing sleeve 529.06 in the conical seat.
4. Tighten hexagon socket head cap screw 914.80 (left-hand thread!).
   Observe the tightening torque. (⇨ Section 7.6, Page 60)
5. Wet the running surface of the bearing sleeve with a suitable liquid.

7.5.2.4 Fastening the pump-end bearing to the rotor

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.2.3, Page 57) have been observed and carried out.

1. Wet the bearing face of the thrust bearing with a suitable liquid.
2. Guide pump-end thrust bearing 314.02 and bearing sleeve 529.21 onto the pump-side shaft end until they will not go any further.
3. Wet the running surface of the bearing sleeve with a suitable liquid.

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7.5.3 Fitting the rotor

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.2.4, Page 57) have been observed/carried out.

✓ Check the running surfaces of the plain bearings for damage and make sure they are clean.

✓ The running surface of the motor-end bearing sleeve has been wetted with a suitable liquid.

1. Carefully insert the rotor into the rotor space until the bearing sleeve (motor end) is held and guided by the bearing bush in bearing carrier 382.

7.5.4 Fitting the casing cover/bearing bracket lantern

Motor DS 90

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.3, Page 58) have been observed/carried out.

✓ The rotor has been installed.

1. Guide casing cover 161 into the centring recess of the motor housing until the O-rings will not go any further.

   Screw plug 903.16 (barrier fluid connection 10E if any) must point vertically upwards when the motor is installed in the system in a horizontal position. This will ensure that the two inclined bores for venting and/or draining will lead to the highest and/or lowest point, respectively.
2. Insert and tighten screws 914.04.
   Observe the tightening torque. (⇨ Section 7.6, Page 60)
3. Pull the free shaft end of the rotor towards the pump end by hand until thrust bearing 314.02 rests against the face of the bearing bush.
4. Wet the bearing face of thrust bearing 314.01 with a suitable liquid. Slide it on the shaft end as far as possible.
5. Fit disc springs 950.23 (pointing in the same direction). The disc springs are correctly fitted if the outside diameter rests against thrust bearing 314.01 and the highest point of the disc spring pack points towards the impeller.
6. Slide ring 540.01 onto the free shaft collar until the ring rests against the disc spring pack.

Motors DS 112 and 132

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.3, Page 58) have been observed/carried out.

✓ The rotor has been installed.

1. Guide bearing bracket lantern 344 with O-rings 412.11/.41/.71 into the centring recess of the motor housing until the O-rings will not go any further.

   Screw plug 903.16 (barrier fluid connection 10E if any) must point vertically upwards when the motor is installed in the system in a horizontal position. This will ensure that the two inclined bores for venting and/or draining will lead to the highest and/or lowest point, respectively.
2. Tighten nuts 920.04.
   Observe the tightening torque. (⇨ Section 7.6, Page 60)
3. Wet the bearing face of thrust bearing 314.01 with a suitable liquid. Slide it on the shaft end as far as possible.
4. Fit disc springs 950.23 (pointing in the same direction). The disc springs are correctly fitted if the outside diameter rests against thrust bearing 314.01 and the highest point of the disc spring pack points towards the impeller.
5. Slide ring 540.01 onto the free shaft collar until the ring rests against the disc spring pack.

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6. Place casing cover 161 onto bearing bracket lantern 344.
   Make sure that O-ring 412.11 is correctly seated.
7. Align the marking (groove) on the casing cover with screw plug 903.16.
8. Tighten nuts 920.15.
   Observe the tightening torque. (⇨ Section 7.6, Page 60)

7.5.5 Fitting the impeller

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.4, Page 58) have been observed/carried out.

1. Insert key 940.01 into the shaft keyway.
2. Slip on impeller 230.
3. Fit disc 550.87 and impeller nut 920.95.
4. Hold the impeller with a belt wrench when tightening impeller nut 920.95, moving the impeller slightly to and fro with the belt wrench.
   Observe the tightening torque. (⇨ Section 7.6, Page 60)
   During tightening, some resistance must be felt due to the pre-loaded disc springs before complete contact of all parts is established.
5. If no resistance can be felt during tightening:
   - Verify that the disc springs have been fitted correctly.
   - Repeat operations (⇨ Section 7.5.4, Page 58) from item 4 onwards.
6. Rotate and axially move the rotor by hand.
   Check that the rotor is able to move freely and easily (axial movement approximately 0.5 mm).
   If there are any rubbing noises or stresses and strains: Find the cause and take remedial action.

7.5.6 Installing the back pull-out unit in the pump casing

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.5, Page 59) have been observed and carried out.

