

Submersible Motor Pump

Amarex KRT

Sizes DN 40 to DN 300, 50 Hz

Motor Sizes

2-pole: 18 2.F to 75 2.F

4-pole: 15 4.F to 75 4.F

6-pole: 15 6.F to 55 6.F

8-pole: 15 8.F to 45 8.F

Installation/Operating Manual



Mat. No.: 05152975

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Installation/Operating Manual Amarex KRT

Original operating manual

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Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Close-coupled design

Motor directly fitted to the pump via a flange or a drive lantern

Discharge line

The pipeline which is connected to the discharge nozzle

Flamepath

The surface of motor housing components which form flameproof joints when an explosion-proof motor is installed.

Hydraulic system

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

Pump set

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

Size group

The size group code serves to group several sizes within a pump type series.

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover (for details, refer to the table below)

Table 1: Variants covered by this operating manual

Size	Size group	Impeller type	Material variant		
			Grey cast iron		
			G	G1	G2
40-252	EP 250	F, K, S	F, K, S	F, K	F, K
80-252	EP 250	F	F	F	F
80-253	EP 250	E, F, K	E, F, K	F, K	F, K
80-315	EP 315	D	D	D	-
80-315	EP 315	K	K	K	K
80-317	EP 315	D	D	D	-
80-317	EP 315	F	F	F	F
100-253	EP 250	D	D	D	-
100-253	EP 250	E, K	E, K	K	K
100-254	EP 250	F, K	F, K	F, K	F, K
100-315	EP 315	D	D	D	-
100-316	EP 315	D	D	D	-
100-316	EP 315	F, K	F, K	F, K	F, K
100-317	EP 315	E	E	-	-
100-400	EP 410	K	K	K	-
100-401	EP 410	E, F, K	E, F, K	F, K	-
100-403	EP 410	D	D	D	D
150-253	EP 250	D	D	D	-
150-315	EP 315	D	D	D	-
150-315	EP 315	F	F	F	F
150-317	EP 315	E, K	E, K	K	K
150-317	EP 315	D	D	D	D
150-400	EP 410	D	D	D	-
150-400	EP 410	K	K	K	K
150-401	EP 410	D	D	D	-
150-401	EP 410	E, F	E, F	F	-
150-403	EP 410	D	D	D	D
150-403	EP 410	K	K	K	K
151-403	EP 410	K	K	K	K
200-315	EP 315	D	D	D	-
200-315	EP 315	K	K	K	K
200-316	EP 315	K	K	K	K
200-317	EP 315	K	K	K	K
200-318	EP 315	K	K	K	K
200-400	EP 410	D	D	D	-
200-401	EP 410	E	E	-	-
200-402	EP 410	D	D	D	D
200-402	EP 410	K	K	K	K
200-403	EP 410	K	K	K	K
200-405	EP 410	D	D	D	D
250-400	EP 410	D	D	D	-
250-401	EP 410	K	K	K	K
250-402	EP 410	D	D	D	D
250-403	EP 410	K	K	K	K
300-400	EP 410	D	D	D	-

Size	Size group	Impeller type	Material variant		
			Grey cast iron		
			G	G1	G2
300-400	EP 410	K	K	K	K
300-401	EP 410	K	K	K	K
300-402	EP 410	D	D	D	D
300-403	EP 410	K	K	K	K

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

The name plate indicates the type series and size, the main operating data, the order number and the order item number. The order number and order item number clearly identify the pump set and serve as identification for all further business processes.

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

1.2 Installation of partly completed machinery

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

1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇒ Section 2.3, Page 12)

1.4 Other applicable documents

Table 2: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump set
General arrangement drawing / outline drawing	Mating dimensions, installation dimensions and weights of the pump set
Hydraulic characteristic curve	Characteristic curves showing head, flow rate, efficiency and power input
General assembly drawing ¹⁾	Sectional drawing of the pump set
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
Supplementary operating manual ¹⁾	Description of the proper and safe use of special accessories, for example

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

¹ If included in agreed scope of supply

1.5 Symbols

Table 3: Symbols used in this manual

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

1.6 Key to safety symbols/markings

Table 4: 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 the UK regulation titled Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016.
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



2 Safety

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

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

2.1 General

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

2.2 Intended use

The pump set must only be operated within the operating limits described in the other applicable documents.

- Only operate pump sets which are in perfect technical condition.
- Do not operate partially assembled pump sets.
- Only use the pump (set) to handle the fluids described in the data sheet or product literature of the pump variant.
- Never operate the system without the fluid to be handled.
- Observe the limits for continuous duty specified in the data sheet or product literature ($Q_{\min}$ and $Q_{\max}$) (to prevent damage such as shaft fracture, bearing failure, mechanical seal damage, etc).
- When untreated waste water is handled, the duty points in continuous operation lie within 0.7 to $1.2 \times Q_{\text{BEP}}$ to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates ($< 0.7 \times Q_{\text{BEP}}$).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the system (prevention of cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.
- Only use the respective impeller types in combination with the fluids described below.

	Free-flow impeller (impeller type F/F-max)	Suitable for the following fluids: fluids containing solids and stringy material as well as fluids with entrapped air or entrapped gas
	Closed single-channel impeller (impeller type E/E-max)	Suitable for the following fluids: fluids containing solids and stringy material
	Open, diagonal single-channel impeller (impeller type D)	Suitable for the following fluids: fluids containing solid substances and long fibres
	Open radial multi-vane impeller (impeller type D-max)	Suitable for the following fluids: fluids containing solid substances and long fibres

Further fluids (impeller types F/F-max, E/E-max, D/D-max):

- Activated sludge
- Digested sludge
- Heating sludge
- Mixed water
- Raw waste water
- Raw sludge
- Recirculated sludge

	Closed multi-channel impeller (impeller type K/K-max)	Suitable for the following fluids: contaminated, solids-laden, non-gaseous fluids without stringy material
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Further fluids (impeller type K/K-max):

- Activated sludge
- Landfill waste water
- Industrial waste water
- Industrial grey water
- Mechanically treated waste water
- Pre-screened waste water
- Stormwater

2.3 Personnel qualification and training

All personnel involved must be fully qualified to transport, install, operate, maintain and inspect the machinery this manual refers to.

The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.

Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.

Training on the pump (set) must always be supervised by technical specialist personnel.

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Contain leakages (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If stopping the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 66)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 61)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

Always observe the information on explosion protection given in this section when operating an explosion-proof pump set.

Sections of the manual marked by the symbol opposite apply to explosion-proof pump sets also when temporarily operated outside potentially explosive atmospheres.

Pumps / pump sets must not be used in potentially explosive atmospheres unless marked as explosion-proof **and** identified as such in the data sheet.

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

Especially adhere to the sections in this manual marked with the symbol opposite. The explosion-proof status of the pump is only assured if the pump is used in accordance with its intended use.

Never operate the product outside the limits stated in the data sheet and on the name plate.

Prevent impermissible modes of operation.

2.9.1 Repair

Special regulations apply to repair work on explosion-proof pumps. Modifications or alterations of the pump set can affect explosion protection and are only permitted after consultation with the manufacturer.

Repair work at the flameproof joints must only be performed in accordance with the manufacturer's instructions. Repair to the values in Table 2 of EN 60079-1 is not permitted.



3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

	⚠ DANGER Improper transport Danger to life from falling parts! Damage to the pump set! ▷ Use the attachment point provided for attaching the lifting accessory. ▷ Never lift the pump set by the electric cables. ▷ Use the lifting chain/rope included in the scope of supply exclusively for lowering or lifting the pump set into/out of the pump sump. ▷ Securely attach the lifting chain/rope to the pump and crane. ▷ Use tested, marked and approved lifting accessories only. ▷ Observe the regional transport regulations. ▷ Observe the documentation of the lifting accessory manufacturer. ▷ The load-carrying capacity of the lifting accessory must be higher than the weight indicated on the name plate of the pump set to be lifted. Take into account any additional system components to be lifted. ▷ Maintain a safe distance during lifting operations (load may swing when being lifted).
	⚠ WARNING Incorrect handling of the electric cable Personal injury and damage to property! ▷ Secure electric cables against falling down. ▷ Avoid electric cables being laid on surfaces without fastening. ▷ When moving the pump set keep at a safe distance to the electric cables.

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

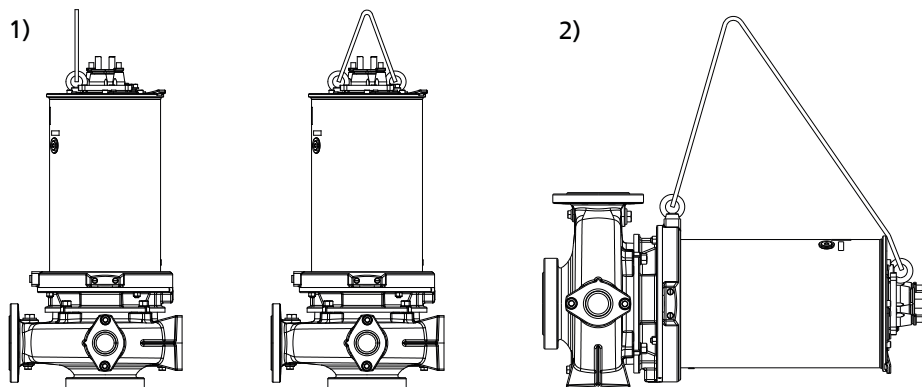


Fig. 1: Transporting the pump set 1) Vertical installation [K and D] 2) Horizontal installation [H]

3.2.1 Placing the pump set down

	⚠ WARNING Incorrect positioning/placing down Personal injury and damage to property! ▷ Position the pump set vertically with the motor on top. ▷ Use appropriate means to secure the pump set against tilting and tipping over. ▷ Refer to the weights given in the data sheet/on the name plate.
	⚠ WARNING Incorrect handling of the electric cable Personal injury and damage to property! ▷ Secure electric cables against falling down. ▷ Avoid electric cables being laid on surfaces without fastening. ▷ When moving the pump set keep at a safe distance to the electric cables.
	⚠ WARNING Improper placing of pump sets in a vertical/horizontal position Personal injury and damage to property! ▷ Use appropriate means to secure the pump set against tilting or tipping over. ▷ If possible, use two pieces of lifting equipment when handling large pump sets (using the attachment point provided on the motor and the discharge nozzle). ▷ Secure electric cables against falling down. ▷ Use additional supports for the transport holder to secure it against tilting. ▷ Maintain adequate safety distance during lifting operations.
	⚠ WARNING Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	⚠ WARNING Placing the pump set on unsecured and uneven surfaces Personal injury and damage to property! ▷ Always place the pump set on a solid and level surface with the pump set in a vertical position and the motor on top. ▷ Only place the pump set on a surface of sufficient load-carrying capacity. ▷ Use appropriate means to secure the pump set against tilting or tipping over.
	CAUTION Improper transport/positioning of pump sets with cooling system Damage to the cooling system! ▷ Never place the pump set on the cooling jacket or fasten it by the cooling system.

Installation type H:

The pump set has a separate support foot.

Installation types K and D:

It may be necessary to place the pump set down in a horizontal position during maintenance or installation.

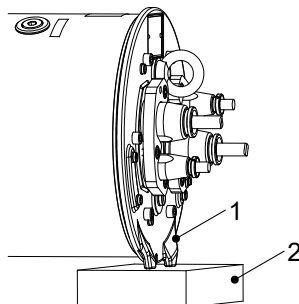


Fig. 2: Placing down a pump set with a support foot

1	Integrated support foot	2	Wooden support
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For placing down the pump set observe the following:

- Integrated support foot (1)
 - Place the pump set down on the integrated support feet (1) at the motor housing cover and the pump casing.
- Wooden support (2)
 - Use wooden supports (2) to prevent any damage to the coating.

3.2.2 Placing the pump set in a vertical position

To change the pump set from a horizontal to a vertical position, attach lifting equipment to the attachment point provided.

When the pump is pulled upright, the pump casing will act as a pivot. Place wooden supports under the pivot points.

Pumps with a nominal discharge nozzle diameter of DN 150 and above have a threaded hole in the claw. If two cranes are available, a swivel eyebolt can be screwed into the claw to pull the pump set upright. The direction of pull of the swivel eyebolt at an angle of 90° to the bolt axis should be approved for the entire pump set weight.

3.3 Storage/preservation

If commissioning is to take place some time after delivery, we recommend that the following measures be taken:

	CAUTION
	Improper storage Damage to the electric cables! ▶ Support the electric cables at the cable gland to prevent permanent deformation. ▶ Only remove the protective caps from the electric cables at the time of installation.
	CAUTION
	Damage during storage due to humidity, dirt or vermin Corrosion/contamination of pump (set)! ▶ For outdoor storage cover the pump (set) and accessories with waterproof material and protect against condensation.

	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.

Table 5: Ambient conditions for storage

Ambient condition	Value
Relative humidity	5 % to 85 % (non-condensing)
Ambient temperature	-20 °C to +70 °C

- Store the pump set under dry and vibration-free conditions, if possible in its original packaging.
1. Spray-coat the inside wall of the pump casing, and in particular the impeller clearance areas, with a preservative.
 2. Spray preservative through the suction and discharge nozzles.
It is advisable to then close the pump nozzles (e.g. with plastic caps or similar).

	NOTE
	Observe the manufacturer's instructions for application/removal of the preservative.

3. Rotate the impeller by hand once every three months.

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 86)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump 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.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 11, Page 136)

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

3.5 Disposal

	 WARNING Fluids handled, consumables and supplies which are hot and/or pose a health hazard Hazard to persons and the environment! ▸ Collect and properly dispose of flushing fluid and any fluid residues. ▸ Wear safety clothing and a protective mask if required. ▸ Observe all legal regulations on the disposal of fluids posing a health hazard.
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1. Dismantle the pump (set).
Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
 - Metals
 - Plastics
 - Electronic waste
 - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

4 Description of the Pump (Set)

4.1 General description

Horizontal or vertical single-stage submersible motor pump in close-coupled design, with various next-generation impeller types, for wet or dry installation, stationary installation, with energy-saving motor; models for use in potentially explosive atmospheres available.

Pump for handling untreated waste water containing long fibres and solid substances, liquids containing air/gas, and raw sludge, activated sludge and digested sludge.

4.2 Product information

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

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see <https://www.ksb.com/en-global/company/corporate-responsibility/reach>.

4.3 Designation

Example: Amarex KRT F 80 - 252 / 15 4 UFG - D IE3

Table 6: Designation key

Code	Description
Amarex KRT	Type series
F	Impeller type
80	Nominal discharge nozzle diameter [mm]
252	Maximum nominal impeller diameter [mm]
15	Motor size
4	Number of motor poles
UF	Motor version
	UF Non-explosion-proof, for fluid temperatures up to 40 °C, ambient temperatures up to 55 °C
	XF Explosion protection  II2G Ex db h IIB T3 Gb, for fluid temperatures up to 40 °C, ambient temperatures up to 55 °C
G	Material variant
	G Standard variant, grey cast iron
	G1 Like G, with impeller made of duplex stainless steel
	G2 Like G, with impeller made of white cast iron
D	Installation type
IE3	Motor efficiency classification
	²⁾ No efficiency classification
	IE3 Efficiency classification ³⁾

²⁾ Blank

³⁾ IEC 60034-30 standard not binding for submersible motor pumps. Efficiencies calculated/determined according to the measurement method specified in IEC 60034-2. The marking is used for submersible motors that achieve efficiency levels similar to those of standardised motors acc. to the IEC 60034-30 standard.

4.4 Name plate

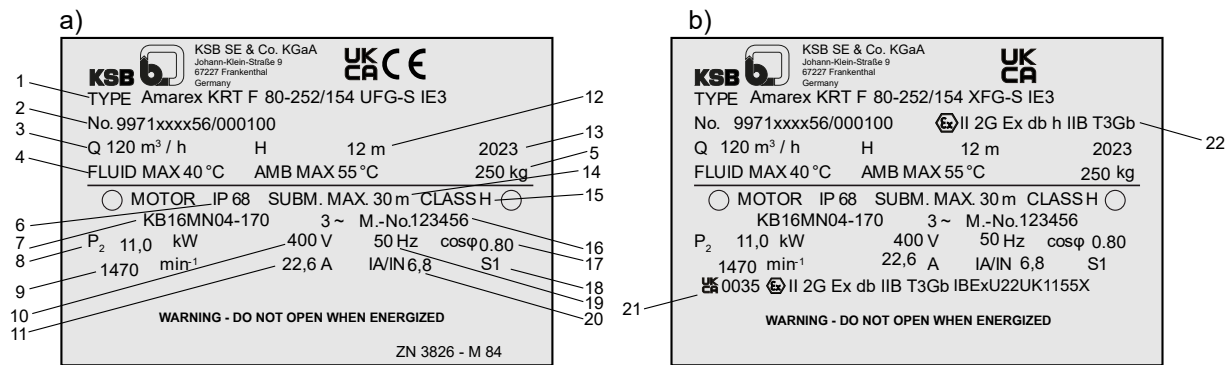


Fig. 3: Name plate (example) a) for non-explosion-proof model, b) for explosion-proof model

1	Designation	2	KSB order number
3	Flow rate	4	Maximum fluid temperature and ambient temperature
5	Total weight	6	Enclosure
7	Motor type	8	Rated power
9	Rated speed	10	Rated voltage
11	Rated current	12	Head
13	Year of construction	14	Maximum submergence ∇
15	Thermal class of winding insulation	16	Motor number
17	Power factor at rated operating point	18	Duty type
19	Rated frequency	20	Starting current ratio
21	Marking for use in potentially explosive atmospheres, submersible motor	22	Marking for use in potentially explosive atmospheres, pump set

4.5 Design details

Design

- Fully floodable submersible motor pump
- Not self-priming
- Close-coupled design

Impeller type

- Various application-oriented impeller types

Shaft seal

- Double cartridge seal with liquid reservoir
- Leakage chamber

Bearings

Drive end:

- Grease-packed bearings sealed for life
- Maintenance-free

Pump-end:

- Standard bearings
 - Grease-packed bearings sealed for life
 - Maintenance-free
- Reinforced bearings
 - Grease-lubricated bearings
 - Can be re-lubricated

Drive

- Three-phase asynchronous squirrel-cage motor
- Type of protection Ex db IIB (applies to explosion-proof pump sets only)

4.6 Installation types



Fig. 4: Installation types

1	Installation type D: stationary dry installation, vertical
2	Installation type H: stationary dry installation, horizontal Amaslide maintenance aid (optional)
3	Installation type K: stationary wet installation with guide rail arrangement
4	Installation type K: stationary wet installation with guide wire arrangement

4.7 Configuration and function

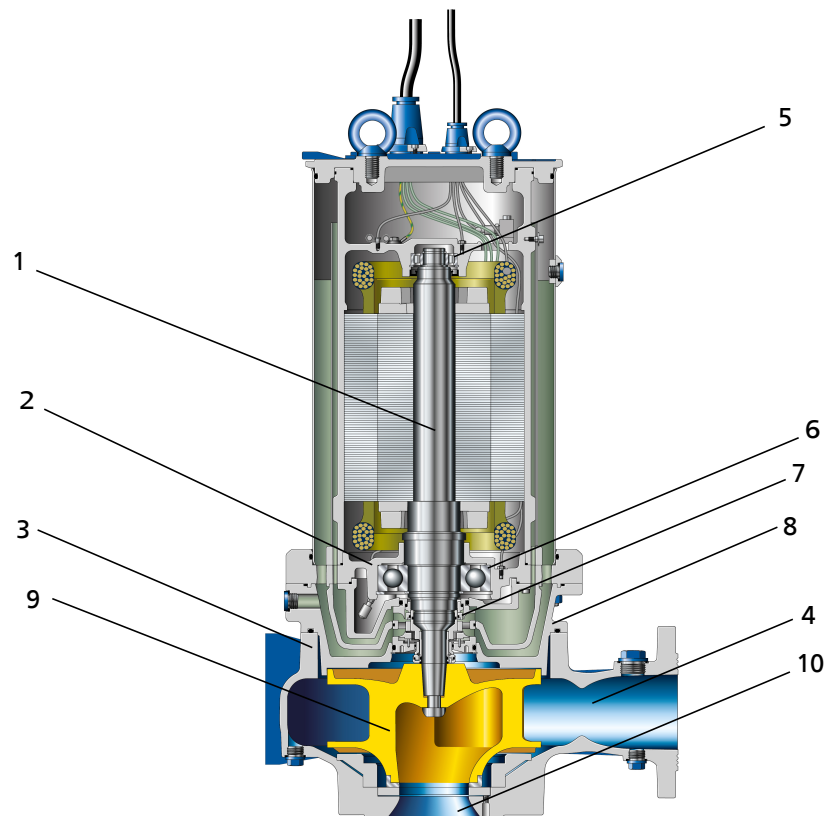


Fig. 5: Sectional drawing

1	Shaft	2	Bearing housing
3	Pump casing	4	Discharge nozzle
5	Bearing, motor end	6	Bearing, pump end
7	Shaft seal	8	Discharge cover
9	Impeller	10	Suction nozzle

Design The pump is designed with an axial fluid inlet and a radial outlet. The hydraulic system sits on the extended motor shaft. The shaft runs in common bearings.

Function The fluid enters the pump axially via the suction nozzle (10) and is accelerated outward in a cylindrical flow by the rotating impeller (9). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (4), where it leaves the pump. At the rear side of the impeller, the shaft (1) enters the hydraulic system via the discharge cover (8). The shaft passage through the discharge cover is sealed with a shaft seal (7). The shaft runs in rolling element bearings (5 and 6), which are supported by a bearing housing (2).

Sealing The pump is sealed by a double cartridge seal.
The mechanical seal is lubricated by the coolant.

Cooling system The pump sets have an integrated cooling system for the motor. The heat generated by the motor is transferred via the discharge cover to the fluid handled by means of internal circulation. The coolant is moved by a pumping element in the mechanical seal area. Apart from its cooling function, the coolant serves as an anti-corrosive and antifreeze agent, and as a lubricant for the mechanical seals.

4.8 Noise characteristics

Table 7: Surface sound pressure level (L_{pA} ^{4) 5)}) depending on speed (n) and rated power (P_2)

P_2	L_{pA}			
	n = 2900 rpm	n = 1450 rpm	n = 960 rpm	n = 725 rpm
[kW]	[dB]			
2,2	65,0	58,5	57,5	57,0
3,0	67,0	60,5	59,0	58,5
4,0	68,5	62,0	60,5	60,0
5,5	70,0	63,5	63,0	62,5
7,5	71,0	65,0	63,5	63,0
11,0	72,5	67,0	65,5	65,0
15,0	73,5	68,0	66,5	66,0
18,5	74,0	68,5	67,5	67,0
22,0	74,5	69,0	68,0	67,5
30,0	75,0	70,5	69,0	68,5
37,0	76,0	71,0	69,5	69,0
45,0	77,0	71,5	70,5	70,0
55,0	77,5	72,5	71,0	70,5
75,0	78,0	73,5	72,0	71,5

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

⁵ For installation types D and H only

4.9 Scope of supply

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

Wet-installed stationary model (installation type K)

- Pump set complete with electric cables
- Claw with sealing elements and fasteners
- Lifting rope/lifting chain
- Mounting bracket with fasteners
- Flanged bend and fastening elements
- Guide wire / guide rail
(guide rails are not included in KSB's scope of supply)

A separate name plate is included in the scope of supply. This name plate must be attached outside the place of installation (e.g. at the control panel, pipeline or mounting bracket) in a clearly visible position.

Dry-installed stationary model (installation types D and H)

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

- Pump set complete with electric cables
- Suction-side flanged spacer with inspection hole⁶⁾ (optional)
- Up to size group 315⁷⁾
Suction elbow with inspection hole and foot
- From size group 410⁷⁾
Suction elbow (accelerating elbow) without foot

A separate name plate is included in the scope of supply. This name plate must be attached outside the place of installation (e.g. at the control panel, pipeline or mounting bracket) in a clearly visible position.

4.10 Dimensions and weights

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

⁶ For nominal discharge nozzle diameter $\geq$ DN 100

⁷ For vertical installation

5 Installation at Site

5.1 Safety regulations

	⚠ DANGER Improper installation in potentially explosive atmospheres Explosion hazard! Damage to the pump set! ▸ Comply with the applicable local explosion protection regulations. ▸ Observe the information given in the data sheet and on the name plate of the pump set.
	⚠ DANGER Risk of falling when working at a great height Danger to life by falling from a great height! ▸ Do not step onto the pump (set) during installation work or dismantling work. ▸ Pay attention to safety equipment, such as railings, covers, barriers, etc. ▸ Observe the applicable local health and occupational safety regulations and accident prevention regulations.
	⚠ DANGER Persons in the tank during pump operation Electric shock! Risk of injury! Danger of death from drowning! ▸ Never start up the pump set when there are persons in the tank.
	⚠ WARNING Hands, other body parts or foreign objects in the impeller or intake area Risk of injury! Damage to the submersible motor pump! ▸ Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area. ▸ Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.
	⚠ WARNING Impermissible solid objects (tools, screws/bolts or similar) in the pump sump/inlet tank during pump start-up Personal injury and damage to property! ▸ Check the pump sump/inlet tank for impermissible solid objects before flooding, and remove, if necessary.

5.2 Checks to be carried out prior to installation

5.2.1 Checking the operating data

Before installing the pump set, verify that the name plate data matches the data given in the purchase order and the site system data.

5.2.2 Preparing the place of installation

	⚠ WARNING Installation on mounting surfaces which are unsecured and cannot support the load Personal injury and damage to property! ▷ Use a concrete of compressive strength class C25/30 which meets the requirements of exposure class XS1 to BS 206 . ▷ The mounting surface must be set, even, and level. ▷ Observe the weights indicated.
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Resonances Any resonances at the usual excitation frequencies (1 x and 2 x rotational frequency, blade passing frequency) must be prevented both in the foundation and in the connected piping, as such frequencies may cause extreme vibrations.

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

5.2.3 Checking the coolant

 	⚠ DANGER Operating a pump set with incomplete coolant fill Explosion hazard! Damage to the pump set! ▷ Never start up a pump set with incompletely filled cooling system.
--	---

Visual inspection for signs of coolant leakage

1. No signs of coolant leakage visible in the area of the pump casing, impeller and transport support.
⇒ The cooling system has been filled properly.
2. Signs of coolant leakage visible in the area of the pump casing, impeller and transport support.
⇒ Check the coolant level.

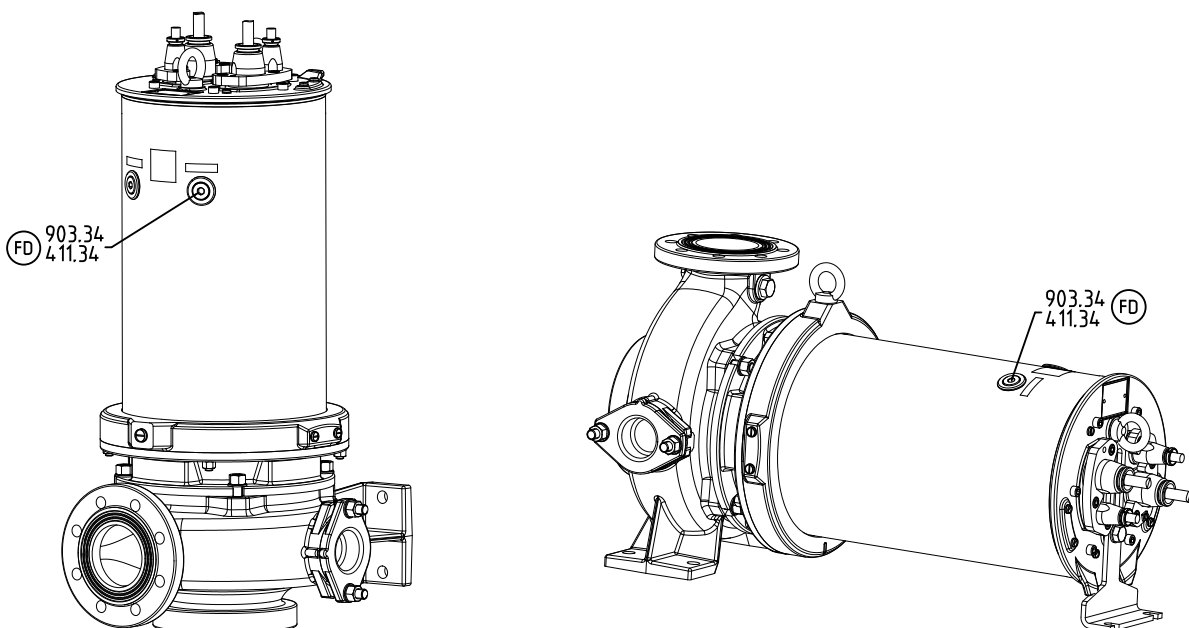


Fig. 6: Coolant filler opening for 1) Vertical installation [K and D] 2) Horizontal installation [H]

- ✓ The pump set has been placed in a vertical or horizontal position in accordance with its installation type.
- 1. Unscrew and remove screw plug 903.34 with joint ring 411.34.
- 2. Insert a paper test strip through the filler opening and read off the coolant level from the paper.
 - ⇒ The fluid level should not be more than 3 cm below the edge of the filler opening.
- 3. If the fluid level is less than 3 cm below the filler opening, the cooling system is filled sufficiently.
- 4. Screw in screw plug 903.34 with joint ring 411.34.
 - ⇒ If the fluid level is more than 3 cm below the edge of the filler opening, this suggests leakage of the cooling system.
- 5. Rectify the cause of the fault.

Table 8: Symbols key

Symbol	Description
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.



NOTE

If the fluid level is more than 3 cm below the edge of the filler opening, this suggests a defect of the cooling system (at a coolant temperature of 20 °C).

5.2.4 Checking the direction of rotation



DANGER

Pump set running dry
Explosion hazard!

- ▷ Check the direction of rotation of explosion-proof pump sets outside potentially explosive atmospheres.

	! WARNING Hands or foreign objects in the pump casing Risk of injuries, damage to the pump! ▷ Never insert your hands or any other objects into the pump. ▷ Check that the inside of the pump is free from any foreign objects. ▷ Take suitable precautions (e.g. wear safety goggles).
	! WARNING Improper positioning of pump set when checking the direction of rotation Personal injury and damage to property! ▷ Use appropriate means to secure the pump set against tilting or tipping over.
	CAUTION Pump set running dry Increased vibrations! Damage to mechanical seals and bearings! ▷ Never operate the pump set for more than 60 seconds without the fluid handled.

✓ The pump set is connected to the power supply. (⇒ Section 5.4.2, Page 57)

1. Start the pump set and stop it again immediately to determine the motor's direction of rotation.
2. Check the direction of rotation.

⇒ **Pump sets for wet installation (installation type K):** Impeller rotation must be anti-clockwise, seen from the pump mouth end. (On some pump casings, the direction of rotation is marked by an arrow.)

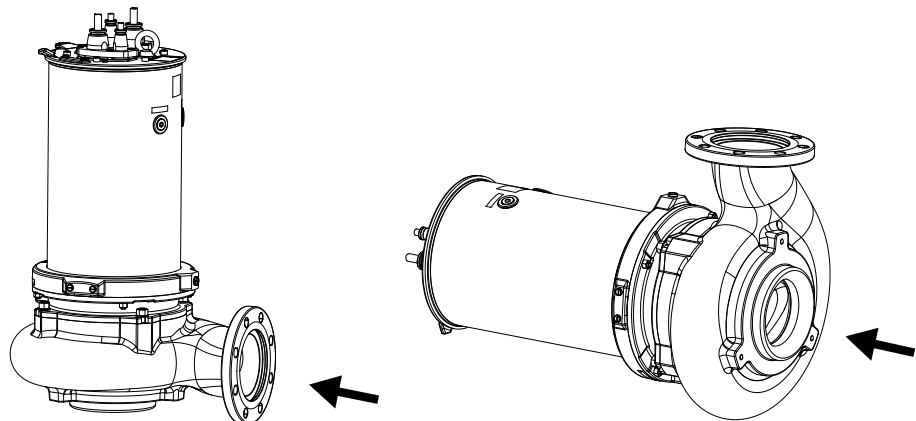


Fig. 7: Checking the direction of rotation

⇒ **Pump sets for dry installation (installation types D and H):** Viewed through the inspection hole of the pump set, impeller rotation must be to the left. (On some pump casings, the direction of rotation is marked by an arrow).

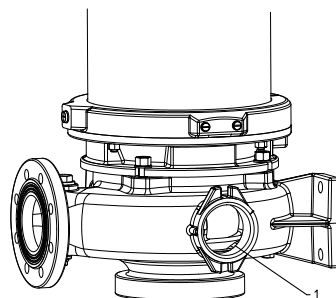


Fig. 8: Inspection hole

1	Inspection hole
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3. If the impeller is running in the wrong direction of rotation, check the electrical connection of the pump and the control system if necessary.
4. Disconnect the pump set from the power supply and make sure it cannot be switched on unintentionally.

5.3 Installing the pump set

Always observe the general arrangement drawing/outline drawing when installing the pump set.

5.3.1 Stationary wet installation

5.3.1.1 Stationary wet-installed model, vertical installation

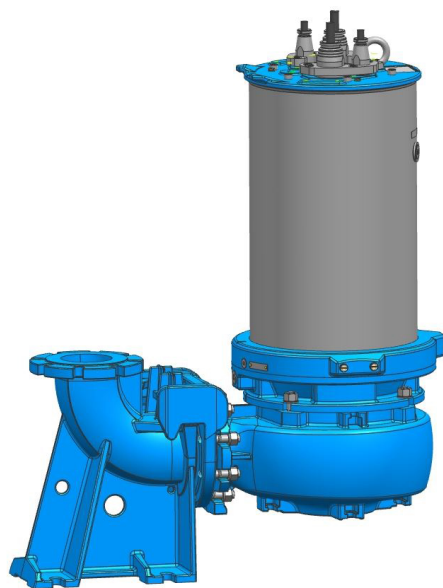


Fig. 9: Wet-installed model, stationary installation

5.3.1.2 Fastening the duckfoot bend

Fastening the duckfoot bend with chemical anchors

Depending on the pump size, the duckfoot bend is fastened with chemical anchors.

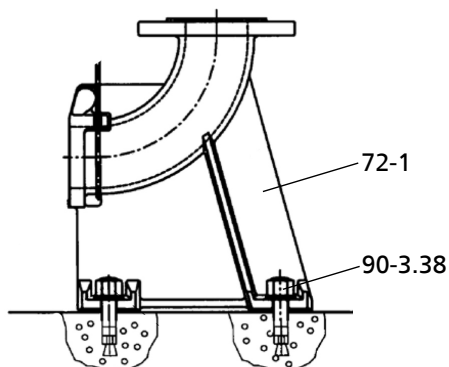


Fig. 10: Fastening the duckfoot bend

1. Position duckfoot bend 72-1 on the floor of the tank/sump.
2. Insert chemical anchors 90-3.38.
3. Bolt duckfoot bend 72-1 to the floor with chemical anchors 90-3.38.

