

Submersible Motor Pump

Amarex KRT

Sizes DN 40 to DN 300, 60 Hz, NEMA

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.: 05035466

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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

If a product is to be returned to the manufacturer, the customer declares in a certificate of decontamination 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 supplied as an integral part of the type series and variant indicated on the front cover (for details, please refer to the table below).

Table 1: Variants covered by this operating manual

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

Size	Size group	Impeller type	Material variant		
			Gray cast iron		
			G	G1	G2
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 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 11)

1.4 Other applicable documents

Table 2: Overview of other applicable documents


Document	Contents
Data sheet	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 with part numbers
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⁾	E.g. for special accessories

For accessories and/or integrated machinery components observe the product literature of the corresponding manufacturer.

¹ If agreed to be included in the 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 This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



2 Safety

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

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





2.1 General

- This operating manual contains general installation, 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 which are 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 pump set 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 $1.2 \times Q_{opt}$ to minimize the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates ($< 0.7 \times Q_{opt}$).
- 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).
- Do not throttle the flow rate on the suction side of the pump set (to prevent 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-vane impeller (impeller type D)	Suitable for the following fluids: fluids containing solid substances and long fibers
	Open, radial multi-vane impeller (impeller type D-max)	Suitable for the following fluids: fluids containing solid substances and long fibers

Further fluids handled (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 gray water
- Mechanically treated waste water
- Pre-screened waste water
- Stormwater

Prevention of foreseeable misuse

- Observe the minimum flow velocities required to fully open the swing check valves to prevent the reduction of pressure and risk of clogging.
(Contact the manufacturer for the required minimum flow velocities/loss coefficients.)
- Never exceed the permissible operating limits and use limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.

2.3 Personnel qualification and personnel 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 sufficiently trained specialist personnel training and instructing the personnel who will carry out the respective tasks. 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 these operating instructions

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

2.5 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 authorized by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation is performed by authorized, 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-energized).
- 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 70)
- 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 65)

2.8 Unauthorized 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

Special conditions apply to the operation of explosion-proof pumps.

- The explosion-proof status of the pump set is only assured if the pump set is used in accordance with its intended use.
- The limits stated in the data sheet and on the name plate must not be exceeded under any circumstances.
- Correct monitoring of the motor temperature is imperative to ensure explosion protection.
- Observe the wiring diagrams.
- Never operate an explosion-proof pump set without temperature monitoring.
- Modifications or alteration of the pump set could affect explosion protection and are only permitted after consultation with the manufacturer.
- Only original spare parts and accessories authorized by the manufacturer must be used for explosion-proof pumps.

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.

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 distributor and the insurance company about the damage in writing immediately.

3.2 Transport

	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Improper transport Danger to life from falling parts! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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.
	<div style="background-color: #f1c40f; color: white; padding: 5px;">⚠ WARNING</div> <p>Incorrect handling of the electric cable Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ 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.

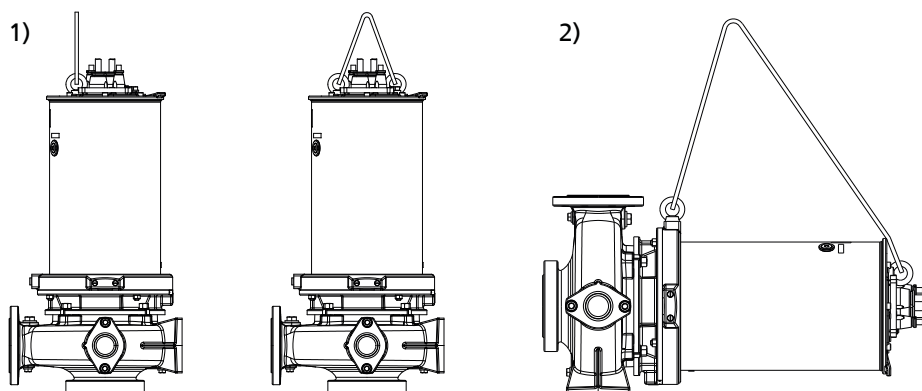








Fig. 1: Transporting the pump set 1) Vertical installation [K and D] 2) Horizontal installation [H]

3.2.1 Placing the pump set down

	<p>⚠ WARNING</p> <p>Incorrect positioning/placing down Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ 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.
	<p>⚠ WARNING</p> <p>Incorrect handling of the electric cable Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ 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.
	<p>⚠ WARNING</p> <p>Improper placing of pump sets in a vertical/horizontal position Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ 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 (1st attachment point on the motor, 2nd attachment point at 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.
	<p>⚠ WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>⚠ WARNING</p> <p>Placing the pump set on unsecured and uneven surfaces Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ 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.
	<p>CAUTION</p> <p>Improper transport / Improper positioning of pump sets with cooling system Damage to the cooling system!</p> <ul style="list-style-type: none"> ▷ Never place the pump set on the cooling jacket or fasten it by the cooling system.

Installation type H:

The pump set is fitted with 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.

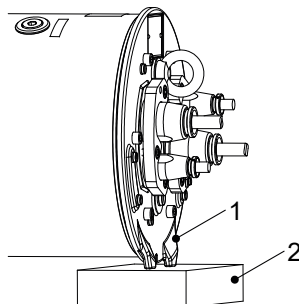


Fig. 2: Placing down a pump set with a support foot

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 for pump set storage:

	CAUTION
	Damage during storage due to humidity, dirt or vermin Corrosion/contamination of pump (set)! <ul style="list-style-type: none"> ▸ 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! <ul style="list-style-type: none"> ▸ 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	-4 °F to 158 °F [- 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 nozzle and discharge nozzle.
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.

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 90)
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 neutralized, 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 10, Page 144)

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

3.5 Disposal

	! WARNING
	Fluids handled, consumables and operating supplies which are hot or pose a health hazard Hazard to persons and the environment! <ul style="list-style-type: none"> ▷ Collect and properly dispose of the flushing fluid and of any residues of the fluid handled. ▷ Wear safety clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

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

4 Description of the Pump (Set)

4.1 General description

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 fibers 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 chemicals Regulation (EC) No. 1907/2006 (REACH), see <https://www.ksb.com/ksb-en/About-KSB/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-explosionproof, for fluid temperatures up to 104 °F [40 °C], ambient temperatures up to 131 °F [55 °C]
XF	Explosion-proof, for fluid temperatures up to 104 °F [40 °C], ambient temperatures up to 131 °F [55 °C]
G	Material variant
G	Standard variant, gray 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 standardized motors acc. to the IEC 60034-30 standard.

4.4 Name plate

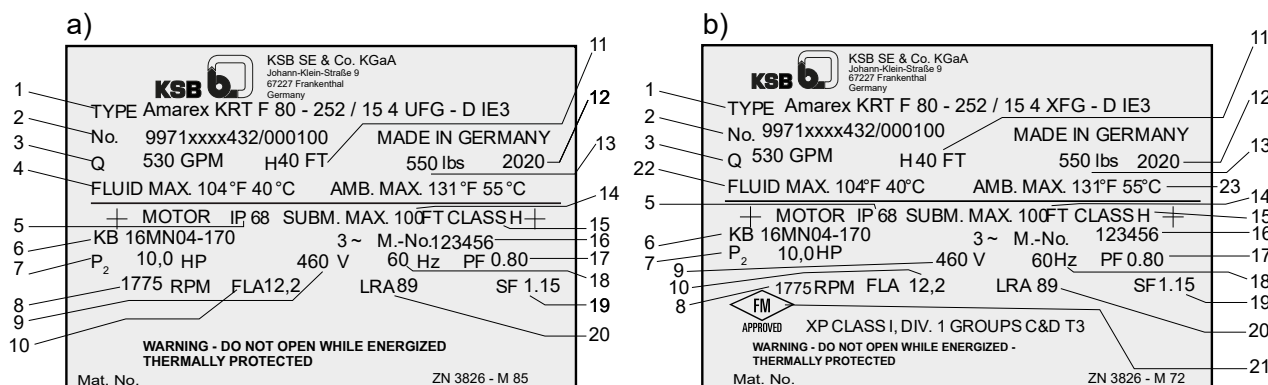


Fig. 3: Name plate (example) a) for non-explosion-proof model, b) for explosion-proof model

1	Designation	2	KSB order number
3	Flow rate	4	Maximum fluid temperature and ambient temperature
5	Enclosure	6	Motor type
7	Rated power	8	Rated speed
9	Rated voltage	10	Rated current
11	Head	12	Year of construction
13	Total weight	14	Maximum submergence
15	Thermal class of winding insulation	16	Motor number
17	Power factor at rated operating point	18	Rated frequency
19	Service factor	20	Starting current
21	Explosion protection marking	22	Maximum fluid temperature
23	Maximum ambient temperature		

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 (⇒ Section 9.3.1, Page 117)
 - Grease-packed bearings
 - Can be re-lubricated

Drive

- Three-phase asynchronous squirrel-cage motor
- Motors integrated in explosion-proof pump sets are supplied in Explosionproof Class I Division 1, Groups C&D, T3.
- Available as single voltage variant or dual voltage variant (230 V / 460 V).

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 cable arrangement

4.7 Configuration and function

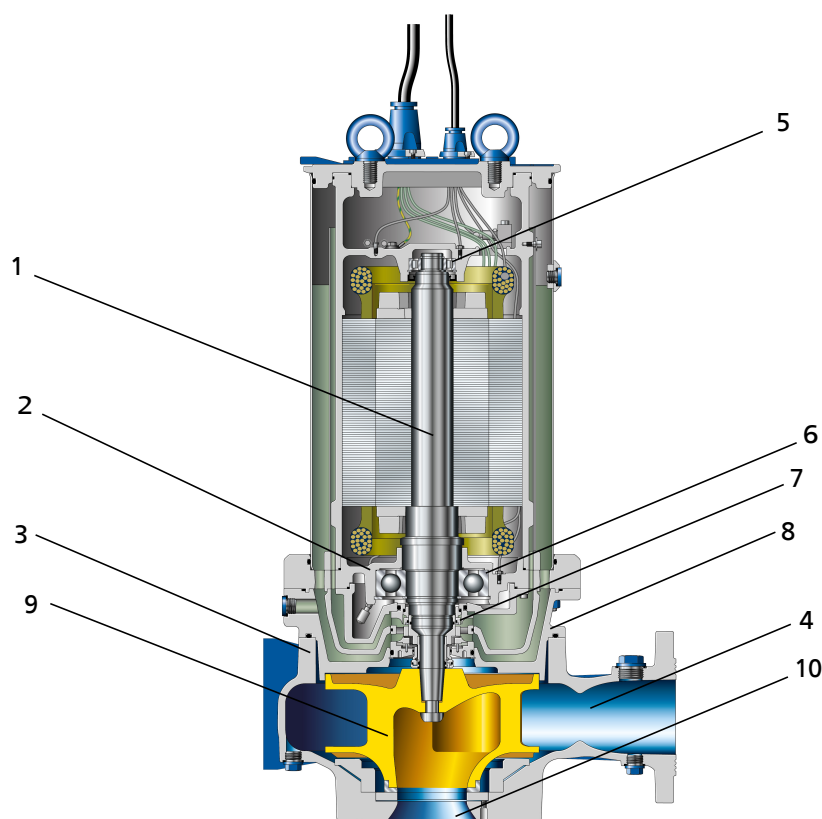


Fig. 5: Sectional drawing

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 a 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 feature an integrated cooling system for the motor. The heat generated by the motor is transferred via the discharge cover to the fluid handled by 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 = 3500 rpm	n = 1750 rpm	n = 1160 rpm	n = 875 rpm
[kW]	[hp]	[dB]	[dB]	[dB]	[dB]
7,5	10,0	71,5	65,0	63,5	63,0
8,5	11,4	72,0	66,0	64,5	64,0
10,0	13,4	72,5	67,0	65,5	65,0
11,0	15,0	72,5	67,0	65,5	65,0
15,0	20,0	73,5	68,0	66,5	66,0
18,5	25,0	74,0	68,5	67,5	67,0
22,0	30,0	74,5	69,0	68,0	67,5
30,0	40,0	75,0	70,5	69,0	68,5
37,0	50,0	76,0	71,0	69,5	69,0
40,0	52	76,5	71,5	70,0	69,5
45,0	60,0	77,0	71,5	70,5	70,0
55,0	74,0	77,5	72,5	71,0	70,5
65,0	87,0	78,0	73,0	71,5	71,0