✓ Studs 902.01 have been fitted in the pump casing and assembly paste applied where necessary.

1. Insert gasket 400.19 into the centring recess of pump casing 102.
2. Insert the pre-assembled studs in pump casing 102 into the holes on casing cover 161 (or on adapter 82-5 for motor size A only).
3. Fit nuts 920.01.
4. Check that the rotor can be rotated easily.
5. Tighten nuts 920.01.
   Observe the tightening torque.
6. Insert screw plug 903.91 with new joint ring 411.91 into motor housing cover 812 and tighten it.
   Observe the tightening torque.
7. If required, fit screw plug 903.01 with new gasket 411.01 on the pump casing.

7.5.7 Checking reassembly

Checking the rotor for smooth rotation

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.6, Page 59) have been observed or carried out.

✓ The pump rotor can be rotated freely and easily.

1. Rotate the impeller by hand in clockwise direction.
   Use a socket wrench on impeller nut 920.95, if required.
2. If rotating the impeller proves difficult or rubbing noises can be heard, open the pump and eliminate the causes.

Checking the pump for leakage

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 55) to (⇨ Section 7.5.6, Page 59) have been observed or carried out.

✓ The pump rotor can be rotated freely and easily.

1. Close the flanges and screw plugs of the pump.
2. Subject the pump to a leak test.
   - Medium: dry compressed air or nitrogen
   - Pressure: 2 bar
   - Duration: 30 minutes
3. Apply a leak detection spray to all sealed parts (e.g. casing seals, screw plugs).
4. If the pressure drops, locate the cause (with the leak detection spray) and ensure tight sealing.
5. If the pressure does not drop, the pump can be returned to operation.
   For installing the pump in the system observe the information in (⇨ Section 5, Page 19) .
   For storage observe (⇨ Section 6.3, Page 42) .

7.6 Tightening torques

Table 17: Tightening points

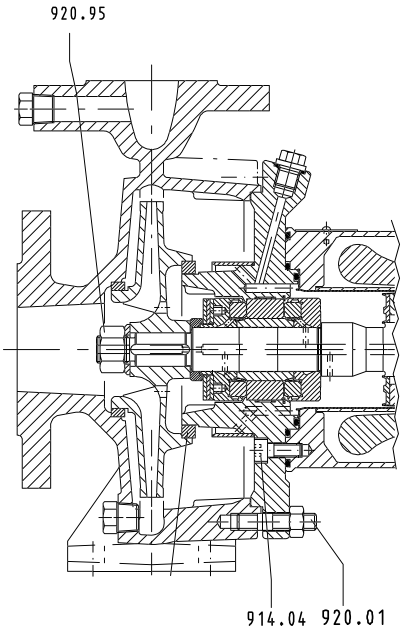
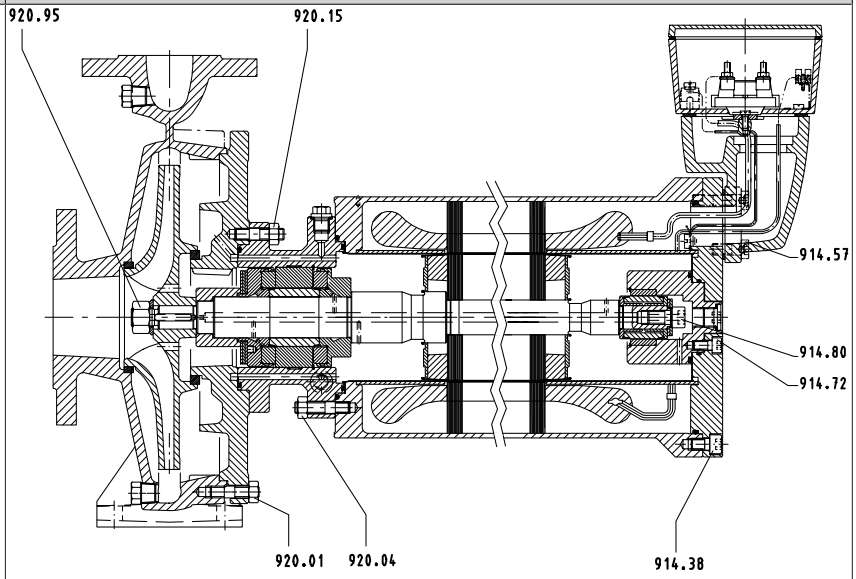
Motors DS 90	Motors DS 112 and DS 132
	