Chemical anchor
dimensions

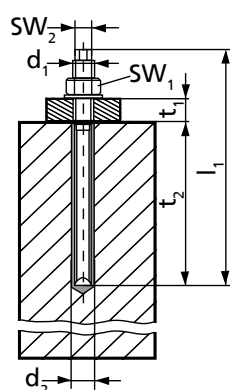


Fig. 11: Dimensions

Table 9: Chemical anchor dimensions

Size ($d_1 \times l_1$)	d_2	t_1	t_2	$SW_1^{8)}$	$SW_2^{8)}$	M_{d1}
	[mm]					[Nm]
M10 $\times$ 130	12	22	90	17	6	20
M12 $\times$ 160	14	25	110	19	8	40
M16 $\times$ 190	18	35	125	24	12	60
M20 $\times$ 260	25	65	170	30	14	120
M24 $\times$ 300 ⁹⁾	28	65	210	36	17	180
M30 $\times$ 380 ⁹⁾	35	65	280	46	-	400

Table 10: Curing times of mortar cartridge

Floor temperature [°C]	Curing time [min]
-5 to 0	240
0 to +10	45
+10 to +20	20
> +20	10

⁸ SW = Width across flats

⁹ Mounting accessories of the respective manufacturer are required.

5.3.1.3 Connecting the piping

	! DANGER Impermissible loads acting on the flange of the bend Danger to life from leakage of hot, toxic, corrosive or flammable fluids! ▷ Observe the permissible flange loads. ▷ Take appropriate measures to compensate for thermal expansion of the piping.
	NOTE When the pump set is used for draining low-level building areas, install a swing check valve in the discharge line to avoid backflow from the sewer system.
	CAUTION Critical speed of reverse rotation Increased vibrations! Damage to mechanical seals and bearings! ▷ If long risers are used, fit a swing check valve to prevent excessive rotational speed of the pump running in reverse after it has been stopped. Watch the venting function when arranging the swing check valve. ▷ Observe the maximum permissible speed (depending on the mechanical seal and bearings) in the event of reverse rotation.
	NOTE For a consultation or any queries please contact KSB Service.

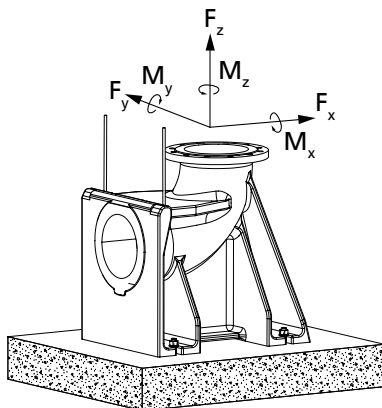


Fig. 12: Permissible flange loads

Table 11: Permissible flange loads

Nominal flange diameter	Forces [N]				Moments [Nm]			
	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM
50	1350	1650	1500	2600	1000	1150	1400	2050
65	1700	2100	1850	3300	1100	1200	1500	2200
80	2050	2500	2250	3950	1150	1300	1600	2350
100	2700	3350	3000	5250	1250	1450	1750	2600
150	4050	5000	4500	7850	1750	2050	2500	3650
200	5400	6700	6000	10450	2300	2650	3250	4800
250	6750	8350	7450	13050	3150	3650	4450	6550
300	8050	10000	8950	15650	4300	4950	6050	8900

5.3.1.4 Fitting the guide wire arrangement

The pump set is guided into the sump or tank along two parallel, tightly stretched guide wires made of stainless steel. It attaches itself automatically to the flanged bend which has been fitted to the floor.



NOTE

Should site conditions/piping layout, etc. require the wire to run off the vertical, do not exceed a maximum angle of 5° to ensure reliable fitting and guiding of the pump set.

Fitting the mounting bracket

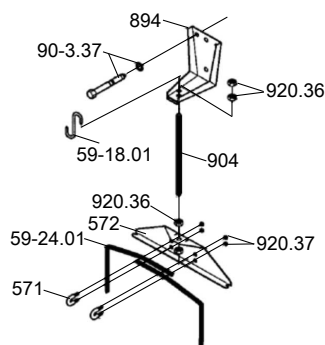


Fig. 13: Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the sump opening with anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 10 Nm.
2. Insert clamping pieces 571 through the holes of suspension bracket 572 and fasten with nuts 920.37.
3. Fasten fully threaded stud 904 with the pre-assembled clamping arrangement to the mounting bracket with nut 920.36.
Tighten nut 920.36 allowing sufficient play for subsequently tensioning the guide wire.

Inserting the guide wire

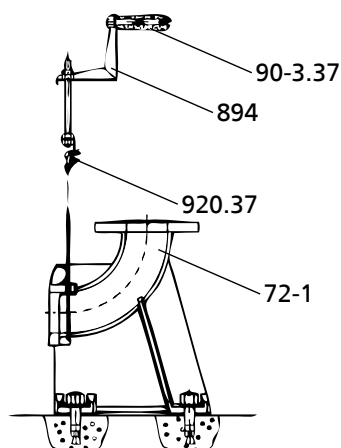


Fig. 14: Inserting the guide wire

1. Lift clamping piece 571 and insert one end of the guide wire.
2. Run wire 59-24.01 around flanged bend 72-1 and back again to suspension bracket 572 and insert it into clamping piece 571.
3. Manually tension cable 59-24.01 and secure it by means of hexagon nuts 920.37.
4. Pull the wire taut by tightening hexagon nuts 920.36 on the upper side of the mounting bracket to a torque of $M_A = 14 \text{ Nm}$ and a wire tension force $P = 6000 \text{ N}$.

5. Secure the nuts with a second hexagon nut.
6. The loose cable ends at guide wire suspension bracket 572 can either be twisted into a ring or the end can be cut off.
After length adjustment, tape the ends to avoid fraying.
7. Attach hook 59-18 to mounting bracket 894 for attaching the lifting chain / lifting rope at a later stage.

5.3.1.5 Fitting the guide rail arrangement

The pump set is guided into the sump or tank along two vertical guide rails. It attaches itself automatically to the flanged bend which has been fitted to the floor.



NOTE

The guide rails are not included in the scope of supply.
Select guide rail materials which are suitable for the fluid handled or as specified by the operator.

Observe the following dimensions for the guide rails:

Table 12: Guide rail dimensions

Size of hydraulic system	Outside diameter [mm]	Wall thickness ¹⁰⁾	
		min. [mm]	max. [mm]
DN 40 to DN 150	60	2	5
DN 200 to DN 300	89	3	6

Fitting the mounting bracket

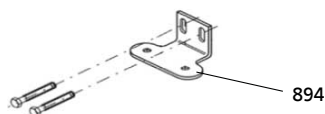


Fig. 15: Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the sump opening with suitable fasteners.
Observe the hole pattern for the fasteners.
See outline drawing. (⇒ Section 1.4, Page 8)

Fitting the guide rails



CAUTION

Improper installation of guide rails

Damage to the guide rail arrangement!

- ▷ Always adjust the guide rails so that they are in a perfectly vertical position.

¹⁰⁾ To DIN 2440/2442/2462 or equivalent standards

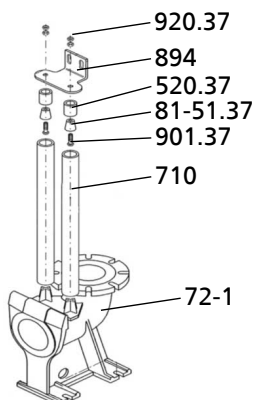


Fig. 16: Fitting the guide rails

1. Place rails 710 onto the conical bosses provided on flanged bend 72-1 and position them vertically.
2. Mark the length of rails 710 (up to the lower edge of the mounting bracket), taking into account the adjusting range of the slotted holes in mounting bracket 894.
3. Shorten rails 710 with a 90° cut to the pipe axis. Debur the rails inside and outside.
4. Insert mounting bracket 894 with elastic sleeves 520.37 into guide rails 710 until the mounting bracket rests on the rail ends.
5. Tighten nuts 920.37.
This pulls clamping sleeves 81-51.37 upwards and expands sleeves 520.37 against the inside pipe diameter.
6. Lock nuts 920.37 with a second nut each and secure them with Loctite 243.



NOTE

For installation depths > 6 m, the scope of supply may include mounting brackets as a middle support for the guide rails. The mounting brackets also serve as spacers between the two guide rails.

Fitting the middle support

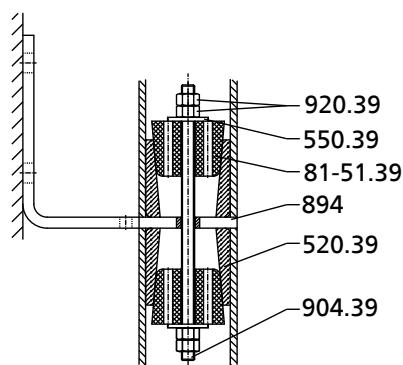


Fig. 17: Fitting the middle support

- ✓ The middle support has been properly fitted to the riser or to a cross-beam.
1. Measure the inside diameter of the guide rails.
 2. Expand elastic sleeves 520.39 with clamping sleeves 81-51.39 to the inside diameter of the guide rails by tightening nuts 920.39.
 3. Slip the guide rails onto the sleeves and verify that there is a tight fit between the guide rails and the sleeves.
 4. Fit and tighten the locknuts.

5.3.1.6 Preparing the pump set

Fitting the claw

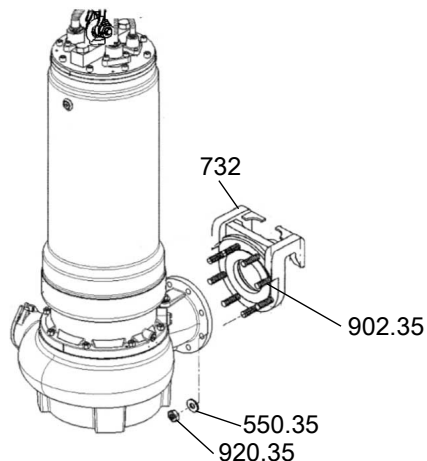


Fig. 18: Fitting the claw

1. Fasten claw 732 to the discharge flange with studs 902.35, discs 550.35 and nuts 920.35.
Observe the tightening torques.
2. Fit profile seal 410 or round cord seal 99-6 into the groove of the claw.
This sealing element will seal the duckfoot bend / pump connection.

Attaching the lifting chain / lifting rope

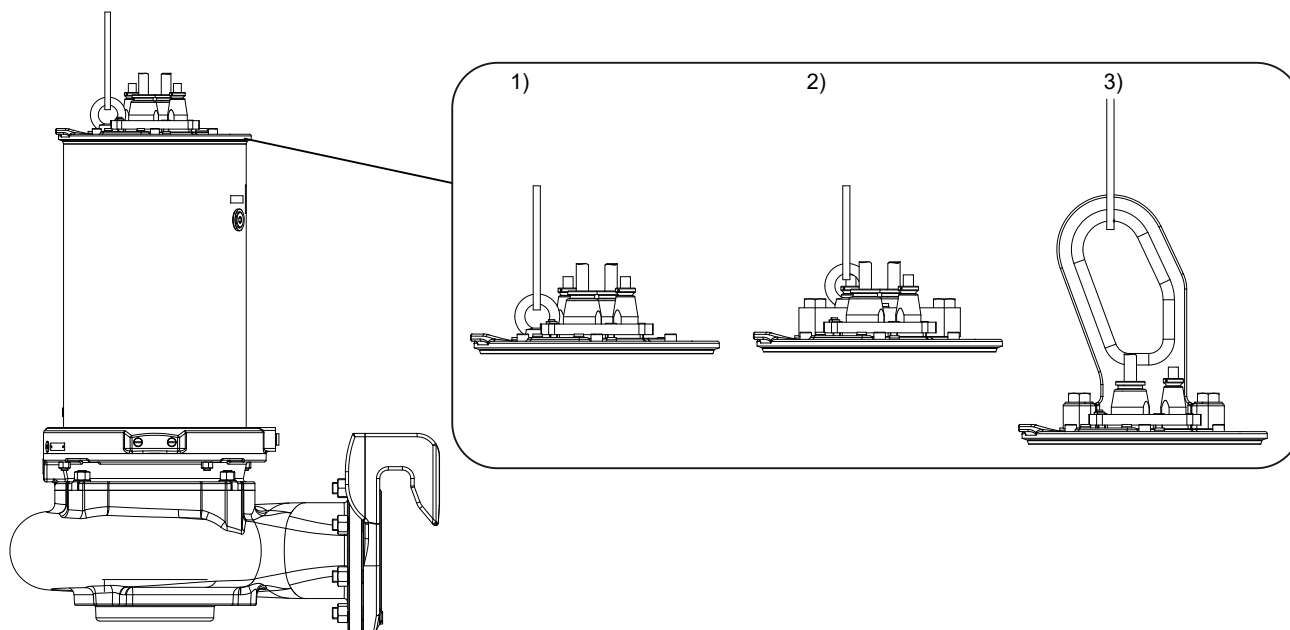


Fig. 19: Attaching the lifting chain / lifting rope – stationary wet installation

1	Standard for guide wire arrangement
2	Standard for guide rail arrangement
3	Optional bail

1. Attach the chain or lifting rope to the pump set as illustrated.
This attachment point achieves a forward inclination of the pump set towards the discharge nozzle, which allows the pump claw to hook onto the duckfoot bend.

5.3.1.7 Installing the pump set



NOTE

Make sure the pump set with the pre-assembled claw can easily be guided over the mounting bracket, threaded onto the guide rails and lowered down. If required, alter the position of the crane during installation.

1. Guide the pump set over the suspension bracket / mounting bracket, thread it onto the guide wire / guide rails and slowly lower it down.

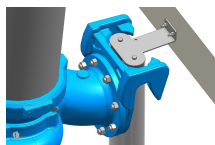


Fig. 20: Attaching the claw

⇒ The pump set attaches itself to duckfoot bend 72-1.

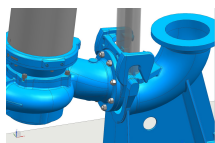


Fig. 21: Claw on duckfoot bend

2. Attach the chain / lifting rope to hook 59-18 at the mounting bracket.

5.3.2 Stationary dry installation

5.3.2.1 Preparing the foundation

Fastening

- Fasten the pump feet, foundation rails or suction elbow to a concrete foundation with chemical anchors.
 - ✓ The foundation has the required strength and characteristics.
 - ✓ The foundation has been prepared in accordance with the dimensions given in the outline drawing / general arrangement drawing.
1. Position the pump set on the foundation and level it with the help of a spirit level placed on the shaft and discharge nozzle.
Permissible deviation 0.2 mm/m.
 2. Mark the outlines of the pump set or suction elbow as well as the fastening points. Use a template if required.

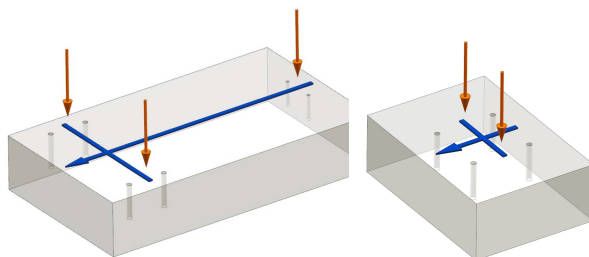


Fig. 22: Marking the fastening points

3. Remove the pump sets or suction elbow.
4. Drill the holes as specified in the "Chemical anchor dimensions" table. Then clean the holes.



WARNING

Improper handling of mortar cartridge

Skin sensitisation and/or irritation!

- ▷ Wear suitable protective clothing.

5. Insert the mortar cartridges into the drilled holes. Observe the curing times of the mortar cartridges.

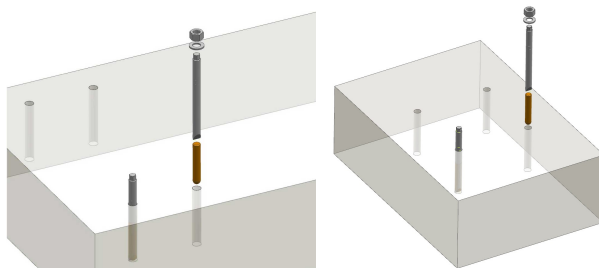


Fig. 23: Chemical anchor

6. Insert fully threaded studs into the corresponding drilled holes with an electric tool (e.g. impact drill, hammer drill). Make sure the fully threaded studs are perfectly vertical. Observe the curing time of the chemical anchors (see table).

7. To ensure optimum contact between the pump set or suction elbow and the concrete floor, apply the chemical mortar using a commercial applicator gun. Work quickly, bearing in mind the curing time of the chemical mortar. Observe the manufacturer's application instructions.

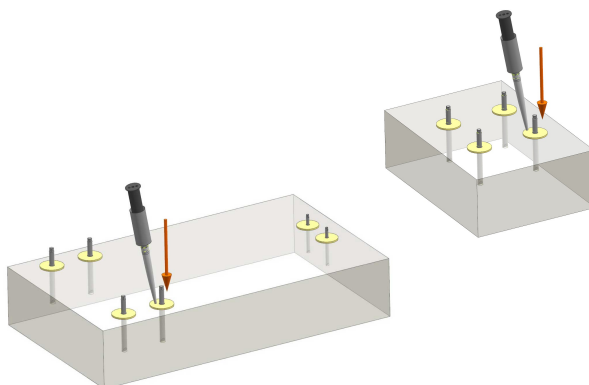


Fig. 24: Chemical mortar

8. Position the pump set on the foundation. Use shims to achieve a minimum thickness of 3 mm for the chemical mortar.

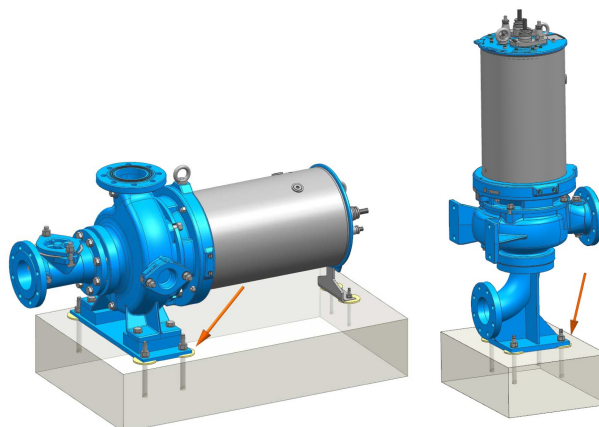


Fig. 25: Shims

9. After the curing time has passed, tighten the chemical anchors.

Chemical anchor dimensions

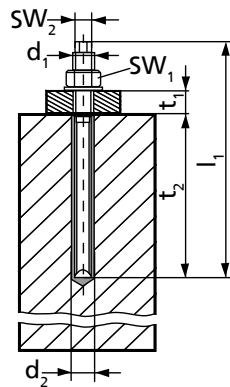


Fig. 26: Dimensions

Table 13: Chemical anchor dimensions

Size ($d_1 \times l_1$)	d_2	t_1	t_2	$SW_1^{11)}$	$SW_2^{11)}$	M_{d1}
	[mm]					[Nm]
M10 × 130	12	22	90	17	6	20
M12 × 160	14	25	110	19	8	40
M16 × 190	18	35	125	24	12	60
M20 × 260	25	65	170	30	14	120
M24 × 300 ¹²⁾	28	65	210	36	17	180
M30 × 380 ¹²⁾	35	65	280	46	-	400

Table 14: Curing times of mortar cartridge

Floor temperature [°C]	Curing time [min]
-5 to 0	240
0 to +10	45
+10 to +20	20
> +20	10

5.3.2.2 Installing the pump set



NOTE

If rails 593 are included in the scope of supply, they must be set in concrete as shown in the general arrangement drawing/outline drawing.

¹¹ SW = Width across flats

¹² Mounting accessories of the respective manufacturer are required.

5.3.2.2.1 Stationary dry installation, horizontal up to size group 410

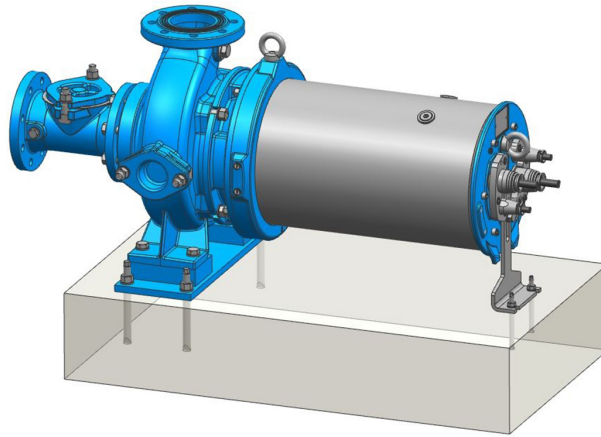


Fig. 27: Dry installation, horizontal, up to size group 410, stationary

5.3.2.2.2 Stationary dry installation, vertical, up to size 315 on suction elbow

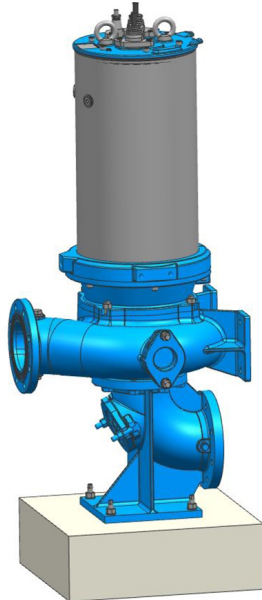


Fig. 28: Dry installation, vertical, up to size group 315 on suction elbow, stationary

5.3.2.2.3 Stationary dry installation, vertical, from size group 410 on concrete foundation

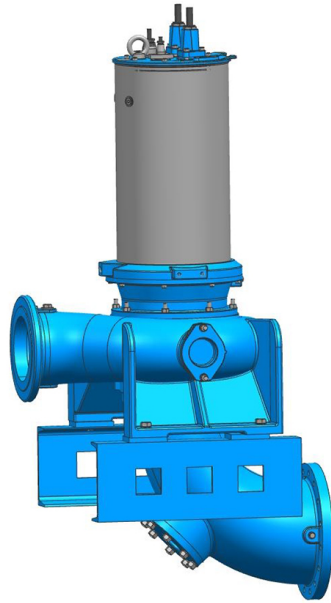


Fig. 29: Dry installation, vertical, from size group 410 on concrete foundation, stationary

5.3.2.2.3.1 Installing the pump set in a vertical position

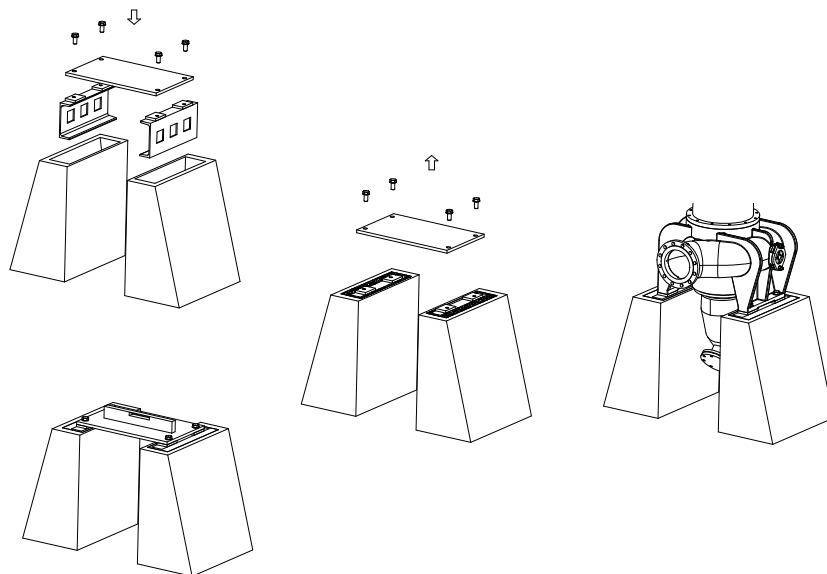


Fig. 30: Preparing the foundation

The pump (set) is installed on horizontally aligned foundation rails. Depending on the pump size, the pump (set) is either mounted on a separate soleplate or on integrally cast feet.

- ✓ The foundation has been prepared in accordance with the dimensions given in the outline drawing / general arrangement drawing. The foundation rails have been grouted with concrete.
- 1. Lift the pump set with the lifting equipment and lower it down onto the prepared foundation.
- 2. Insert hexagon head bolts 901.16 with discs 550.16 into the drilled holes provided. Tighten the bolts.

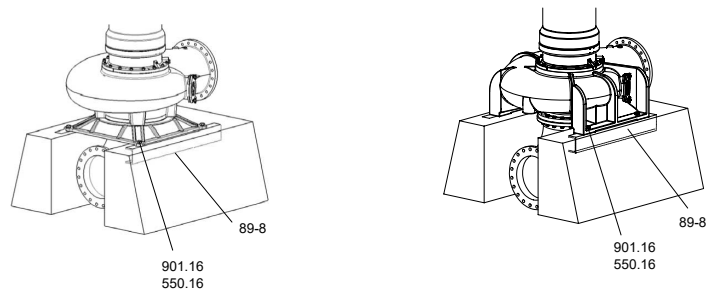


Fig. 31: Vertical installation

89-8	Foundation rail	89-9	Foundation frame
550.16	Disc	901.16	Hexagon head bolt

5.3.2.2.3.2 Installing the pump set with a soleplate

Only for sizes xxx - 400, xxx - 401, xxx - 402, xxx - 403

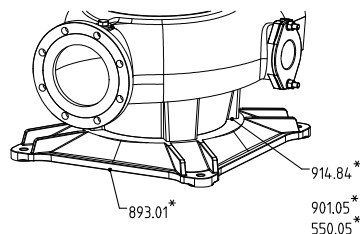


Fig. 32: Vertical dry installation

*: On specific designs only

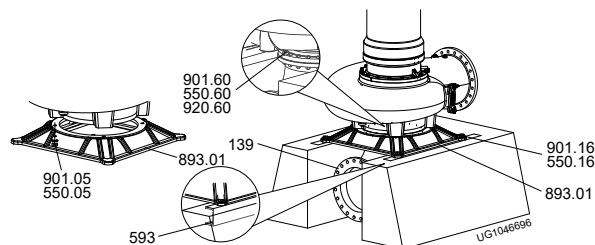


Fig. 33: Installing the pump set with a soleplate

1. Fasten suction elbow 139 to the suction nozzle with hexagon head bolts 901.01, discs 550.07 and nuts 920.18.
2. Fasten soleplate 893.01 to the pump set with hexagon head bolts 901.05 and discs 550.05.
3. Place the pump set in a vertical position. Attach lifting equipment to the attachment point on the discharge nozzle side (eyebolt or bail).
4. Place the pump set on the foundation.
Make sure the pump casing is evenly seated; use shims, if necessary.
5. Fasten the pump set with soleplate to the foundation with hexagon head bolts 901.16, discs 550.05 and rails 89-8 (optional).

5.3.2.2.3.3 Installing the pump set with integrally cast pump feet

Only for sizes xxx - 400, xxx - 401, xxx - 402, xxx -403

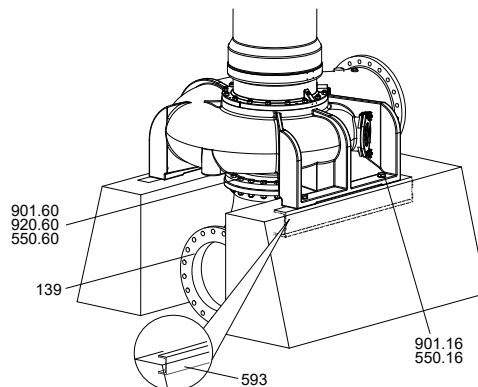


Fig. 34: Installing the pump set with pump feet

1. Fasten suction elbow 139 to the suction nozzle with hexagon head bolts 901.01, discs 550.07 and nuts 920.18.
2. Place the pump set in a vertical position. Attach lifting equipment to the attachment point provided (eyebolt).
3. Place the pump set on the foundation.
Make sure the pump casing is evenly seated; use shims, if necessary.
4. Fasten the integrally cast pump feet of the pump set to foundation rails 89-8 with hexagon head bolts 901.16 and discs 550.16.

5.3.2.3 Piping

5.3.2.3.1 Connecting the piping

	⚠ DANGER Impermissible loads acting on the pump nozzles Danger to life from leakage of hot, toxic, corrosive or flammable fluids! ▸ Do not use the pump as an anchorage point for the piping. ▸ Anchor the pipelines in close proximity to the pump and connect them properly without transmitting any stresses or strains. ▸ Observe the permissible forces and moments at the pump nozzles. ▸ Take appropriate measures to compensate for thermal expansion of the piping.
	CAUTION Incorrect earthing during welding work at the piping Destruction of rolling element bearings (pitting effect)! ▸ Never earth the electric welding equipment on the pump or baseplate. ▸ Prevent current flowing through the rolling element bearings.



NOTE

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

- ✓ The suction lift line has been laid with a rising slope, the suction head line with a downward slope towards the pump.¹³⁾
 - ✓ A flow stabilisation section having a length equivalent to at least five times the diameter of the suction flange has been provided upstream of the suction flange.¹³⁾
 - ✓ The nominal sizes of the pipelines are equal to or greater than the nominal sizes of the pump nozzles.¹³⁾
 - ✓ To prevent excessive pressure losses, adapters to larger nominal diameters are designed with a diffuser angle of approx. 8°.¹³⁾
 - ✓ The pipelines have been anchored in close proximity to the pump or, for vertical installation, in close proximity to the suction elbow and connected without transmitting any stresses or strains.¹³⁾
1. Thoroughly clean, flush and blow through all vessels, pipes and connections (especially of new installations).
 2. Before installation in the piping, remove the flange covers on the suction nozzle and the discharge nozzle.
 3. Connect the pump nozzles to the piping.



CAUTION

Pumps connected with unbraced expansion joints

Machine damage by impermissible nozzle loads!

- ▷ Never connect the pump with unbraced expansion joints.

4. If the owner / operator supplies an expansion joint, it has to be braced with external tie rods to prevent impermissible nozzle loads.

¹³⁾ If suction line requirements cannot be met, contact KSB Service.

5.3.2.3.2 Permissible forces and moments at the pump nozzles

Installation on pump feet (horizontal)

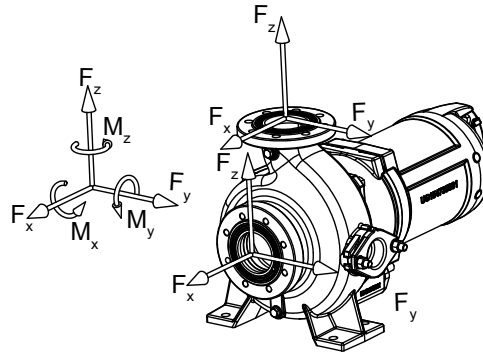


Fig. 35: Forces and moments at the pump nozzles for installation on pump feet

The data on forces and moments apply to static piping loads only. If the limits are exceeded, they must be checked and verified.

If a computerised strength analysis is required, values are available on request only. The values are only applicable if the pump is installed on a completely grouted baseplate and bolted to a rigid and level foundation.

The values correspond with those specified in BS ISO 5199 for horizontal installation of pump family 1A for cast iron at 20 °C.