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 mounting elements
- Lifting rope / lifting chain
- Mounting bracket with mounting elements
- Flanged bend and fastening elements
- Guide cable / guide rail
(guide rails are not included in KSB's scope of supply)

A separate name plate is included in KSB's scope of supply. Attach this name plate in a clearly visible position outside the place of installation, e.g. at the control panel, pipeline or mounting bracket.

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)
- 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 KSB's scope of supply. Attach this name plate in a clearly visible position outside the place of installation, e.g. at the control panel, pipeline or mounting bracket.

⁴⁾ Measured at a distance of 1 m from the pump outline

⁵⁾ For installation types D and H only

⁶⁾ For nominal discharge nozzle diameter \geq DN100











⁷⁾ For vertical installation

4.10 Dimensions and weights

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

5 Installation at Site

5.1 Safety regulations



	<div data-bbox="507 315 683 360"> DANGER</div> <p>Improper installation in potentially explosive atmospheres Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Comply with the applicable local explosion protection regulations. ▸ Observe the information given in the data sheet and on the pump/motor name plates.
	<div data-bbox="507 593 683 638"> DANGER</div> <p>Risk of falling when working at great heights Danger to life by falling from great heights!</p> <ul style="list-style-type: none"> ▸ 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 occupational safety regulations and accident prevention regulations.
	<div data-bbox="507 911 683 956"> DANGER</div> <p>Persons in the tank during pump operation Electric shock! Risk of personal injury! Danger of death from drowning!</p> <ul style="list-style-type: none"> ▸ Never start up the pump set when there are persons in the tank.
	<div data-bbox="507 1191 703 1236"> WARNING</div> <p>Hands, other body parts or foreign objects in the impeller or intake area Risk of injury! Damage to the submersible motor pump!</p> <ul style="list-style-type: none"> ▸ Never insert your hands, other body parts or foreign objects into the impeller and/or impeller intake area. ▸ Always make sure that the electrical connections are disconnected before checking that the impeller can rotate freely.
	<div data-bbox="507 1500 703 1545"> WARNING</div> <p>Impermissible solid objects (tools, screws/bolts or similar) in the pump sump/inlet tank during pump start-up Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ 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 system data.



5.2.2 Preparing the place of installation

	 WARNING
	<p>Installation on mounting surfaces which are unsecured and cannot support the load</p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use a concrete of compressive strength class C25/30 which meets the requirements of exposure class XC1 to EN 206 . ▷ The mounting surface must be set, even, and level. ▷ Observe the weights indicated.

Resonances Any resonances at the usual excitation frequencies (1x and 2x 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
	<p>Operating a pump set with incomplete coolant fill</p> <p>Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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.

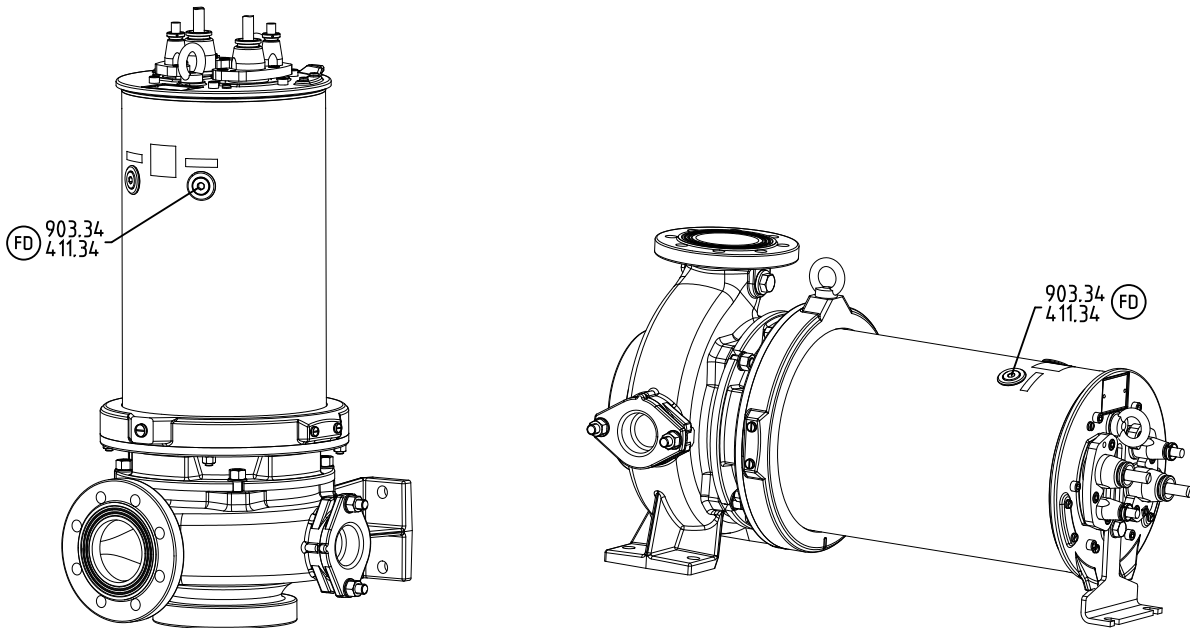


Fig. 6: Coolant filler opening for 1) Vertical installation [K and D] 2) Horizontal installation [H]

- ✓ 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 1.2 in [3 cm] below the edge of the filler opening.
- 3. If the fluid level is less than 1.2 in [3 cm] below the edge of 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 1.2 in [3 cm] below the edge of the filler opening, this suggests leakage of the cooling system.
- 5. Remedy the cause.

Table 8: Key to the symbols




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

	NOTE
	If the fluid level is more than 1.2 in [3 cm] below the edge of the filler opening, this suggests a defect of the cooling system (at a coolant temperature of 68 °F [20 °C]).

5.2.4 Checking the direction of rotation

	⚠ DANGER
	Pump set running dry Explosion hazard! ▷ Check the direction or rotation of explosion-proof pump sets outside potentially explosive atmospheres.

2553.831/05-EN-US

	<p>! WARNING</p> <p>Hands and/or foreign objects in the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▷ 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).
	<p>! WARNING</p> <p>Improper positioning of pump set when checking the direction of rotation Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use appropriate means to secure the pump set against tilting or tipping over.
	<p>CAUTION</p> <p>Pump set running dry Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without the fluid to be handled for more than 60 seconds.

✓ The pump set is connected to the power supply.

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.)

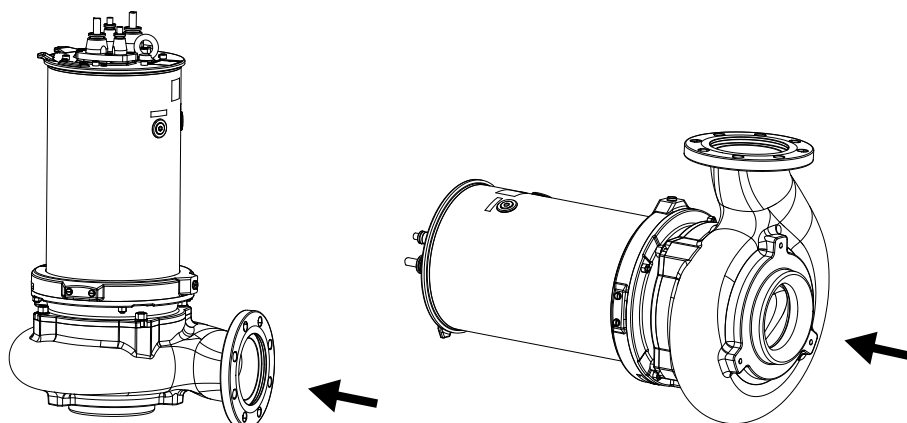


Fig. 7: Checking the direction of rotation

⇒ **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).

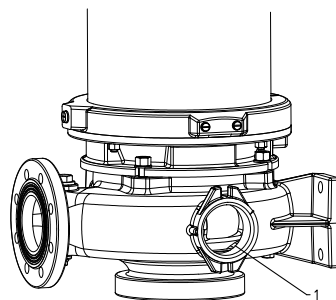


Fig. 8: Inspection hole

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 refer to and comply with the general arrangement drawing/outline drawing when installing the pump set.

5.3.1 Stationary wet installation

5.3.1.1 Wet-installed stationary model, vertical

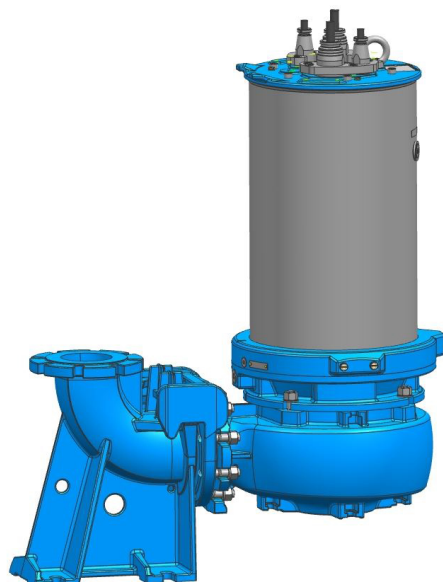


Fig. 9: Wet-installed model, vertical stationary installation

5.3.1.2 Fastening the flanged elbow

Fastening the flanged elbow with chemical anchors

Depending on the pump size, the flanged elbow is fastened with chemical anchors.