Table 18: Tightening torques

Part No.	Description	Thread	Material	Tightening torque [Nm]
902.01	Stud	M10	8.8	35
			A2-70	35
914.04	Hexagon socket head cap screw	M8	A4-70	18
914.38		M8	A4-70	18
		M10	A4-70	35
		M10	8.8	45
914.57		M8	A4-70	18
		M8	8.8	25
		M10	8.8	45

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Part No.	Description	Thread	Material	Tightening torque [Nm]
914.72	Hexagon socket head cap screw	M8	A4-70	18
914.80		M12-LH	A4-70	45
920.01	Nut	M10	8.8	35
			A2-70	35
920.95		M16	A4-70	100

Table 19: Tightening torques for screw plugs

Part No.	Description	Thread	With joint ring		Tightening torque
			Part No.	Seal material	[Nm]
903.91	Screw plug[15]	G 3/8	911.91	DPAF	20
				PTFE-GF25	
		G 1/4		DPAF	15
				PTFE-GF25	
903.01[16]		G 3/8	911.01	DPAF	20
				PTFE-GF25	

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 65)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 20: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pump sets (including stand-by pumps)						
		2	3	4	5	6	8	10 and more
161	Casing cover	-	-	-	1	1	1	10 %
230	Impeller	1	1	2	2	2	3	30 %
314.01/.02	Thrust bearing	-	-	-	1	1	1	10 %

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15 Wet the joint rings (e.g. with a drop of water).
16 If applicable

Part No.	Description	Number of pump sets (including stand-by pumps)						
		2	3	4	5	6	8	10 and more
344	Bearing bracket lantern [17)18)]	-	-	-	1	1	1	10 %
382	Bearing carrier	-	-	-	1	1	1	10 %
515.23/.24	Taper lock ring	-	-	-	1	1	1	10 %
529.06/.21	Bearing sleeve	-	-	-	1	1	1	10 %
	Motor unit [17)]	-	-	-	1	1	1	10 %
818	Rotor [17)]	-	-	-	1	1	1	10 %
	Set of sealing elements	2	2	4	4	6	8	100 %
	Spare motor	-	-	-	-	-	-	10 %

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17 If more than 5 identical motors are in operation, we recommend to keep a spare motor on stock instead of the parts bearing this index

18 For size DS 112/132 only

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

- ▷ For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.

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

A Pump is running, but does not deliver
B Pump delivers insufficient flow rate
C Motor is overloaded
D Excessive current consumption
E Excessive power consumption
F Leakage at the pump
G Vibrations during pump operation
H Impermissible temperature increase in the pump
I Rubbing noises

Table 21: Trouble-shooting

A	B	C	D	E	F	G	H	I	Possible cause	Remedy[19]
✗	-	-	-	-	-	-	✗	-	▪ Motor is not running because of lack of voltage.	▪ Check electrical connections.
✗	-	-	-	-	-	-	✗	-	▪ Rotor blocked due to corrosion or oxidation (risk of dry running)	
✗	-	-	✗	-	-	-	-	-	▪ Motor winding or integrated power cable are defective.	
✗	✗	-	-	-	-	-	-	-	▪ Wrong direction of rotation	Interchange two of the phases of the power cable.
✗	✗	✗	✗	-	-	-	-	-	▪ Motor is running on 2 phases only.	Replace the defective fuse. Check the electric cable connections.
-	✗	-	-	-	-	-	-	-	▪ Excessively high back pressure	▪ Re-adjust to duty point by opening the shut-off valves accordingly. ▪ Check system for impurities, remove any impurities. ▪ Fit a larger impeller.[20]
-	✗	-	-	-	-	-	-	-	▪ Formation of air pockets in the piping	▪ Alter piping layout.Fit vent valve.
-	✗	-	-	-	-	-	-	-	▪ Supply line or impeller clogged	▪ Remove deposits in the pump and/or piping.
-	✗	-	-	-	-	-	-	-	▪ Suction lift is too high.	▪ Clean suction strainer and suction lines. ▪ Check/alter liquid level. ▪ Change suction line.

19 Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.
20 Contact KSB.