Table 15: Forces [N] and moments [Nm] at the pump nozzles

Size	Impeller type	Suction nozzle								Discharge nozzle							
		Forces [N]				Moments [Nm]				Forces [N]				Moments [Nm]			
		F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
40-252	F, K	650	600	750	1150	400	400	550	750	350	450	400	700	300	350	450	650
80-252	F	1050	950	1200	1850	450	500	600	900	700	900	800	1400	400	450	600	800
80-253	F	1050	950	1200	1850	450	500	600	900	700	900	800	1400	400	450	600	800
80-253	E, K	1050	950	1200	1850	450	500	600	900	700	900	800	1400	400	450	600	800
80-315	D	1050	950	1200	1850	450	500	600	900	700	900	800	1400	400	450	600	800
80-315	K	1050	950	1200	1850	450	500	600	900	700	900	800	1400	400	450	600	800
80-317	D	1050	950	1200	1850	450	500	600	900	700	900	800	1400	400	450	600	800
80-317	F	1050	950	1200	1850	450	500	600	900	700	900	800	1400	400	450	600	800
100-253	E	1050	950	1200	1850	450	500	600	900	950	1200	1050	1850	450	500	600	900
100-253	K	1050	950	1200	1850	450	500	600	900	950	1200	1050	1850	450	500	600	900
100-253	D	1600	1400	1750	2750	600	700	900	1300	950	1200	1050	1850	450	500	600	900
100-254	F	1050	950	1200	1850	450	500	600	900	950	1200	1050	1850	450	500	600	900
100-254	K	1050	950	1200	1850	450	500	600	900	950	1200	1050	1850	450	500	600	900
100-315	D	1250	1100	1400	2150	550	650	750	1050	950	1200	1050	1850	450	500	600	900
100-316	D	1600	1400	1750	2750	600	700	900	1300	950	1200	1050	1850	450	500	600	900
100-316	F, K	1600	1400	1750	2750	600	700	900	1300	950	1200	1050	1850	450	500	600	900
100-317	E	1250	1100	1400	2150	550	650	750	1050	950	1200	1050	1850	450	500	600	900
100-400	K	1600	1400	1750	2750	600	700	900	1300	950	1200	1050	1850	450	500	600	900
100-401	E, F, K	1250	1100	1400	2150	550	650	750	1050	950	1200	1050	1850	450	500	600	900
100-403	D	2100	1900	2350	3650	800	950	1150	1700	950	1200	1050	1850	450	500	600	900
150-253	D	1600	1400	1750	2750	600	700	900	1300	1400	1750	1600	2750	600	700	900	1300
150-315	F	1600	1400	1750	2750	600	700	900	1300	1400	1750	1600	2750	600	700	900	1300
150-315	D	1600	1400	1750	2750	600	700	900	1300	1400	1750	1600	2750	600	700	900	1300
150-317	E, K	1600	1400	1750	2750	600	700	900	1300	1400	1750	1600	2750	600	700	900	1300
150-317	D	2100	1900	2350	3650	800	950	1150	1700	1400	1750	1600	2750	600	700	900	1300
150-400	D, K	2100	1900	2350	3650	800	950	1150	1700	1400	1750	1600	2750	600	700	900	1300

Size	Impeller type	Suction nozzle								Discharge nozzle							
		Forces [N]				Moments [Nm]				Forces [N]				Moments [Nm]			
		F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
150-401	D	2600	2400	2950	4550	1100	1300	1550	2300	1400	1750	1600	2750	600	700	900	1300
150-401	E, F	1600	1400	1750	2750	600	700	900	1300	1400	1750	1600	2750	600	700	900	1300
150-403	D	2100	1900	2350	3650	800	950	1150	1700	1400	1750	1600	2750	600	700	900	1300
150-403	K	2100	1900	2350	3650	800	950	1150	1700	1400	1750	1600	2750	600	700	900	1300
151-403	K	2100	1900	2350	3650	800	950	1150	1700	1400	1750	1600	2750	600	700	900	1300
200-315	K	2100	1900	2350	3650	800	950	1150	1700	1900	2350	2100	3650	800	950	1150	1700
200-315	D	2100	1900	2350	3650	800	950	1150	1700	1900	2350	2100	3650	800	950	1150	1700
200-316	K	2100	1900	2350	3650	800	950	1150	1700	1900	2350	2100	3650	800	950	1150	1700
200-317	K	2100	1900	2350	3650	800	950	1150	1700	1900	2350	2100	3650	800	950	1150	1700
200-318	K	2100	1900	2350	3650	800	950	1150	1700	1900	2350	2100	3650	800	950	1150	1700
200-400	D	2600	2400	2950	4550	1100	1300	1550	2300	1900	2350	2100	3650	800	950	1150	1700
200-401	E	2100	1900	2350	3650	800	950	1150	1700	1900	2350	2100	3650	800	950	1150	1700
200-402	D	2600	2400	2950	4550	1100	1300	1550	2300	1900	2350	2100	3650	800	950	1150	1700
200-402	K	2100	1900	2350	3650	800	950	1150	1700	1900	2350	2100	3650	800	950	1150	1700
200-403	K	2100	1900	2350	3650	800	950	1150	1700	1900	2350	2100	3650	800	950	1150	1700
200-405	D	2600	2400	2950	4550	1100	1300	1550	2300	1900	2350	2100	3650	800	950	1150	1700
250-400	D	2600	2400	2950	4550	1100	1300	1550	2300	2400	2950	2600	4550	1100	1300	1550	2300
250-401	K	2600	2400	2950	4550	1100	1300	1550	2300	2400	2950	2600	4550	1100	1300	1550	2300
250-402	D	2600	2400	2950	4550	1100	1300	1550	2300	2400	2950	2600	4550	1100	1300	1550	2300
250-403	K	2600	2400	2950	4550	1100	1300	1550	2300	2400	2950	2600	4550	1100	1300	1550	2300
300-400	D, K	3150	2800	3500	5500	1500	1750	2100	3100	2800	3500	3150	5500	1500	1750	2100	3100
300-401	K	3150	2800	3500	5500	1500	1750	2100	3100	2800	3500	3150	5500	1500	1750	2100	3100
300-402	D	3150	2800	3500	5500	1500	1750	2100	3100	2800	3500	3150	5500	1500	1750	2100	3100
300-403	K	3150	2800	3500	5500	1500	1750	2100	3100	2800	3500	3150	5500	1500	1750	2100	3100

Installation on a suction elbow (vertical)

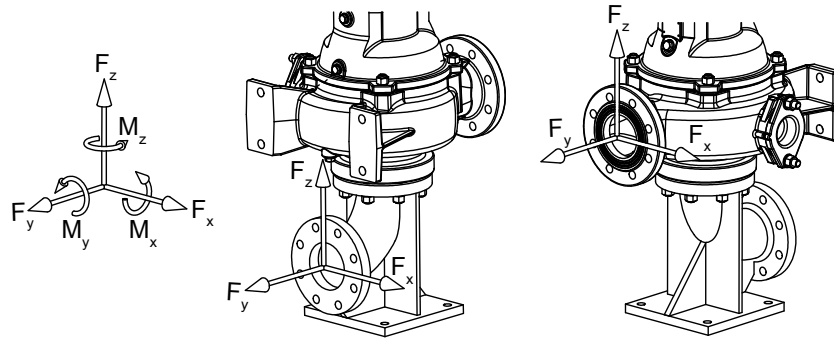


Fig. 36: Forces and moments at the pump nozzles for installation on a suction elbow

Table 16: Forces [N] and moments [Nm] at the pump nozzles

Size	Impeller type	Suction nozzle								Discharge nozzle							
		Forces [N]				Moments [Nm]				Forces [N]				Moments [Nm]			
		F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
80-252	F	2700	3350	3000	5250	1250	1450	1750	2600	900	700	800	1400	400	450	600	800
80-253	F	2700	3350	3000	5250	1250	1450	1750	2600	900	700	800	1400	400	450	600	800
80-253	E, K	2700	3350	3000	5250	1250	1450	1750	2600	900	700	800	1400	400	450	600	800
80-315	D	2700	3350	3000	5250	1250	1450	1750	2600	900	700	800	1400	400	450	600	800
80-315	K	2700	3350	3000	5250	1250	1450	1750	2600	900	700	800	1400	400	450	600	800
80-317	D	2700	3350	3000	5250	1250	1450	1750	2600	900	700	800	1400	400	450	600	800
80-317	F	2700	3350	3000	5250	1250	1450	1750	2600	900	700	800	1400	400	450	600	800
100-253	E	2700	3350	3000	5250	1250	1450	1750	2600	1200	950	1050	1850	450	500	600	900
100-253	K	2700	3350	3000	5250	1250	1450	1750	2600	1200	950	1050	1850	450	500	600	900
100-253	D	4050	5000	4500	7850	1750	2050	2500	3650	1200	950	1050	1850	450	500	600	900
100-254	F	2700	3350	3000	5250	1250	1450	1750	2600	1200	950	1050	1850	450	500	600	900
100-254	K	2700	3350	3000	5250	1250	1450	1750	2600	1200	950	1050	1850	450	500	600	900
100-315	D	3200	3950	3550	6200	1500	1900	2100	3050	1200	950	1050	1850	450	500	600	900
100-316	D	4050	5000	4500	7850	1750	2050	2500	3650	1200	950	1050	1850	450	500	600	900
100-316	F, K	4050	5000	4500	7850	1750	2050	2500	3650	1200	950	1050	1850	450	500	600	900
100-317	E	3200	3950	3550	6200	1500	1900	2100	3050	1200	950	1050	1850	450	500	600	900
150-253	D	4050	5000	4500	7850	1750	2050	2500	3650	1750	1400	1600	2750	600	700	900	1300
150-315	F	4050	5000	4500	7850	1750	2050	2500	3650	1750	1400	1600	2750	600	700	900	1300
150-315	D	4050	5000	4500	7850	1750	2050	2500	3650	1750	1400	1600	2750	600	700	900	1300
150-317	E,K	4050	5000	4500	7850	1750	2050	2500	3650	1750	1400	1600	2750	600	700	900	1300
150-317	D	5400	6700	6000	10450	2300	2650	3250	4800	1750	1400	1600	2750	600	700	900	1300
200-315	K	5400	6700	6000	10450	2300	2650	3250	4800	2350	1900	2100	3650	800	950	1150	1700
200-315	D	5400	6700	6000	10450	2300	2650	3250	4800	2350	1900	2100	3650	800	950	1150	1700
200-316	K	5400	6700	6000	10450	2300	2650	3250	4800	2350	1900	2100	3650	800	950	1150	1700
200-317	K	5400	6700	6000	10450	2300	2650	3250	4800	2350	1900	2100	3650	800	950	1150	1700
200-318	K	5400	6700	6000	10450	2300	2650	3250	4800	2350	1900	2100	3650	800	950	1150	1700

Installation on a concrete foundation (vertical)

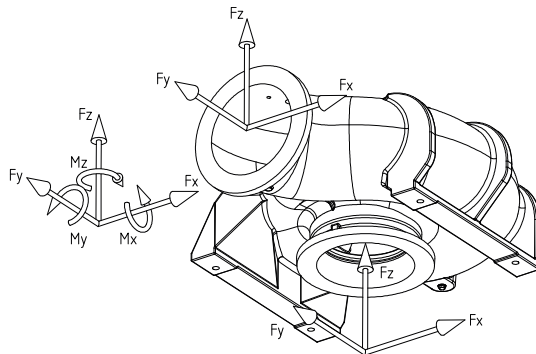


Fig. 37: Forces and moments at the pump nozzles for vertical installation

Table 17: Forces [N] and moments [Nm] at the pump nozzles

Size	Impeller type	Suction nozzle								Discharge nozzle							
		Forces [N]				Moments [Nm]				Forces [N]				Moments [Nm]			
		F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
100-400	K	4050	5000	4500	7850	1750	2050	2500	3650	2700	3350	3000	5250	1250	1450	1750	2600
100-401	E	3200	3950	3550	6200	1500	1900	2100	3050	2700	3350	3000	5250	1250	1450	1750	2600
100-401	F	3200	3950	3550	6200	1500	1900	2100	3050	2700	3350	3000	5250	1250	1450	1750	2600
100-401	K	3200	3950	3550	6200	1500	1900	2100	3050	2700	3350	3000	5250	1250	1450	1750	2600
100-403	D	5400	6700	6000	10450	2300	2650	3250	4800	2700	3350	3000	5250	1250	1450	1750	2600
150-400	D	5400	6700	6000	10450	2300	2650	3250	4800	4050	5000	4500	7850	1750	2050	2500	3650
150-400	K	5400	6700	6000	10450	2300	2650	3250	4800	4050	5000	4500	7850	1750	2050	2500	3650
150-401	E	4050	5000	4500	7850	1750	2050	2500	3650	4050	5000	4500	7850	1750	2050	2500	3650
150-401	F	4050	5000	4500	7850	1750	2050	2500	3650	4050	5000	4500	7850	1750	2050	2500	3650
150-401	K	4050	5000	4500	7850	1750	2050	2500	3650	4050	5000	4500	7850	1750	2050	2500	3650
150-401	E	4050	5000	4500	7850	1750	2050	2500	3650	4050	5000	4500	7850	1750	2050	2500	3650
150-401	D	6750	8350	7450	13050	3150	3650	4450	6550	4050	5000	4500	7850	1750	2050	2500	3650
150-403	D	5400	6700	6000	10450	2300	2650	3250	4800	4050	5000	4500	7850	1750	2050	2500	3650
150-403	K	5400	6700	6000	10450	2300	2650	3250	4800	4050	5000	4500	7850	1750	2050	2500	3650
151-403	K	5400	6700	6000	10450	2300	2650	3250	4800	4050	5000	4500	7850	1750	2050	2500	3650
151-401	K	4050	5000	4500	7850	1750	2050	2500	3650	4050	5000	4500	7850	1750	2050	2500	3650
200-401	E	5400	6700	6000	10450	2300	2650	3250	4800	5400	6700	6000	10450	2300	2650	3250	4800
200-401	K	5400	6700	6000	10450	2300	2650	3250	4800	5400	6700	6000	10450	2300	2650	3250	4800
200-400	D	6750	8350	7450	13050	3150	3650	4450	6550	5400	6700	6000	10450	2300	2650	3250	4800
200-402	D	6750	8350	7450	13050	3150	3650	4450	6550	5400	6700	6000	10450	2300	2650	3250	4800
200-402	K	5400	6700	6000	10450	2300	2650	3250	4800	5400	6700	6000	10450	2300	2650	3250	4800
200-403	K	5400	6700	6000	10450	2300	2650	3250	4800	5400	6700	6000	10450	2300	2650	3250	4800
200-405	D	6750	8350	7450	13050	3150	3650	4450	6550	5400	6700	6000	10450	2300	2650	3250	4800
250-400	K	6750	8350	7450	13050	3150	3650	4450	6550	6750	8350	7450	13050	3150	3650	4450	6550
250-400	D	6750	8350	7450	13050	3150	3650	4450	6550	6750	8350	7450	13050	3150	3650	4450	6550
250-401	K	6750	8350	7450	13050	3150	3650	4450	6550	6750	8350	7450	13050	3150	3650	4450	6550
250-402	D	6750	8350	7450	13050	3150	3650	4450	6550	6750	8350	7450	13050	3150	3650	4450	6550
250-403	K	6750	8350	7450	13050	3150	3650	4450	6550	6750	8350	7450	13050	3150	3650	4450	6550
300-400	K	8050	10000	8950	15650	4300	4950	6050	8900	8050	10000	8950	15650	4300	4950	6050	8900
300-400	D	8050	10000	8950	15650	4300	4950	6050	8900	8050	10000	8950	15650	4300	4950	6050	8900
300-401	K	8050	10000	8950	15650	4300	4950	6050	8900	8050	10000	8950	15650	4300	4950	6050	8900
300-402	D	8050	10000	8950	15650	4300	4950	6050	8900	8050	10000	8950	15650	4300	4950	6050	8900
300-403	K	8050	10000	8950	15650	4300	4950	6050	8900	8050	10000	8950	15650	4300	4950	6050	8900

5.3.2.3.3 Vacuum balance line



NOTE

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

The following rules apply to vacuum balance lines:

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

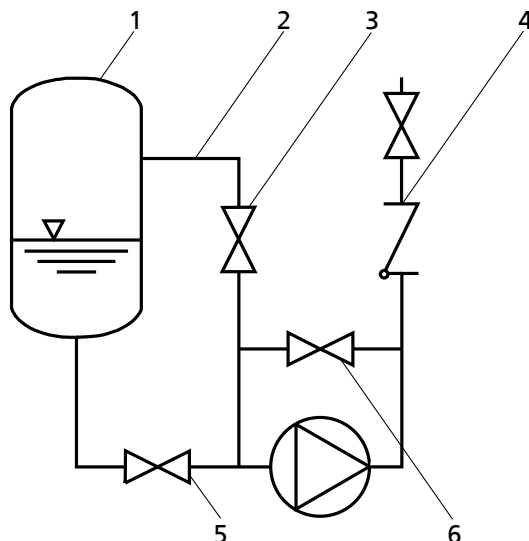


Fig. 38: Vacuum balance system

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



NOTE

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

5.3.2.4 Auxiliary connections



WARNING

Screw plugs subjected to pressure

Risk of injuries by parts flying off and escaping fluid!

- ▷ Never use screw plugs for releasing pressure from the pump casing.
- ▷ Always use suitable venting devices (e.g. vent valve).

The following auxiliary connections are available:

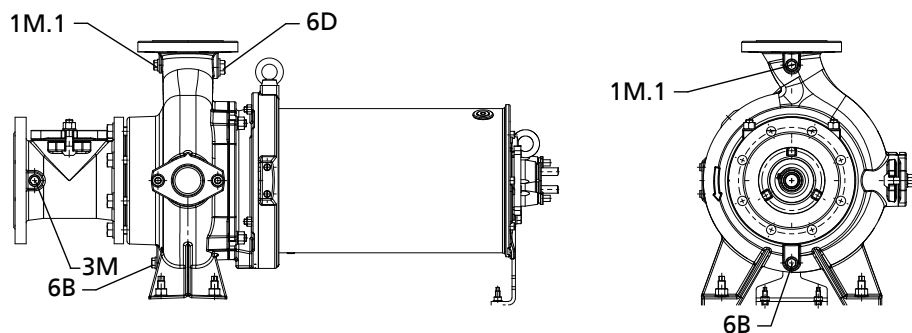


Fig. 39: Auxiliary connections

Table 18: Size of auxiliary connections

Size	Impeller type	Connection			
		Pressure gauge	Vent	Pressure/vacuum gauge	Casing drain
		1 M.1	6 D	3 M	6 B
40-252	F, K, S	G 1/2	G 1/2	G 1/2	G 1/2
80-252	F	G 1/2	G 1	G 1/2	G 1/2
80-253	E, F, K	G 1/2	G 1	G 1/2	G 1/2
80-315	D	G 1/2	G 1	G 1/2	G 1/2
80-315	K	G 1/2	G 1	G 1/2	G 1/2
80-317	D	G 1/2	G 1	G 1/2	G 1/2
80-317	F	G 1/2	G 1	G 1/2	G 1/2
100-253	D	G 1/2	G 1	G 1/2	G 1/2
100-253	E, K	G 1/2	G 1	G 1/2	G 1/2
100-254	F, K	G 1/2	G 1	G 1/2	G 1/2
100-315	D	G 1/2	G 1	G 1/2	G 1/2
100-316	D	G 1/2	G 1	G 1/2	G 1/2
100-316	F, K	G 1/2	G 1	G 1/2	G 1/2
100-317	E	G 1/2	G 1	G 1/2	G 1/2
100-400	K	G 1/2	G 1	G 1/2	G 1
100-401	E, F, K	G 1/2	G 1	G 1/2	G 1
100-403	D	G 1/2	G 1	G 1/2	G 1
150-253	D	G 1/2	G 1	G 1/2	G 1/2
150-315	D	G 1/2	G 1	G 1/2	G 1
150-315	F	G 1/2	G 1	G 1/2	G 1
150-317	E, K	G 1/2	G 1	G 1/2	G 1
150-317	D	G 1/2	G 1	G 1/2	G 1
150-400	D	G 1/2	G 1 1/4	G 1/2	G 1
150-400	K	G 1/2	G 1 1/4	G 1/2	G 1
150-401	D	G 1/2	G 1 1/4	G 1/2	G 1
150-401	E, F	G 1/2	G 1 1/4	G 1/2	G 1
150-403	D	G 1/2	G 1 1/4	G 1/2	G 1
150-403	K	G 1/2	G 1 1/4	G 1/2	G 1
151-403	K	G 1/2	G 1 1/4	G 1/2	G 1
200-315	D	G 1/2	G 1	G 1/2	G 1
200-315	K	G 1/2	G 1	G 1/2	G 1
200-316	K	G 1/2	G 1	G 1/2	G 1
200-317	K	G 1/2	G 1	G 1/2	G 1

Size	Impeller type	Connection			
		Pressure gauge	Vent	Pressure/ vacuum gauge	Casing drain
		1 M.1	6 D	3 M	6 B
200-318	K	G 1/2	G 1	G 1/2	G 1
200-400	D	G 1/2	G 1 1/4	G 1/2	G 1
200-401	E	G 1/2	G 1 1/4	G 1/2	G 1
200-402	D	G 1/2	G 1 1/4	G 1/2	G 1
200-402	K	G 1/2	G 1 1/4	G 1/2	G 1
200-403	K	G 1/2	G 1 1/4	G 1/2	G 1
200-405	D	G 1/2	G 1 1/4	G 1/2	G 1
250-400	D	G 1/2	G 1 1/4	G 1/2	G 1
250-401	K	G 1/2	G 1 1/4	G 1/2	G 1
250-402	D	G 1/2	G 1 1/4	G 1/2	G 1
250-403	K	G 1/2	G 1 1/4	G 1/2	G 1
300-400	D	G 1/2	G 1 1/4	G 1/2	G 1
300-400	K	G 1/2	G 1 1/4	G 1/2	G 1
300-401	K	G 1/2	G 1 1/4	G 1/2	G 1
300-402	D	G 1/2	G 1 1/4	G 1/2	G 1
300-403	K	G 1/2	G 1 1/4	G 1/2	G 1

5.4 Electrical system

5.4.1 Information for planning the control system

For the electrical connection of the pump set observe the wiring diagrams.
(⇒ Section 9.6, Page 122)

	NOTE When laying a cable between the control system and the pump set's connection point, verify that the number of cores is sufficient for the sensors. A minimum cross-section of 1.5 mm² is required.
---	---

The motors can be connected to electrical low-voltage grids with mains voltages and voltage tolerances to IEC 60038. The permissible tolerances must be observed.
(⇒ Section 6.2.2, Page 64)

5.4.1.1 Starting method

The pump set is wired for DOL starting. Star-delta starting is technically possible.
This excludes:

- Pump sets with a 4G16 power cable and one or two 8G1.5 control cables

For reducing the starting current autotransformers or soft starters can be used. For selecting suitable devices observe the rated current of the motor.
At least three times the rated current is required for reliable start-up. The run-up time must not exceed 4 seconds.

After start-up of the pump, a soft starter must always be bypassed.

5.4.1.2 Setting the overload protection device

1. Protect the pump set against overloading by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.
2. Set the overload protection device to the rated current specified on the name plate. (⇒ Section 4.4, Page 20)

5.4.1.3 Level control system

	⚠ DANGER Pump set running dry Explosion hazard! ▷ Never allow an explosion-proof pump set to run dry!
	CAUTION Fluid level below the specified minimum Damage to the pump set by cavitation! ▷ Never allow the fluid level to drop below the specified minimum.

Observe the minimum fluid level indicated.

5.4.1.4 Operation on a frequency inverter

The pump set is driven by an induction machine to IEC 60034-12 designed for fixed speed operation. In accordance with IEC 60034-25, Section 18, the pump set is suitable for operation on a frequency inverter.

	 DANGER Operation outside the permitted frequency range Explosion hazard! ▷ Never operate an explosion-proof pump set outside the specified range.
	 DANGER Incorrect selection and setting of the frequency inverter Explosion hazard! ▷ Observe the following information on selecting and setting a frequency inverter.

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

- Data provided by the manufacturer
- Electrical data of the pump set, particularly the rated current
- Only voltage source inverters (VSI) with pulse width modulation (PWM) and carrier frequencies between 1 and 16 kHz are suitable.

Setting Observe the following instructions for setting a frequency inverter:

- Set the current limit to max. 1.2 times the rated current. The rated current is indicated on the name plate.

Start-up Observe the following instructions for starting the frequency inverter:

- Short start ramps (maximum 5 seconds)
- Only start variable speed control after 2 minutes at the earliest.
Pump start-up with long start ramps and low frequency may cause clogging.

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

- Only utilise up to 95 % of the motor rating P_2 indicated on the name plate.
- Frequency range 25 - 50 Hz

Electromagnetic compatibility Operation on a frequency inverter produces interference emissions whose level varies depending on the inverter used (type, interference suppression, make). To prevent the drive system, consisting of a motor and a frequency inverter, from exceeding any given limits always observe the EMC information provided by the inverter manufacturer. If the inverter manufacturer recommends a shielded power cable, make sure to use a pump set with shielded power cable.

Interference immunity The pump set generally meets the interference immunity requirements to IEC 61000-6-1. For monitoring the sensors installed the operator must ensure sufficient interference immunity by appropriately selecting and laying the cables in the plant. No modifications are required on the power/control cable of the pump set. Suitable analysing devices must be selected. To monitor the leakage sensor inside the motor using a special relay available from KSB is recommended.

5.4.1.5 Sensors

 	 DANGER Operating an incompletely connected pump set Explosion hazard! Damage to the pump set! ▷ Never start up a pump set with incompletely connected electric cables or non-operational monitoring devices.
---	---

2553.8307/03-EN

**CAUTION****Incorrect wiring**

Damage to the sensors!

- Observe the limits stated in the following sections of this manual when connecting the sensors.

The pump set features sensors designed to prevent hazards and damage to the pump set.

Measuring transducers are required for analysing the sensor signals supplied. Suitable devices for 230 V AC can be supplied by KSB.

**NOTE**

Reliable and safe operation of the pump within the scope of our warranty is only possible if the sensor signals are properly analysed as stipulated in this manual.

All sensors are located inside the pump set and are connected to the power cable. For information on wiring and core identification please refer to the "Wiring diagrams" section.

The individual sensors and the limit values to be set are described in the following sections.

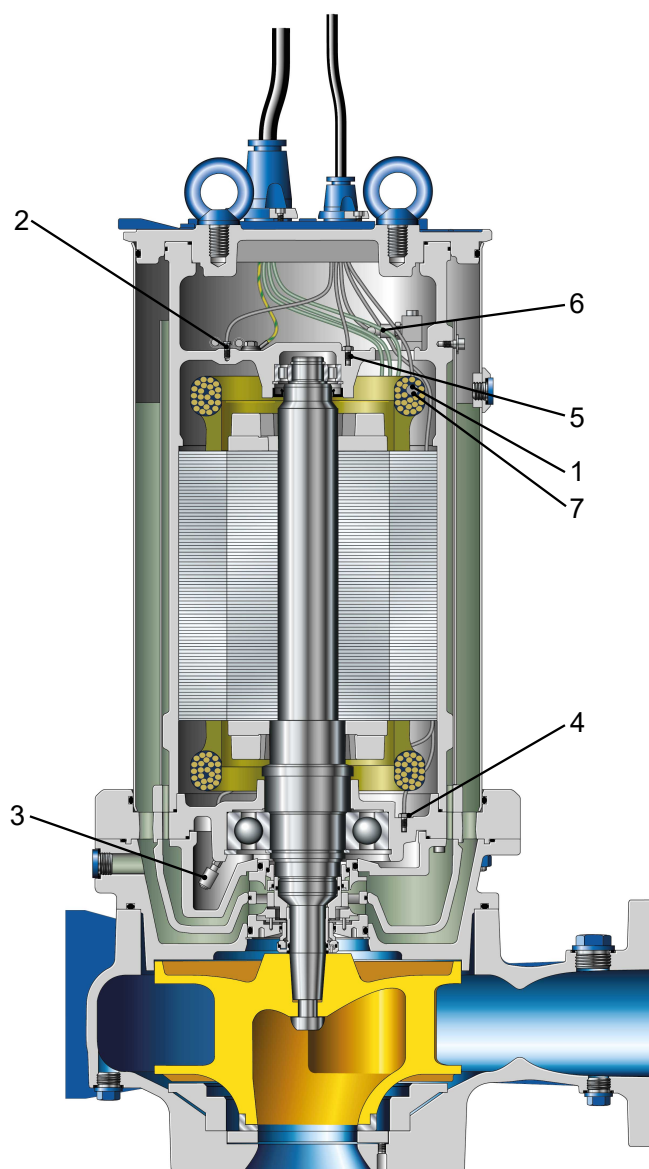


Fig. 40: Sensor positions

Pos.	Sensor	Sensor packages		
		Basic (Standard)	Basic+	Premium
1	Motor temperature (PTC)	X	X	X
2	Leakage inside the motor	X	X	X
3	Mechanical seal leakage	X	X	X
4	Bearing temperature, pump end	-	X	X
5	Bearing temperature, motor end	-	-	X
6	Vibration sensor	-	-	X
7	Motor temperature (Pt100)	-	-	X

2553.8307/03-EN

5.4.1.5.1 Motor temperature

	 DANGER Insufficient cooling Explosion hazard! Winding damage! ▷ Never operate a pump set without operational temperature monitoring equipment. ▷ For explosion-proof pump sets use a thermistor motor protection relay with manual reset and certification for use in potentially explosive atmospheres for monitoring the temperature of explosion-proof motors in "flameproof enclosure" type of protection.
	CAUTION Temperature monitoring devices not properly connected Winding damage! ▷ Never use the Pt100 resistance thermometers as the only means of monitoring the motor temperature.

Pt100 resistance thermometer

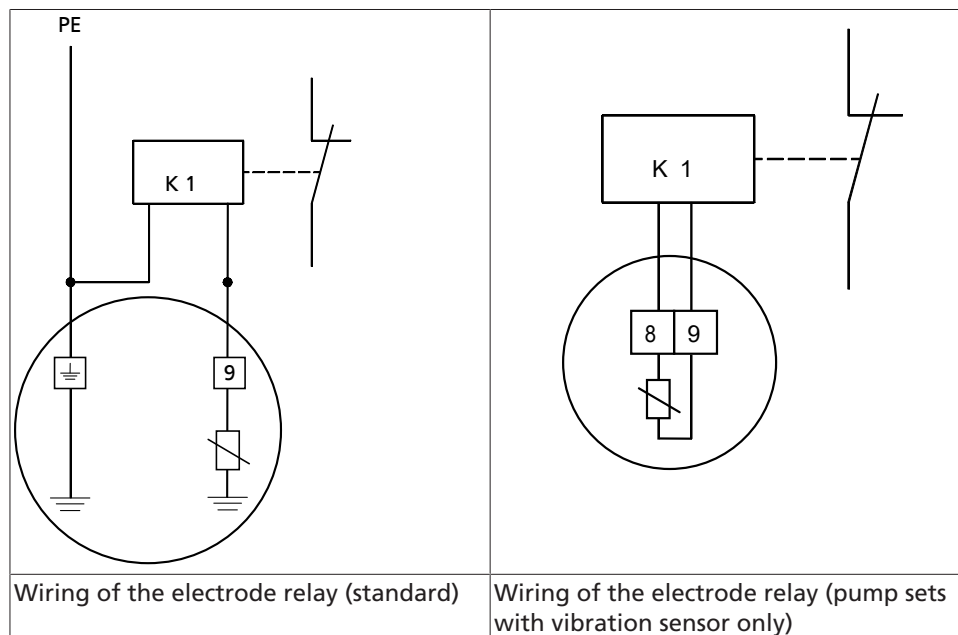
As an option, in addition to the above, the motor can be fitted with Pt100 resistance thermometers in the winding. These can be used to display the motor temperature (sensor circuit maximum 300mV/3 mA).

5.4.1.5.2 Leakage inside the motor

	 DANGER Incorrect monitoring of leakage electrode Explosion hazard! Danger of death from electric shock! ▷ Voltages must be < 30 V AC and tripping currents < 0.5 mA.
---	--

An electrode fitted inside the motor monitors the motor space for leakage. The electrode is intended for connection to an electrode relay (core marking 9). Tripping of the electrode relay must result in the pump set cutting out.

The electrode relay (K1) must trip the motor at a tripping resistance between 3 and 60 kΩ.



Pump sets with vibration sensors

A different wiring system is used for the electrodes of pump sets with vibration sensors.

5.4.1.5.3 Mechanical seal leakage

The chamber for mechanical seal leakage is equipped with a float switch (core identification 3 and 4). The contact (maximum 250 V~/2 A/40 VA) opens when leakage is detected in the leakage chamber. Opening of the contact shall trigger an alarm signal.

5.4.1.5.4 Bearing temperature

As an option, the pump set can be supplied with temperature monitoring in the area of the pump-end bearings.

Check in the data sheet whether the pump set is equipped with bearing temperature monitoring.

The bearing temperature sensor is a Pt100 resistance thermometer. It must be connected to a temperature control device with a Pt100 input and two separate outputs for two different switching points (sensor circuit maximum 300mV/3mA).

Set the following limit values for the pump-end bearing assembly:

Standard bearings

- Alert at 110 °C
- Cut-out of the pump set at 130 °C

Reinforced bearings (⇒ Section 9.3.1, Page 114)

- Alert at 130 °C
- Cut-out of the pump set at 150 °C

As an option, the motor-end bearing assembly can also be equipped with a temperature sensor. The bearing temperature sensor is a Pt100 resistance thermometer. It must be connected to a temperature control device with a Pt100 input and two separate outputs for two different switching points (sensor circuit maximum 6 V/2 mA).

Set the following limit values for the motor-end bearing assembly:

- Alert at 130 °C
- Cut-out of the pump set at 150 °C

Check in the data sheet whether the pump set is equipped with bearing temperature monitoring.

5.4.1.5.5 Vibrations

As an option, the pump set can be supplied with a vibration sensor in the area of the motor-end bearing assembly. The sensor is matched to KSB's diagnosis systems.

The vibration sensor measures the root-mean-square value of the radial vibration velocity at the motor-end bearing. The vibration sensor has an integrated signal converter with a standardised output (4 - 20 mA). This allows simple integration into existing PLC systems or process control systems.

Table 19: Technical data of the sensor

Characteristic	Value
Measuring range	4 - 20 mA at 0 - 20 mm/s
Measurement error	< 5 %
Long-term stability	+/- 1 % in 10 years
Maximum shock load	500 g
Frequency range	2 Hz - 1000 Hz
Resonant frequency	> 18 kHz
Output impedance	max. 200 Ohm
Power supply	18 - 30 V (smoothed)
Load (maximum working resistance)	50 - 100 Ohm

Connecting the vibration sensor

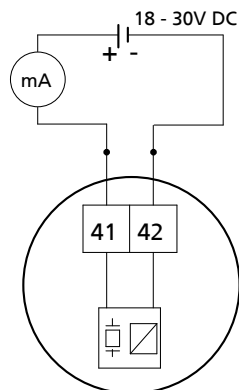


Fig. 41: Connecting the vibration sensor

We recommend the following settings for vibration monitoring with the (optional) vibration sensor fitted at the factory:

- Alarm to be triggered at $v_{\text{eff}} = 11 \text{ mm/s}$ (for impeller types E and D: $v_{\text{eff}} = 14 \text{ mm/s}$)
 - This vibration limit requires remedial action.
 - In general, pump operation may continue until the causes of the change in vibration level have been detected and remedies have been determined.
- Cut-out at $v_{\text{eff}} = 14 \text{ mm/s}$ (for impeller types E and D: $v_{\text{eff}} = 17 \text{ mm/s}$)
 - If this vibration velocity is exceeded, continued pump set operation may result in damage.
 - Suitable action to reduce vibrations should be taken immediately, or the pump set should be switched off.

5.4.2 Connection to power supply

	⚠ DANGER Electrical connection work by unqualified personnel Danger of death from electric shock and explosion! ▷ Always have the electrical connections installed by an electrically qualified person. ▷ Observe regulations IEC 60364 and, for explosion-proof versions, BS 60079 .
--	--

	⚠ WARNING Incorrect connection to the mains Damage to the power supply network, short circuit! ▷ Observe the technical specifications of the local energy supply companies.
	CAUTION Improper routing of electric cables Damage to the electric cables! ▷ Never move the electric cables at temperatures below -25 °C. ▷ Never kink or crush the electric cables. ▷ Never lift the pump set by the electric cables. ▷ Adjust the length of the electric cables to the site requirements.
	CAUTION Motor overload Damage to the motor! ▷ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.

For the electrical connection observe the wiring diagrams (⇒ Section 9.6, Page 122) and the information for planning the control system (⇒ Section 5.4.1, Page 51) .

The pump set is supplied with electric cables. Always connect all marked cores.

 	⚠ DANGER Incorrect wiring Explosion hazard! ▷ The connection point of the cable ends must be located outside of the potentially explosive atmosphere or inside electrical equipment approved to equipment category II2G.
 	⚠ DANGER Operating an incompletely connected pump set Explosion hazard! Damage to the pump set! ▷ Never start up a pump set with incompletely connected electric cables or non-operational monitoring devices.
	⚠ DANGER Connection of damaged electric cables Danger of death from electric shock! ▷ Check the electric cables for any damage before connecting them. ▷ Never connect damaged electric cables. ▷ Replace damaged electric cables.

**CAUTION****Flow-induced motion**

Damage to the cable!

- ▷ If the pump is installed in a tank, run the electric cables directly upwards without slack.

1. If the pump is installed in a tank, run the electric cables directly upwards without slack and fasten them.
2. Only remove the protective caps from the electric cables immediately before connecting the cables.
3. If necessary, adjust the length of the electric cables to the site requirements.
4. After shortening the cables, correctly re-affix the markings of the individual cores at the cable ends.