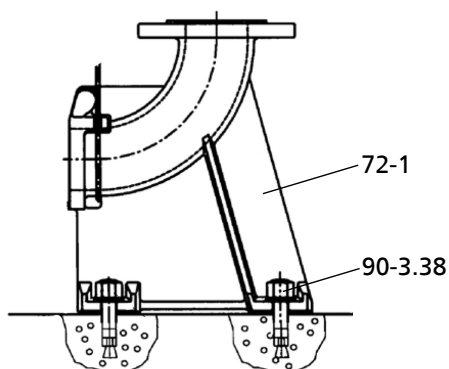


Fig. 10: Fastening the flanged elbow

1. Position base elbow 72-1 at the bottom of the tank/well.
2. Fit chemical anchors 90-3.38.
3. Bolt base elbow 72-1 to the floor using chemical anchors 90-3.38.

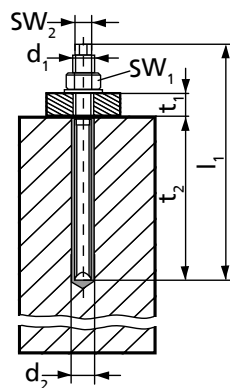
Chemical anchor
dimensions


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} [ft lb]
$3/8 \times 5 1/8$	$7/16$	$7/8$	$3 9/16$	$11/16$	$1/4$	14,75
$7/16 \times 6 5/16$	$9/16$	1	$4 5/16$	$3/4$	$5/16$	29,50
$5/8 \times 7 1/2$	$11/16$	$1 3/8$	$4 15/16$	$15/16$	$7/16$	44,25
$13/16 \times 10 1/4$	1	$2 9/16$	$6 11/16$	$1 3/16$	$9/16$	88,50
$15/16 \times 11 13/16^{9)}$	$1 1/8$	$2 9/16$	$8 1/4$	$1 7/16$	$11/16$	132,76
$1 3/16 \times 14 15/16^{9)}$	$1 3/8$	$2 9/16$	11	$1 13/16$	-	295,02

Size ($d_1 \times l_1$)	d_2 [mm]	t_1 [mm]	t_2 [mm]	$SW_1^{8)}$ [mm]	$SW_2^{8)}$ [mm]	M_{d1} [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 ⁹⁾	28	65	210	36	17	180
M30 × 380 ⁹⁾	35	65	280	46	-	400

Table 10: Curing times of mortar cartridge




Floor temperature		Curing time
[°F]	[°C]	[min]
23 to 32	-5 to 0	240
32 to 50	0 to +10	45
50 to 68	+10 to +20	20
> 68	> +20	10

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.

⁸ SW = Width across flats

⁹ Mounting accessories of the respective manufacturer are required.

	<p>NOTE</p> <p>When the pump set is used for draining low-level building areas, fit a swing check valve into the discharge line to avoid backflow from the sewer system.</p>
	<p>CAUTION</p> <p>Critical speed of reverse rotation Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▸ 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.
	<p>NOTE</p> <p>For a consultation or any queries please contact KSB Service.</p>

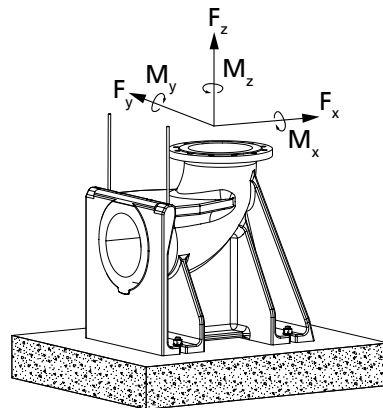


Fig. 12: Permissible flange loads

Table 11: Permissible flange loads

DN ¹⁰	Forces								Moments							
	F _y		F _z		F _x		ΣF		M _y		M _z		M _x		ΣM	
	[lbf]	[N]	[lbf]	[N]	[lbf]	[N]	[lbf]	[N]	[lbf ft]	[Nm]	[lbf ft]	[Nm]	[lbf ft]	[Nm]	[lbf ft]	[Nm]
50	305	1350	373	1650	339	1500	588	2600	733	1000	843	1150	1027	1400	1503	2050
65	384	1700	475	2100	418	1850	746	3300	807	1100	880	1200	1100	1500	1613	2200
80	463	2050	565	2500	509	2250	893	3950	843	1150	953	1300	1173	1600	1723	2350
100	610	2700	757	3350	678	3000	1187	5250	917	1250	1063	1450	1283	1750	1907	2600
150	916	4050	1130	5000	1017	4500	1775	7850	1283	1750	1503	2050	1833	2500	2677	3650
200	1221	5400	1515	6700	1356	6000	2363	10450	1687	2300	1943	2650	2383	3250	3520	4800
250	1526	6750	1888	8350	1684	7450	2950	13050	2310	3150	2677	3650	3263	4450	4803	6550
300	1820	8050	2261	10000	2023	8950	3538	15650	3153	4300	3630	4950	4437	6050	6527	8900

5.3.1.4 Fitting the guide cable arrangement

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

¹⁰ Nominal flange diameter



NOTE

Should site conditions/piping layout, etc. require the guide cable 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

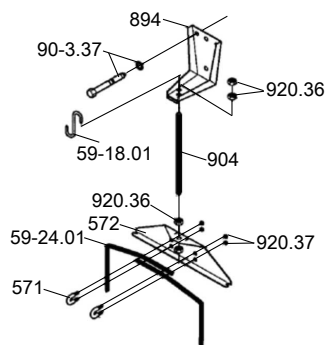


Fig. 13: Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the sump opening with steel anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 7.4 lbf ft [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 slightly, allowing sufficient play for subsequently tensioning the guide cable.

Inserting the guide cable

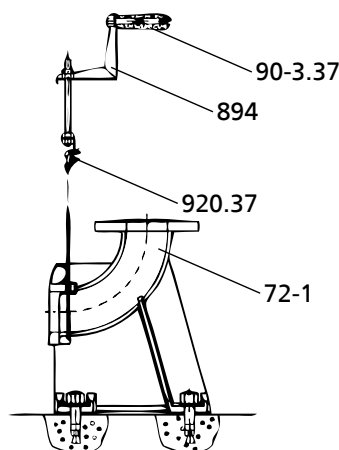



Fig. 14: Inserting the guide cable

1. Lift clamping piece 571 and insert one end of the guide cable.
2. Run cable 59-24.01 around base elbow 72-1 and back again to guide cable 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 cable taut by tightening hexagon nuts 920.36 on the upper side of the mounting bracket to a torque $M_A = 10.3 \text{ lbf ft}$ [14 Nm] and a cable tensioning force $P = 1349 \text{ lbf}$ [6000 N].
5. Secure the nuts with a second hexagon nut.

6. The loose cable ends at guide cable 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 base elbow which has been fitted to the floor.

	<p>NOTE</p> <p>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.</p>
---	--

Observe the following dimensions for the guide rails:

Table 12: Guide rail dimensions

Size of hydraulic system	Outside diameter		Wall thickness ¹¹⁾			
			min.		max.	
	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]
DN 40 to DN 150	2,36	60	0,079	2	0,197	5
DN 200 to DN 300	3,5	89	0,118	3	0,236	6

Fitting the mounting bracket

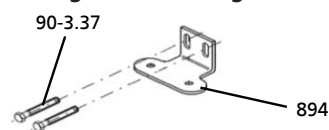



Fig. 15: Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the sump opening with steel anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 7.4 lbf ft [10 Nm].
Observe the hole pattern for the anchor bolts. (See outline drawing.)

Fitting the guide rails

	<p>CAUTION</p> <p>Improper installation of guide rails Damage to the guide rail arrangement!</p> <p>▷ Always adjust the guide rails so that they are in a perfectly vertical position.</p>
---	--

¹¹ To DIN 2440/2442/2462 or equivalent standards

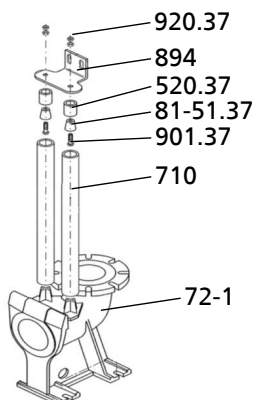


Fig. 16: Fitting the guide rails

1. Place rails 710 onto the conical bosses provided on base elbow 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 of more than 19.7 ft [6 m], the scope of supply may include 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

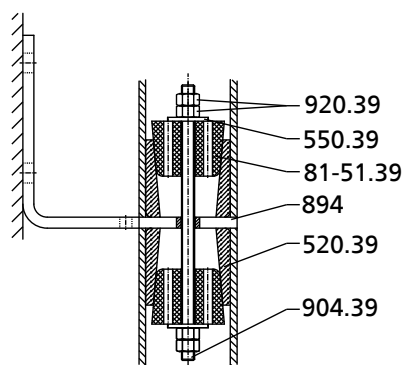


Fig. 17: Fitting the middle support

- ✓ 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. Secure the nuts with locknuts.

5.3.1.6 Preparing the pump set

Fitting the claw

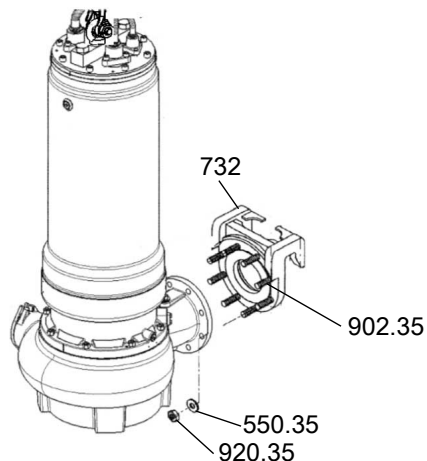


Fig. 18: Fitting the claw

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 will seal the base elbow/pump connection.