A	B	C	D	E	F	G	H	I	Possible cause	Remedy[19]
-	✗	-	-	-	-	-	-	-	▪ Speed is too low. [19] – Operation with frequency inverter – Operation without frequency inverter	▪ – Increase voltage/frequency at the frequency inverter in the permissible range. – Check voltage.
-	✗	-	-	-	-	✗	✗	-	▪ Pump or piping are not completely vented or primed.	▪ Vent and/or prime.
-	✗	-	-	-	-	✗	✗	-	▪ $NPSH_{available}$ (positive suction head) is too low.	▪ Check/alter liquid level. ▪ Fully open shut-off element in suction/inlet line. ▪ Change suction/inlet line, if the friction losses in the suction/inlet line are too high. ▪ Check any strainers installed/suction opening. ▪ Observe permissible speed of pressure fall.
-	✗	✗	✗	✗	-	✗	-	-	▪ Wear of internal components	▪ Replace worn components by new ones.
-	-	✗	-	-	-	-	-	-	▪ Pump back pressure is lower than specified in the purchase order.	▪ Re-adjust to duty point. ▪ In the case of persistent overloading, turn down impeller. [20]
-	-	✗	-	-	-	-	-	-	▪ Excessive temperature ▪ Temperature of fluid handled is too high.	▪ Adjust the fluid temperature to the value given in the data sheet.
-	-	✗	-	-	-	-	-	-	▪ Density or viscosity of the fluid handled is higher than stated in the purchase order.	▪
-	-	✗	-	-	-	-	✗	-	▪ Bores for cooling/lubricating flow are clogged.	▪ Clean.
-	-	✗	✗	-	-	-	-	-	▪ Supply voltage too low	▪ Increase voltage; check voltage drop in the power cable.
-	-	✗	✗	-	-	-	-	-	▪ Incorrect operating data	▪ Flow rate is too high. ▪ Viscosity is too high.
-	-		✗	✗	-	✗	-	✗	▪ Defective bearing(s)	▪ Replace.
-	-	-	-	-	✗	-	-	-	▪ Connection bolts have worked loose.	▪ Re-tighten the bolts. ▪ Fit new sealing elements.
-	-	-	-	-	-	✗	-	-	▪ Rotor out of balance	▪ Clean the rotor. ▪ Balance the rotor.
-	-	-	-	-	-	✗	-	✗	▪ Impeller and/or rotor rub on the pump casing.	▪ Check bearing for wear. ▪ Remove any deposits on impeller and/or rotor. ▪ Check contact points of impeller and rotor for any damage and reuseability. Replace components if necessary.
-	-	-	-	-	-	-	✗	-	▪ Flow rate too low	▪ Verify minimum flow rate against data sheet. Increase flow rate accordingly.

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9 Related Documents

9.1 General assembly drawing with list of components

9.1.1 Pump set with motor sizes 12 and 22

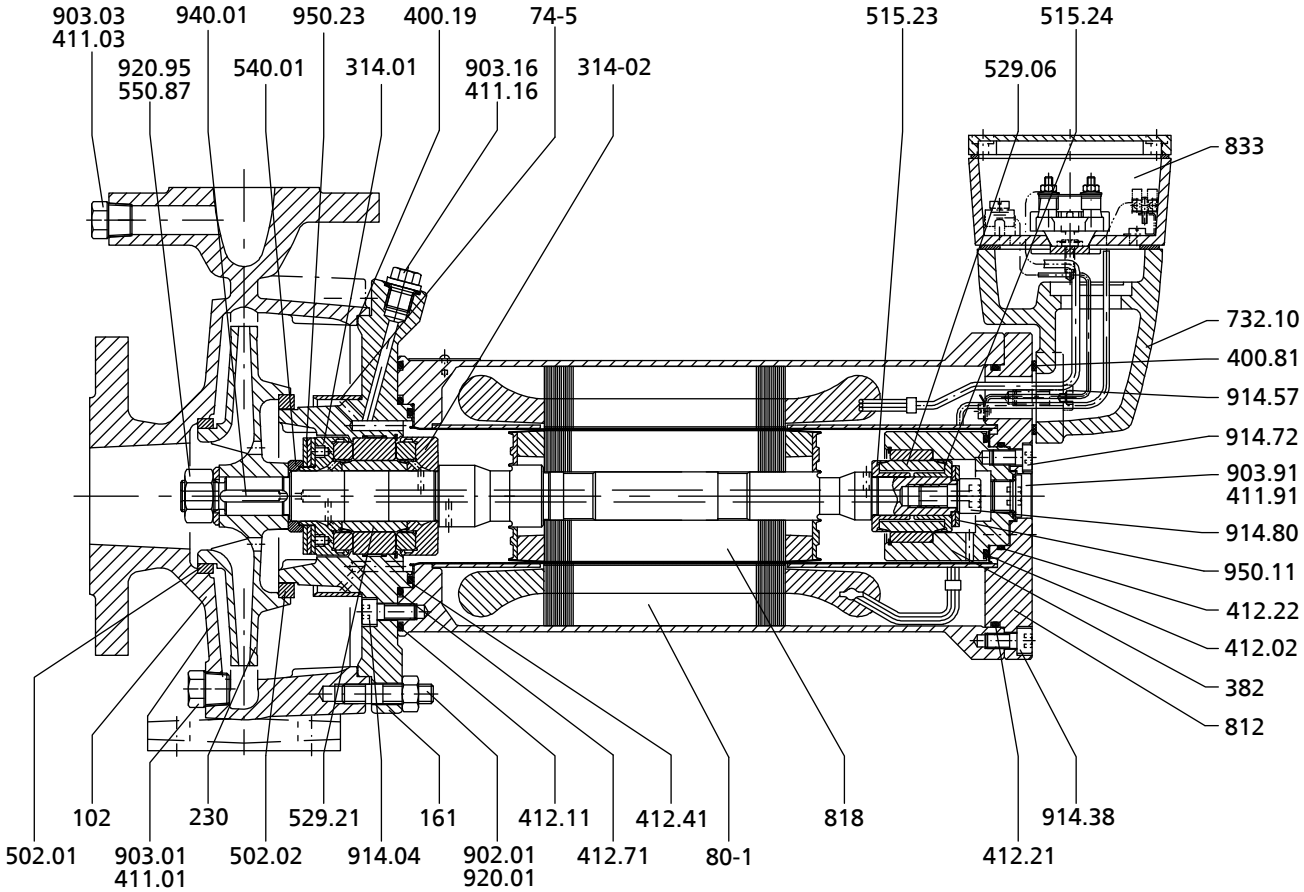
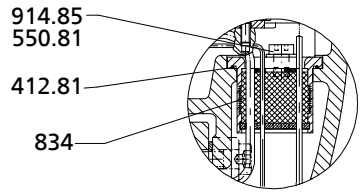
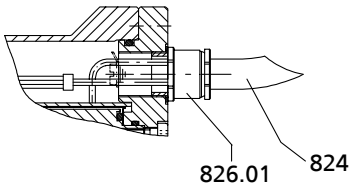