5.4.2.1 Potential equalisation

**Wet installation
(installation type K)**

The pump set is not fitted with an external potential equalisation connection (risk of corrosion).

	⚠ DANGER Incorrect wiring Explosion hazard! ▷ Explosion-proof pump sets installed in a tank must never be retrofitted with an external potential equalisation connection!
	⚠ DANGER Touching the pump set during operation Electric shock! ▷ Make sure that the pump set cannot be touched during operation.

Dry installation (installation types D and H)

Pump sets for dry installation are provided with an external potential equalisation connection. Potential equalisation shall be provided for in compliance with IEC 60204.

Connecting the potential equalisation conductor

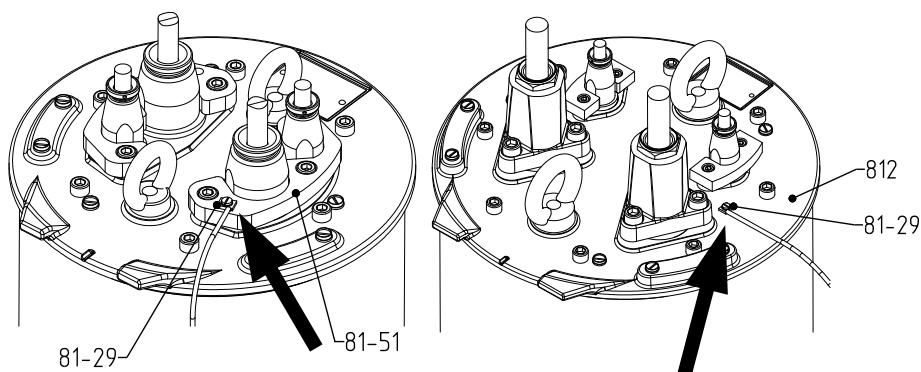


Fig. 42: Connecting the potential equalisation conductor

81-29	Connection terminal
81-51	Clamping element

1. Connect the potential equalisation conductor to terminal 81-29 provided on clamping element 81-51 or to motor housing cover 812.

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump has been filled with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked. (⇒ Section 5.2.4, Page 27)
- All auxiliary connections required are connected and operational.
- The cooling liquid has been checked. (⇒ Section 5.2.3, Page 26)

	⚠ DANGER Persons in the tank during pump operation Electric shock! Risk of injury! Danger of death from drowning! ▷ Never start up the pump set when there are persons in the tank.
	⚠ DANGER Exceeding the operating limits Pump casing could burst/leak! Pressurised hot or toxic fluid could escape! Flying parts! ▷ Maintain an adequate safety distance from pump sets which are in operation.

6.1.2 Priming and venting the pump set (dry installation only - installation types D and H)

	⚠ DANGER Shaft seal failure caused by insufficient lubrication Hot or toxic fluid could escape! Damage to the pump! ▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.
---	---

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

6.1.3 Start-up

	CAUTION Re-starting while motor is still running down Damage to the pump set! ▷ Do not re-start the pump set before it has come to a standstill. ▷ Never start up the pump set while the pump is running in reverse.
---	--

✓ The fluid level is sufficiently high.

	CAUTION Start-up against a closed shut-off element Increased vibrations! Damage to mechanical seals and bearings! ▷ Never operate the pump set against a closed shut-off element.
---	--

1. Fully open the discharge line shut-off element, if any.
2. Start up the pump set.

For dry installation only (installation types D and H)

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

	⚠ DANGER Excessive temperatures due to dry running or excessive gas content in the fluid handled Explosion hazard! Damage to the pump set! ▷ Never operate the pump set without liquid fill. ▷ Prime the pump as per operating instructions. ▷ Always operate the pump within the permissible operating range.
---	---

	⚠ WARNING Hot surface Risk of burns ▷ Never touch a pump set which is in operation.
---	--

	⚠ WARNING
	Very high noise emission during operation Personal injury! ▷ Minimise exposure in the vicinity of the pump set. ▷ For required work near running pump sets use appropriate ear protection.

	⚠ WARNING
	Abnormal noises, vibrations, temperatures or leakage Damage to the pump! Risk of personal injury! ▷ Switch off the pump (set) immediately. ▷ Eliminate the causes before returning the pump set to service.

- ✓ Pump, suction line and inlet tank (if fitted) have been vented and primed with the fluid to be handled.
- ✓ The priming lines and venting lines have been closed.

	CAUTION
	Start-up against open discharge line Motor overload! ▷ Make sure the motor has sufficient power reserves. ▷ Use a soft starter. ▷ Use speed control.

1. Fully open the shut-off element in the suction head/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 comply with the duty point.

6.1.4 Shutdown (dry installation only - installation types D and H)

- ✓ The shut-off element in the suction line is and remains open.
1. Switch off the motor.
 2. Immediately after having switched off the motor, close the shut-off element in the discharge line.

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

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Close any auxiliary lines.

	CAUTION
	Danger of freezing! Damage to the pump set! ▷ Drain the pump set or protect it against freezing.

6.2 Operating limits

	 DANGER
	Non-compliance with operating limits Damage to the pump set! ▷ Comply with the operating data specified in the data sheet. ▷ Never operate an explosion-proof pump set at ambient temperatures or fluid temperatures exceeding those specified in the data sheet and/or on the name plate. ▷ Never operate the pump set outside the limits specified below.

6.2.1 Frequency of starts

	CAUTION
	Excessive frequency of starts Risk of damage to the motor! ▷ Never exceed the specified frequency of starts.

To prevent high temperature increases in the motor and excessive loads on the motor, seal elements and bearings, the frequency of starts shall not exceed 10 starts per hour.

These values apply to mains start-up (DOL or with star-delta contactor, autotransformer, soft starter). This limitation does not apply to operation on a frequency inverter.

	CAUTION
	Re-starting while motor is still running down Damage to the pump set! ▷ Do not re-start the pump set before it has come to a standstill. ▷ Never start up the pump set while the pump is running in reverse.

6.2.2 Operation on the power supply mains

	 DANGER
	Permissible tolerances for operation on mains power exceeded Explosion hazard! ▷ Never operate an explosion-proof pump (set) outside the specified range.

The mains voltage and mains frequency may fluctuate around the rated values as defined for zone B to IEC 60034-1. The voltage difference between the individual phases must not exceed 1 %.

6.2.3 Operation on a frequency inverter

	⚠ DANGER Operation outside the permitted frequency range Explosion hazard! ▸ Never operate an explosion-proof pump set outside the specified range.
	CAUTION Pumping solids-laden fluids at reduced speed Increased wear and clogging! ▸ Never operate the pump set with flow velocities below 0.7 m/s in horizontal pipes and 1.2 m/s in vertical pipes.

Frequency inverter operation of the pump set is permitted in the frequency range from 25 to 50 Hz.

6.2.4 Fluid handled

6.2.4.1 Fluid temperature

The pump set is designed for transporting liquids. The pump set is not operational under freezing conditions.

	CAUTION Danger of freezing! Damage to the pump set! ▸ Drain the pump set or protect it against freezing.
--	--

Refer to the maximum permissible fluid temperature and ambient temperature indicated on the name plate and/or in the data sheet.

6.2.4.2 Minimum level of fluid handled (for installation type K only)

	⚠ DANGER Pump set running dry Explosion hazard! ▸ Never allow an explosion-proof pump set to run dry!
	CAUTION Fluid level below the specified minimum Damage to the pump set by cavitation! ▸ Never allow the fluid level to drop below the specified minimum.

Pump sets of installation type K are suitable for continuous operation with the motor outside the fluid.

Ready for operation

The pump set is ready for operation when the minimum fluid level has been reached (dimension B). For exact dimensions see general arrangement drawing / outline drawing.

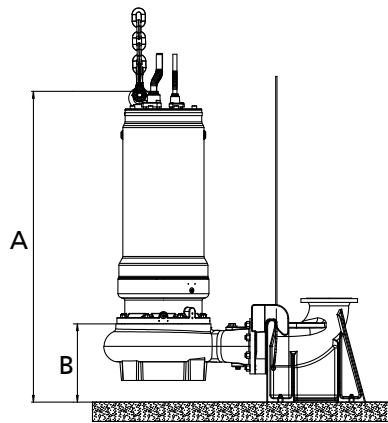


Fig. 43: Minimum fluid level



NOTE

Compliance with dimension B does not guarantee trouble-free operation of the pump set.
Depending on the pump's duty point, higher fluid levels may be required. Observe the NPSH values indicated in the characteristic curve (see hydraulic characteristic curves).

6.2.4.3 Density of the fluid handled

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



CAUTION

Impermissibly high density of the fluid handled

Motor overload!

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

6.2.4.4 Abrasive fluids

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

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump set remains installed



WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

	WARNING Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury! ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
	CAUTION Danger of frost/freezing Damage to the pump set! ▷ If there is any danger of frost/freezing, remove the pump set from the fluid handled and clean, preserve and store it.

✓ Make sure sufficient fluid is available for the functional check run of the pump set.

1. For prolonged shutdown periods, start up the pump set regularly once every three months for approximately one minute.
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.
 - ✓ The safety instructions for dismantling the pump have been observed.
(⇒ Section 7.1, Page 69)
 - ✓ The permissible ambient temperature for storing the pump is observed.
(⇒ Section 3.3, Page 16)
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 nozzle and discharge nozzle.
It is advisable to then close the pump nozzles (e.g. with plastic caps).
 3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved, if required) to protect them against corrosion.
Observe the additional instructions on preservation.

6.4 Returning to service

For returning the pump set to service, observe the instructions on commissioning/start-up. (⇒ Section 6.1, Page 61)

Refer to and comply with the operating limits. (⇒ Section 6.2, Page 64)

For returning the pump set to service after storage also follow the instructions for maintenance/inspection.

	 WARNING Failure to re-install or re-activate protective devices Risk of injury from moving parts or escaping fluid! ▸ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.
	NOTE On pumps/pump sets older than 5 years we recommend replacing all elastomer seals.

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.

	 DANGER Sparks produced during servicing work Explosion hazard! ▷ Observe the safety regulations in force at the place of installation! ▷ Never open an energised pump set. ▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.
 	 DANGER Improperly serviced pump set Explosion hazard! Damage to the pump set! ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants, electric cables, bearing assembly and shaft seal.
	 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 the IEC 61557 regulations as well as any regional regulations.
	 DANGER Improper lifting/moving of heavy assemblies or components Danger to life from falling parts! Damage to the pump set! ▷ Use suitable transport equipment, lifting equipment and lifting tackle to move heavy assemblies or components. ▷ Use the attachment point provided for attaching the lifting accessory. ▷ Never lift the pump set by the electric cables. ▷ Use the lifting chain/rope included in the scope of supply exclusively for lowering or lifting the pump set into/out of the pump sump. ▷ Securely attach the lifting chain/rope to the pump and crane. ▷ Use tested, marked and approved lifting accessories only. ▷ Observe the regional transport regulations. ▷ Observe the documentation of the lifting accessory manufacturer. ▷ The load-carrying capacity of the lifting accessory must be higher than the weight indicated on the name plate of the pump set to be lifted. Take into account any additional system components to be lifted. ▷ Maintain a safe distance during lifting operations (load may swing when being lifted).

	 DANGER Risk of falling when working at a great height Danger to life by falling from a great height! ▷ Do not step onto the pump (set) during installation work or dismantling work. ▷ Pay attention to safety equipment, such as railings, covers, barriers, etc. ▷ Observe the applicable local health and occupational safety regulations and accident prevention regulations.
	 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 Hands, other body parts or foreign objects in the impeller or intake area Risk of injury! Damage to the submersible motor pump! ▷ Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area. ▷ Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.
	 WARNING Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury! ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
	 WARNING Hot surface Risk of injury! ▷ Allow the pump set to cool down to ambient temperature.
	 WARNING Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

	 WARNING Insufficient stability Risk of crushing hands and feet! ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.
---	--

	NOTE Special regulations apply to repair work on explosion-proof pump sets. Modification or alteration of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.
---	--

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

	NOTE All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact.
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Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 20: Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 4000 operating hours ¹⁴⁾	Insulation resistance measurement	(⇒ Section 7.2.2.4, Page 74)
	Checking the power cables	(⇒ Section 7.2.2.3, Page 73)
	Visual inspection of the lifting chain / lifting rope	(⇒ Section 7.2.2.1, Page 73)
	Visual inspection of lifting accessories	(⇒ Section 7.2.2.2, Page 73)
Every 10,000 operating hours ¹⁵⁾	Checking the sensors	(⇒ Section 7.2.2.5, Page 74)
	Lubricating the bearings ¹⁶⁾	(⇒ Section 7.2.3, Page 79)
	Checking the mechanical seal leakage	(⇒ Section 7.2.2.6, Page 76)
Every 5 years	General overhaul (including coolant change)	E.g. (⇒ Section 7.2.4, Page 81)



NOTE

In demanding conditions (e.g. high mechanical and hydraulic loads) reduce the maintenance interval accordingly.
For a consultation or any queries please contact KSB Service.

7.2.1 Supervision of operation (for installation types D and H only)



DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

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



CAUTION

Increased wear due to dry running

Damage to the pump set!

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



CAUTION

Impermissibly high temperature of fluid handled

Damage to the pump!

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

¹⁴⁾ At least once a year

¹⁵⁾ At least every three years

¹⁶⁾ Only for reinforced bearings

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

- The pump set must run quietly and free from vibrations at all times.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
To make sure that stand-by pumps are ready for operation, start them up once a week.

7.2.2 Inspection work

7.2.2.1 Checking the lifting chain/rope

- ✓ The pump set has been lifted out of the pump sump and cleaned. (Applies to installation type K only.)
- 1. Inspect the lifting chain/rope as well as their fasteners (shackles) for any visible damage.
- 2. Replace any damaged components by original spare parts.
- 3. Assess the lifting chain/lifting rope/shackle in accordance with the locally applicable regulations for lifting tackle.
- 4. In addition, observe the operating manual of the lifting accessories.

7.2.2.2 Checking the lifting accessories

- ✓ The pump set has been lifted out of the pump sump and cleaned. (Applies to installation type K only.)
- 1. Check the bail or eyebolt including fasteners (screws/bolts) for any visible damage.
- 2. Replace any damaged components by original spare parts.

7.2.2.3 Checking the power cables

Visual inspection ✓ The pump set has been lifted out of the pump sump and cleaned. (Applies to installation type K only.)

1. Inspect the power cables for visible damage.
2. Replace any damaged components by original spare parts.

Earth conductor test 1. Measure the resistance between the earth conductor and chassis ground.
The electrical resistance must be lower than 1 Ω.
2. Replace any damaged components by original spare parts.



DANGER

Defective earth conductor

Electric shock!

- ▷ Never switch on a pump set with a defective earth conductor.

7.2.2.4 Measuring the insulation resistance

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

- ✓ The pump set has been disconnected in the control cabinet.
- ✓ Use an insulation resistance measuring device.
- ✓ The recommended measuring voltage equals 500 V (maximum permissible 1000 V).
 1. Measure the winding to chassis ground.
To do so, connect all winding ends together.
 2. Measure the winding temperature sensors to chassis ground.
To do so, connect all core ends of the winding temperature sensors together and connect all winding ends to chassis ground.
- ⇒ The insulation resistance of the core ends to chassis ground must not be lower than 1 MΩ.
If the resistance measured is lower, power cable and motor resistance must be measured separately. Disconnect the power cable from the motor for this purpose.

	NOTE
	If the insulation resistance of the power cable is lower than 1 MΩ, the power cable is defective and must be replaced.

	NOTE
	If the insulation resistances measured on the motor are too low, the winding insulation is defective. The pump set must not be returned to service in this case.

7.2.2.5 Checking the sensors

	CAUTION
	Excessive test voltage Damage to the sensors! ▷ Use a commercially available ohmmeter to measure the resistance.

The tests described below measure the resistance at the core ends of the control cable. The actual sensor function is not tested.

Temperature sensors in the motor winding

Table 21: Resistance measurement

Measurement between terminals ...	Resistance
	[Ω]
10 and 11	100 to 1000
31 and 32 ¹⁷⁾	100 to 120

If the specified tolerances are exceeded, disconnect the power cable at the pump set and repeat the check inside the motor.

If the tolerances are exceeded here, too, the motor section has to be opened and overhauled. The temperature sensors are fitted in the stator winding and cannot be replaced.

If the sensors are defective, use the back-up sensors provided at the same place in the stator winding.

¹⁷ Optional

Leakage sensor in the motor
Table 22: Resistance measurement of the leakage sensor in the motor

Measurement between terminals ...	Resistance
	[kΩ]
9 and earth conductor (PE)	> 60
8 and 9 ¹⁸⁾	> 60

Lower resistance values suggest water ingress into the motor. In this case the motor section must be opened and overhauled.

Float switch (mechanical seal leakage)
Table 23: Resistance measurement of the float switch

Measurement between terminals ...	Resistance
	[Ω]
3 and 4	< 1

If the readings suggest an open switch, check for mechanical seal leakage.

Bearing temperature sensor
Table 24: Resistance measurement of the bearing temperature sensors

Measurement between terminals ...	Resistance
	[Ω]
15 and 16 ¹⁹⁾	100 to 120
16 and 17 ¹⁹⁾	100 to 120

Vibration sensor
Table 25: Current measurement at vibration sensor

Measurement between terminals ...	Current value
41 and 42 ²⁰⁾	Constant 4 mA during standstill

Functional test

Connect the vibration sensor. Measure the current in the measuring circuit with a suitable ammeter. (⇒ Section 5.4.1.5.5, Page 57)

¹⁸⁾ Only for pump sets with vibration sensor

¹⁹⁾ Optional

²⁰⁾ Optional

7.2.2.6 Checking the mechanical seal leakage

	! WARNING Fluids handled, consumables and supplies which are hot and/or pose a health hazard Hazard to persons and the environment! ▸ Collect and properly dispose of flushing fluid and any fluid residues. ▸ Wear safety clothing and a protective mask if required. ▸ Observe all legal regulations on the disposal of fluids posing a health hazard.
	! WARNING Excess pressure inside the pump set Risk of injury when opening the pump set! ▸ Be careful when opening the inner chambers.
	NOTE Slight wear of the mechanical seal is unavoidable. This will be aggravated by abrasive substances contained in the fluid handled.

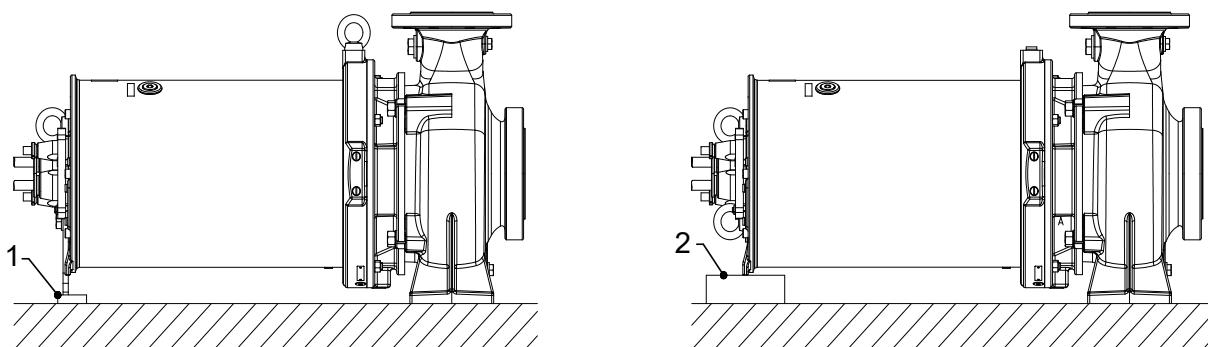


Fig. 44: Support options for placing down the pump

1	Support foot (for horizontal installation)
2	Wooden support

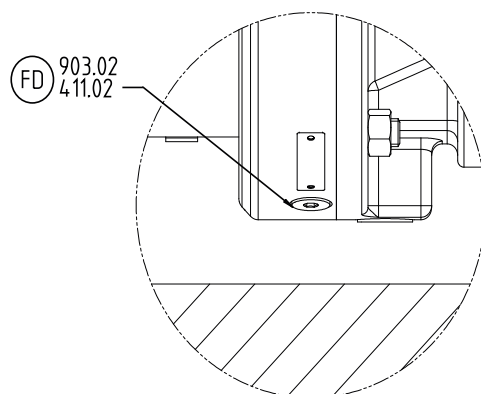


Fig. 45: Checking the mechanical seal leakage

Table 26: Symbols key

Symbol	Description
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

✓ Position the pump set as shown.

1. Place a suitable container under screw plug 903.02.
2. Remove screw plug 903.02 and joint ring 411.02.
3. Drain the leakage.



NOTE

If more than 0.3 litres of leakage should escape we recommend replacing the mechanical seals.

4. Close screw plug 903.02, fitting joint ring 411.02 and applying liquid sealant.

7.2.2.7 Visual inspection through the inspection hole (for inspection types D and H only and for pump sets with nominal diameters ≥ 100)

If there are problems with clogging, the inside of the casing and the impeller can be checked via the inspection hole.



WARNING

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

Hazard to persons and the environment!

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



WARNING

Hands or foreign objects in the pump casing

Risk of injuries, damage to the pump!

- ▷ Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
- ▷ Never insert your hands or any other objects into the pump, if the pump set has not been disconnected from the power supply and secured against unintentional start-up.

If a problem has occurred which requires visual inspection, observe the following instructions:

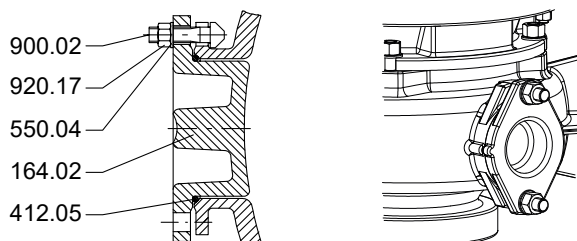


Fig. 46: Inspection hole in the casing

Opening the inspection hole

- Close the shut-off element on the suction side.
- Switch off the drive and make sure it cannot be re-started unintentionally.
- Close the shut-off element on the discharge side.

- Open the drain plug (auxiliary connection 6B).
- Collect and dispose of any liquid residues.
- Loosen nuts 920.17 at the inspection hole. Remove inspection cover 164.02.
- Perform a visual inspection with a lamp or similar.

Closing the inspection hole

- Fit new O-ring 412.05.
- Fit inspection cover 164.02.
- Fit discs 550.04 and nuts 920.17 on screws 900.02. Tighten the nuts.
- Observe the instructions on commissioning/start-up.

7.2.3 Lubricating the rolling element bearings

The rolling element bearings of the pump set are grease-packed and maintenance-free, with the exception described below.

For a pump set with reinforced bearings (⇒ Section 9.3.1, Page 114) the pump-end rolling element bearings must be re-lubricated as part of the maintenance work.

7.2.3.1 Grease quality

	CAUTION
	Mix of different grease types Damage to the pump set! ▷ Make sure to use the right type of grease. ▷ Never mix different types of grease.

The following greases can be used to lubricate the rolling element bearings:

Table 27: Lubricant characteristics

Base oil	Thickener	NLGI grade (DIN 51518)	Worked penetration at 25 °C, 0.1 mm (DIN 51818)	Drop point (ISO 2176)	Application temperature range [°C]	Viscosity at 40 °C (DIN 51562)
Ester oil	Polyurea	2	265 to 295	>250 °C	-40 to +180	100

The re-lubrication and maintenance intervals apply to the grease type originally used by the manufacturer:

- Klüberquiet BQH 72-102 made by Klüber Lubrication KG München

7.2.3.2 Grease quantity

Use 60g grease to lubricate the rolling element bearings.

7.2.3.3 Re-lubrication

Pump sets with reinforced bearing assembly

An encapsulated water-tight lubricating nipple allows re-lubrication of the angular contact ball bearings without opening the pump.

	 DANGER Dry running Explosion hazard! ▷ Re-lubricate explosion-proof pump sets outside potentially explosive atmospheres.
	 WARNING Hands inside the pump casing Risk of injuries, damage to the pump! ▷ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

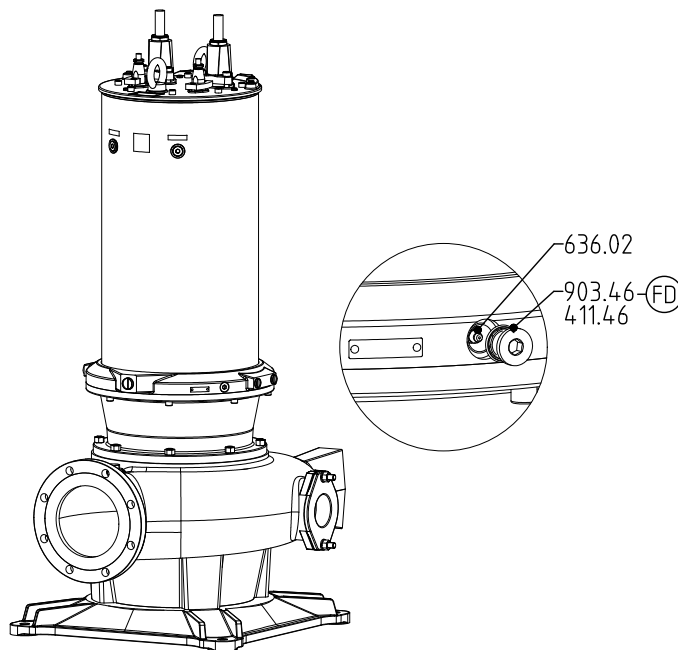


Table 28: Symbols key

Symbol	Description
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.



CAUTION

Incomplete re-lubrication

Bearing damage!

- Always re-lubricate the bearings with the pump set in operation.

- ✓ The pump set has been positioned on a level surface.
- ✓ The pump set is secured against tipping over.
- 1. Remove screw plug 903.46 and joint ring 411.46.
- 2. Connect the pump set to the power supply. (⇒ Section 5.4.2, Page 57)



CAUTION

Pump set running dry

Increased vibrations!

Damage to mechanical seals and bearings!

- Never operate the pump set for more than 60 seconds without the fluid handled.

- 3. Secure the pump set against tilting.
- 4. Start up the pump set.
- 5. Fill in grease via lubricating nipple 636.02.
- 6. Disconnect the pump set from the power supply again and make sure it cannot be started up unintentionally.
- 7. Fit screw plug 903.46 with joint ring 411.46.

7.2.4 Coolant

The pump set's cooling system is filled at the factory with an environmentally friendly water/propylene glycol mixture. The coolant additive prevents corrosion in the cooling system and provides frost protection down to -20 °C. The coolant also lubricates the mechanical seals.

7.2.4.1 Coolant quality

	CAUTION
	Incorrect coolant mixture
	Corrosion of the cooling system ▷ Always use the exact coolant mixture.

Water/propylene glycol mixture with corrosion inhibitors for frost protection down to -20 °C (e.g. Tyfocor L²¹)/water mixture, mixing ratio 62:38)

7.2.4.2 Coolant quantity

Table 29: Coolant quantity in litres

Size	Impeller type	Installation types K and D				Installation type H			
		Motor							
		18 2.F	30 2.F	55 4.F	55 2.F	18 2.F	30 2.F	55 4.F	55 2.F
		22 2.F	37 2.F	31 6.F	65 2.F	22 2.F	37 2.F	31 6.F	65 2.F
		26 2.F	30 4.F	37 6.F	75 2.F	26 2.F	30 4.F	37 6.F	75 2.F
		15 4.F	37 4.F	30 8.F	65 4.F	15 4.F	37 4.F	30 8.F	65 4.F
		18 4.F	22 6.F		75 4.F	18 4.F	22 6.F		75 4.F
		22 4.F	30 6.F		45 6.F	22 4.F	30 6.F		45 6.F
		15 6.F	15 8.F		55 6.F	15 6.F	15 8.F		55 6.F
		18 6.F	18 8.F		37 8.F	18 6.F	18 8.F		37 8.F
	22 8.F		45 8.F		22 8.F		45 8.F		
[I]									
40-252	F, K, S	12,3	-	-	-	14,7	-	-	-
80-252	F	12,3	-	12,3	-	14,7	-	14,7	-
80-253	E, F, K	12,3	-	12,3	-	14,7	-	14,7	-
80-315	D	12,9	20,3	33,5	37,8	15,3	22,9	35,4	39,3
80-315	K	12,9	20,3	27,3	31,6	15,3	22,9	29,2	33,1
80-317	D	12,9	20,3	-	-	15,3	22,9	-	-
80-317	F	12,9	20,3	27,3	31,6	15,3	22,9	29,2	33,1
100-253	D	12,3	-	12,3	-	14,7	-	14,7	-
100-253	E, K	12,3	-	12,3	-	14,7	-	14,7	-
100-254	F, K	12,3	-	12,3	-	14,7	-	14,7	-
100-315	D	12,9	20,3	33,5	37,8	15,3	22,9	35,4	39,3
100-316	D	12,9	20,3	-	-	15,3	22,9	-	-
100-316	F, K	12,9	20,3	27,3	31,6	15,3	22,9	29,2	33,1
100-317	E	12,9	20,3	-	-	15,3	22,9	-	-
100-400	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
100-401	E, F, K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
100-403	D	-	26,9	32,1	36,4	-	29,0	33,9	37,8
150-253	D	12,3	-	12,3	-	14,7	-	14,7	-
150-315	D	12,9	20,3	-	-	15,3	22,9	-	-
150-315	F	12,9	20,3	27,3	31,6	15,3	22,9	29,2	33,1
150-317	E, K	12,9	20,3	27,3	31,6	15,3	22,9	29,2	33,1

²¹ Made by: Metasol Chemie, Magdeburg, Germany

Size	Impeller type	Installation types K and D				Installation type H			
		Motor							
		18 2.F	30 2.F	55 4.F	55 2.F	18 2.F	30 2.F	55 4.F	55 2.F
		22 2.F	37 2.F	31 6.F	65 2.F	22 2.F	37 2.F	31 6.F	65 2.F
		26 2.F	30 4.F	37 6.F	75 2.F	26 2.F	30 4.F	37 6.F	75 2.F
		15 4.F	37 4.F	30 8.F	65 4.F	15 4.F	37 4.F	30 8.F	65 4.F
		18 4.F	22 6.F		75 4.F	18 4.F	22 6.F		75 4.F
		22 4.F	30 6.F		45 6.F	22 4.F	30 6.F		45 6.F
		15 6.F	15 8.F		55 6.F	15 6.F	15 8.F		55 6.F
		18 6.F	18 8.F		37 8.F	18 6.F	18 8.F		37 8.F
	22 8.F		45 8.F		22 8.F		45 8.F		
[I]									
150-317	D	12,9	20,3	27,3	31,6	15,3	22,9	29,2	33,1
150-400	D	-	26,9	34,4	38,7	-	29,0	36,3	40,2
150-400	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
150-401	D	-	26,9	34,4	38,7	-	29,0	36,3	40,2
150-401	E, F	-	26,9	32,1	36,4	-	29,0	33,9	37,8
150-403	D	-	26,9	32,1	36,4	-	29,0	33,9	37,8
150-403	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
151-403	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
200-315	D	12,9	20,3	-	-	15,3	22,9	-	-
200-315	K	12,9	20,3	-	-	15,3	22,9	-	-
200-316	K	12,9	20,3	-	-	15,3	22,9	-	-
200-317	K	12,9	20,3	27,3	31,6	15,3	22,9	29,2	33,1
200-318	K	12,9	20,3	27,3	31,6	15,3	22,9	29,2	33,1
200-400	D	-	26,9	34,4	38,7	-	29,0	36,3	40,2
200-401	E	-	26,9	32,1	36,4	-	29,0	33,9	37,8
200-402	D	-	26,9	32,1	36,4	-	29,0	33,9	37,8
200-402	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
200-403	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
200-405	D	-	26,9	32,1	36,4	-	29,0	33,9	37,8
250-400	D	-	26,9	34,4	38,7	-	29,0	36,3	40,2
250-401	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
250-402	D	-	26,9	32,1	36,4	-	29,0	33,9	37,8
250-403	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
300-400	D	-	26,9	34,4	38,7	-	29,0	36,3	40,2
300-400	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
300-401	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8
300-402	D	-	26,9	32,1	36,4	-	29,0	33,9	37,8
300-403	K	-	26,9	32,1	36,4	-	29,0	33,9	37,8

7.2.4.3 Changing the coolant

	! WARNING Coolants and supplies which pose a health hazard or are hot Hazard to persons and the environment! ▷ When draining the coolant take appropriate measures to protect persons and the environment. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
	! WARNING Coolant spurting out due to excessive pressure in the cooling liquid reservoir at operating temperature! Risk of injuries by parts flying off and escaping cooling liquid! ▷ Open the screw plug of the cooling liquid reservoir very carefully.

Draining the coolant

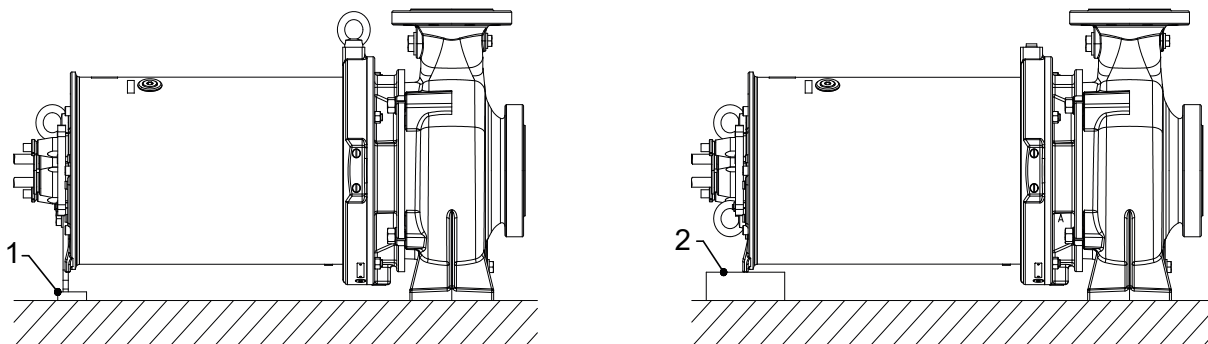
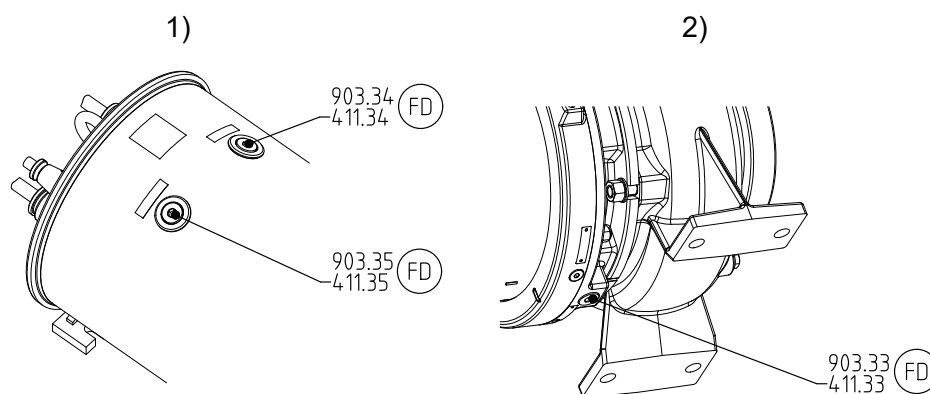


Fig. 47: Support options for placing down the pump

1	Support foot (for horizontal installation)
2	Wooden support


Fig. 48: Screw plugs

1	Coolant filler plug (903.34) and vent plug (903.35)
2	Coolant drain plug (903.33)

Table 30: Symbols key

Symbol	Description
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

✓ The pump set has been placed in a horizontal position.