Attaching the lifting chain / lifting rope

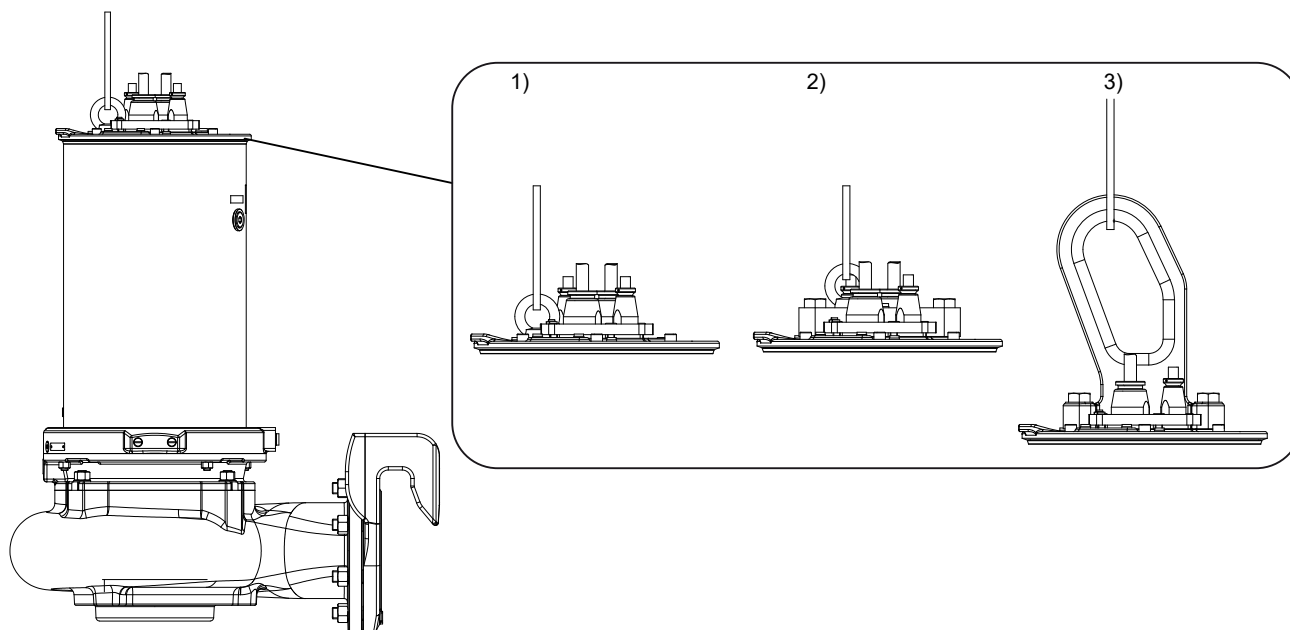


Fig. 19: Attaching the lifting chain / lifting rope – stationary wet installation

1	Standard for guide cable 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 base elbow.

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 cables and lowered down. If required, alter the position of the crane during installation.

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

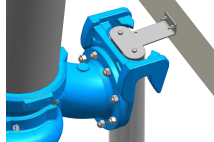


Fig. 20: Attaching the claw

⇒ The pump set attaches itself to base elbow 72-1.

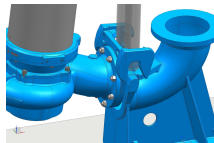


Fig. 21: Claw on base elbow

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 base 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 align it with the help of a spirit level placed on the shaft and discharge nozzle.
Permissible deviation: 0.0025 in/ft [0.2 mm/m].
 2. Mark the outlines of the pump set or suction base elbow as well as the fastening points. Use a template if required.

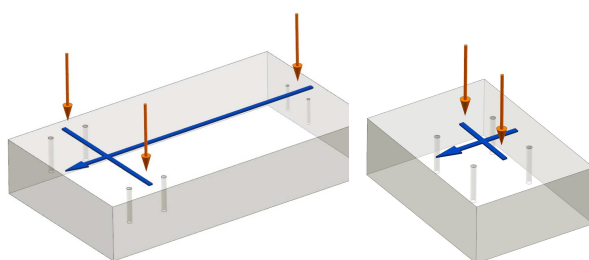



Fig. 22: Marking the fastening points

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

	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Improper handling of mortar cartridge Skin sensitization and/or irritation!</p> <p>▷ Wear suitable protective clothing.</p>
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5. Insert the mortar cartridges into the drilled holes. Observe the curing times of the mortar cartridges.

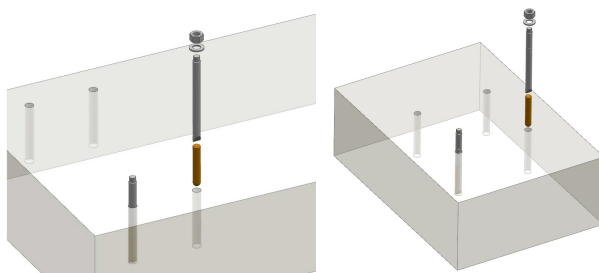


Fig. 23: Chemical anchors

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 base elbow and the concrete floor, apply the chemical mortar as shown below, using a commercial applicator gun.
Work quickly, bearing in mind the curing time of the chemical mortar. Observe the manufacturer's application instructions.

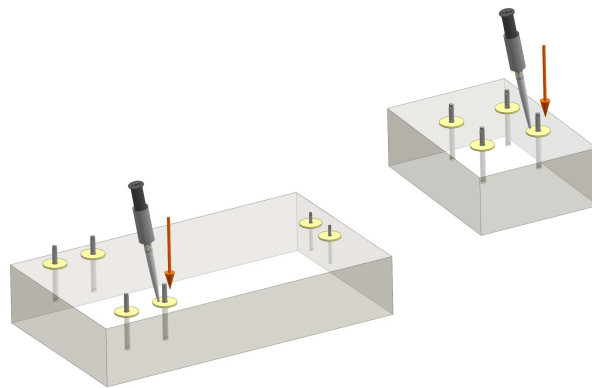


Fig. 24: Chemical mortar

8. Place the pump set on the foundation.

Use shims to achieve a minimum thickness of $\frac{1}{8}$ in [3 mm] for the chemical mortar.

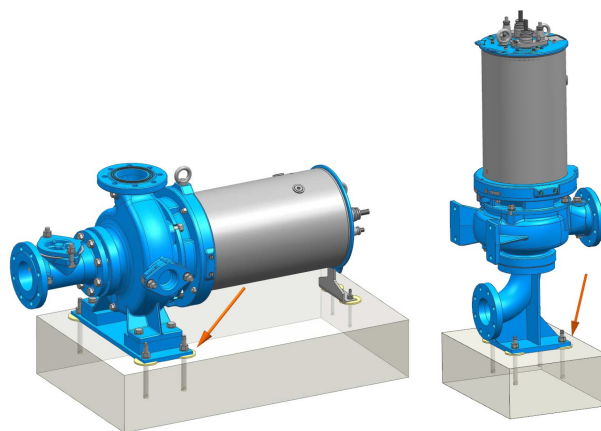


Fig. 25: Shims

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

Chemical anchor
dimensions

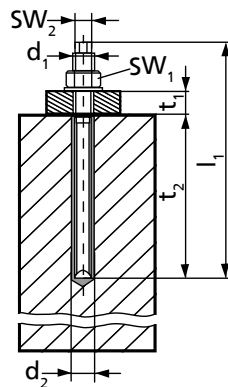


Fig. 26: Dimensions

Table 13: Chemical anchor dimensions

Size ($d_1 \times l_1$)	d_2 ["]	t_1 ["]	t_2 ["]	$SW_1^{12)}$ ["]	$SW_2^{12)}$ ["]	M_{d1} [ft lb]
$\frac{3}{8} \times 5 \frac{1}{8}$ "	$\frac{7}{16}$	$\frac{7}{8}$	$3 \frac{9}{16}$	$\frac{11}{16}$	$\frac{1}{4}$	14,75
$\frac{7}{16} \times 6 \frac{5}{16}$ "	$\frac{9}{16}$	1	$4 \frac{5}{16}$	$\frac{3}{4}$	$\frac{5}{16}$	29,50
$\frac{5}{8} \times 7 \frac{1}{2}$ "	$\frac{11}{16}$	$1 \frac{3}{8}$	$4 \frac{15}{16}$	$\frac{15}{16}$	$\frac{7}{16}$	44,25
$\frac{13}{16} \times 10 \frac{1}{4}$ "	1	$2 \frac{9}{16}$	$6 \frac{11}{16}$	$1 \frac{3}{16}$	$\frac{9}{16}$	88,50

¹²⁾ SW = Width across flats

Size ($d_1 \times l_1$)	d_2 ["]	t_1 ["]	t_2 ["]	$SW_1^{12)}$ ["]	$SW_2^{12)}$ ["]	M_{d1} [ft lb]
$1\frac{15}{16} \times 11\frac{13}{16}$ ¹³⁾	$1\frac{1}{8}$	$2\frac{9}{16}$	$8\frac{1}{4}$	$1\frac{7}{16}$	$1\frac{1}{16}$	132,76
$1\frac{3}{16} \times 14\frac{15}{16}$ ¹³⁾	$1\frac{3}{8}$	$2\frac{9}{16}$	11	$1\frac{13}{16}$	-	295,02

Size ($d_1 \times l_1$)	d_2 [mm]	t_1 [mm]	t_2 [mm]	$SW_1^{12)}$ [mm]	$SW_2^{12)}$ [mm]	M_{d1} [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 ¹³⁾	28	65	210	36	17	180
M30 × 380 ¹³⁾	35	65	280	46	-	400

Table 14: Curing times of mortar cartridge

Floor temperature		Curing time
[°F]	[°C]	[min]
23 to 32	-5 to 0	240
32 to 50	0 to +10	45
50 to 68	+10 to +20	20
> 68	> +20	10

¹³⁾ Mounting accessories of the respective manufacturer are required.

5.3.2.2 Installing the pump set



NOTE

If foundation rails 89-8 are included in KSB's scope of supply, they must be set in concrete as shown in the general arrangement drawing/outline drawing.

5.3.2.2.1 Stationary dry installation, horizontal up to size group 410

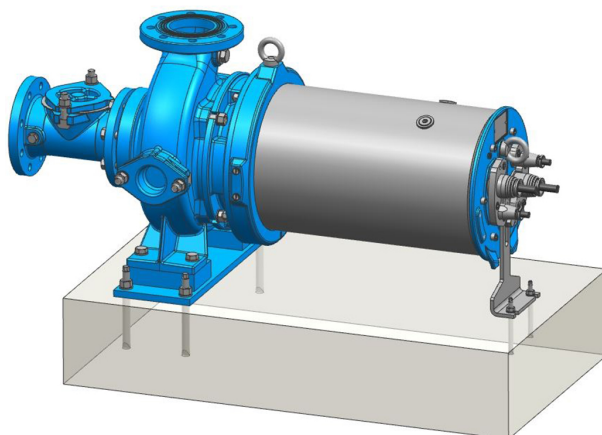


Fig. 27: Dry installation, horizontal, up to size group 410, stationary

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

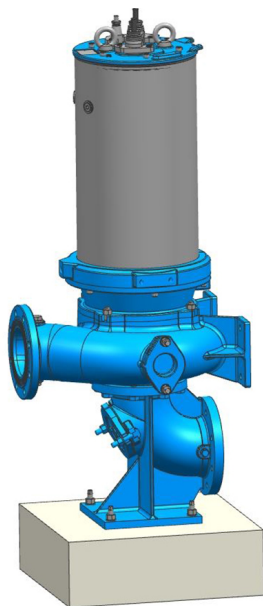


Fig. 28: Dry installation, vertical, up to size group 315 on suction elbow, stationary

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

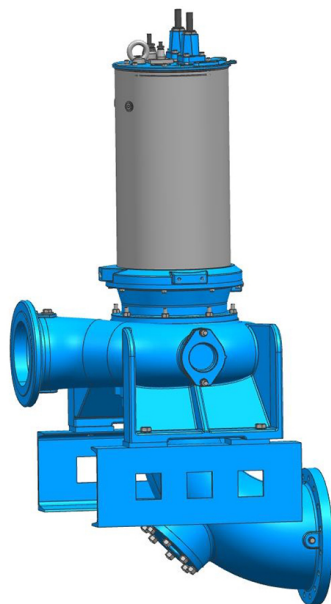


Fig. 29: Dry installation, vertical, from size group 410 on concrete foundation, stationary