Fig. 28: General assembly drawing of pump set with motor sizes 12 and 22



Version with sealed terminal gland



Version with integrated power cable

Table 22: List of components

Part No.	Comprising	Description
102	102	Volute casing
	502.01	Casing wear ring
	902.01	Stud
	920.01	Nut
	903.01/.03	Screw plug
	411.01/.03	Joint ring
161	161	Casing cover
	400.19	Gasket
	74-5	Separator
	903.16	Screw plug

Part No.	Comprising	Description
161	411.16	Joint ring
	-	Bearing bush
230	230	Impeller
	502.02	Impeller wear ring
-[21]	-	Plain bearing assembly, pump side
	314.01/.02	Thrust bearing
	529.21	Bearing sleeve
	950.23	Disc spring
-[21]	-	Plain bearing assembly, drive end
	515.23/.24	Locking sleeves
	529.06	Bearing sleeve
	914.80	Hexagon socket head cap screw (left-hand thread)
	950.11	Disc spring
382	382	Bearing carrier
	411.91	Joint ring
	903.91	Screw plug
	900.72[22]	Countersunk head screw
	914.72[23]	Hexagon socket head cap screw
540.01	540.01	Bush
550.87	550.87	Disc
80-1	80-1	Motor unit
	412.21/.22/.41/.71	O-ring
	812	Motor housing cover
	81-15[24]	PE terminal stud
	81-29.04[25]	PE terminal
	900.38[26]	Countersunk head screw
	914.04/.38[27]	Hexagon socket head cap screw
	902.04	Stud
	920.04	Nut
	-	Motor housing
	-	Stator
	-	Can
	-	Support
818	818	Rotor
	940.01	Key
99-9	99-9	Set of sealing elements
	400.19/.81	Gasket
	411.01/.03/.16/.91	Joint ring
	412.02/.11/.21/.22/.41/.71/.81	O-ring
Electrical connection for version with terminal box		
833	833	Terminal box
	400.81	Gasket

21 Rotating parts, bearing bush not included
22 Or 914.72
23 Or 900.72
24 Or 81-29.04
25 Or 81-15
26 Or 914.38
27 Or 900.38

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Part No.	Comprising	Description
833	732.10	Holder
	914.57	Hexagon socket head cap screw
	-	Cable gland[28)]
834	834	Sealed terminal gland[28)]
	412.81	O-ring
	550.81	Disc
	914.85	Hexagon socket head cap screw
Electrical connection for version with integrated power cable		
-	-	Power cable
	824	Cable
	826.01	Cable gland