1. Place a suitable container under screw plug 903.33. (Observe the specified cooling liquid quantity.)
2. Unscrew both screw plugs 903.34/903.35 with joint rings 411.34/411.35 at the coolant filler openings.
3. Undo screw plug 903.33 with joint ring 411.33 and drain off the coolant.



NOTE

The coolant is bright and transparent in appearance. A slight discolouration, caused by the running-in process of new mechanical seals or small amounts of leakage from the fluid handled, has no detrimental effect. However, if the coolant is severely contaminated by the fluid handled, this suggests a defect at the mechanical seals.

Topping up the coolant



CAUTION

Filling in coolant in a position that is different to the installation type

Insufficient cooling
Larger coolant quantity
Higher pressure in the cooling system
Leakages

- ▷ Always fill in the coolant with the pump set in the position of its installation type.

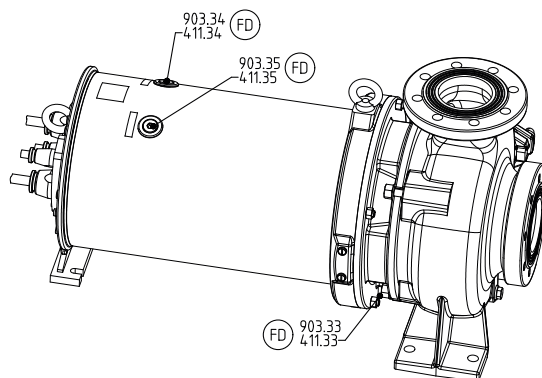


Fig. 49: Position during filling – installation type H

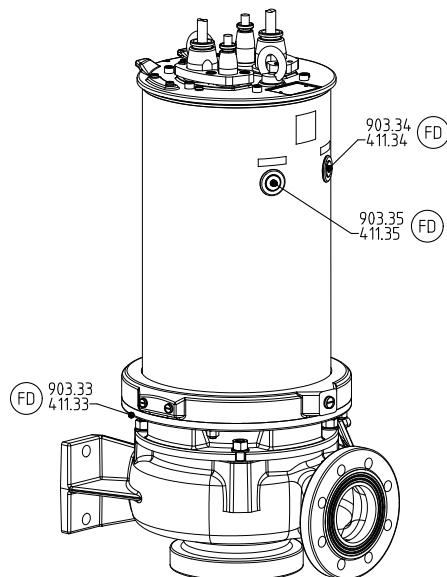


Fig. 50: Position during filling – installation types K and D

✓ The pump set has been placed in a horizontal or vertical position in accordance with its installation type.

1. Screw in screw plugs 903.33 with joint ring 411.33.
2. Fill coolant through the filler opening (screw plug 903.34) until it overflows.
3. Screw in both screw plugs 903.34/903.35 with new joint rings 411.34/411.35.

Table 31: Symbols key

Symbol	Description
(FD)	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

7.3 Drainage/cleaning

	⚠ WARNING
	Fluids handled, consumables and supplies which are hot and/or pose a health hazard Hazard to persons and the environment! ▷ Collect and properly dispose of flushing fluid and any fluid residues. ▷ Wear safety clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump set.
(⇒ Section 11, Page 136)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

	⚠ WARNING
	Unqualified personnel performing work on the pump (set) Risk of injury! ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.
	⚠ WARNING
	Hot surface Risk of injury! ▷ Allow the pump set to cool down to ambient temperature.
	⚠ WARNING
	Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

Observe the safety instructions and information.

For dismantling and reassembly observe the general assembly drawing.

In the event of damage you can always contact KSB Service.

	⚠ DANGER
	Insufficient preparation of work on the pump (set) Risk of injury! ▷ Properly shut down the pump set. ▷ Close the shut-off elements in the suction line and discharge line. ▷ Drain the pump and release the pump pressure. ▷ Shut off any auxiliary feed lines. ▷ Allow the pump set to cool down to ambient temperature.

	⚠ WARNING
	Components with sharp edges Risk of cutting or shearing injuries! ▷ Always use appropriate caution for installation and dismantling work. ▷ Wear work gloves.

7.4.2 Preparing the pump set

7.4.2.1 Preparing the pump set (installation type K)

- ✓ The pump set has been removed from the pump sump.
- ✓ The pump set has been cleaned. (⇒ Section 7.3, Page 86)
 1. Interrupt the power supply and make sure it cannot be switched on again unintentionally.

7.4.2.2 Preparing the pump set (for installation types D and H only)

7.4.2.2.1 Separating the pump from the piping

- ✓ The pump set has been switched off properly.
- ✓ The shut-off elements in the suction line and discharge line have been closed.
- ✓ Any auxiliary connections have been closed.
- ✓ The pump has been drained and the pump pressure has been released.
 1. Disconnect any auxiliary feed lines.
 2. Remove the discharge nozzle and suction nozzle from the piping.

	NOTE
	After the pump set has been dismantled, the suction casing should be cleaned with water. Suitable protective clothing is recommended.

7.4.2.2.2 Removing the pump set from the piping

	⚠ WARNING
	Pump set tilting Risk of squashing hands and feet! ▷ Suspend or support the pump set.

- ✓ The pump set has been disconnected from the piping.
(⇒ Section 7.4.2.2.1, Page 87)
 1. Suspend the pump set as specified for transport.
 2. At the foundation, undo the fastening bolts of the pump foot or soleplate, depending on the type of installation.

7.4.2.2.3 Removing the back pull-out unit

For pump casing maintenance work only, the coolant does not need to be drained. The back pull-out unit is a fully sealed system.

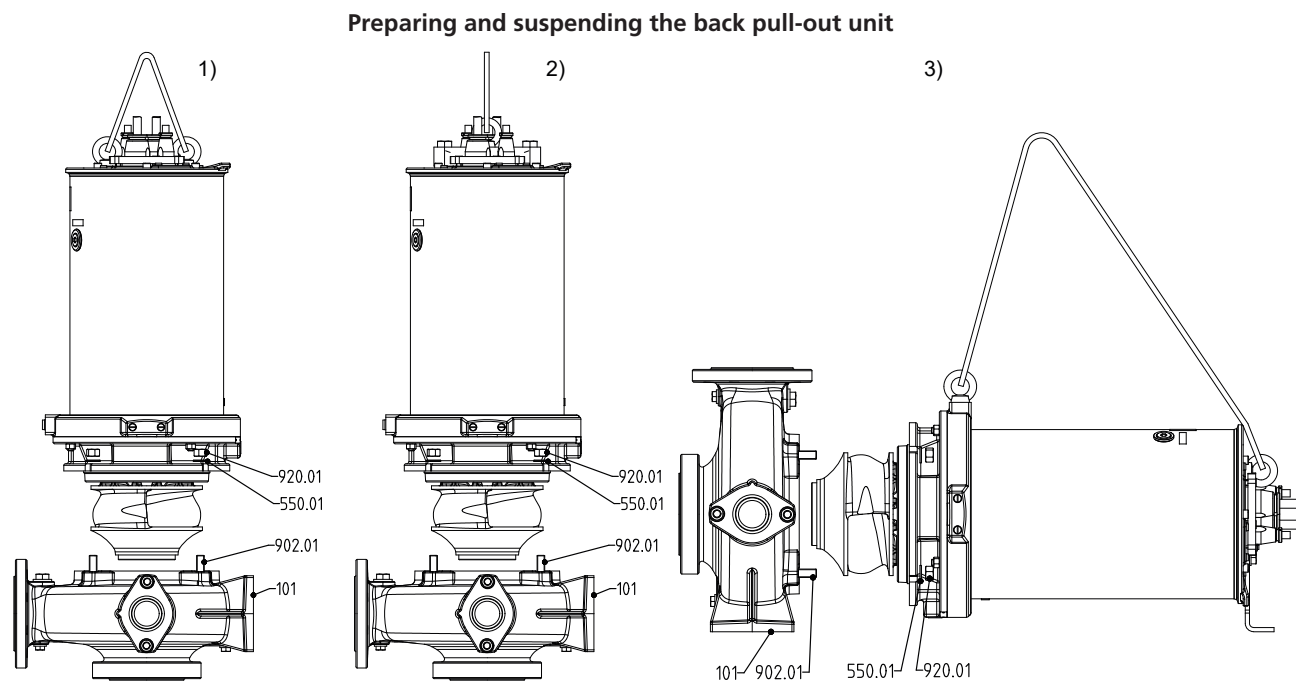


Fig. 51: Suspending the back pull-out unit

1	Installation type K with guide wire arrangement and installation type D
2	Installation type K with guide rail arrangement
3	Installation type H

Preparing installation type K / guide wire arrangement:

1. Remove screw plug 903.58. Screw a second eyebolt 900 or a suitable swivel eyebolt into motor housing cover 812.

Preparing installation type K / guide rail arrangement:

1. Unscrew and remove eyebolt 900.04 from strip 575.
2. Remove screw plug 903.56 from the middle of strip 575.
3. Screw eyebolt 900.04 into this threaded hole.

Option with bail:

- ✓ Opening of suspension arrangement: not centred

1. Undo nuts 920.13. Remove bail 571.
2. Screw suitable (swivel) eyenuts onto studs 902.13.

- ✓ Opening of suspension arrangement: centred

1. Bail 571 does not need to be removed.

Preparing installation type D

1. Attach lifting equipment to the two eyebolts 900 provided.

Removing the back pull-out unit

1. Undo screwed connections 902.01 and 920.01. Pull the complete back pull-out unit out of pump casing 101.
2. Place the back pull-out unit in a safe and dry assembly area. Secure it against tipping over or rolling off.

7.4.3 Dismantling the pump section

Dismantle the pump section in accordance with the relevant general assembly drawing.

7.4.3.1 Removing the impeller

- ✓ The cooling liquid has been drained.
- ✓ The back pull-out unit has been removed.
- 1. Undo and remove impeller fastening screw 914.10.
The impeller/shaft connection is a tapered fit.
- 2. For dismantling the impeller, a jacking thread is provided at the impeller hub.
Screw in the forcing screw and remove the impeller.



NOTE

The forcing screw is not included in the scope of supply. It can be ordered separately from KSB.

Table 32: Forcing screws for pulling off the impeller

Size	Impeller type	Forcing screw	
		Thread	Code
40-252	F, K, S	M16	ADS 8
80-252	F	M16	ADS 8
80-253	E, F, K	M20	ADS 2
80-315	D	M24	ADS 5
80-315	K	M20	ADS 2
80-317	D	M20	ADS 2
80-317	F	M20	ADS 2
100-253	D	M16	ADS 3
100-253	E, K	M20	ADS 2
100-254	F, K	M16	ADS 8
100-315	D	M24	ADS 5
100-316	D	M20	ADS 2
100-316	F, K	M20	ADS 2
100-317	E	M20	ADS 2
100-400	K	M24	ADS 5
100-401	E, F, K	M24	ADS 5
100-403	D	M24	ADS 5
150-253	D	M16	ADS 3
150-315	D	M20	ADS 4
150-315	F	M20	ADS 2
150-317	E, K	M20	ADS 2
150-317	D	M20	ADS 4
150-400	D	M24	ADS 5
150-400	K	M24	ADS 5
150-401	D	M24	ADS 5
150-401	E, F	M24	ADS 5
150-403	D	M24	ADS 5
150-403	K	M24	ADS 5
151-403	K	M24	ADS 5
200-315	D	M20	ADS 4
200-315	K	M20	ADS 2
200-316	K	M20	ADS 2
200-317	K	M20	ADS 2
200-318	K	M20	ADS 2
200-400	D	M24	ADS 5
200-401	E	M24	ADS 5

Size	Impeller type	Forcing screw	
		Thread	Code
200-402	D	M24	ADS 5
200-402	K	M24	ADS 5
200-403	K	M24	ADS 5
200-405	D	M24	ADS 5
250-400	D	M24	ADS 5
250-401	K	M24	ADS 5
250-402	D	M24	ADS 9
250-403	K	M24	ADS 5
300-400	D	M24	ADS 5
300-400	K	M24	ADS 5
300-401	K	M24	ADS 5
300-402	D	M24	ADS 9
300-403	K	M24	ADS 5

7.4.3.2 Dismantling the mechanical seal

Dismantle the mechanical seal in accordance with the general arrangement drawings.

7.4.3.2.1 Removing the 4STK mechanical seal

The mechanical seal is a double cartridge seal. It can be installed and removed as a complete unit.

Two threaded holes of size M6 are provided at the mechanical seal for attaching a removal tool or puller. To protect the threaded holes during operation they are closed with grub screws.

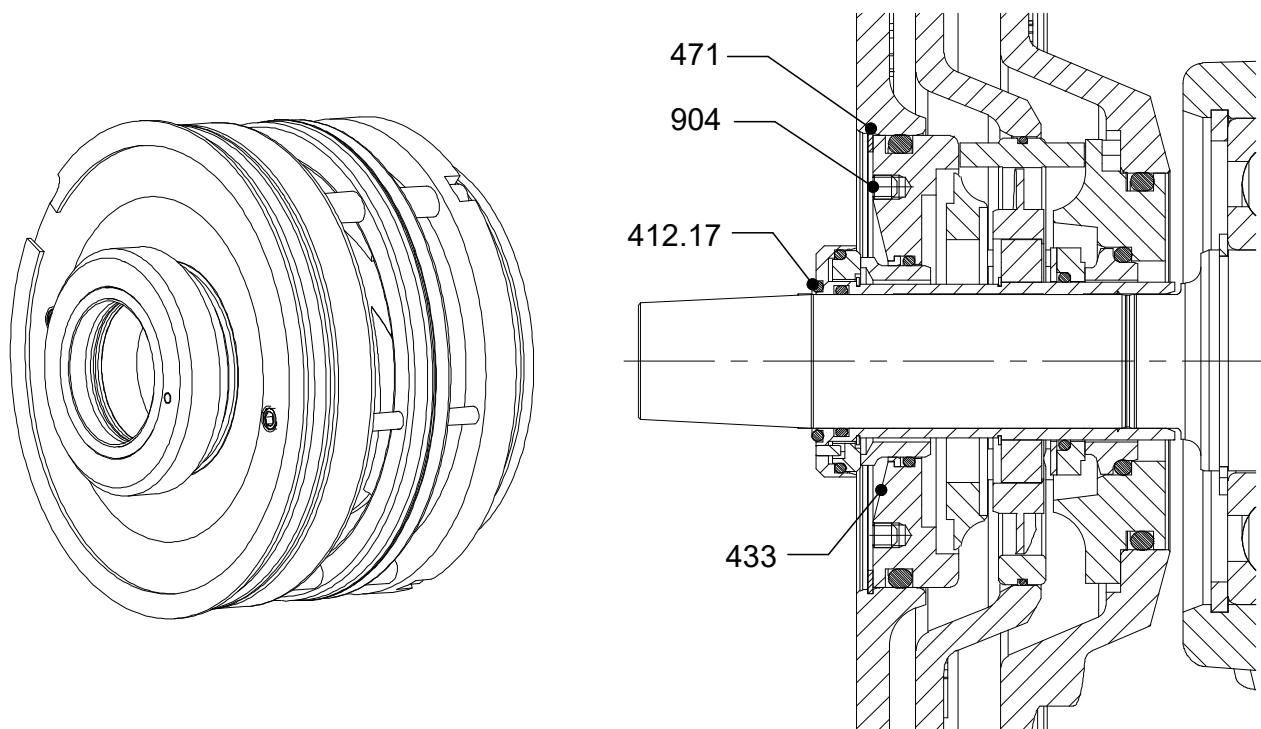


Fig. 52: Installing and removing the mechanical seal

- ✓ The back pull-out unit and impeller have been removed.
- 1. Remove grub screws 904 from the threaded holes for the puller.
- 2. Remove clip 471 and O-ring 412.
- 3. Screw a suitable removal tool or puller into the threaded holes from which grub screws 904 have been removed.
- 4. Pull mechanical seal 433 out of the discharge cover.

7.4.3.3 Removing the wear plate (for D impeller only)

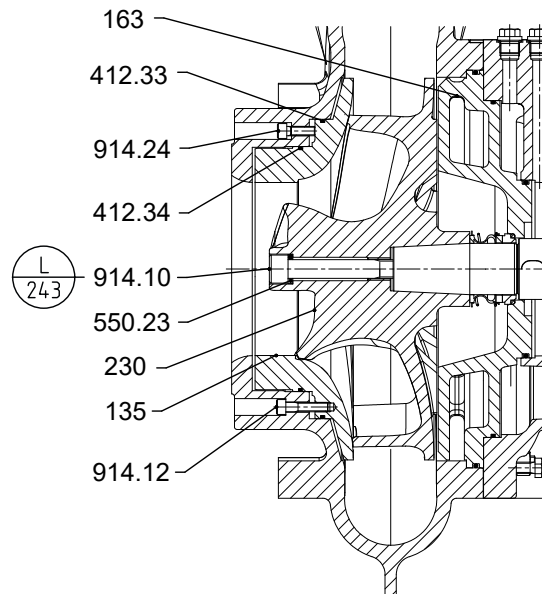


Fig. 53: Removing the wear plate

- ✓ The back pull-out unit has been separated from the pump casing.
 - ✓ The inside of the casing has been cleaned.
 - ✓ The wear plate needs to be replaced as a result of visual inspection.
1. Undo hexagon socket head cap screws 914.12.
 2. Remove wear plate 135 with O-rings 412.33/412.34.

7.4.4 Dismantling the motor section

	NOTE Special regulations apply to repair work on explosion-proof pump sets. Modifications or alteration of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.
	NOTE The motors of explosion-proof pump sets are supplied in "flameproof enclosure" type of protection. Any work on the motor section which could affect explosion protection, such as re-winding and repair work involving machining, must be inspected and approved by an approved expert or performed by the motor manufacturer. No modifications must be made to the internal configuration of the motor space. Repair work at the flameproof joints must only be performed in accordance with the manufacturer's instructions. Repair in accordance with the values specified in BS 60079-1 Table 2 is not permitted.
	NOTE Prior to dismantling the motor part, the cooling system must be drained. (⇒ Section 7.2.4.3, Page 83) .

When dismantling the motor section and the electric cables make sure that the cores/terminals are clearly marked for future reassembly.

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.
	! WARNING Components with sharp edges Risk of cutting or shearing injuries! ▸ Always use appropriate caution for installation and dismantling work. ▸ Wear work gloves.
	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.
	NOTE Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Refer to the "Flamepaths" annex for the position of the flamepaths.

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

- Sealing elements**
- O-rings
 - Check O-rings for any damage and replace by new O-rings, if required.
 - Never use O-rings that have been made by cutting an O-ring cord to size and gluing the ends together.
 - Assembly adhesives
 - Avoid the use of assembly adhesives, if possible.

Tightening torques When reassembling the pump set, tighten all screws/bolts as indicated.
In addition, secure all screwed connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).

7.5.2 Reassembling the pump section

7.5.2.1 Installing the 4STK mechanical seal

The mechanical seal is a double cartridge seal. It can be installed and removed as a complete unit.

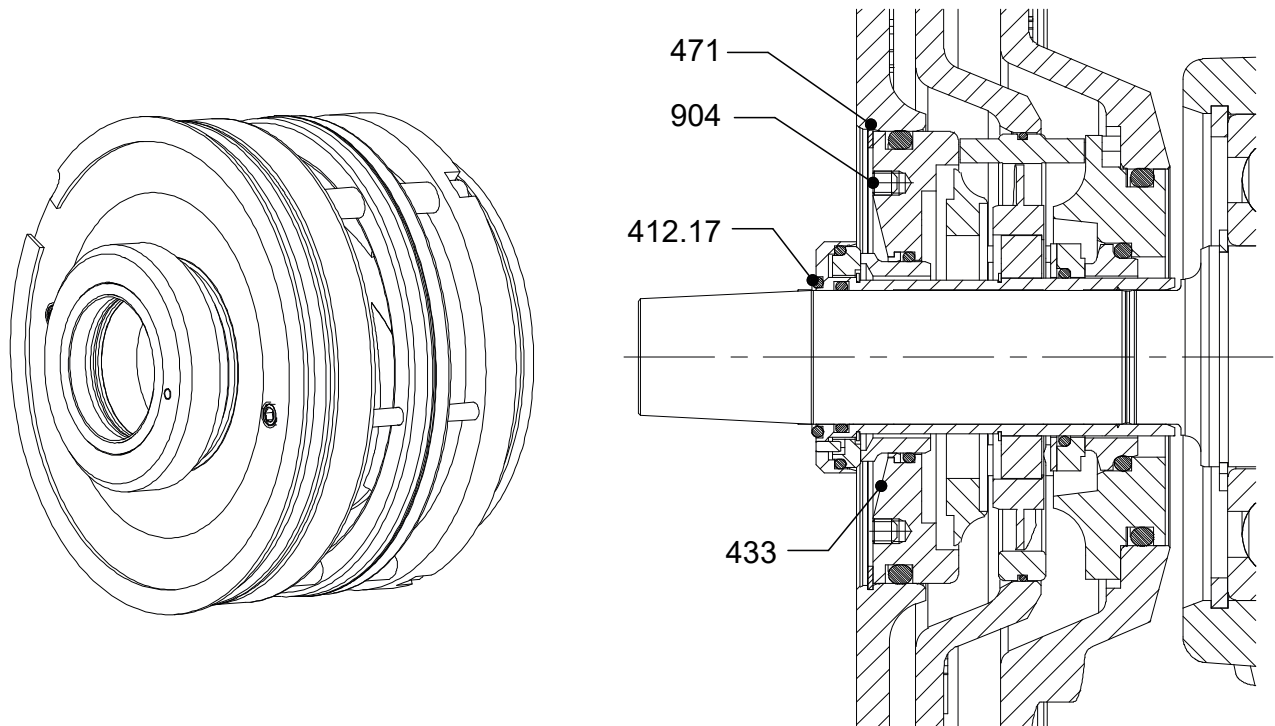


Fig. 54: Installing and removing the mechanical seal

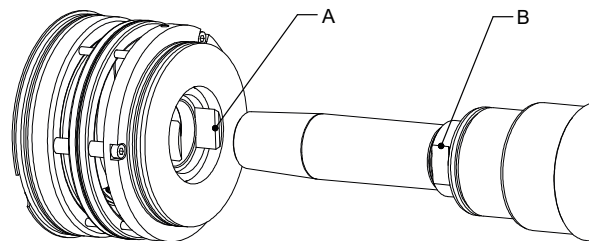


Fig. 55: A) Anti-rotation device of the mechanical seal B) Flat edge at the shaft

- The shaft surface as well as the seal faces of adjacent components must be spotlessly clean and undamaged.
- For easier installation wet the O-rings with soapy water (not oil).

	CAUTION
	Use of grease or other permanent lubricants Torque transmission impeded / overheating of and damage to the pump! ▷ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal. ▷ Use soft soap to reduce any friction caused during assembly. ▷ Never coat the mechanical seal faces with grease or oil.

- ✓ The back pull-out unit of the pump has been placed in a clean and level assembly area.
- ✓ The mechanical seal is fully assembled (except O-ring 412) and undamaged.
 1. Slide the mechanical seal onto the shaft and into the casing. To do so, turn the mechanical seal until the anti-rotation device of the mechanical seal (A) aligns with the corresponding flat edges of the shaft (B).
 2. Fit circlip 471.
 3. Close the threaded holes for the puller with grub screws 904.
 4. Slide O-ring 412 onto the shaft / insert it into the mechanical seal.

7.5.2.2 Fitting the impeller

	NOTE
	For bearing brackets with tapered fit make sure that the tapered fit of impeller and shaft is undamaged and assembled free from grease.

- ✓ The shaft and rolling element bearings have been properly installed.
- ✓ The mechanical seals have been properly installed.
 1. Slide impeller 230 onto the shaft end.
 2. Apply thread-locking agent Loctite 243 to the thread of the impeller screw.
 3. Screw in impeller screw 914.10 and disc 550.23 if any. Tighten with a torque wrench. Observe the tightening torques depending on the bolt/screw materials (⇒ Section 7.6, Page 103) .

Table 33: Tightening torques for the impeller screws

Size	Impeller type	Thread	Tightening torque
			[Nm]
40-252	F, K, S	M10	35
80-252	F	M10	35
80-253	E, F, K	M16	150
80-315	D	M20	290
80-315	K	M16	150
80-317	D	M16	150
80-317	F	M16	150
100-253	D	M10	35
100-253	E, K	M16	150
100-254	F, K	M10	35
100-315	D	M20	290
100-316	D	M16	150
100-316	F, K	M16	150
100-317	E	M16	150
100-400	K	M20	290
100-401	E, F, K	M20	290

Size	Impeller type	Thread	Tightening torque
			[Nm]
100-403	D	M20	290
150-253	D	M10	35
150-315	D	M16	150
150-315	F	M16	150
150-317	E, K	M16	150
150-317	D	M16	150
150-400	D	M20	290
150-400	K	M20	290
150-401	D	M20	290
150-401	E, F	M20	290
150-403	D	M20	290
150-403	K	M20	290
151-403	K	M20	290
200-315	D	M16	150
200-315	K	M16	150
200-316	K	M16	150
200-317	K	M16	150
200-318	K	M16	150
200-400	D	M20	290
200-401	E	M20	290
200-402	D	M20	290
200-402	K	M20	290
200-403	K	M20	290
200-405	D	M20	290
250-400	D	M20	290
250-401	K	M20	290
250-402	D	M20	290
250-403	K	M20	290
300-400	D	M20	290
300-400	K	M20	290
300-401	K	M20	290
300-402	D	M20	290
300-403	K	M20	290

7.5.2.3 Installing the back pull-out unit

7.5.2.3.1 Fitting the casing wear ring with axial clearance

	NOTE After casing wear rings with a radial clearance have been fitted in pump casing 101, they have the required inside diameter and do not need to be readjusted.
	NOTE The axial clearance must be adjusted quickly before the Loctite hardens.

1. Apply Loctite 2701 to the outside diameter of the casing wear ring.
2. Use a rubber mallet to insert casing wear ring 502 into pump casing 101 as far as it will go.
3. Insert the complete back pull-out unit into the pump casing.
4. Evenly tighten bolted/screwed connection 902.01 and 920.01 and/or 914.74 between pump casing and discharge cover.

	CAUTION Axial displacement of the rotor Damage to shaft seal and bearings! ► Always adjust and check the axial clearance with the pump set in a vertical position.
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5. To lift the pump set suspend it from the lifting tackle as shown.

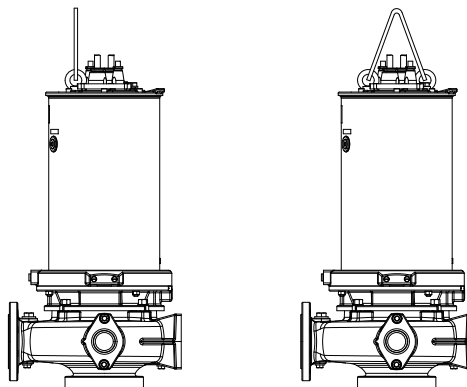


Fig. 56: Suspending the pump set

7.5.2.3.2 Adjusting the axial clearance at the casing wear ring

1. Use the rubber mallet or grub screw 904.01 to push casing wear ring 502 close to impeller 230.
2. Adjust the axial clearance to $A = 0.3 \pm 0.1$ mm.

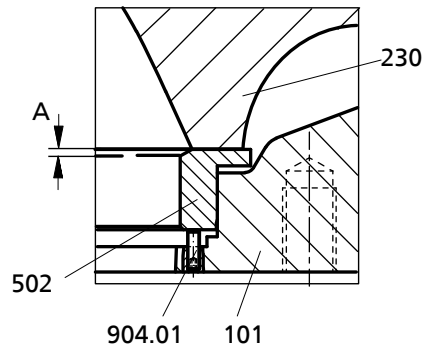


Fig. 57: Fitting the casing wear ring

7.5.2.3.3 Fitting the wear plate (for D impeller only)

- ✓ The shaft, rolling element bearings, mechanical seal and impeller have been assembled properly.

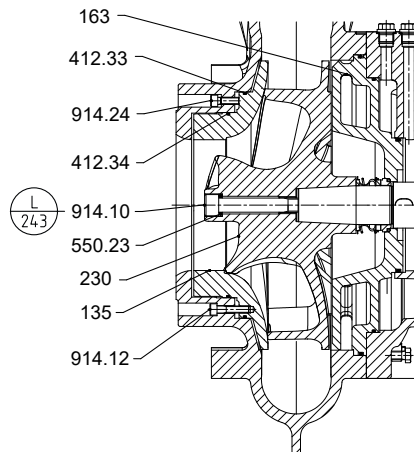


Fig. 58: Fitting the wear plate

1. Equip wear plate 135 with two new O-rings 412.33 and 412.34.
2. Insert wear plate 135 into pump casing 101.
3. Fasten wear plate 135 to pump casing 101 with hexagon socket head cap screws 914.12.
4. Adjust the clearance between impeller 230 and wear plate 135 by tightening and loosening screws 914.12 and 914.24.
 - ⇒ Screw 914.24 presses the wear plate in the direction of the impeller.
 - ⇒ The clearance equals 0.3 ± 0.1 mm (measured on the suction side from the outer surface of the impeller vane to the wear plate).
5. Insert the complete back pull-out unit into the pump casing.
6. Evenly tighten bolted/screwed connection 920.01 and 902.01 and/or 914.74 between pump casing and bearing housing.

7.5.2.3.4 Adjusting the wear plate (for D impeller only)

1. Insert the complete back pull-out unit into the pump casing.
2. Evenly tighten bolted/screwed connection 920.01 and 902.01 and/or 914.74 between pump casing and bearing housing.

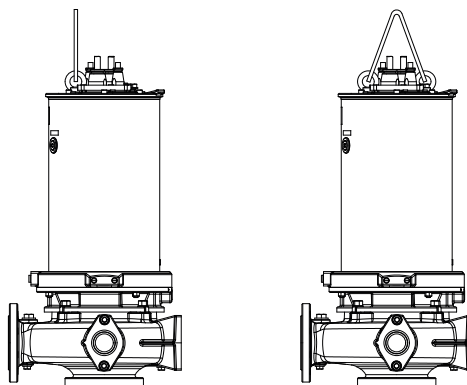


Fig. 59: Suspending the pump set

- ✓ The pump set has been suspended and lifted as illustrated.

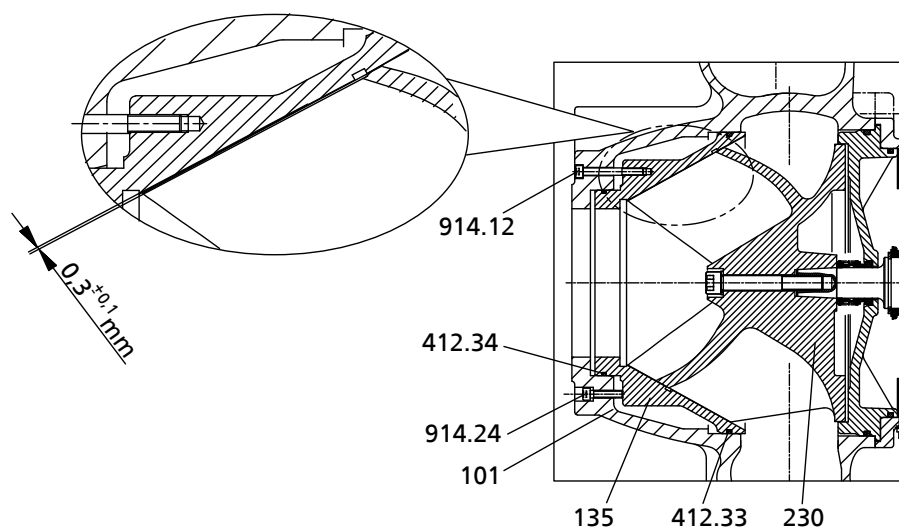


Fig. 60: Adjusting the wear plate

1. Adjust the clearance between impeller 230 and wear plate 135 by tightening and loosening screws 914.12 and 914.24.
 - ⇒ Screw 914.24 pushes the wear plate in the direction of the impeller.
 - ⇒ With a D impeller (single-vane impeller), the clearance equals 0.3 ± 0.1 mm (measured on the suction side from the outer surface of the impeller vane to the wear plate).
 - ⇒ With a D impeller (multi-vane impeller), the clearance equals 0.3 ± 0.1 mm (measured at the outer diameter from the outer surface of the impeller vane to the wear plate).

7.5.2.3.5 Reassembling the motor section

	NOTE Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof pumps. Observe the flamepath positions specified in the Annex (Flamepaths on explosion-proof motors). (⇒ Section 9.4, Page 121) Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).
	 DANGER Wrong screws/bolts Explosion hazard! ▷ Always use the original screws/bolts for assembling an explosion-proof pump set. ▷ Never use screws/bolts of different dimensions or of a lower property class.

7.5.3 Leak testing

After reassembly, the mechanical seal area / cooling system and the motor must be tested for leakage.