5.3.2.2.3.1 Installing the pump set in a vertical position

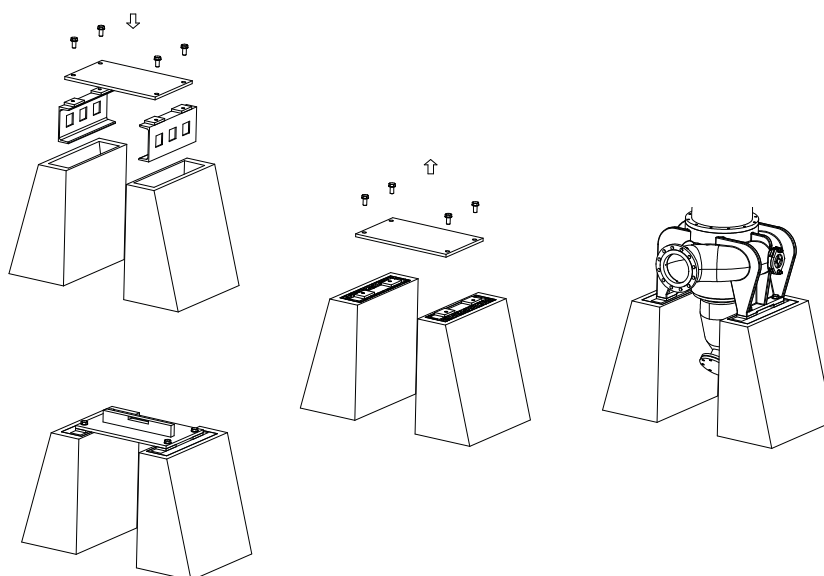


Fig. 30: Preparing the foundation

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.

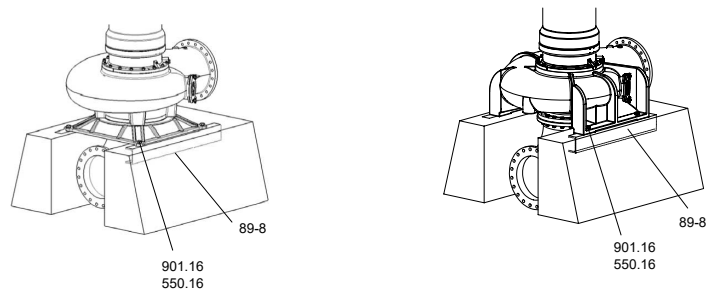


Fig. 31: Vertical installation

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

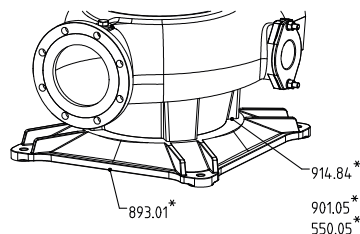


Fig. 32: Vertical dry installation

*: On specific designs only

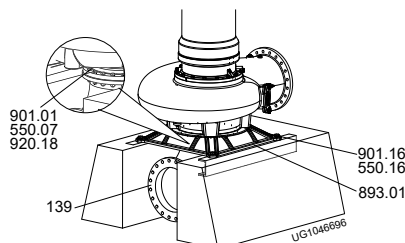


Fig. 33: Installing the pump set with a soleplate

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

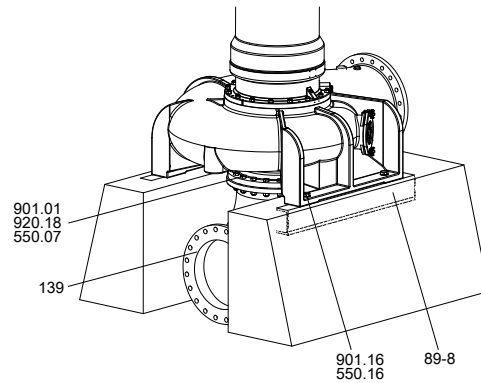




Fig. 34: Installing the pump set with pump feet

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

	<div data-bbox="499 1153 683 1198" style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Impermissible loads acting on the pump nozzles Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> ▸ 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.
	<div data-bbox="499 1512 638 1545" style="background-color: #f1c40f; color: black; padding: 5px;">CAUTION</div> <p>Incorrect grounding during welding work on the piping Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> ▸ Never ground the electric welding equipment on the pump or baseplate. ▸ Prevent current flowing through the rolling element bearings.

**NOTE**

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

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

5.3.2.3.2 Permissible forces and moments at the pump nozzles

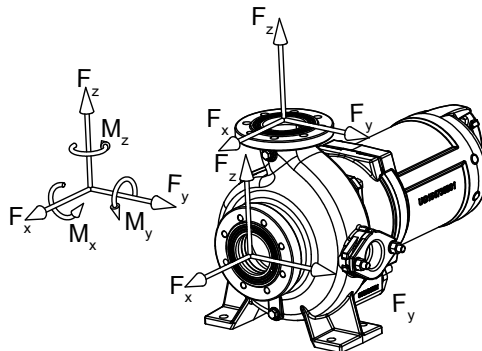


Fig. 35: Forces and moments at the pump nozzles for installation on pump feet

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 computerized strength analysis is required, please contact KSB.

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 EN ISO 5199 for horizontal installation of pump family 1A, for cast iron and 68 °F [20 °C].

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

Size	Impeller type	Forces [N]								Moments [Nm]							
		Suction nozzle				Discharge nozzle				Suction nozzle				Discharge nozzle			
		F _y	F _z	F _x	ΣF	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
40-252	F, K	650	600	750	1150	350	450	400	700	400	400	550	750	300	350	450	650
80-252	F	1050	950	1200	1850	700	900	800	1400	450	500	600	900	400	450	600	800
80-253	F	1050	950	1200	1850	700	900	800	1400	450	500	600	900	400	450	600	800
80-253	E, K	1050	950	1200	1850	700	900	800	1400	450	500	600	900	400	450	600	800
80-315	D	1050	950	1200	1850	700	900	800	1400	450	500	600	900	400	450	600	800
80-315	K	1050	950	1200	1850	700	900	800	1400	450	500	600	900	400	450	600	800
80-317	D	1050	950	1200	1850	700	900	800	1400	450	500	600	900	400	450	600	800
80-317	F	1050	950	1200	1850	700	900	800	1400	450	500	600	900	400	450	600	800
100-253	E	1050	950	1200	1850	950	1200	1050	1850	450	500	600	900	450	500	600	900
100-253	K	1050	950	1200	1850	950	1200	1050	1850	450	500	600	900	450	500	600	900
100-253	D	1600	1400	1750	2750	950	1200	1050	1850	600	700	900	1300	450	500	600	900
100-254	F	1050	950	1200	1850	950	1200	1050	1850	450	500	600	900	450	500	600	900
100-254	K	1050	950	1200	1850	950	1200	1050	1850	450	500	600	900	450	500	600	900
100-315	D	1250	1100	1400	2150	950	1200	1050	1850	550	650	750	1050	450	500	600	900
100-316	D	1600	1400	1750	2750	950	1200	1050	1850	600	700	900	1300	450	500	600	900
100-316	F, K	1600	1400	1750	2750	950	1200	1050	1850	600	700	900	1300	450	500	600	900
100-317	E	1250	1100	1400	2150	950	1200	1050	1850	550	650	750	1050	450	500	600	900
100-400	K	1600	1400	1750	2750	950	1200	1050	1850	600	700	900	1300	450	500	600	900
100-401	E, F, K	1250	1100	1400	2150	950	1200	1050	1850	550	650	750	1050	450	500	600	900
100-403	D	2100	1900	2350	3650	950	1200	1050	1850	800	950	1150	1700	450	500	600	900
150-253	D	1600	1400	1750	2750	1400	1750	1600	2750	600	700	900	1300	600	700	900	1300
150-315	F	1600	1400	1750	2750	1400	1750	1600	2750	600	700	900	1300	600	700	900	1300
150-315	D	1600	1400	1750	2750	1400	1750	1600	2750	600	700	900	1300	600	700	900	1300
150-317	E, K	1600	1400	1750	2750	1400	1750	1600	2750	600	700	900	1300	600	700	900	1300
150-400	D, K	2100	1900	2350	3650	1400	1750	1600	2750	800	950	1150	1700	600	700	900	1300
150-401	D	2600	2400	2950	4550	1400	1750	1600	2750	1100	1300	1550	2300	600	700	900	1300
150-401	E, F	1600	1400	1750	2750	1400	1750	1600	2750	600	700	900	1300	600	700	900	1300

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

Table 16: Forces [lbf] and moments [ft lbf] at the pump nozzles

Size	Impeller type	Forces [lbf]								Moments [ft lbf]							
		Suction nozzle				Discharge nozzle				Suction nozzle				Discharge nozzle			
		F _y	F _z	F _x	ΣF	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
40-252	F, K	147	136	170	260	79	102	90	158	293	293	403	550	220	257	330	477
80-252	F	237	215	271	418	158	203	181	317	330	367	440	660	293	330	440	587
80-253	F	237	215	271	418	158	203	181	317	330	367	440	660	293	330	440	587
80-253	E, K	237	215	271	418	158	203	181	317	330	367	440	660	293	330	440	587
80-315	D	237	215	271	418	158	203	181	317	330	367	440	660	293	330	440	587
80-315	K	237	215	271	418	158	203	181	317	330	367	440	660	293	330	440	587
80-317	D	237	215	271	418	158	203	181	317	330	367	440	660	293	330	440	587
80-317	F	237	215	271	418	158	203	181	317	330	367	440	660	293	330	440	587
100-253	E	237	215	271	418	215	271	237	418	330	367	440	660	330	367	440	660
100-253	K	237	215	271	418	215	271	237	418	330	367	440	660	330	367	440	660
100-253	D	362	317	396	622	215	271	237	418	440	513	660	953	330	367	440	660
100-254	F	237	215	271	418	215	271	237	418	330	367	440	660	330	367	440	660
100-254	K	237	215	271	418	215	271	237	418	330	367	440	660	330	367	440	660
100-315	D	283	249	317	486	215	271	237	418	403	477	550	770	330	367	440	660
100-316	D	362	317	396	622	215	271	237	418	440	513	660	953	330	367	440	660
100-316	F, K	362	317	396	622	215	271	237	418	440	513	660	953	330	367	440	660
100-317	E	283	249	317	486	215	271	237	418	403	477	550	770	330	367	440	660
100-400	K	362	317	396	622	215	271	237	418	440	513	660	953	330	367	440	660