28 Optional

9.1.2 Pump set with motor sizes 42, 52, 72, 112 and 152

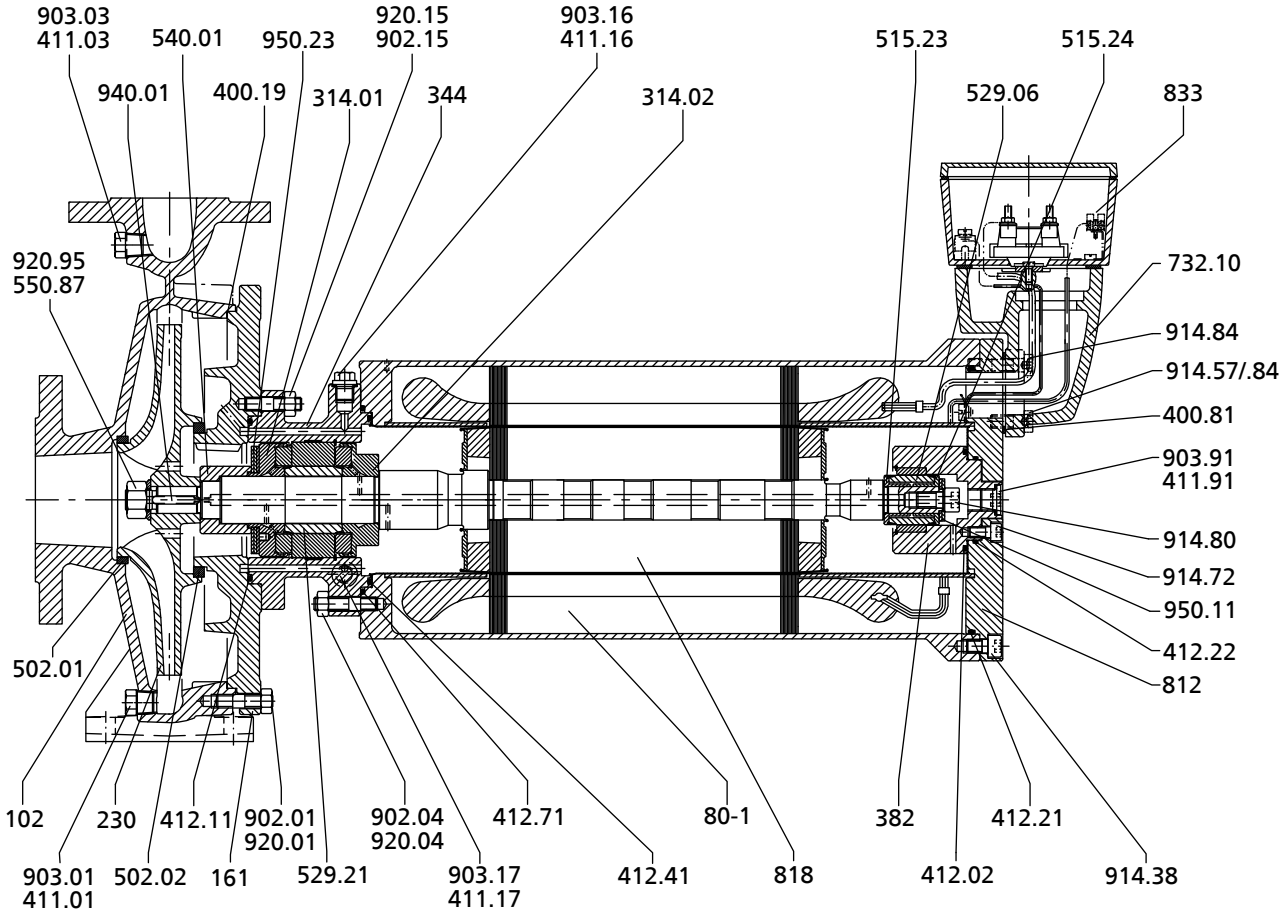
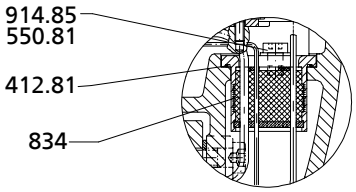
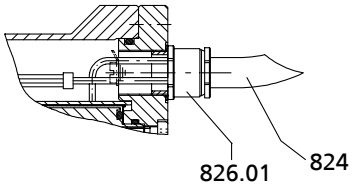


Fig. 29: General assembly drawing of pump set with motor sizes 42, 52, 72, 112 and 152