7.5.3.1 Checking the mechanical seal area / cooling system

Observe the following values for leak testing:

- **Test medium:** compressed air
- **Test pressure:** 1 bar
- **Test duration:** 5 minutes
- **Opening:** coolant filler plug (903.34), vent plug (903.35) or coolant drain plug (903.33)
 - Coolant filler opening or coolant drainage opening

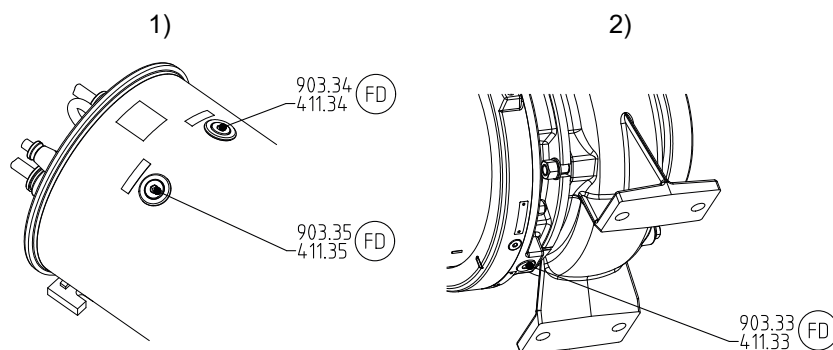


Fig. 61: Screw plugs

1	Coolant filler plug (903.34) and vent plug (903.35)
2	Coolant drain plug (903.33)
FD	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

1. Unscrew and remove any one of the screw plugs and the corresponding joint ring of the cooling system.
2. Screw the testing device tightly into the G½ plug thread.
3. Carry out the leak test with the values specified above.
 - ⇒ The pressure must not drop during the test period.
 - ⇒ If the pressure does drop, check the sealing elements and screwed connections.
4. Repeat the leak test if required.
5. Remove the testing device.
6. After the leak test, top up the coolant.
7. Re-insert and tighten the corresponding screw plug and joint ring.

7.5.3.2 Checking the motor for leakage

Observe the following values for leak testing:

- **Test medium:** compressed air
- **Test pressure:** 0.8 bar maximum
- **Test duration:** 2 minutes

Opening: control opening for mechanical seal leakage (903.02)

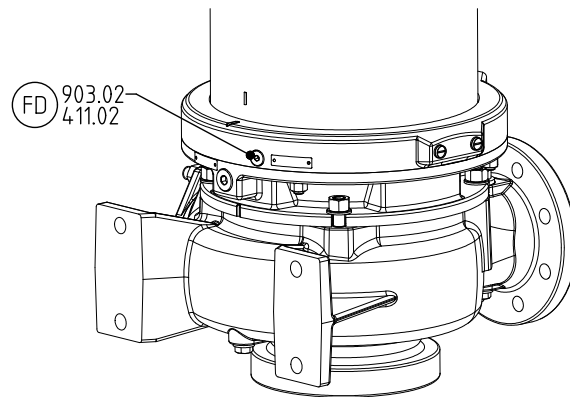


Fig. 62: Leak testing the motor

Table 34: Symbols key

Symbol	Description
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

1. Remove screw plug 903.02 and joint ring 411.02.
2. Screw the testing device tightly into the G 1/4 plug thread.
3. Carry out the leak test with the values specified above.
 - ⇒ The pressure must not drop during the test period.
 - ⇒ If the pressure does drop, check the sealing elements and screwed connections.
4. Repeat the leak test if required.
5. Remove the testing device.
6. Re-insert and tighten screw plug 903.02 with new joint ring 411.02.

7.5.4 Checking the connection of motor/power supply

Check the electric cables after reassembly. (⇒ Section 7.2.2, Page 73)

7.6 Tightening torques

Table 35: Tightening torques [Nm] depending on thread, material and property class

Thread	Material					
	A4-50	A4-70	A4-70	1.4462	D6-80	8.8 / C3-80
	Property class Rp 0.2 ^N / _{mm²}					
	210	250	450	450	600	640
M5	-	-	4	4	-	6
M6	-	-	7	7	-	10
M8	-	-	17	17	23	25
M10	-	-	35	35	46	50
M12	-	-	60	60	79	85
M14	-	-	90	90	121	130
M16	-	-	150	150	196	210
M20	-	-	290	290	384	410
M24	230	278	-	500	656	700
M30	460	-	-	1000	1312	1400
M42	1300	-	-	2750	3656	3900
M48	1950	-	-	4200	5625	6000

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
- Year of construction
- Motor number

Refer to the name plate for all data.

Also specify the following data:

- Part No. and description (⇒ Section 9.2, Page 107)
- 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 36: Quantity of spare parts for recommended spare parts stock²²⁾

Part No.	Description	Number of pump sets (including stand-by pump sets)						
		2	3	4	5	6 and 7	8 and 9	10 and more
80-1	Motor unit	-	-	-	1	1	2	30 %
834	Cable gland	1	1	2	2	2	3	40 %
818	Rotor	-	-	-	1	1	2	30 %
230	Impeller	1	1	1	2	2	3	30 %
502	Casing wear ring	2	2	2	3	3	4	50 %
433	Mechanical seal	2	3	4	5	6	7	90 %
322	Radial roller bearing, motor end	1	1	2	2	3	4	50 %
321	Radial ball bearing, pump end	1	1	2	2	3	4	50 %
99-9	Set of sealing elements for the motor	4	6	8	8	9	10	100 %
99-9	Set of sealing elements for the hydraulic system	4	6	8	8	9	10	100 %

²²⁾ For two years of continuous operation or 17,800 operating hours

8 Trouble-shooting

- A Pump is running, but does not deliver
- B Pump delivers insufficient flow rate
- C Excessive current/power input
- D Insufficient discharge head
- E Vibrations and noise during pump operation

Table 37: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy
-	X	X	X	X	Excessive clearance between the impeller and the casing wear ring / wear plate	Check and adjust the clearance.
-	X	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point.
-	X	-	-	-	Gate valve in the discharge line is not fully open.	Fully open the gate valve.
-	-	X	-	X	Pump running in off-design conditions (part load / overload)	Check the pump's operating data.
X	-	-	-	-	Pump and/or piping are not vented.	Installation type K: Vent by lifting the pump off the duckfoot bend and lowering it again. Installation types D/H: Vent / prime the pump via auxiliary vent connection 6D. Vent by lifting the pump off the duckfoot bend and lowering it again.
X	-	-	-	-	Pump intake clogged by deposits	Clean the intake, pump components and lift check valve.
-	X	-	X	X	Inlet line or impeller clogged	Remove deposits in the pump and/or piping.
-	-	X	-	X	Dirt/fibres in the clearance between the casing wall and impeller; sluggish rotor.	Check that the impeller can be rotated easily. If necessary clean the impeller.
-	X	X	X	X	Wear of internal components	Replace worn components by new ones.
X	X	-	X	-	Defective riser (pipe and sealing elements)	Replace defective risers. Fit new sealing elements.
-	X	-	X	X	Impermissible air or gas content in the fluid handled	Contact the manufacturer.
-	-	-	-	X	System-induced vibrations	Contact the manufacturer.
-	X	X	X	X	Wrong direction of rotation	Check the electrical connection of the motor and the control system if any.
-	-	X	-	-	Wrong supply voltage	Check the power cables. Check the cable connections.
X	-	-	-	-	Motor is not running because of lack of voltage.	Check the electrical installation. Contact the energy supplier.
X	-	X	-	-	Motor winding or power cable defective	Replace by new original KSB parts or contact KSB.
-	X	-	X	-	For star-delta starting: motor runs in star configuration only	Check star-delta contactor.
-	-	-	-	X	Defective rolling element bearing	Contact the manufacturer.
-	X	-	-	-	Water level lowered too much during operation	Check level control equipment.
X	-	-	-	-	Temperature limiter (explosion protection) has tripped the pump as a result of the permissible winding temperature being exceeded.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	-	Leakage monitoring has tripped.	Have cause determined and eliminated by qualified and trained personnel.

9 Related Documents

9.1 General overview of part numbers

Part No.	Description	Part No.	Description
23-7	Impeller body	69-14	Leakage sensor
101	Pump casing	66-2	Cooling jacket
135	Wear plate	69-6	Temperature sensor
162	Suction cover	69-8	Measurement transmitter (vibration sensor)
163	Discharge cover	811	Motor housing
164	Inspection cover	812	Motor housing cover
181	Pump stool	81-18	Cable terminal
183	Support foot	81-29	Terminal
230	Impeller	81-45	Float switch
321	Radial ball bearing	81-51	Clamping element
322	Radial roller bearing	81-59	Stator
330	Bearing bracket	818	Rotor
350	Bearing housing	82-5	Adapter
411	Joint ring	82-14	Cable with plug
412	O-ring	834	Cable gland
421	Lip seal	893	Soleplate
433	Mechanical seal	900	Bolt/screw
441	Shaft seal housing	901	Hexagon head bolt
442	Cooling insert	902	Stud
502	Casing wear ring	903	Screw plug
503	Impeller wear ring	904	Grub screw
520	Sleeve	914	Hexagon socket head cap screw
550	Disc	920	Nut
561	Grooved pin	930	Safety device
571	Bail	932	Circlip
575	Strip	970	Label/plate
596	Wire	99-17	Desiccant
59-8	Turnbuckle	99-27	Strap

Table 38: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

9.2 General arrangement drawings with list of components

9.2.1 Amarex KRT – General assembly drawing

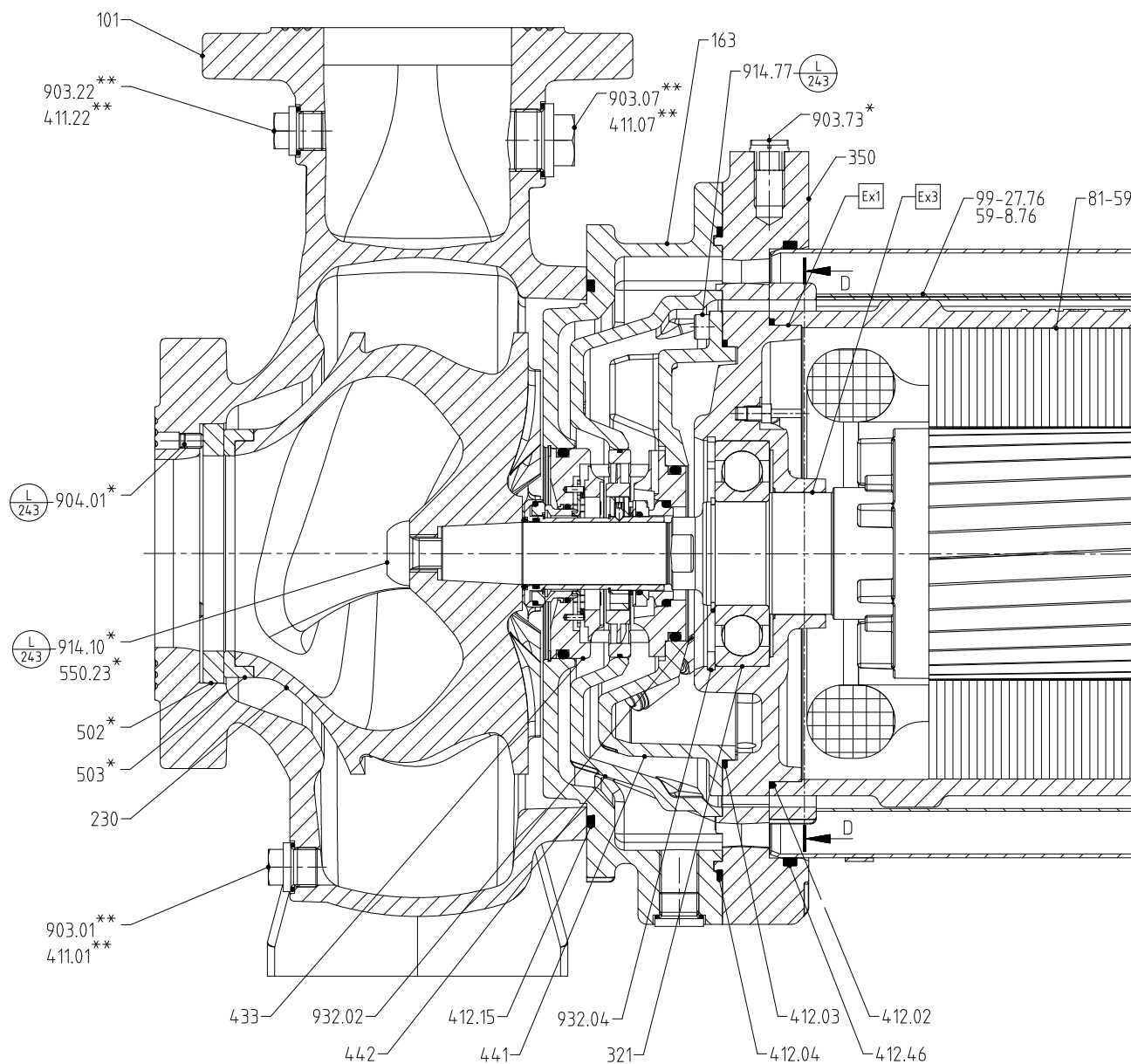


Fig. 63: General assembly drawing of Amarex KRT, part 1 of 2

*: On specific designs only

** : Only for dry installation types D and H

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

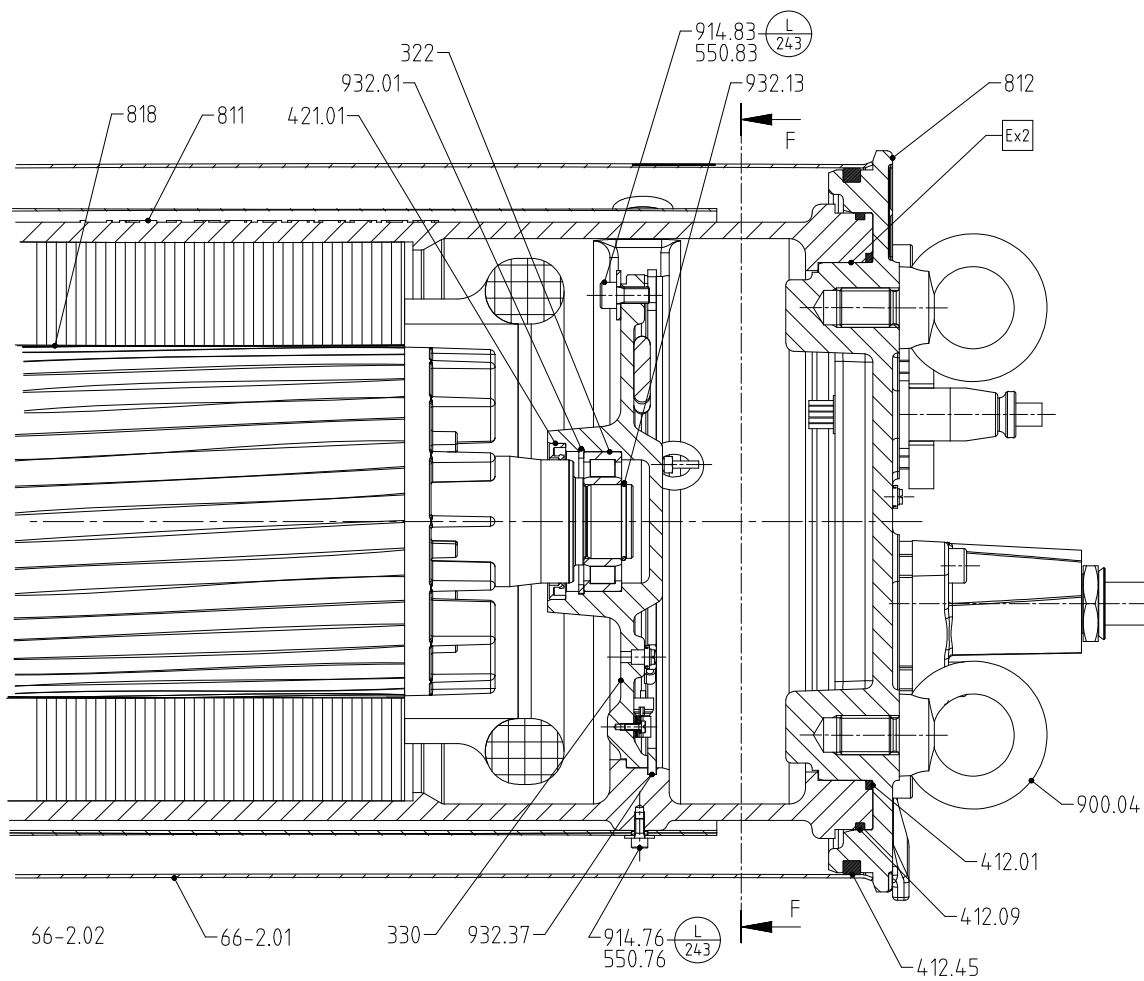


Fig. 64: General assembly drawing of Amarex KRT, part 2 of 2

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

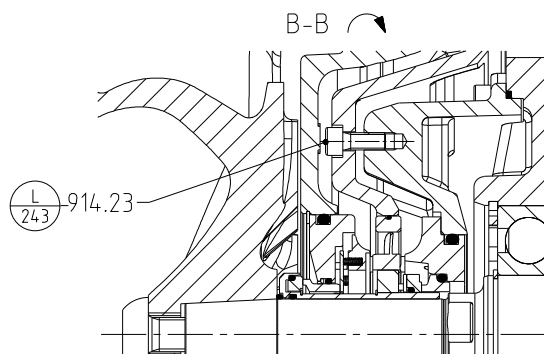


Fig. 65: General assembly drawing of Amarex KRT, mechanical seal and impeller

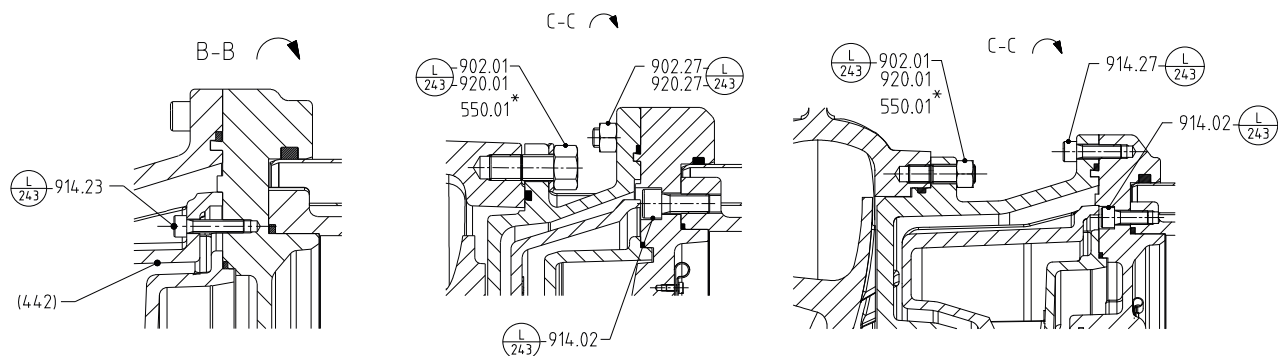


Fig. 66: General assembly drawing of Amarex KRT, fastening of cooling insert and discharge cover depending on the motor size

*: On specific designs only

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

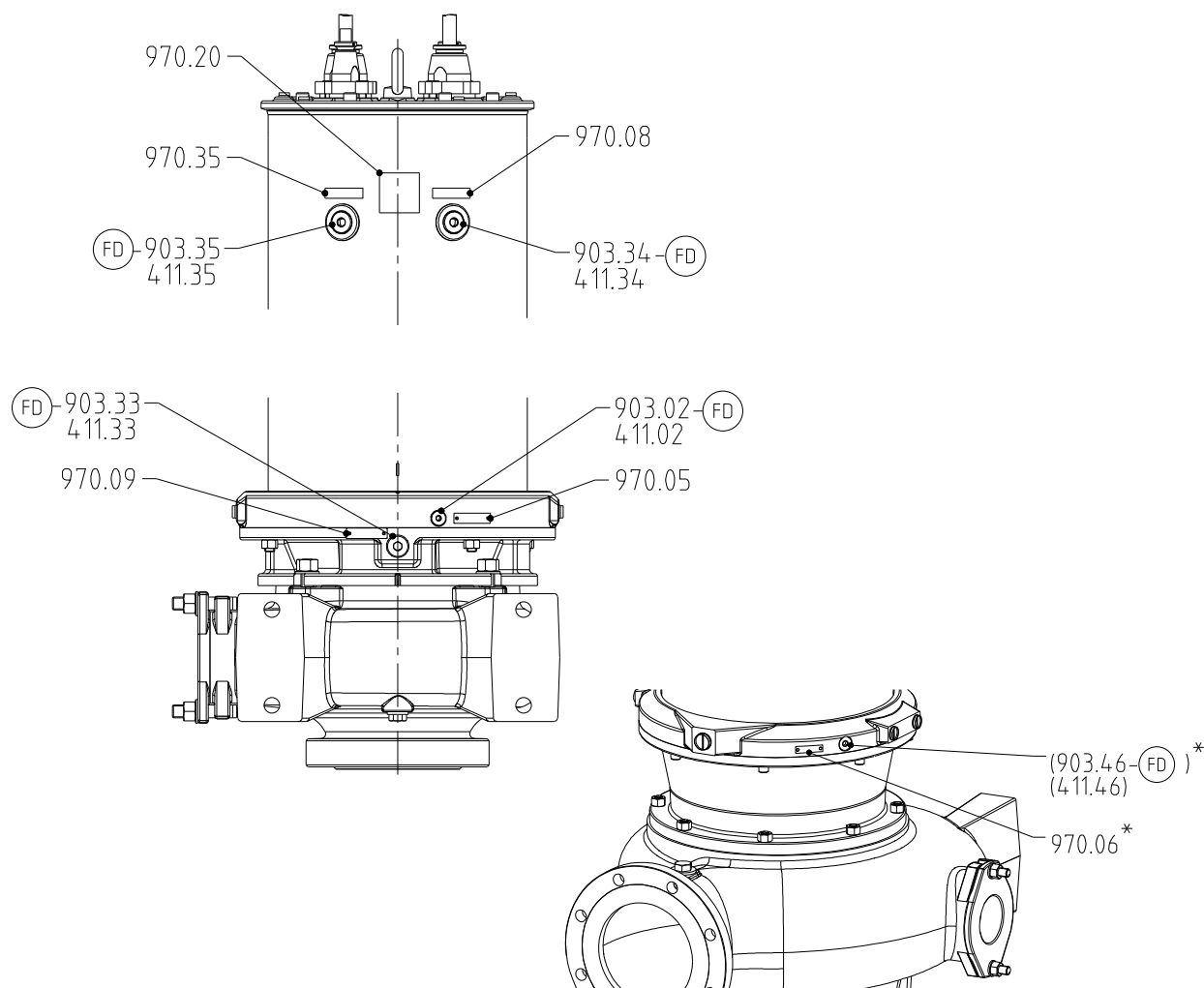


Fig. 67: General assembly drawing of Amarex KRT, filler and drain openings

*: For reinforced bearings only (⇒ Section 9.3.1, Page 114)

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

9.2.2 Amarex KRT - Motor and fastening

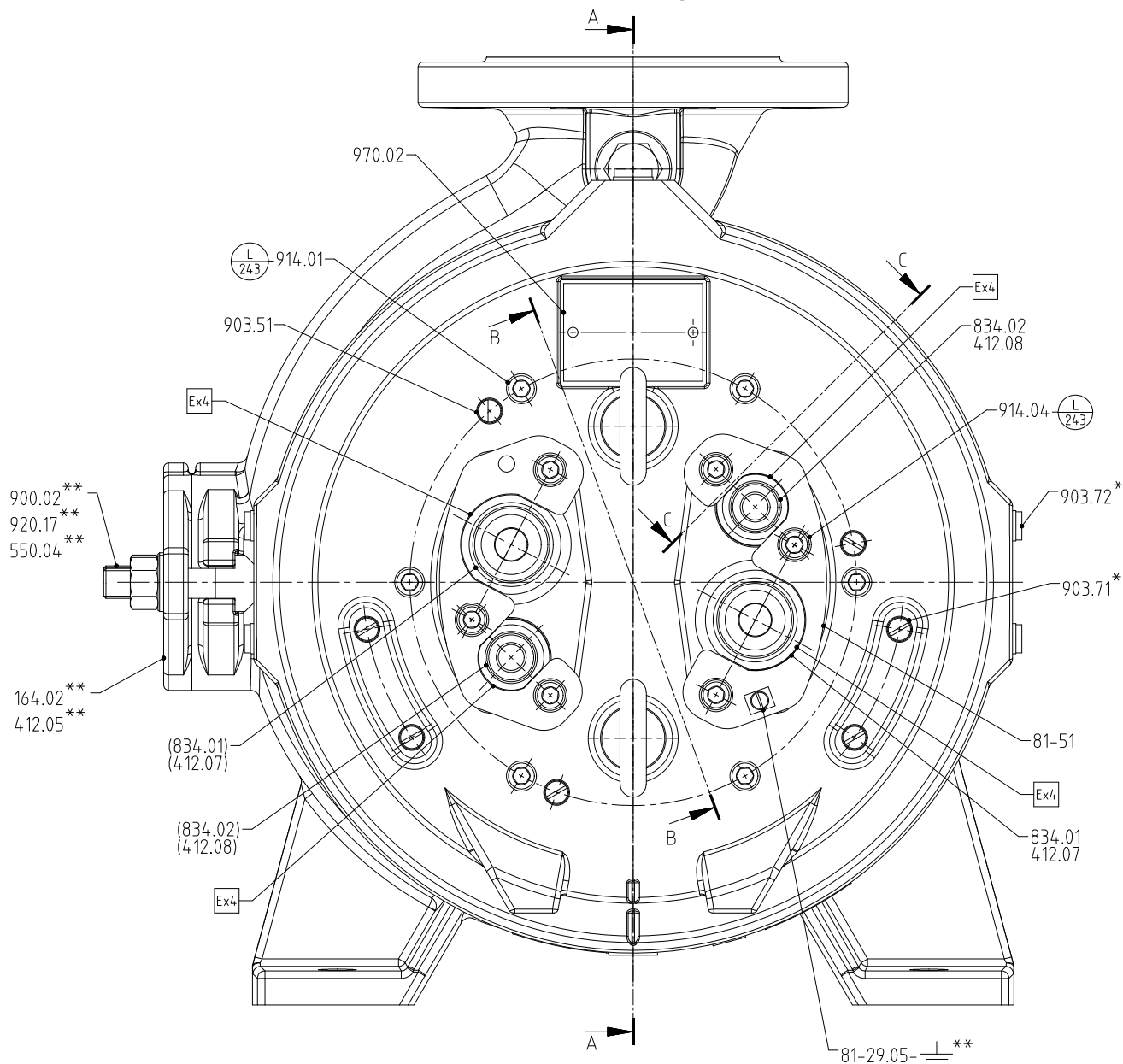


Fig. 68: Motor and fastening of cable glands

*: On specific designs only

** : Only for dry installation types D and H

Table 39: Corresponding motor sizes

Motor			
18 2.F	15 4.F	15 6.F	15 8.F
22 2.F	18 4.F	18 6.F	18 8.F
26 2.F	22 4.F	22 6.F	22 8.F
30 2.F	30 4.F	30 6.F	
37 2.F	37 4.F		

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

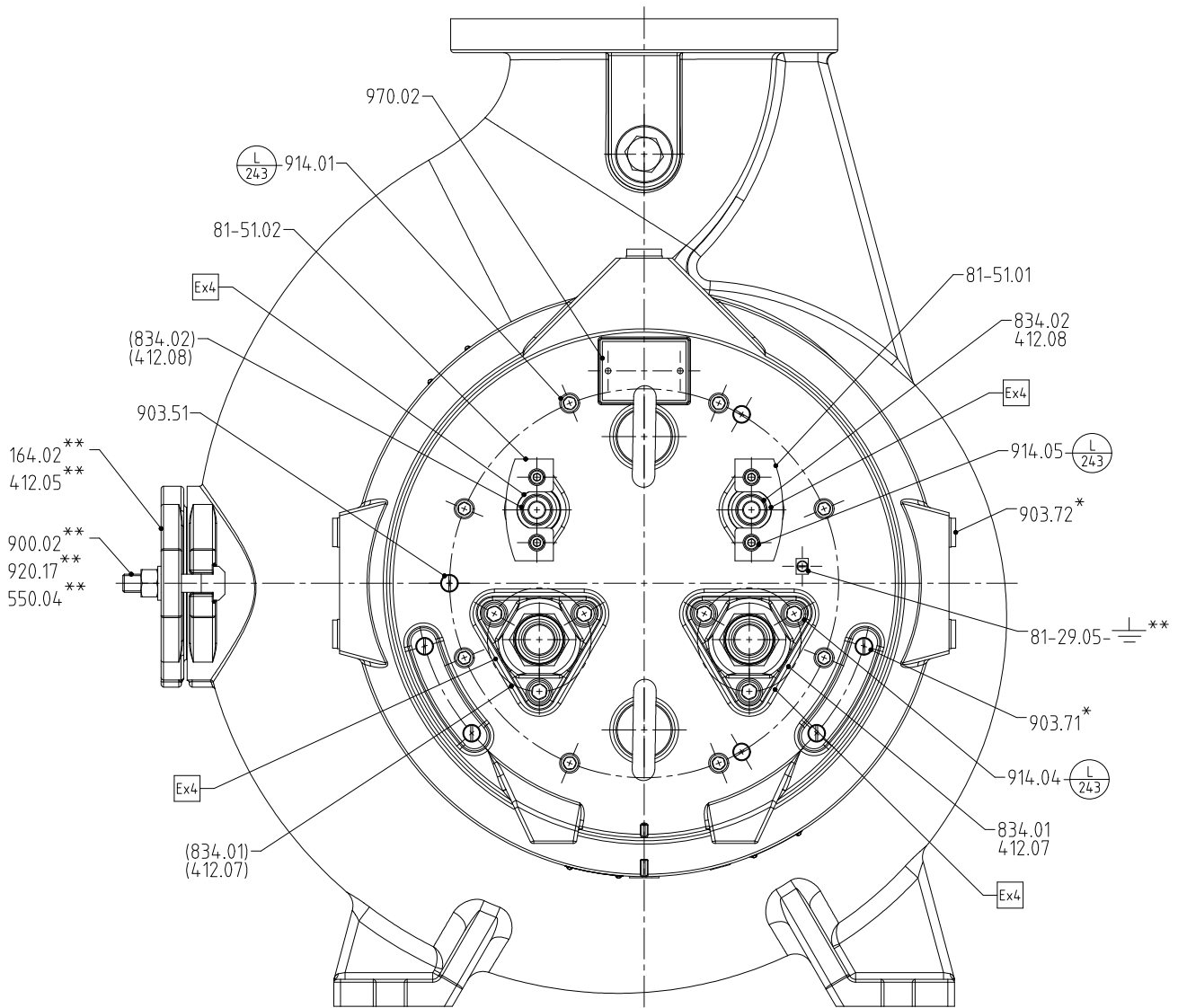


Fig. 69: Motor and fastening of cable glands

*: On specific designs only

** : Only for dry installation types D and H

Table 40: Corresponding motor sizes

Motor			
55 2.F	55 4.F	31 6.F	30 8.F
65 2.F	65 4.F	37 6.F	37 8.F
75 2.F	75 4.F	45 6.F	45 8.F
		55 6.F	

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

Bearing bracket fastening

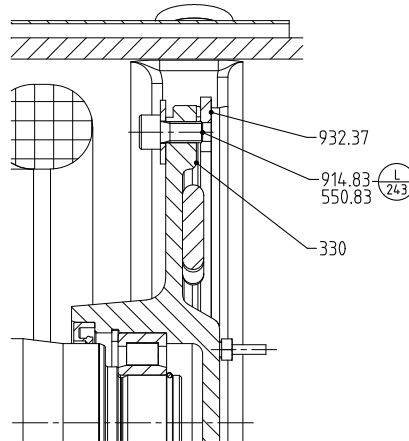


Fig. 70: Bearing bracket fastening of Amarex KRT

Table 41: Corresponding motor sizes

Motor			
55 2.F	55 4.F	31 6.F	30 8.F
65 2.F	65 4.F	37 6.F	37 8.F
75 2.F	75 4.F	45 6.F	45 8.F
		55 6.F	

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

9.3 Detail drawings

9.3.1 Reinforced bearings

Table 42: Sizes with reinforced bearings

Size	Impeller type	Motor size and number of poles													
		55 2.F	65 2.F	75 2.F	55 4.F	65 4.F	75 4.F	31 6.F	37 6.F	45 6.F	55 6.F	30 8.F	37 8.F	45 8.F	
80-315	D	X	X	X	-	-	-	-	-	-	-	-	-	-	
100-315	D	X	X	X	-	-	-	-	-	-	-	-	-	-	
150-400	D	-	-	-	X	X	X	X	X	X	X	X	X	X	
150-401	D	-	-	-	X	X	X	X	X	X	X	X	X	X	
200-400	D	-	-	-	X	X	X	X	X	X	X	X	X	X	
250-400	D	-	-	-	X	X	X	X	X	X	X	X	X	X	
300-400	D	-	-	-	X	X	X	X	X	X	X	X	X	X	

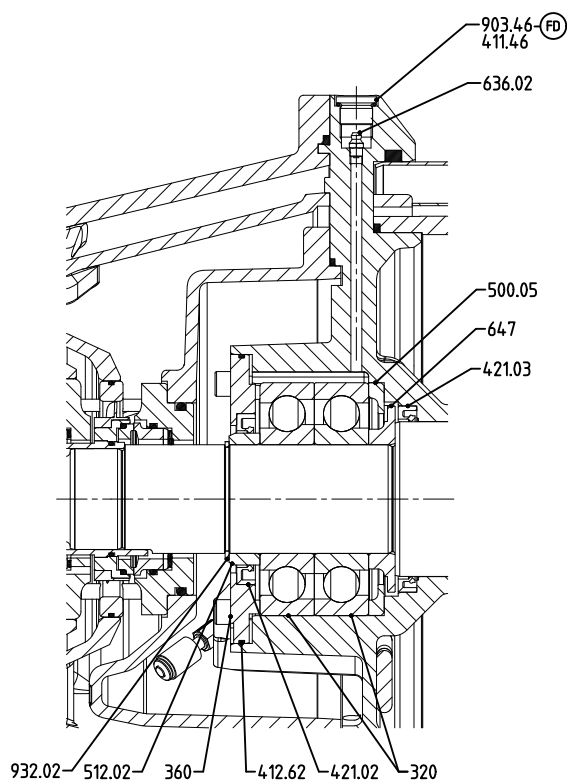


Fig. 71: Reinforced bearings

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

9.3.2 Impeller type E

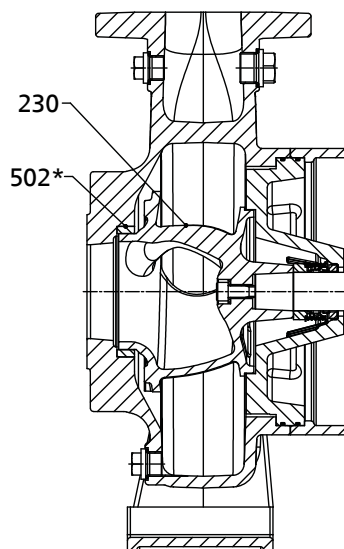


Fig. 72: Impeller type E

*: On specific designs only

Table 43: Impeller type E

Part. No.	Description	Part. No.	Description
230	Impeller	502	Casing wear ring

9.3.3 Impeller type D (single-vane impeller)

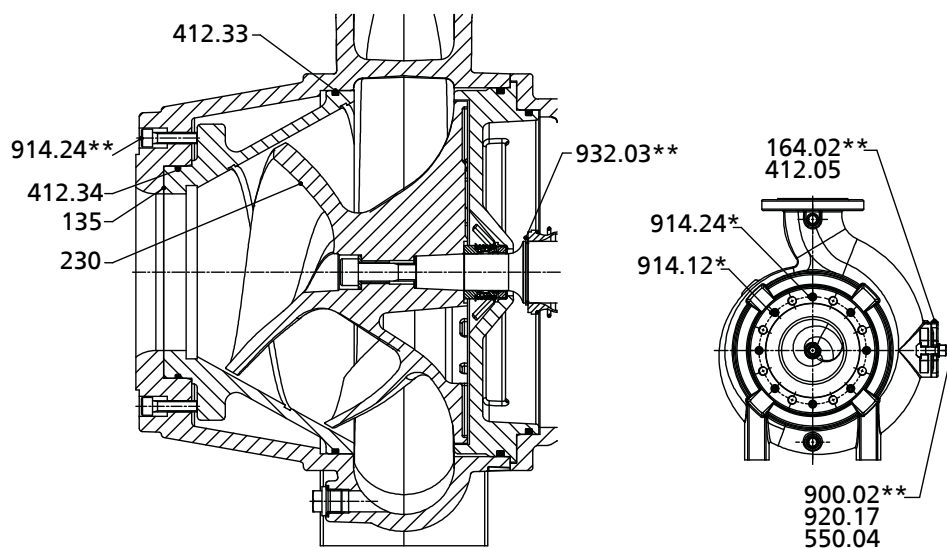


Fig. 73: Impeller type D (single-vane impeller)