Size	Impeller type	Forces [lbf]								Moments [ft lbf]							
		Suction nozzle				Discharge nozzle				Suction nozzle				Discharge nozzle			
		F _y	F _z	F _x	ΣF	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
100-401	E, F, K	283	249	317	486	215	271	237	418	403	477	550	770	330	367	440	660
100-403	D	475	430	531	825	215	271	237	418	587	697	843	1247	330	367	440	660
150-253	D	362	317	396	622	317	396	362	622	440	513	660	953	440	513	660	953
150-315	F	362	317	396	622	317	396	362	622	440	513	660	953	440	513	660	953
150-315	D	362	317	396	622	317	396	362	622	440	513	660	953	440	513	660	953
150-317	E, K	362	317	396	622	317	396	362	622	440	513	660	953	440	513	660	953
150-400	D, K	475	430	531	825	317	396	362	622	587	697	843	1247	440	513	660	953
150-401	D	588	543	667	1029	317	396	362	622	807	953	1137	1687	440	513	660	953
150-401	E, F	362	317	396	622	317	396	362	622	440	513	660	953	440	513	660	953
150-403	D	475	430	531	825	317	396	362	622	587	697	843	1247	440	513	660	953
150-403	K	475	430	531	825	317	396	362	622	587	697	843	1247	440	513	660	953
151-403	K	475	430	531	825	317	396	362	622	587	697	843	1247	440	513	660	953
200-315	K	475	430	531	825	430	531	475	825	587	697	843	1247	587	697	843	1247
200-315	D	475	430	531	825	430	531	475	825	587	697	843	1247	587	697	843	1247
200-316	K	475	430	531	825	430	531	475	825	587	697	843	1247	587	697	843	1247
200-317	K	475	430	531	825	430	531	475	825	587	697	843	1247	587	697	843	1247
200-318	K	475	430	531	825	430	531	475	825	587	697	843	1247	587	697	843	1247
200-400	D	588	543	667	1029	430	531	475	825	807	953	1137	1687	587	697	843	1247
200-401	E	475	430	531	825	430	531	475	825	587	697	843	1247	587	697	843	1247
200-402	D	588	543	667	1029	430	531	475	825	807	953	1137	1687	587	697	843	1247
200-402	K	475	430	531	825	430	531	475	825	587	697	843	1247	587	697	843	1247
200-403	K	475	430	531	825	430	531	475	825	587	697	843	1247	587	697	843	1247
200-405	D	588	543	667	1029	430	531	475	825	807	953	1137	1687	587	697	843	1247
250-400	D	588	543	667	1029	543	667	588	1029	807	953	1137	1687	807	953	1137	1687
250-401	K	588	543	667	1029	543	667	588	1029	807	953	1137	1687	807	953	1137	1687
250-402	D	588	543	667	1029	543	667	588	1029	807	953	1137	1687	807	953	1137	1687
250-403	K	588	543	667	1029	543	667	588	1029	807	953	1137	1687	807	953	1137	1687
300-400	D, K	712	633	791	1243	633	791	712	1243	1100	1283	1540	2273	1100	1283	1540	2273
300-401	K	712	633	791	1243	633	791	712	1243	1100	1283	1540	2273	1100	1283	1540	2273
300-402	D	712	633	791	1243	633	791	712	1243	1100	1283	1540	2273	1100	1283	1540	2273
300-403	K	712	633	791	1243	633	791	712	1243	1100	1283	1540	2273	1100	1283	1540	2273

Installation on a suction elbow (vertical)

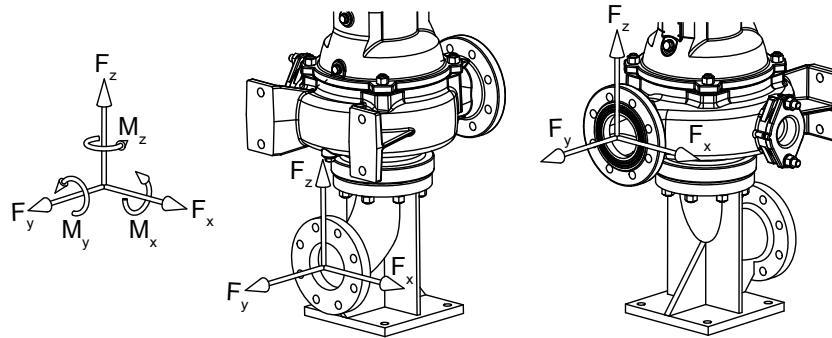


Fig. 36: Forces and moments at the pump nozzles for installation on a suction elbow

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

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

Table 18: Forces [lbf] and moments [ft lbf] at the pump nozzles

Size	Impeller type	Forces [lbf]								Moments [ft lbf]							
		Suction nozzle				Discharge nozzle				Suction nozzle				Discharge nozzle			
		F _y	F _z	F _x	ΣF	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
80-252	F	610	757	678	1187	203	158	181	317	917	1063	1283	1907	293	330	440	587
80-253	F	610	757	678	1187	203	158	181	317	917	1063	1283	1907	293	330	440	587
80-253	E, K	610	757	678	1187	203	158	181	317	917	1063	1283	1907	293	330	440	587
80-315	D	610	757	678	1187	203	158	181	317	917	1063	1283	1907	293	330	440	587
80-315	K	610	757	678	1187	203	158	181	317	917	1063	1283	1907	293	330	440	587
80-317	D	610	757	678	1187	203	158	181	317	917	1063	1283	1907	293	330	440	587
80-317	F	610	757	678	1187	203	158	181	317	917	1063	1283	1907	293	330	440	587
100-253	E	610	757	678	1187	271	215	237	418	917	1063	1283	1907	330	367	440	660
100-253	K	610	757	678	1187	271	215	237	418	917	1063	1283	1907	330	367	440	660
100-253	D	916	1130	1017	1775	271	215	237	418	1283	1503	1833	2677	330	367	440	660
100-254	F	610	757	678	1187	271	215	237	418	917	1063	1283	1907	330	367	440	660
100-254	K	610	757	678	1187	271	215	237	418	917	1063	1283	1907	330	367	440	660
100-315	D	723	893	803	1402	271	215	237	418	1100	1393	1540	2237	330	367	440	660
100-316	D	916	1130	1017	1775	271	215	237	418	1283	1503	1833	2677	330	367	440	660
100-316	F, K	916	1130	1017	1775	271	215	237	418	1283	1503	1833	2677	330	367	440	660
100-317	E	723	893	803	1402	271	215	237	418	1100	1393	1540	2237	330	367	440	660
150-253	D	916	1130	1017	1775	396	317	362	622	1283	1503	1833	2677	440	513	660	953
150-315	F	916	1130	1017	1775	396	317	362	622	1283	1503	1833	2677	440	513	660	953
150-315	D	916	1130	1017	1775	396	317	362	622	1283	1503	1833	2677	440	513	660	953
150-317	E, K	916	1130	1017	1775	396	317	362	622	1283	1503	1833	2677	440	513	660	953
200-315	K	1221	1515	1356	2363	531	430	475	825	1687	1943	2383	3520	587	697	843	1247
200-315	D	1221	1515	1356	2363	531	430	475	825	1687	1943	2383	3520	587	697	843	1247
200-316	K	1221	1515	1356	2363	531	430	475	825	1687	1943	2383	3520	587	697	843	1247
200-317	K	1221	1515	1356	2363	531	430	475	825	1687	1943	2383	3520	587	697	843	1247
200-318	K	1221	1515	1356	2363	531	430	475	825	1687	1943	2383	3520	587	697	843	1247

Installation on a concrete foundation (vertical)

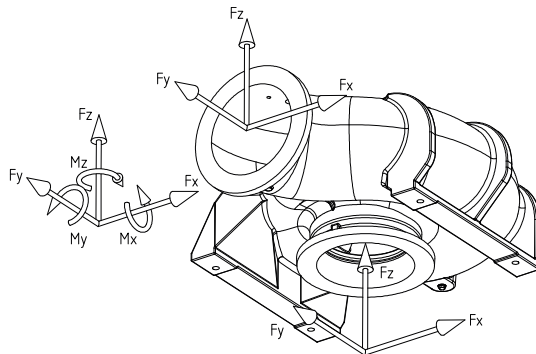


Fig. 37: Forces and moments at the pump nozzles for vertical installation

Table 19: Forces [N] and moments [Nm] at the pump nozzles

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

Table 20: Forces [lbf] and moments [ft lbf] at the pump nozzles

Size	Impeller type	Forces [lbf]								Moments [ft lbf]							
		Suction nozzle				Discharge nozzle				Suction nozzle				Discharge nozzle			
		F _y	F _z	F _x	ΣF	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM	M _y	M _z	M _x	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
100-400	K	916	1130	1017	1775	610	757	678	1187	1283	1503	1833	2677	917	1063	1283	1907
100-401	E	723	893	803	1402	610	757	678	1187	1100	1393	1540	2237	917	1063	1283	1907
100-401	F	723	893	803	1402	610	757	678	1187	1100	1393	1540	2237	917	1063	1283	1907
100-401	K	723	893	803	1402	610	757	678	1187	1100	1393	1540	2237	917	1063	1283	1907
100-403	D	1221	1515	1356	2363	610	757	678	1187	1687	1943	2383	3520	917	1063	1283	1907
150-400	D	1221	1515	1356	2363	916	1130	1017	1775	1687	1943	2383	3520	1283	1503	1833	2677
150-400	K	1221	1515	1356	2363	916	1130	1017	1775	1687	1943	2383	3520	1283	1503	1833	2677
150-401	E	916	1130	1017	1775	916	1130	1017	1775	1283	1503	1833	2677	1283	1503	1833	2677
150-401	F	916	1130	1017	1775	916	1130	1017	1775	1283	1503	1833	2677	1283	1503	1833	2677
150-401	K	916	1130	1017	1775	916	1130	1017	1775	1283	1503	1833	2677	1283	1503	1833	2677
150-401	E	916	1130	1017	1775	916	1130	1017	1775	1283	1503	1833	2677	1283	1503	1833	2677
150-401	D	1526	1888	1684	2950	916	1130	1017	1775	2310	2677	3263	4803	1283	1503	1833	2677
150-403	D	1221	1515	1356	2363	916	1130	1017	1775	1687	1943	2383	3520	1283	1503	1833	2677
150-403	K	1221	1515	1356	2363	916	1130	1017	1775	1687	1943	2383	3520	1283	1503	1833	2677
151-403	K	1221	1515	1356	2363	916	1130	1017	1775	1687	1943	2383	3520	1283	1503	1833	2677
151-401	K	916	1130	1017	1775	916	1130	1017	1775	1283	1503	1833	2677	1283	1503	1833	2677
200-401	E	1221	1515	1356	2363	1221	1515	1356	2363	1687	1943	2383	3520	1687	1943	2383	3520
200-401	K	1221	1515	1356	2363	1221	1515	1356	2363	1687	1943	2383	3520	1687	1943	2383	3520
200-400	D	1526	1888	1684	2950	1221	1515	1356	2363	2310	2677	3263	4803	1687	1943	2383	3520
200-402	D	1526	1888	1684	2950	1221	1515	1356	2363	2310	2677	3263	4803	1687	1943	2383	3520
200-402	K	1221	1515	1356	2363	1221	1515	1356	2363	1687	1943	2383	3520	1687	1943	2383	3520
200-403	K	1221	1515	1356	2363	1221	1515	1356	2363	1687	1943	2383	3520	1687	1943	2383	3520
200-405	D	1526	1888	1684	2950	1221	1515	1356	2363	2310	2677	3263	4803	1687	1943	2383	3520
250-400	K	1526	1888	1684	2950	1526	1888	1684	2950	2310	2677	3263	4803	2310	2677	3263	4803
250-400	D	1526	1888	1684	2950	1526	1888	1684	2950	2310	2677	3263	4803	2310	2677	3263	4803
250-401	K	1526	1888	1684	2950	1526	1888	1684	2950	2310	2677	3263	4803	2310	2677	3263	4803
250-402	D	1526	1888	1684	2950	1526	1888	1684	2950	2310	2677	3263	4803	2310	2677	3263	4803
250-403	K	1526	1888	1684	2950	1526	1888	1684	2950	2310	2677	3263	4803	2310	2677	3263	4803
300-400	K	1820	2261	2023	3538	1820	2261	2023	3538	3153	3630	4437	6527	3153	3630	4436	6526
300-400	D	1820	2261	2023	3538	1820	2261	2023	3538	3153	3630	4437	6527	3153	3630	4436	6526
300-401	K	1820	2261	2023	3538	1820	2261	2023	3538	3153	3630	4437	6527	3153	3630	4436	6526
300-402	D	1820	2261	2023	3538	1820	2261	2023	3538	3153	3630	4437	6527	3153	3630	4436	6526
300-403	K	1820	2261	2023	3538	1820	2261	2023	3538	3153	3630	4437	6527	3153	3630	4436	6526

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: 0.98 inch [25 mm].
- The line extends above the highest permissible fluid level in the tank.