Version with sealed terminal gland



Version with integrated power cable

Part No.	Comprising	Description
102	102	Volute casing
	411.01/.03	Joint ring
	502.01	Casing wear ring
	902.01	Stud
	903.01/.03	Screw plug
	920.01	Nut
161	161	Casing cover
	400.19	Gasket
	902.15	Stud
	920.15	Nut
230	230	Impeller
	502.02	Casing wear ring
310.10	310.10	Plain bearing
	314.01/.02	Thrust bearing
	529.21	Bearing sleeve
	950.23	Spring

Part No.	Comprising	Description
310.11	310.11	Plain bearing
	515.23/.24	Taper lock ring
	529.06	Bearing sleeve
	914.80	Hexagon socket head cap screw
	950.11	Spring
344	344	Bearing bracket lantern
	903.16	Screw plug
	411.16	Joint ring
	-	Bearing bush
382	382	Bearing carrier
	411.91	Joint ring
	903.91	Screw plug
	914.72	Hexagon socket head cap screw
540.01	540.01	Bush
550.87	550.87	Disc
80-1	80-1	Motor unit
	412.21/.22/.41/.71	O-ring
	812	Motor housing cover
	81-15	PE terminal stud
	900.38[29)]	Countersunk head screw
	914.04/.38[30)]	Hexagon socket head cap screw
	902.04	Stud
	920.04	Nut
	-	Motor housing
	-	Stator
	-	Can
	-	Support
818	818	Rotor
	940.01	Key
920.95	920.95	Nut
99-9	99-9	Set of sealing elements
	400.19/.81	Gasket
	411.01/.03/.16/.17/.91	Joint ring
	412.02/.11/.21/.22/.41/.71/.81	O-ring
Electrical connection for version with terminal box		
833	833	Terminal box
	400.81	Gasket
	732.10	Holder
	914.57/.84	Hexagon socket head cap screw
	-	Cable gland
834	834	Sealed terminal gland[31)]
	412.81	O-ring
	550.81	Disc
	914.85	Hexagon socket head cap screw
Electrical connection for version with integrated power cable		
-	-	Power cable

29 Or 914.38
30 Or 900.38
31 Optional

Part No.	Comprising	Description
-	824	Cable
	826.01	Cable gland

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9.2 Spare motor unit

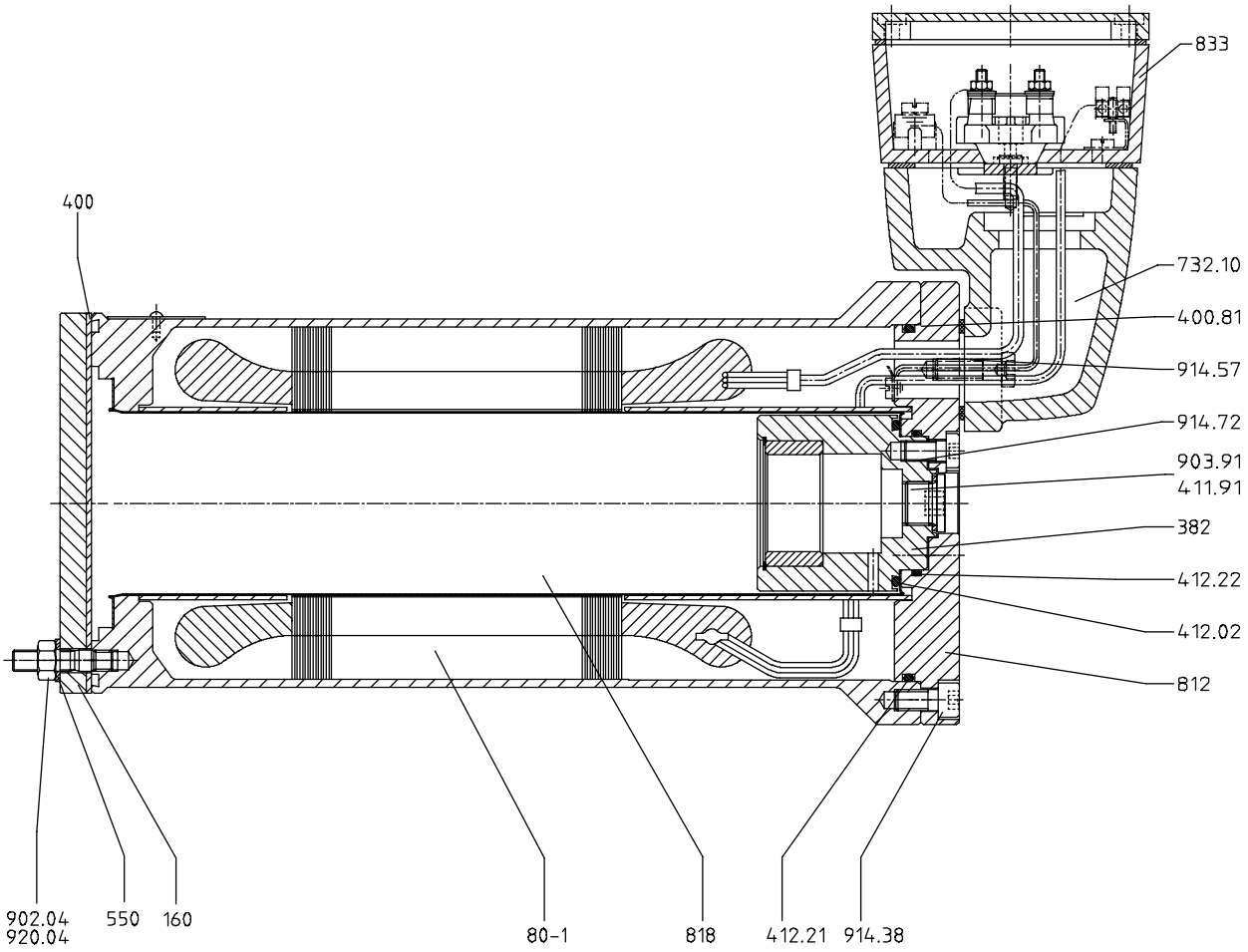
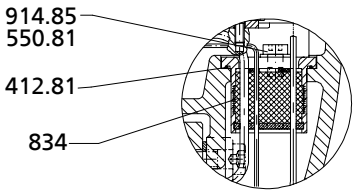