*: On specific designs only

** Only for installation types K, D and H

Table 44: Impeller type D

Part No.	Description	Part No.	Description
135	Wear plate	900	Bolt/screw
164	Inspection cover	914	Hexagon socket head cap screw
230	Impeller	920	Nut
412	O-ring	932	Circlip
550	Disc		

9.3.4 Impeller type D (multi-vane impeller)

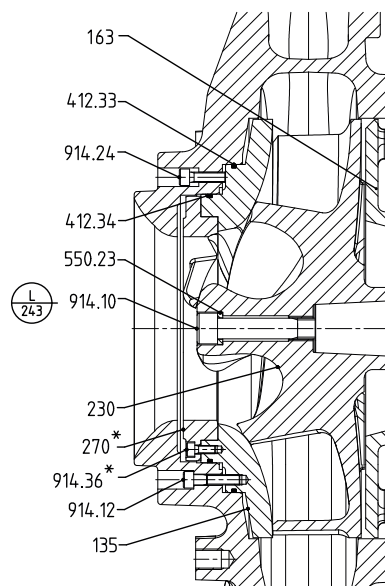


Fig. 74: Impeller type D (multi-vane impeller)

*: On specific designs only

Table 45: Impeller type D

Part No.	Description	Part No.	Description
135	Wear plate	412	O-ring
163	Discharge cover	550	Disc
230	Impeller	914	Hexagon socket head cap screw
270	Deflector		

9.3.5 Impeller type K

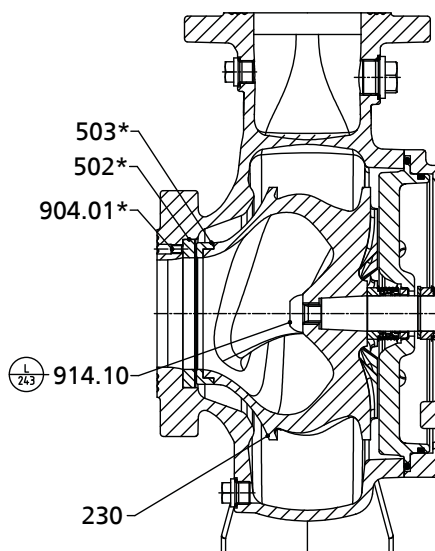


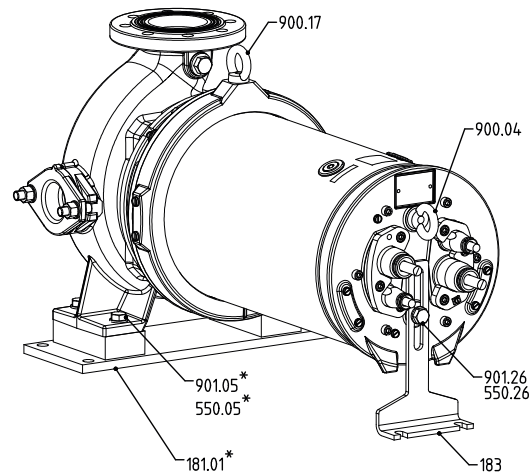
Fig. 75: Impeller type K

*: On specific designs only

Table 46: Impeller type K

Part No.	Description	Part No.	Description
230	Impeller	904	Grub screw
502	Casing wear ring	914	Hexagon socket head cap screw
503	Impeller wear ring		

9.3.6 Horizontal installation



*: On specific designs only

For the part numbers refer to the table (⇒ Section 9.1, Page 106)

9.3.7 Vertical dry installation

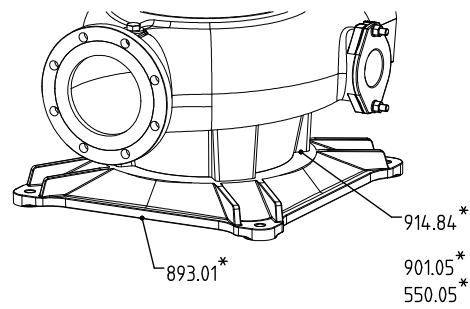


Fig. 76: Vertical dry installation

*: On specific designs only

For the part numbers refer to the table (⇒ Section 9.1, Page 106)

9.3.8 Attachment elements

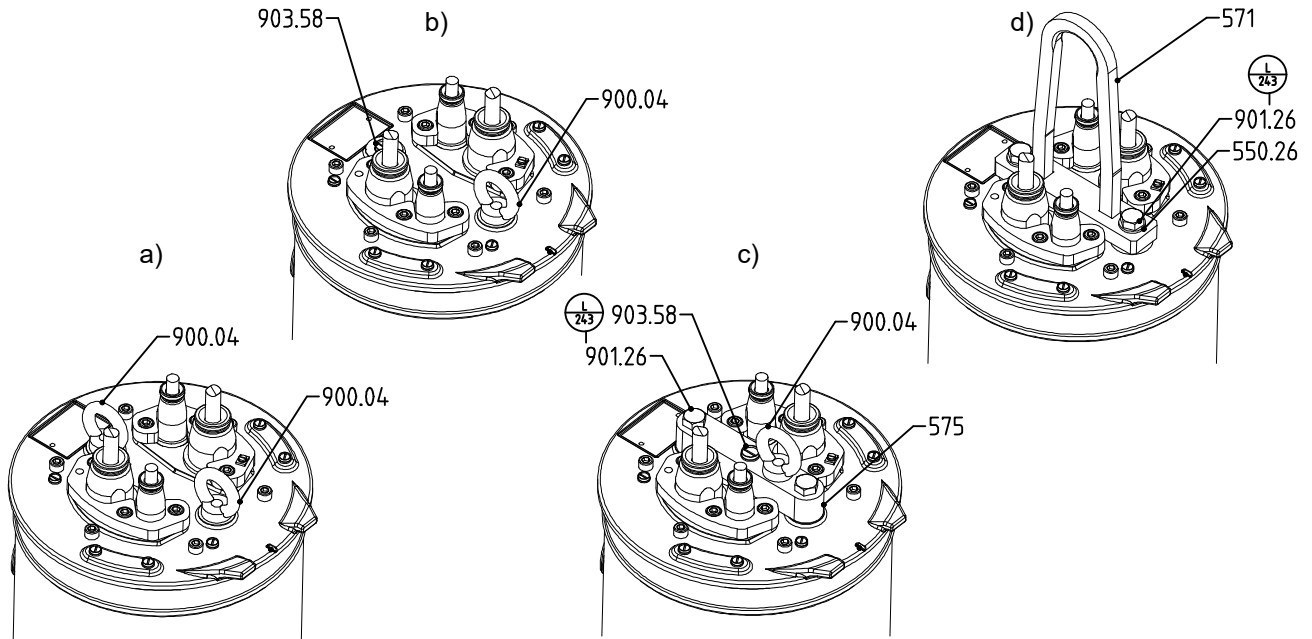


Fig. 77: Attachment elements a) Installation type D b) Installation type K (guide wire arrangement) c) Installation type K (guide rail arrangement) d) Installation types K and D (option: bail)

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

9.3.9 Sensors and terminals

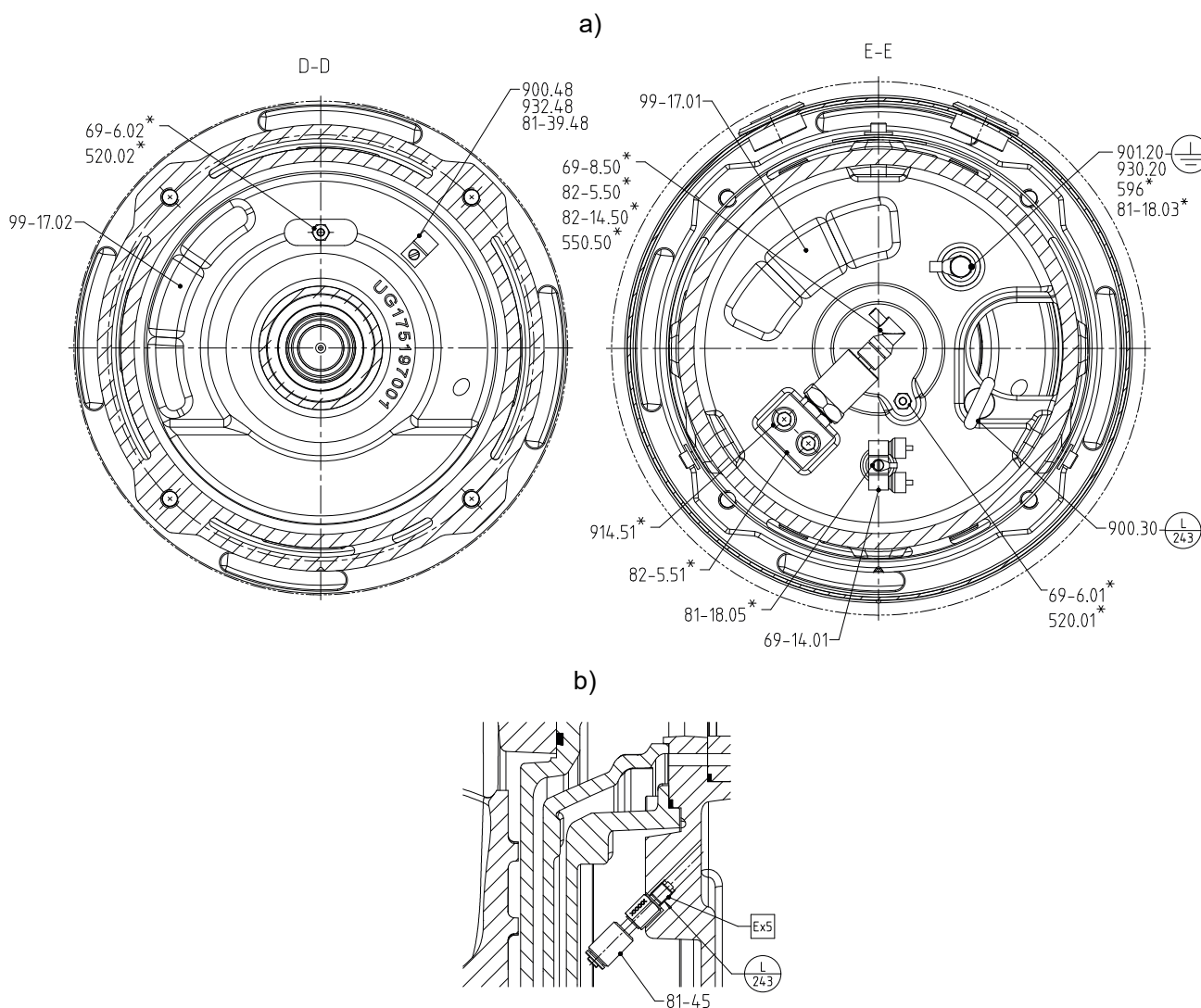


Fig. 78: Amarex KRT a) Sensors and terminals depending on the motor size b) Detailed view of the float switch

*: On specific designs only

Table 47: Corresponding motor sizes

Motor			
18 2.F	15 4.F	15 6.F	15 8.F
22 2.F	18 4.F	18 6.F	18 8.F
26 2.F	22 4.F	22 6.F	22 8.F
30 2.F	30 4.F	30 6.F	
37 2.F	37 4.F		

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

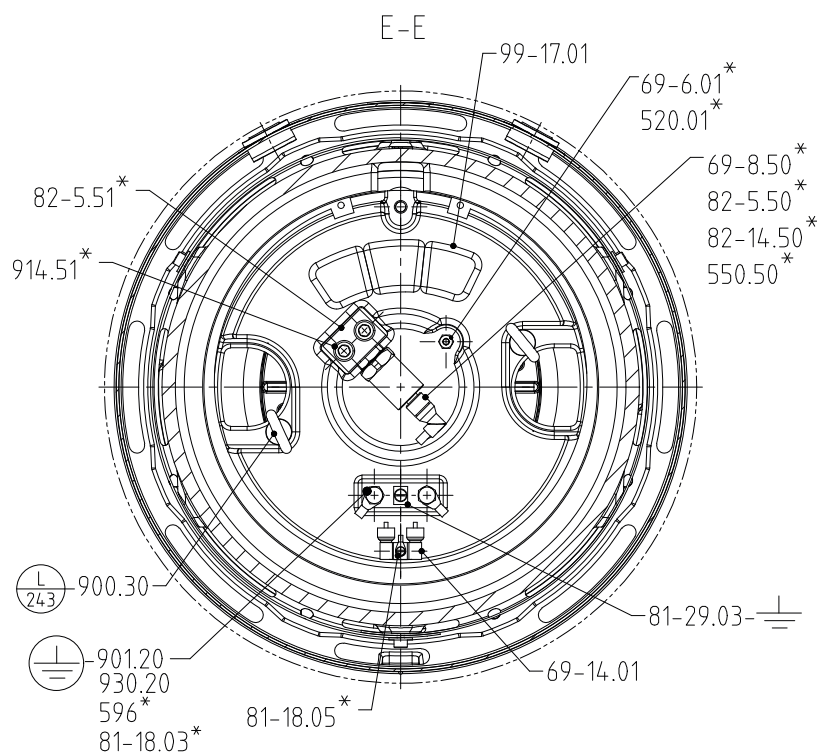


Fig. 79: Amarex KRT - Sensors and terminals depending on the motor size

*: On specific designs only

Table 48: Corresponding motor sizes

Motor			
55 2.F	55 4.F	31 6.F	30 8.F
65 2.F	65 4.F	37 6.F	37 8.F
75 2.F	75 4.F	45 6.F	45 8.F
		55 6.F	

For the part numbers refer to the table (⇒ Section 9.1, Page 106) .

9.4 Flamepaths on explosion-proof motors

9.4.1 Amarex KRT

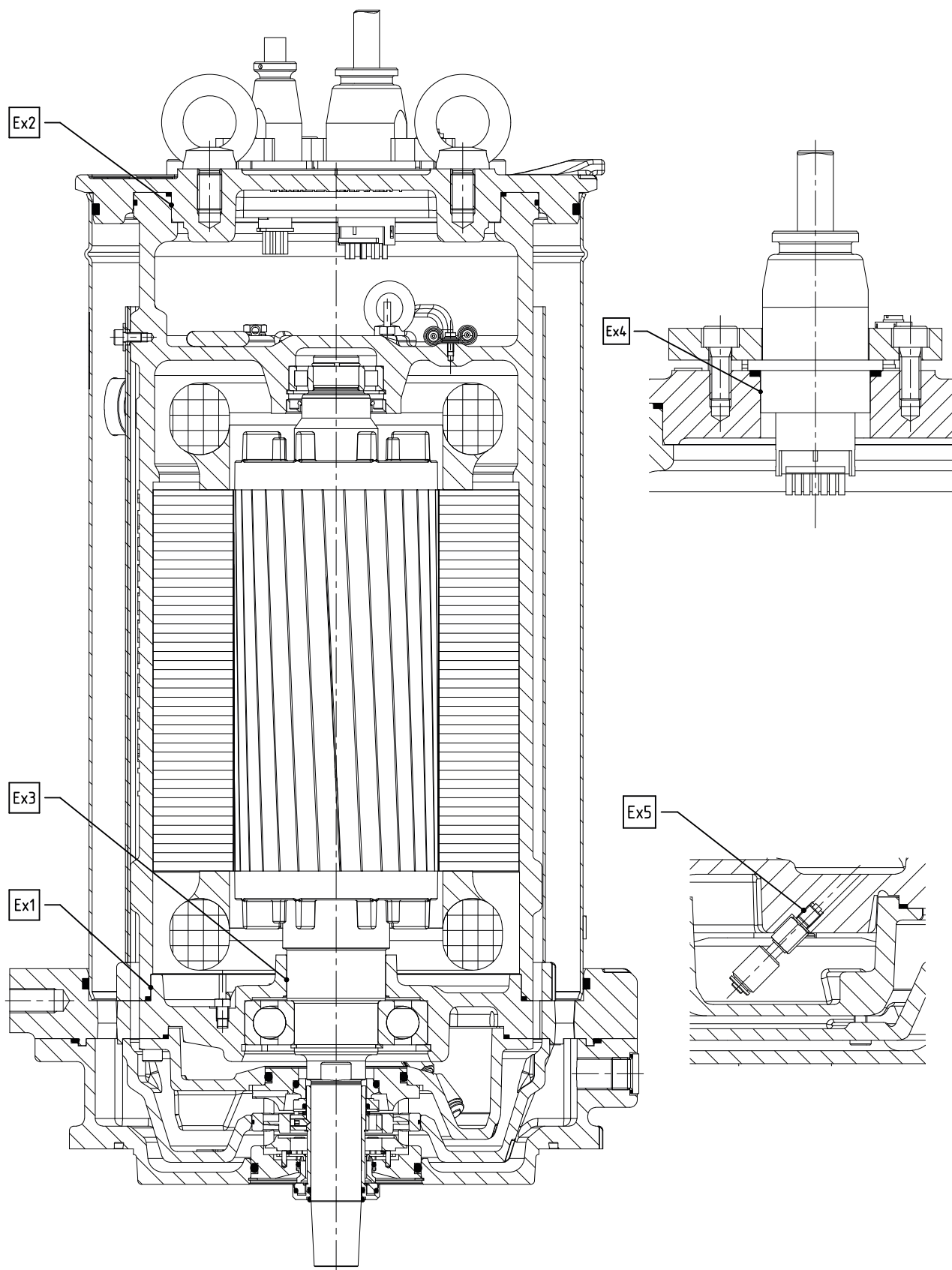


Fig. 80: Flamepaths Amarex KRT

9.5 Illustration of the mechanical seal

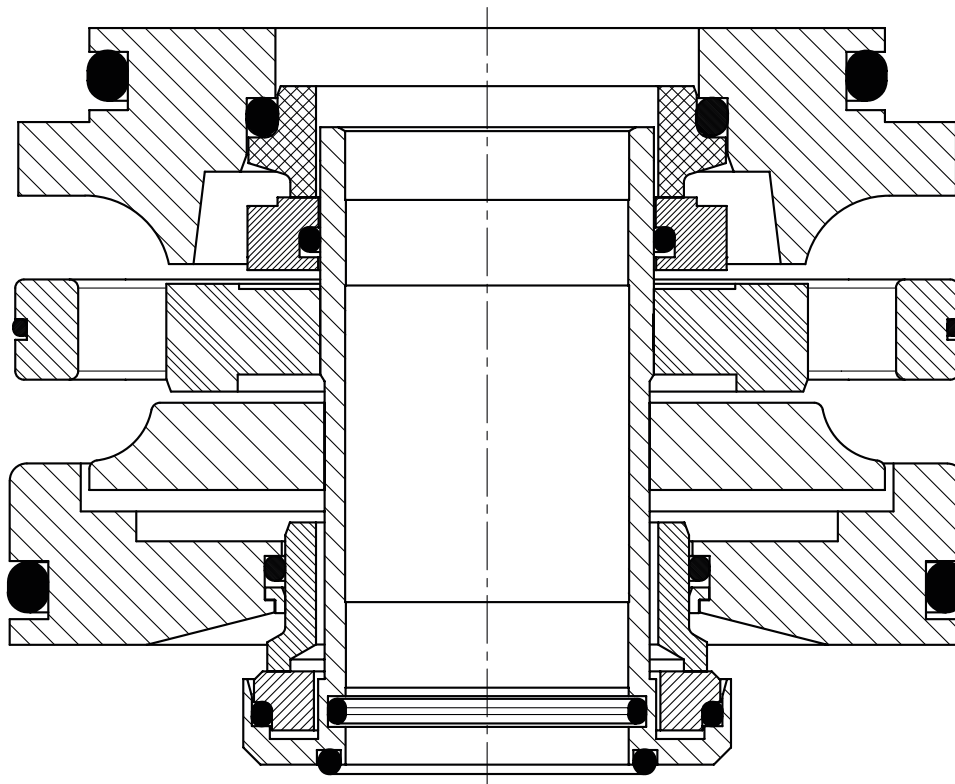


Fig. 81: Double cartridge seal

9.6 Wiring diagrams

9.6.1 Planning the control system

For the electrical connection observe the wiring diagrams (⇒ Section 9.6, Page 122) in the Annex and the information for planning the control system .

The types of electrical connection are differentiated as follows:

1. Sensor package (⇒ Section 5.4.1.5, Page 52)
2. Type of electric cables

The pump set is supplied complete with connection cables. Always use all cables provided and connect all marked cores of the control cable.

9.6.2 Sensor package Basic/Basic+

9.6.2.1 Single voltage - Sensor package Basic - 12G1.5 / 12G2.5 (AWG 15-12 / 13-12)

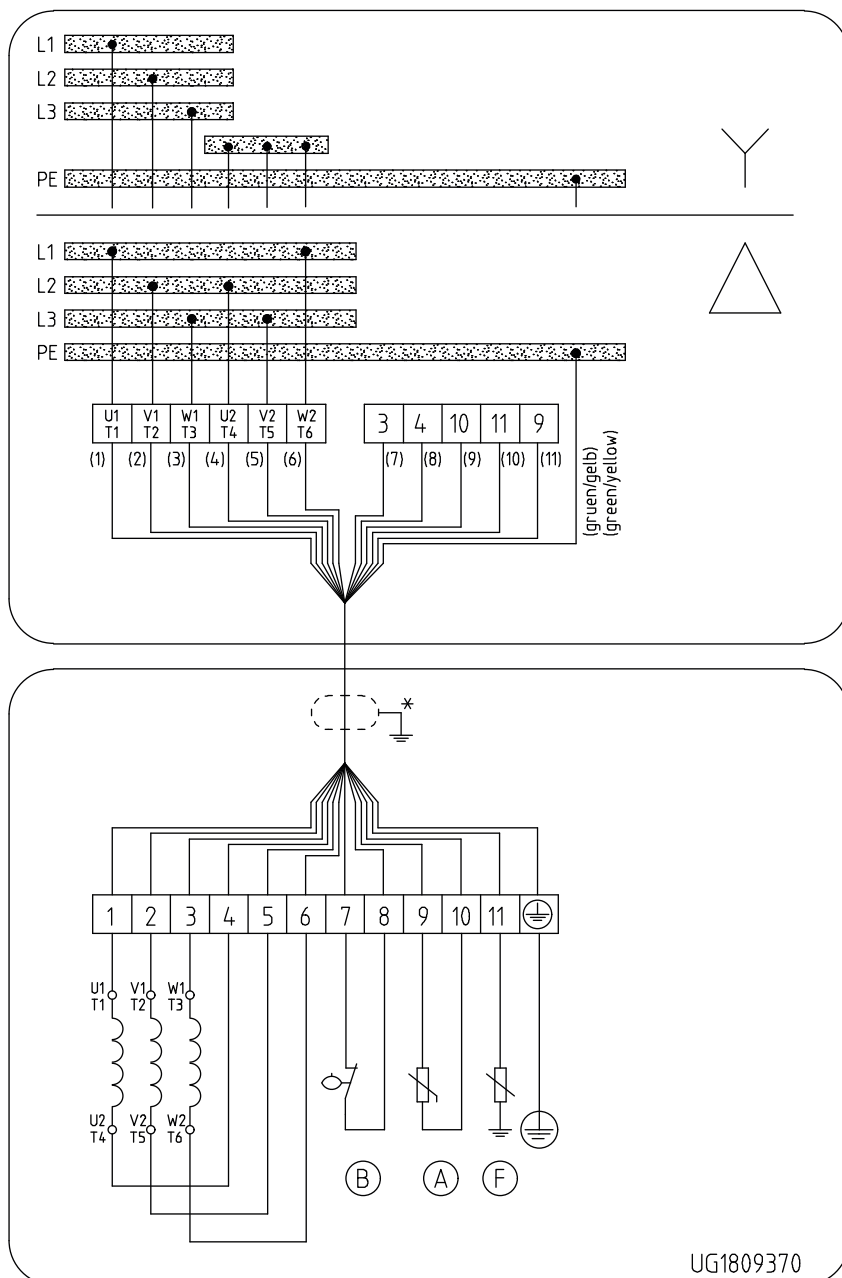


Fig. 82: Single voltage / Sensor package Basic / Power cable 12G1.5 / 12G2.5 (AWG 15-12 / 13-12)

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(F)	Leakage inside the motor
*	Shielded cable option

9.6.2.2 Single voltage - Sensor package Basic - 7GX+5×1.5 (AWG X-7+15-5)

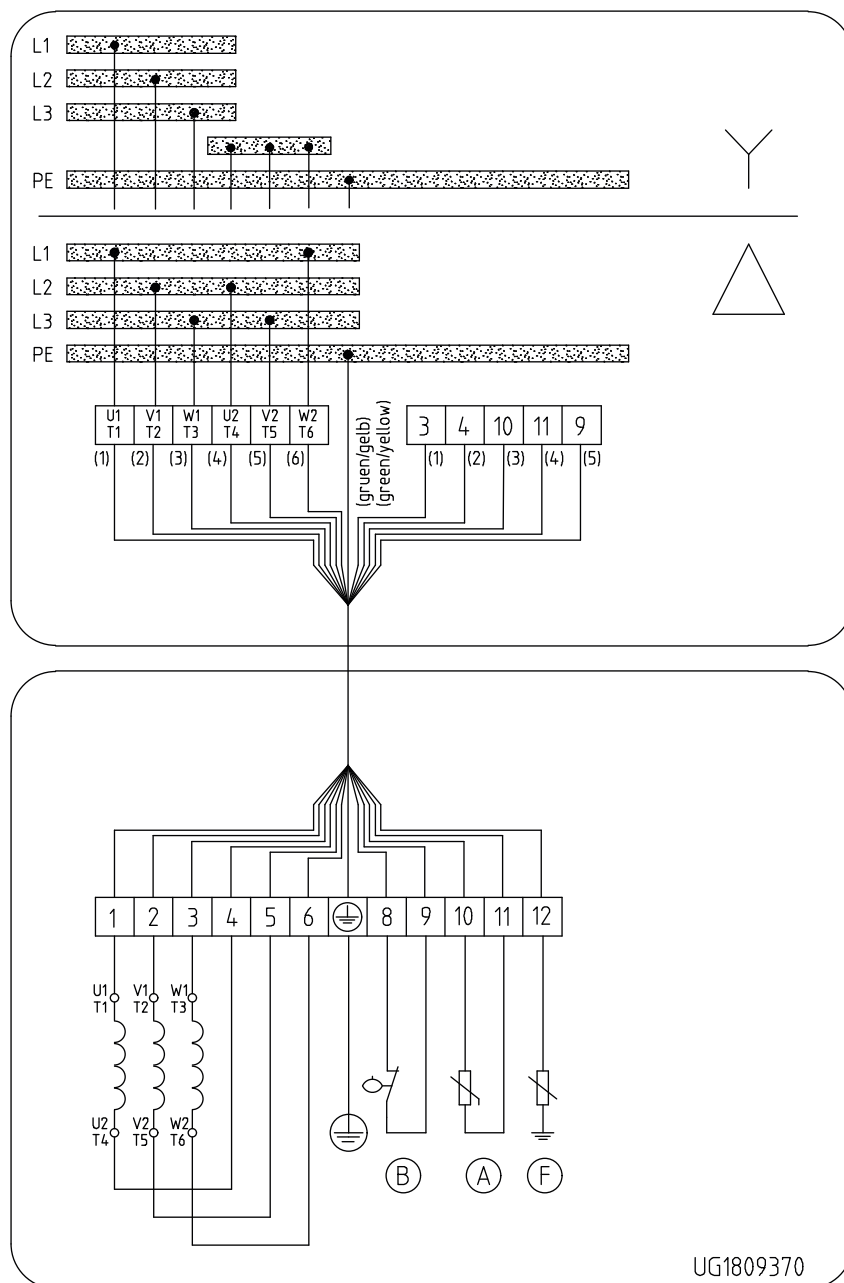


Fig. 83: Single voltage / Sensor package Basic / Power cable 7GX+5×1.5 (AWG X-7+15-5)

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓕ	Leakage inside the motor

9.6.2.3 Single voltage - Sensor package Basic+ - 12G1.5 / 12G2.5 plus 8G1.5 (AWG 15-12 / 13-12 plus 15-8)

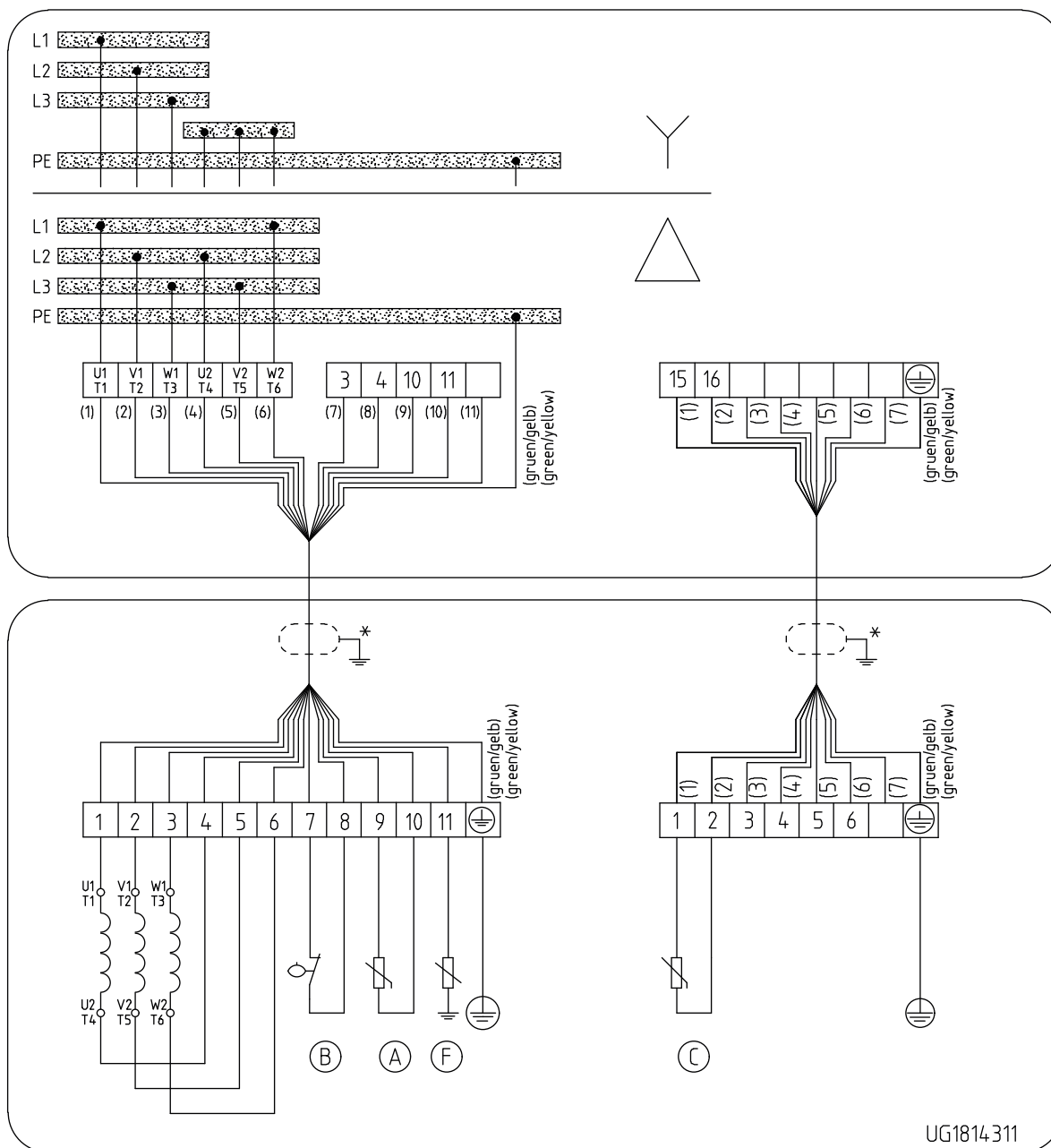
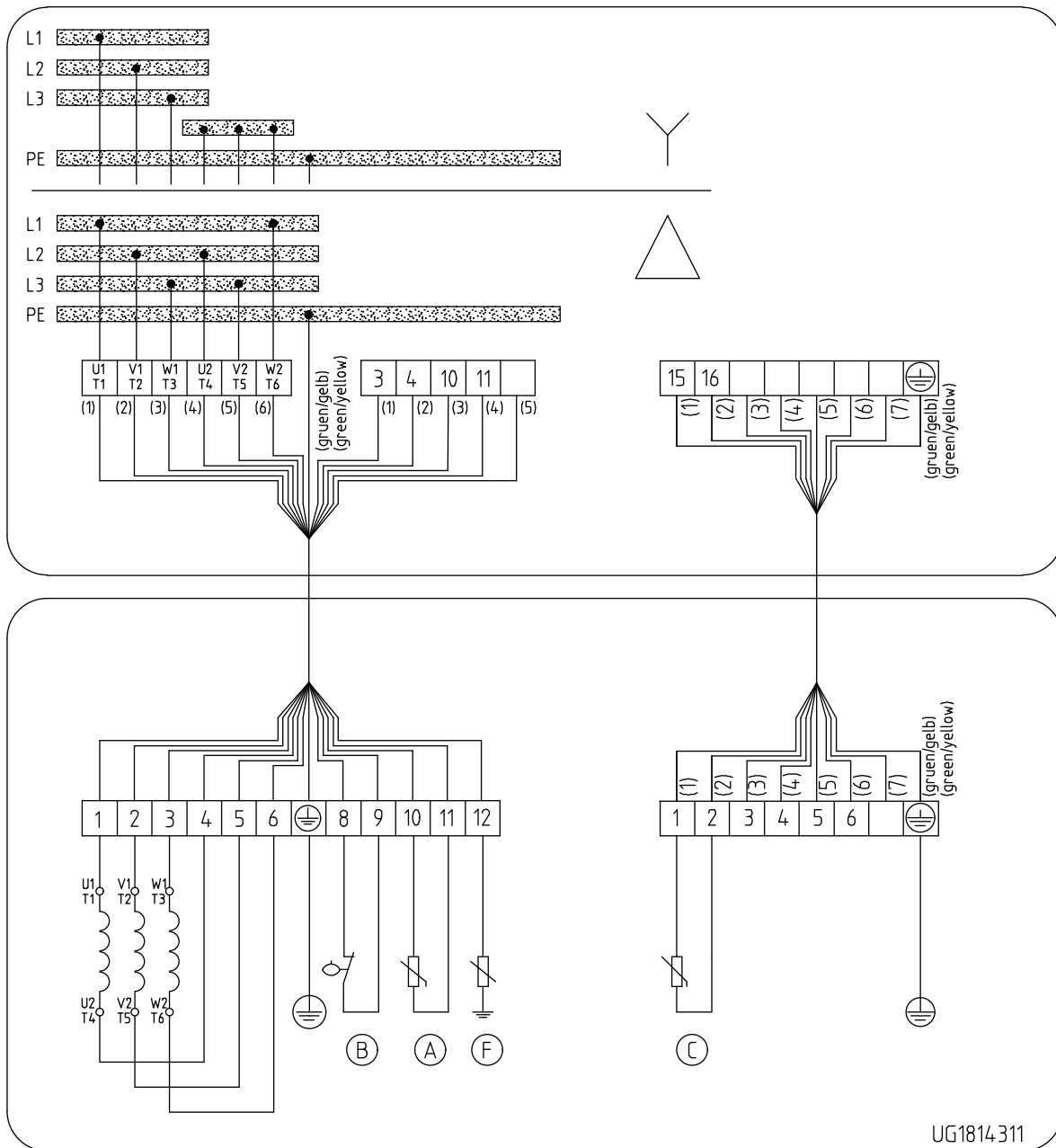