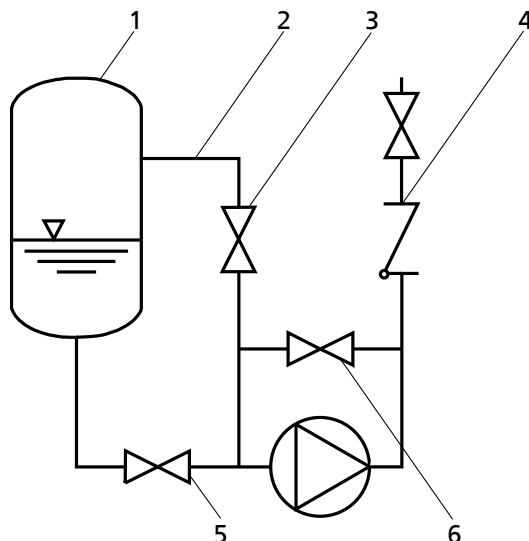


Fig. 38: Vacuum balance line


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



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 a suitable venting device (e.g. vent valve).

The following auxiliary connections are available:

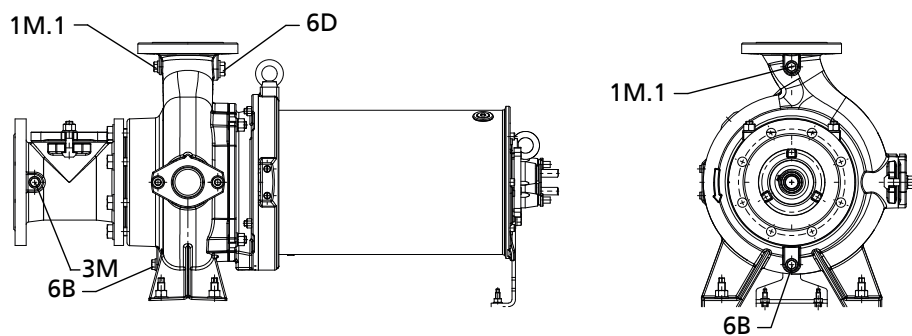


Fig. 39: Auxiliary connections

Table 21: Size of auxiliary connections


Size	Impeller type	Connection			
		Pressure gage	Vent	Pressure/ vacuum gage	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
150-400	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

Size	Impeller type	Connection			
		Pressure gage	Vent	Pressure/ vacuum gage	Casing drain
		1 M.1	6 D	3 M	6 B
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
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 125)

	<p>NOTE</p> <p>When laying a cable between the control system and the pump set's connection point, make sure the number of cores for the sensors is sufficient. A minimum cross-section of AWG 15 [1.5 mm²] is required.</p>
---	--

The motors can be connected to electrical low-voltage grids with rated voltages and voltage tolerances to IEC 60038. The permissible tolerances must be observed.

5.4.1.1 Starting method

The pump set is wired for DOL starting.

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.


Single voltage

For the single voltage variant, star-delta starting is technically possible. Excluded are pump sets with a 4G16 power cable and one or two 8G1.5 control cables.

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 19)

5.4.1.3 Level control



	<p>CAUTION</p> <p>Fluid level below the specified minimum</p> <p>Damage to the pump set by cavitation!</p> <p>▷ Never allow the fluid level to drop below the specified minimum.</p>
---	--

Automatic operation of the pump set in a sump or tank requires the use of level control equipment.
Observe the specified minimum fluid level.

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.

	<p>⚠ DANGER</p> <p>Operation outside the permitted frequency range</p> <p>Explosion hazard!</p> <p>▷ Never operate an explosion-proof pump set outside the specified range.</p>
---	---

	<p>NOTE</p> <p>For pump sets with rated voltages exceeding 500 V, a dv/dt filter should be fitted at the output of the frequency inverter to reduce the rate of voltage rise to the limits specified in IEC 60034-25, Section 18. Otherwise a considerably reduced service life of the insulation system has to be expected.</p>
	<p>! DANGER</p> <p>Incorrect selection and setting of the frequency inverter</p> <p>Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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 intermediate-circuit 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 up a frequency inverter:

- Ensure short start ramps (maximum 5 seconds).
- Only start speed-controlled operation after 2 minutes at the earliest. Pump start-up with long start ramps and low frequency may cause clogging.


Operation Observe the following limits when operating the pump set on a frequency inverter:

- Only utilize up to 95 % of the rated power P_2 indicated on the name plate.
- Frequency range 30 to 60 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 submersible 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 submersible motor pump with shielded power cables.

Interference immunity The submersible motor pump generally meets interference immunity requirements. For monitoring the sensors installed the operator must ensure sufficient interference immunity by appropriately selecting and laying the power cables in the plant. No modifications are required on the power/control cable of the submersible motor pump. Suitable analyzing devices must be selected. This applies in particular to the leakage sensor inside the motor.

5.4.1.5 Sensors

	<p>! DANGER</p> <p>Operating an incompletely connected pump set</p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.
---	--

**CAUTION****Incorrect connection**

Damage to the sensors!

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

The pump set features sensors that avoid hazards and damage to the pump set.

**NOTE**

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

All sensors are located inside the pump set and are connected to the sensor cable.

For information on wiring and core marking see (⇒ Section 9.6, Page 125)

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

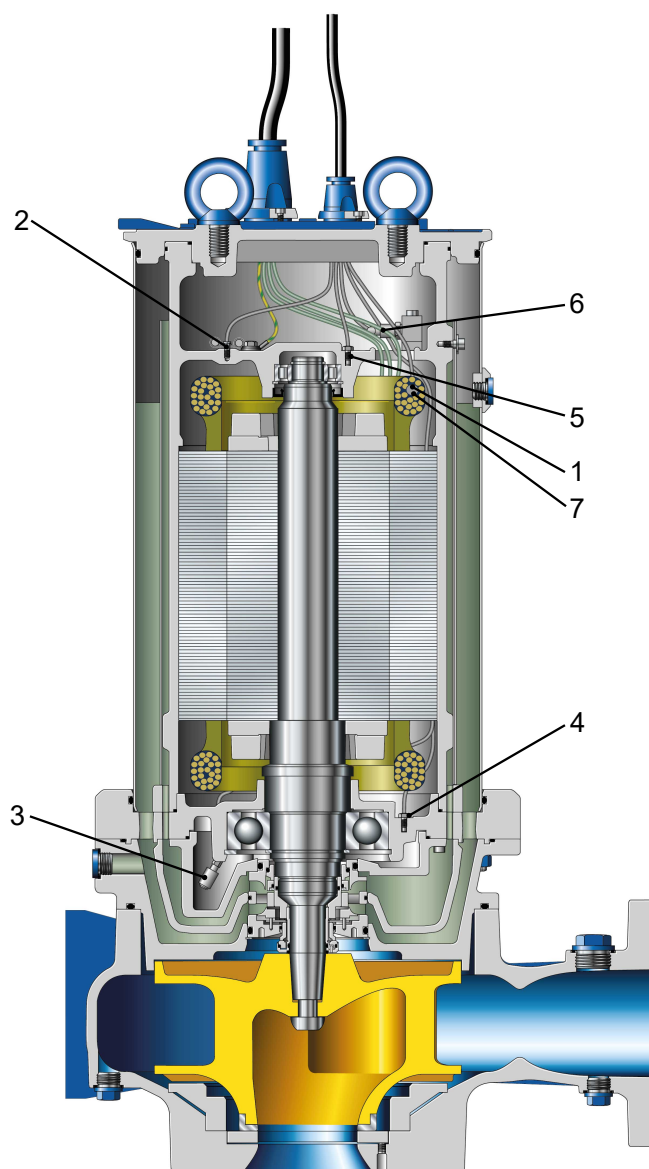




Fig. 40: Sensor positions

Item	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

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5.4.1.5.1 Motor temperature


	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Insufficient cooling Explosion hazard! Winding damage!</p> <ul style="list-style-type: none"> ▷ Never operate a pump set without operational temperature monitoring equipment.
	<div style="background-color: #f1c40f; color: black; padding: 5px;">CAUTION</div> <p>Temperature monitoring equipment not properly connected Winding damage!</p> <ul style="list-style-type: none"> ▷ Never use the Pt100 resistance thermometers as a sole means of monitoring the motor temperature.

The motor is monitored by three series-connected PTC thermistors with terminals 10 and 11. Tripping must result in the pump set cutting out. Automatic re-start is not permitted.