Fig. 30: Spare motor unit



Version with sealed terminal gland

Table 23: List of components of spare motor unit 80-1

Part No.	Comprising	Description
	80-1	Motor unit
	412.21/.22/.41/.71	O-ring
	812	Motor housing cover
	81-15[32)]	PE terminal stud
	81-29.04[33)]	PE terminal
	900.38[34)]	Countersunk head screw
	914.04/.38[35)]	Hexagon socket head cap screw
	902.04	Stud

32 Or 81-29.04
33 Or 81-15
34 Or 914.38
35 Or 900.38

Part No.	Comprising	Description
	920.04	Nut
	382	Bearing carrier
	411.91	Joint ring
	903.91	Screw plug
	900.72[36)]	Countersunk head screw
	914.72[37)]	Hexagon socket head cap screw
	833[38)]	Terminal box
	834	Sealed terminal gland[39)]
	-[40)]	Power cable
	-	Motor housing
	-	Stator
	-	Can
	-	Support
	-	Bearing bush
99-9	99-9	Set of sealing elements
	400.19/.81	Gasket
	411.01/.03/.16/.91	Joint ring
	412.02/.11/.21/.22/.41/.71/.81	O-ring
Electrical connection for version with terminal box		
833	833	Terminal box
	400.81	Gasket
	732.10	Holder
	914.57/.84[41)]	Hexagon socket head cap screw
	-	Cable gland[42)]
834	834	Sealed terminal gland[42)]
	412.81	O-ring
	550.81	Disc
	914.85	Hexagon socket head cap screw
Electrical connection for version with integrated power cable		
-	-	Power cable
	824	Cable
	826.01	Cable gland
Transport lock		
	160	Cover
	400	Sealing element
	550	Disc
	902.04	Stud
	920.04	Hexagon head bolt

36 Or 914.72
37 Or 900.72
38 Or power cable
39 Optional on versions with terminal box only
40 Or terminal box
41 Only for motor sizes 42, 52, 72, 112, 132
42 Optional

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10 EU Declaration of Conformity

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

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

Etaseco (ESO), Etaseco-I (ESO-I), Etaseco-M (ESO-M), Etaseco RVP (ESO RVP)

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
  - EN 60034-1, EN 60034-5/A1

Person authorised to compile the technical file:

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

The EU Declaration of Conformity was issued in/on:

Place, date

.....[43)].....

Name

Function

Company
Address

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

11 Certificate of Decontamination

Type: .....

Order number/

Order item number[44]: .....

Delivery date: .....

Field of application: .....

Fluid handled[44]: .....

Please tick where applicable[44]:

☐ Radioactive

☐ Explosive

☐ Corrosive

☐ Toxic

☐ Harmful

☐ Bio-hazardous

☐ Highly flammable

☐ Safe

Reason for return[44]: .....

Comments: .....

.....

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

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

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

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

☐ No special safety precautions are required for further handling.

☐ The following safety precautions are required for flushing fluids, fluid residues and disposal:

.....

.....

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

.....	.....	.....
Place, date and signature	Address	Company stamp

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44 Required fields

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