Fig. 84: Single voltage / Sensor package Basic+ / Power cable 12G1.5 / 12G2.5 plus 8G1.5 (AWG 15-12 / 13-12 plus 15-8)

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.6.2.4 Single voltage - Sensor package Basic+ - 7GX+5×1.5 plus 8G1.5 (AWG X-7+15-5 plus 15-8)



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Fig. 85: Single voltage / Sensor package Basic+ / Power cable 7GX+5×1.5 plus 8G1.5 (AWG X-7+15-5 plus 15-8)

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(F)	Leakage inside the motor

9.6.2.5 Single voltage - Sensor package Basic/Basic+ - 4G16 plus 8G1.5 (AWG 5-4 plus 15-8)

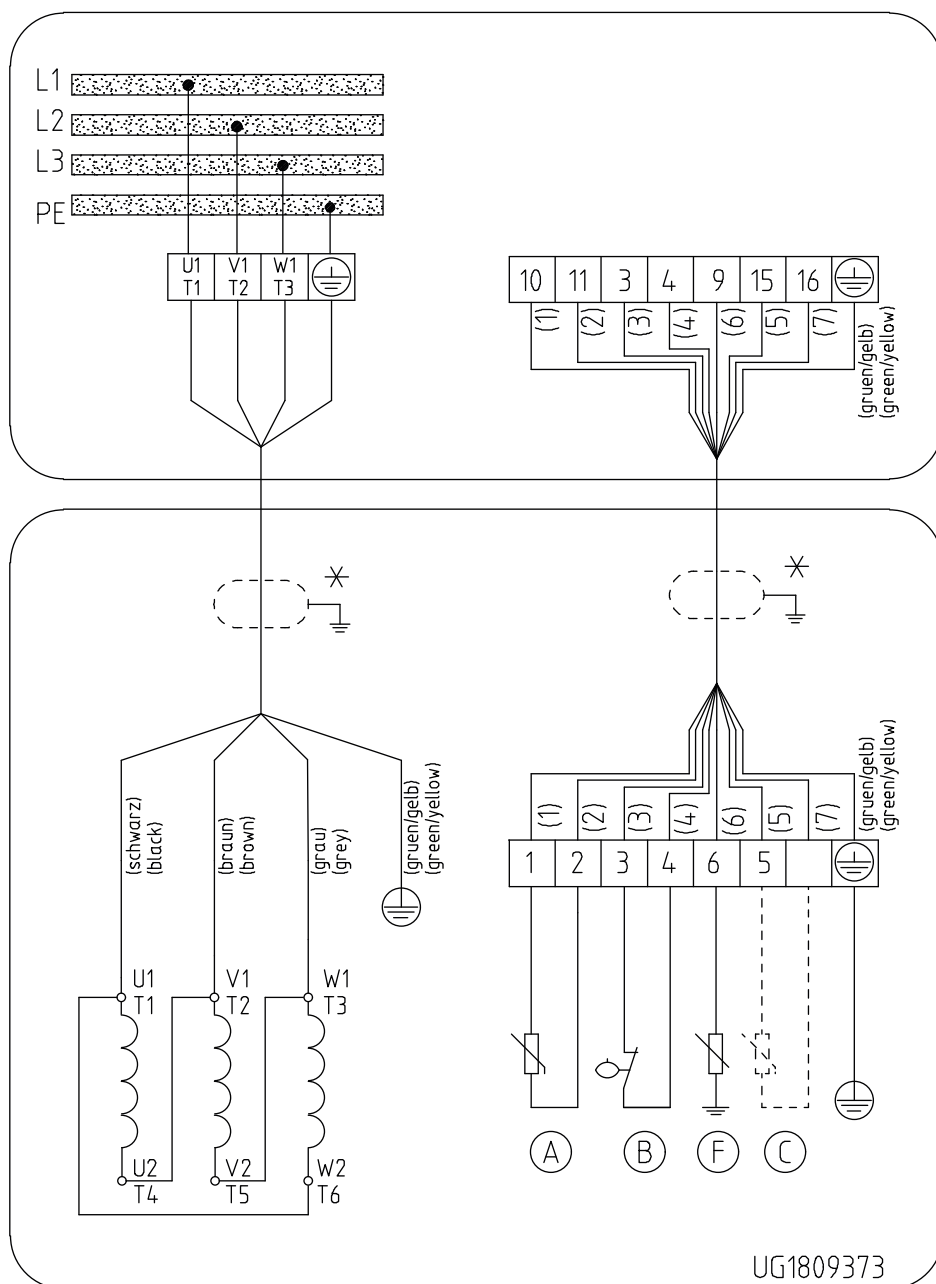


Fig. 86: Single voltage / Sensor package Basic/Basic+ / Power cable 4G16 plus 8G1.5 (AWG 5-4 plus 15-8)

A	Motor temperature (PTC)
B	Mechanical seal leakage
C	Bearing temperature (pump end)
F	Leakage inside the motor
*	Shielded cable option

9.6.2.6 Single voltage - Sensor package Basic/Basic+ - 7G6 plus 8G1.5 (AWG 9-7 plus 15-5)

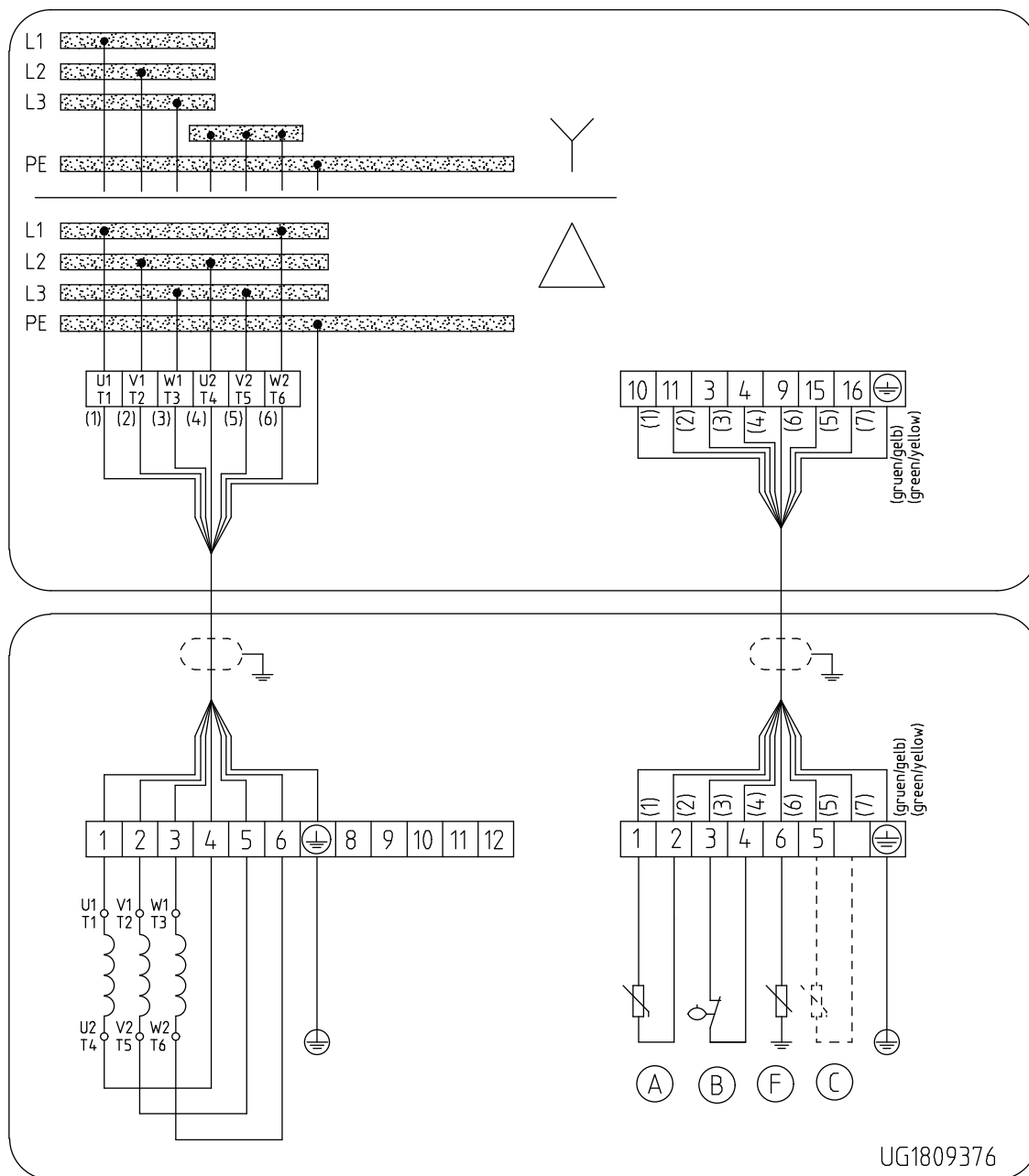


Fig. 87: Single voltage / Sensor package Basic/Basic+ / Power cables 7G6 plus 8G1.5 (AWG 9-7 plus 15-5)

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(F)	Leakage inside the motor

9.6.2.7 Single voltage - Sensor package Basic/Basic+ - 2x4GX plus 8G1.5 (2xAWG X-4 plus 15-8)

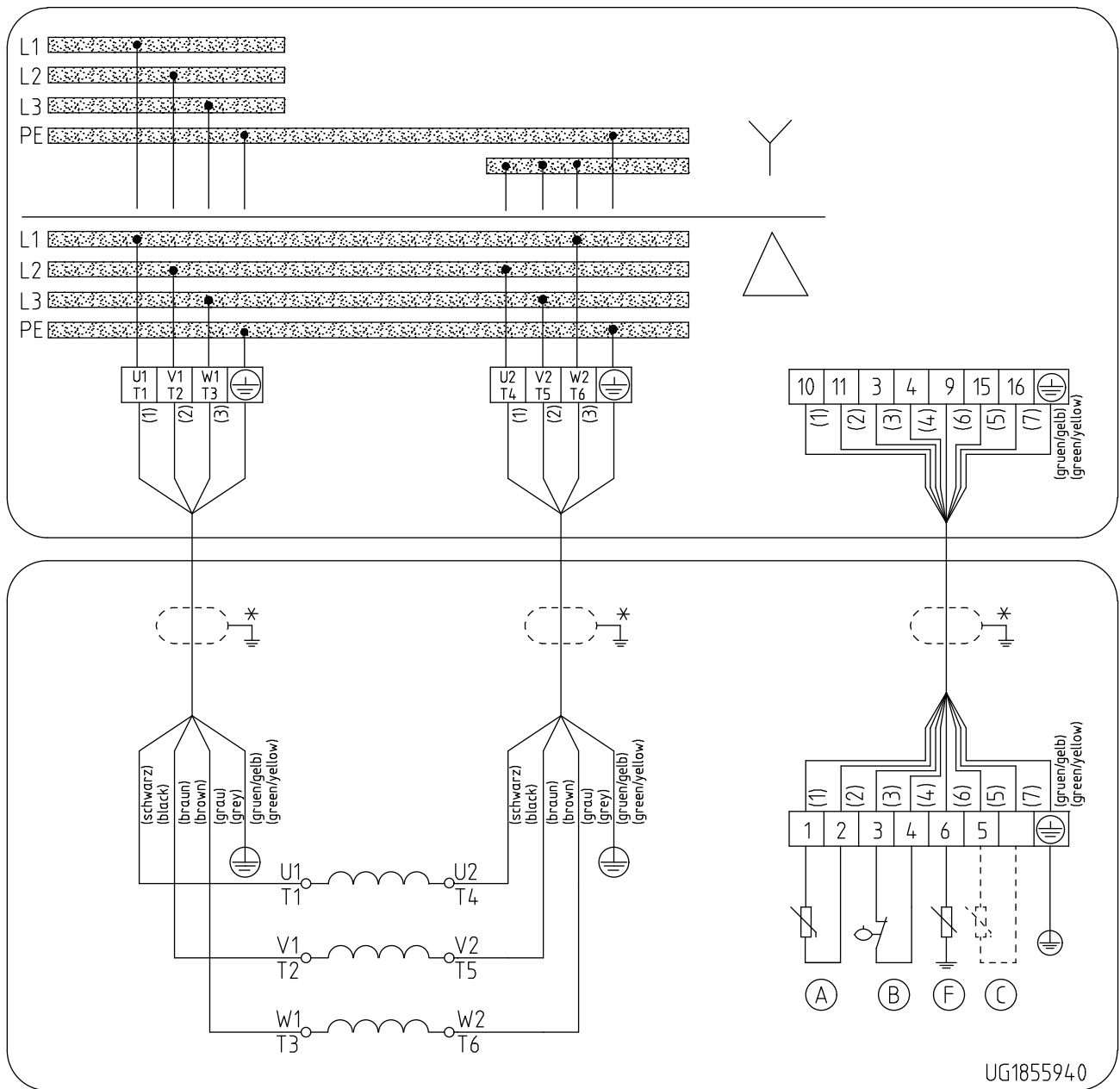


Fig. 88: Single voltage / Sensor package Basic/Basic+ / Power cables 2x4GX plus 8G1.5 (2xAWG X-4 plus 15-8)

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(F)	Leakage inside the motor
*	Shielded cable option

9.6.3 Sensor package Premium

9.6.3.1 Single voltage - Sensor package Premium - 12G1.5 / 12G2.5 plus 12G1.5 (AWG 15-12 / 13-12 plus 15-12)

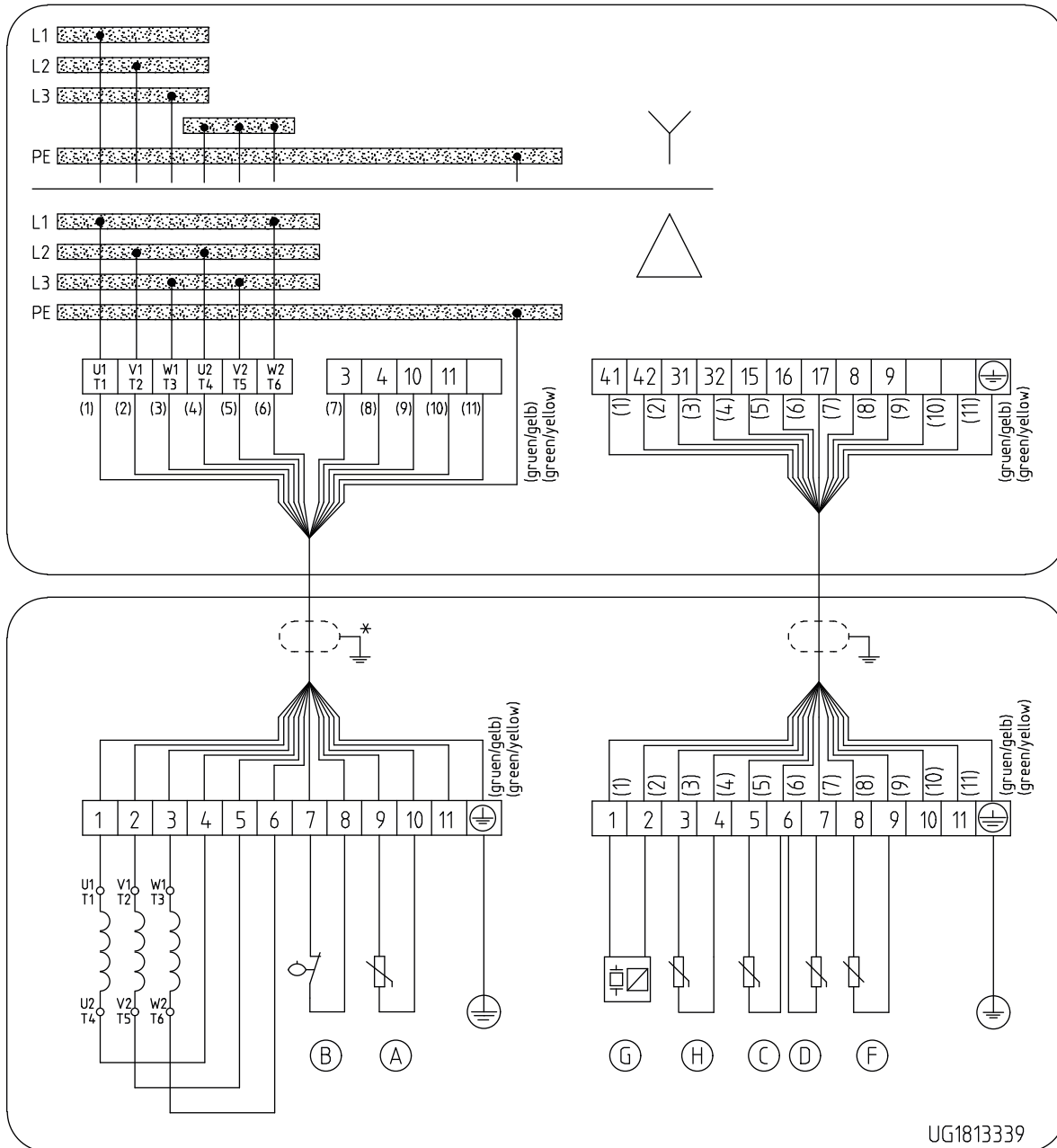


Fig. 89: Single voltage / Sensor package Premium / Power cable 12G1.5 / 12G2.5 plus 12G1.5 (AWG 15-12 / 13-12 plus 15-12)

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(D)	Bearing temperature (motor end)
(E)	Leakage inside the motor
(G)	Vibration sensor
(H)	Motor temperature (Pt100)
*	Shielded cable option

9.6.3.2 Single voltage - Sensor package Premium - 7GX+5×1.5 plus 12G1.5 (AWG X-7+15-5 plus 15-12)

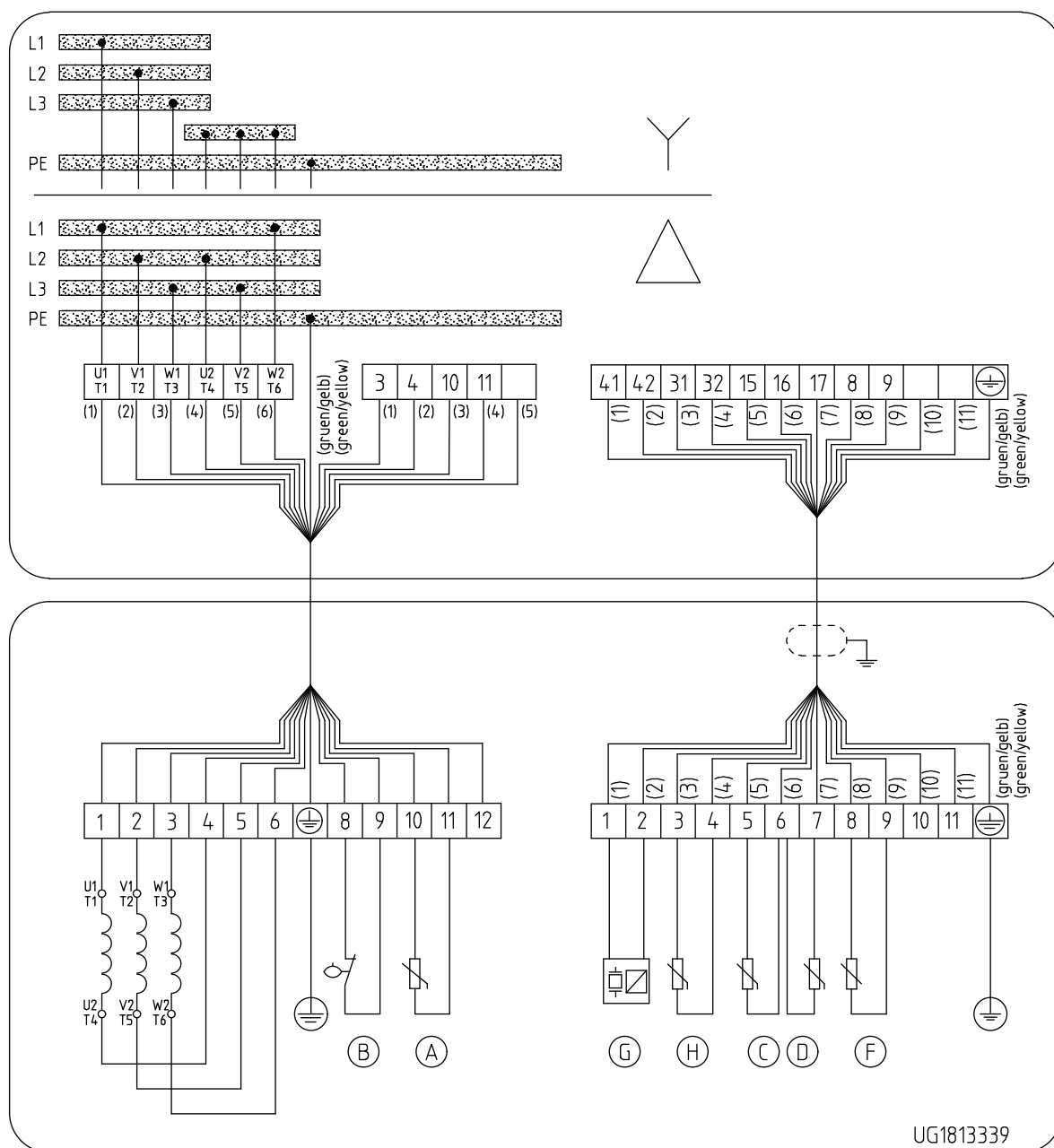


Fig. 90: Single voltage / Sensor package Premium / Power cable 7GX+5×1.5 plus 12G1.5 (AWG X-7+15-5 plus 15-12)

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(D)	Bearing temperature (motor end)
(E)	Leakage inside the motor
(G)	Vibration sensor
(H)	Motor temperature (Pt100)

9.6.3.3 Single voltage - Sensor package Premium - 4G16 plus 8G1.5 plus 8G1.5
(AWG 5-4 plus 15-8 plus 15-8)

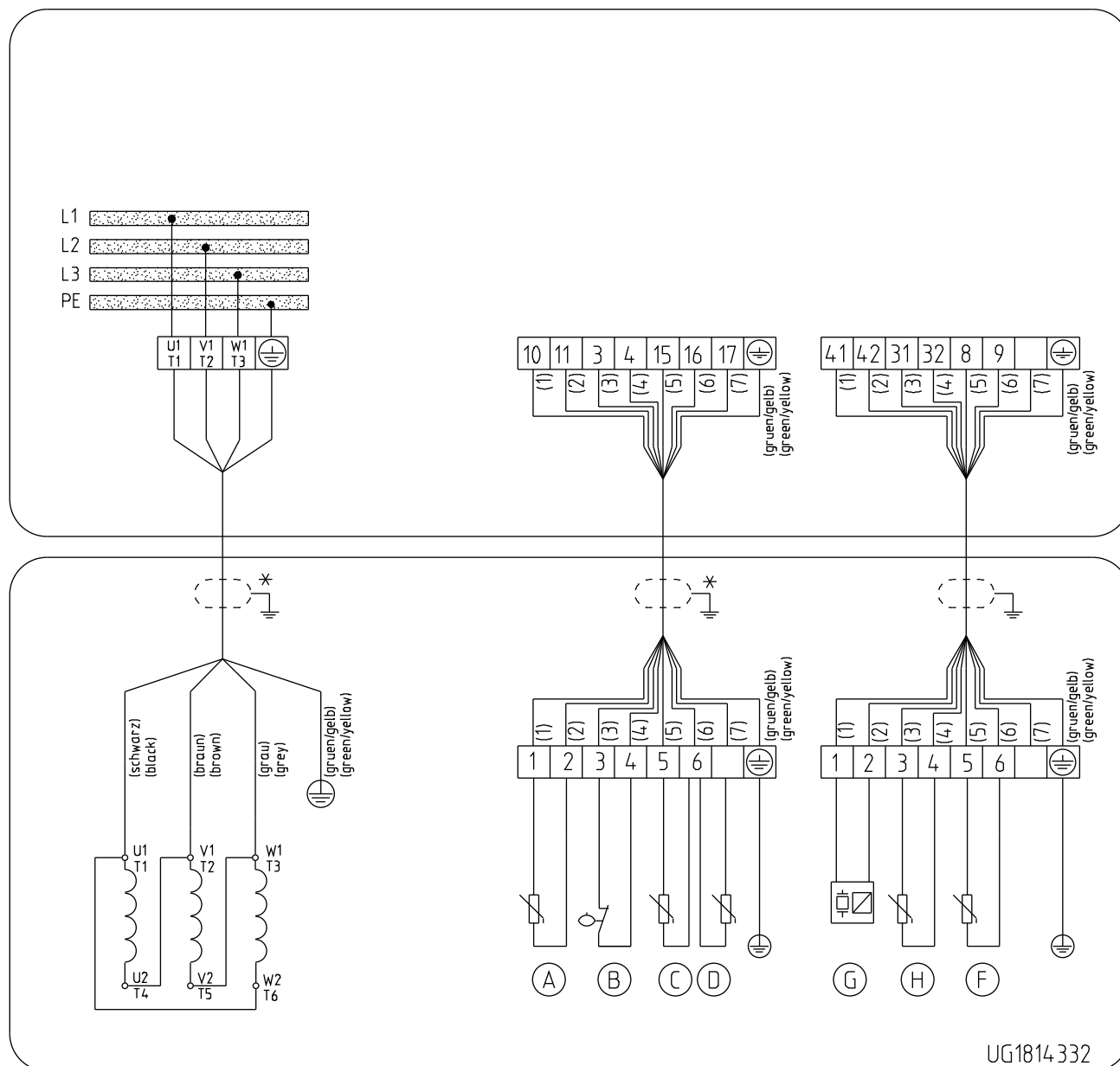


Fig. 91: Single voltage / Sensor package Premium / Power cables 4G16 plus 8G1.5 plus 8G1.5 (AWG 5-4 plus 15-8 plus 15-8)

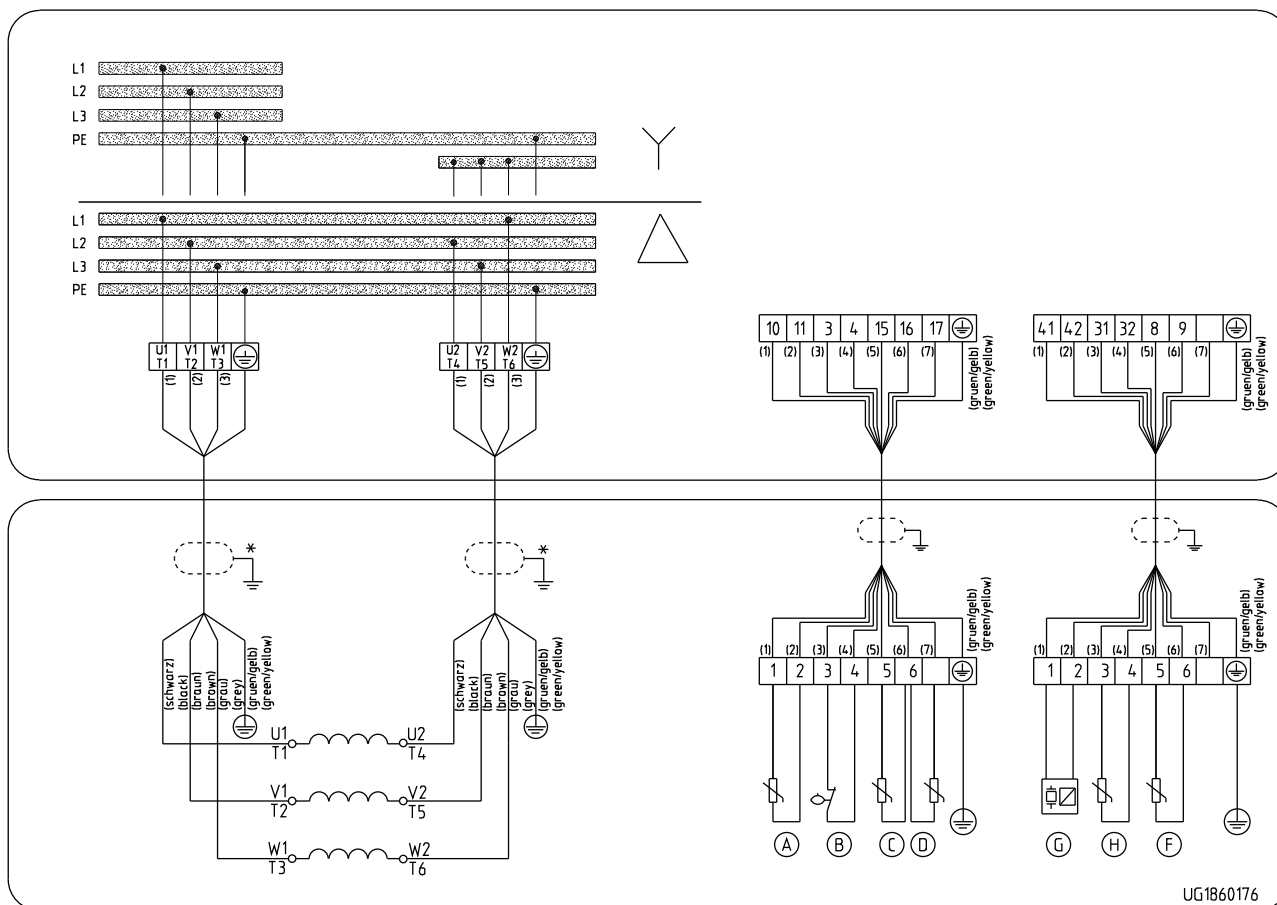
Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓓ	Bearing temperature (motor end)
Ⓕ	Leakage inside the motor
Ⓖ	Vibration sensor
Ⓗ	Motor temperature (Pt100)
*	Shielded cable option

The diagram illustrates the connection of a 6-core cable to a 12-pin connector for different motor types (Y and Δ) and their connection to a 12-pin terminal block. The diagram includes labels for L1, L2, L3, PE, U1-T1, V1-T2, W1-T3, U2-T4, V2-T5, W2-T6, and terminal numbers 1 through 12. It also shows the internal wiring of the motor windings and the connection to a 12-pin terminal block with a ground symbol.

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(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(D)	Bearing temperature (motor end)
(F)	Leakage inside the motor
(G)	Vibration sensor
(H)	Motor temperature (Pt100)

9.6.3.5 Single voltage - Sensor package Premium - 2x4GX plus 8G1.5 plus 8G1.5 (2xAWG X-4 plus 15-8 plus 15-8)



UG1860176

Fig. 93: Single voltage / Sensor package Premium / Power cables 2x4GX plus 8G1.5 plus 8G1.5 (2xAWG X-4 plus 15-8 plus 15-8)

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(D)	Bearing temperature (motor end)
(F)	Leakage inside the motor
(G)	Vibration sensor
(H)	Motor temperature (Pt100)
*	Shielded cable option

10 UK Declaration of Conformity

Manufacturer:

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

This UK Declaration of Conformity is issued under the sole responsibility of the manufacturer.

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

Amarex KRT

KSB order number:

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
 - Pump (set): Supply of Machinery (Safety) Regulations 2008
 - Electrical components²³⁾: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- the following *designated standards*²⁴⁾ 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 UK Declaration of Conformity was issued in/on:

Place, date

.....²⁵⁾.....
 Name
 Function
 Company
 Address

²³ Where applicable

²⁴ Apart from the standards listed here referring to the *Supply of Machinery (Safety) Regulations 2008*, further standards are observed for explosion-proof versions (*Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016*) as applicable and are listed in the legally binding UK Declaration of Conformity.

²⁵ A signed, legally binding UK Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type:

Order number /
Order item number²⁶⁾:

Delivery date:

Application:

Fluid handled²⁶⁾:

Please tick where applicable²⁶⁾:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:²⁶⁾

Comments:

.....

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

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

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

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

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

.....

.....

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

.....
Place, date and signature

.....
Address

.....
Company stamp

²⁶⁾ Required field

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