Pt100 resistance thermometer

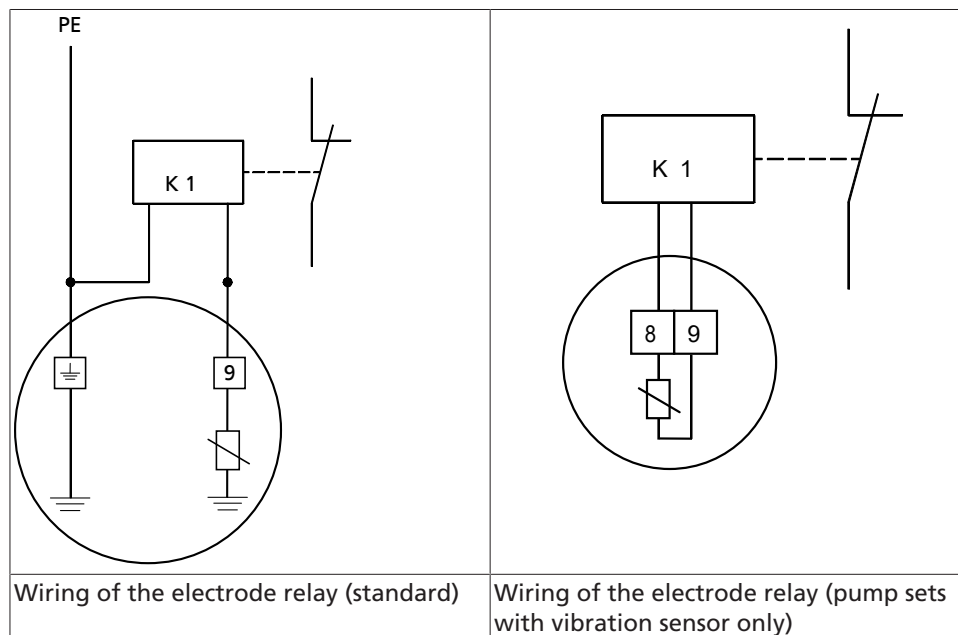
As an option, in addition to the above, the motor can be fitted with Pt100 resistance thermometers in the winding. These can be used for reading the motor temperature (sensor circuit maximum 300 mV / 3 mA).

5.4.1.5.2 Leakage inside the motor

	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Incorrect monitoring of leakage electrode Explosion hazard! Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ 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 at a 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 must 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 bearing.

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 300 mV/3 mA).

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

Standard bearings

- Alert at 230 °F [110 °C]
- Cut-out of the pump set at 266 °F [130 °C]

Reinforced bearings (⇒ Section 9.3.1, Page 117)

- Alert at 266 °F [130 °C]
- Cut-out of the pump set at 302 °F [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 value for the motor-end bearing assembly:

- Alert at 266 °F [130 °C]
- Cut-out of the pump set at 302 °F [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 upper 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 upper bearing. The sensor has an integrated signal converter with a standardized output (4 to 20 mA). This allows simple integration into existing PLC systems or process control systems.

Table 22: Technical data of the sensor

Characteristic	Value
Measuring range	4 - 20 mA at 0 - 0.79 in/s RMS [0 - 20 mm/s]
Measurement error	< 5 %
Long-term stability	+/- 1 % in 10 years
Max. shock load	1.1 lb [500 g]
Frequency range	2 Hz - 1000 Hz
Resonant frequency	18 kHz
Output impedance	200 Ohm max.
Voltage supply	18 - 30 V (smoothed)
Working resistance	50 - 100 Ohm

Connecting the vibration sensor

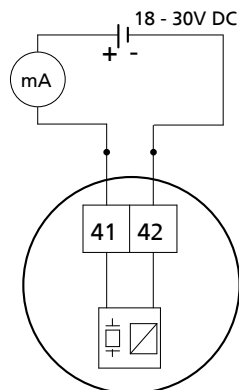





Fig. 41: Connecting the vibration sensor

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

- Alert triggered at $v_{eff} = 0.43$ in/s [11 mm/s] (impeller types E and D: $v_{eff} = 0.55$ in/s [14 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 $v_{eff} = 0.55$ in/s [14 mm/s] (impeller types E and D: $v_{eff} = 0.66$ in/s [17 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 Electrical connection

	DANGER
	<p>Electrical connection work by unqualified personnel</p> <p>Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained electrician. ▷ Observe the EN 61557 regulations as well as any locally applicable regulations.



	<p>⚠ WARNING</p> <p>Incorrect connection to the mains Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> ▷ Observe the technical specifications of the local energy supply companies.
	<p>CAUTION</p> <p>Improper routing of power cables Damage to the power cables!</p> <ul style="list-style-type: none"> ▷ Never move the power cables at temperatures below -13 °F [-25 °C]. ▷ Never kink or crush the power cables. ▷ Never lift the pump set by the power cables. ▷ Adjust the length of the power cables to the site requirements.
	<p>CAUTION</p> <p>Motor overload Damage to the motor!</p> <ul style="list-style-type: none"> ▷ 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 125) in the Annex and the information for planning the control system (⇒ Section 5.4.1, Page 55) .




A distinction is made between different types of electrical connection based on:

1. Single voltage or dual voltage¹⁴⁾
2. Sensor package
3. Type of power cables

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

	<p>⚠ DANGER</p> <p>Incorrect connection Explosion hazard!</p> <ul style="list-style-type: none"> ▷ The connection point of the cable ends must be located outside hazardous areas or in an area approved for electrical equipment.
	<p>⚠ DANGER</p> <p>Operating an incompletely connected pump set Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.

¹⁴ For 60 Hz only



	<div data-bbox="504 192 683 237">  DANGER </div> <div data-bbox="491 253 936 286"> Connection of damaged electric cables </div> <div data-bbox="491 291 914 322"> Danger of death from electric shock! </div> <div data-bbox="512 329 1291 443"> <ul style="list-style-type: none"> ▷ Check the electric cables for any damage before connecting them. ▷ Never connect damaged electric cables. ▷ Replace damaged electric cables. </div>
	<div data-bbox="504 483 639 517"> CAUTION </div> <div data-bbox="491 542 742 573"> Flow-induced motion </div> <div data-bbox="491 577 829 609"> Damage to the electric cable! </div> <div data-bbox="512 616 1367 676"> <ul style="list-style-type: none"> ▷ If the pump is installed in a tank, run the electric cables directly upwards without slack. </div>

1. For installation in a tank, run the power cables directly upwards without slack, and fasten them.
2. Only remove the protective caps from the power cables immediately before connecting the cables.
3. If necessary, adjust the length of the power 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 equalization

**Wet installation
(installation type K)**

The pump set does not have an external PE connection (risk of corrosion).

	<p>⚠ DANGER</p> <p>Incorrect connection Explosion hazard!</p> <ul style="list-style-type: none"> ▸ Explosion-proof pump sets installed in a tank must never be retrofitted with an external potential equalization connection.
	<p>⚠ DANGER</p> <p>Touching the pump set during operation Electric shock!</p> <ul style="list-style-type: none"> ▸ 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 equalization connection. Potential equalization shall be provided for in compliance with IEC 60204.

Connecting the potential equalization conductor

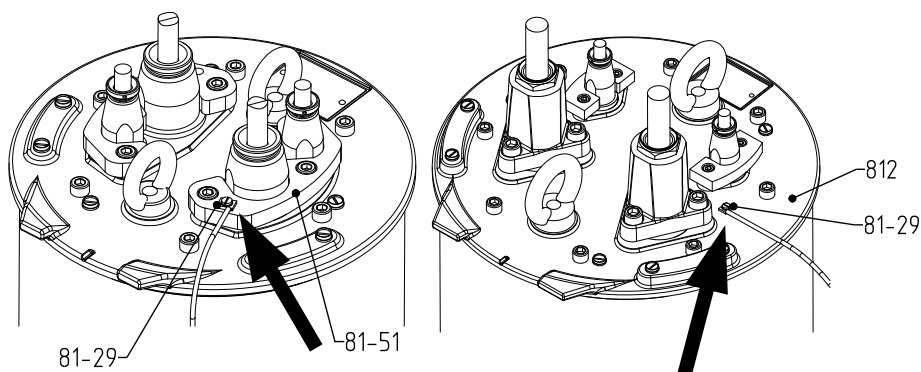


Fig. 42: Connecting the potential equalization conductor

81-29	Connection terminal
81-51	Clamping element

1. Connect the potential equalization 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 primed with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked. (⇒ Section 5.2.4, Page 26)
- All auxiliary feed lines required are connected and operational.
- The coolant level has been checked. (⇒ Section 5.2.3, Page 25)


	<div style="background-color: #e67e22; color: white; padding: 5px;"> DANGER</div> <p>Persons in the tank during pump operation Electric shock! Risk of personal injury! Danger of death from drowning!</p> <p>▷ Never start up the pump set when there are persons in the tank.</p>
	<div style="background-color: #e67e22; color: white; padding: 5px;"> DANGER</div> <p>Exceeding the operating limits Pump casing could burst/leak! Pressurized hot or toxic fluid could escape! Flying parts!</p> <p>▷ Maintain an adequate safety distance from pump sets which are in operation.</p>

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


	<div style="background-color: #e67e22; color: white; padding: 5px;"> DANGER</div> <p>Shaft seal failure caused by insufficient lubrication Hot or toxic fluid could escape! Damage to the pump!</p> <p>▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.</p>
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1. Vent the pump and suction line and prime both with the fluid to be handled.
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary connections (barrier fluid, flushing liquid, etc).

6.1.3 Commissioning/start-up



	CAUTION
	<p>Re-starting while motor is still running down Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Do not re-start the pump set before it has come to a standstill. ▷ Never start the pump set while the pump is running in reverse.



✓ The fluid level is sufficiently high.



	CAUTION
	<p>Start-up against a closed shut-off element Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▷ Never start up 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
	<p>Non-compliance with the permissible pressure limits and temperature limits due to pump being operated with the suction and discharge lines closed. Explosion hazard! Hot or toxic fluids escaping!</p> <ul style="list-style-type: none"> ▷ 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
	<p>Excessive temperatures due to dry running or excessive gas content in the fluid handled Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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
	<p>Hot surface Risk of burns</p> <ul style="list-style-type: none"> ▷ Never touch a pump set which is in operation.

	⚠ WARNING
	Very high noise emission during operation Personal injury! <ul style="list-style-type: none"> ▷ Minimize 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! <ul style="list-style-type: none"> ▷ Switch off the pump (set) immediately. ▷ Eliminate the causes before returning the pump set to service.


- ✓ The pump, suction line and inlet tank (if any) 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! <ul style="list-style-type: none"> ▷ Make sure the motor has sufficient power reserves. ▷ Use a soft starter. ▷ Use speed control.

1. Fully open the shut-off element in the suction head line / suction lift line.
2. 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
	<p>Danger of freezing! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Drain the pump set or protect it against freezing.

6.2 Operating limits


	 DANGER
	<p>Non-compliance with operating limits Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Comply with the operating data indicated 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
	<p>Excessive frequency of starts Damage to the motor!</p> <ul style="list-style-type: none"> ▷ Never exceed the specified frequency of starts.

To prevent high temperature increases in the motor and excessive loads on the motor, sealing 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). These limits do not apply to operation on a frequency inverter.



	CAUTION
	<p>Re-starting while motor is still running down Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Do not re-start the pump set before it has come to a standstill. ▷ Never start the pump set while the pump is running in reverse.

6.2.2 Operation on the power supply network

	 DANGER
	<p>Permissible tolerances for operation on the power supply network exceeded Explosion hazard</p> <ul style="list-style-type: none"> ▷ 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 approx. 25 in/s [0.7 m/s] in horizontal pipes and approx. 45 in/s [1.2 m/s] in vertical pipes.

Frequency inverter operation of the pump set is permitted in the frequency range from 30 to 60 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). Exact dimensions see general arrangement drawing / outline drawing.

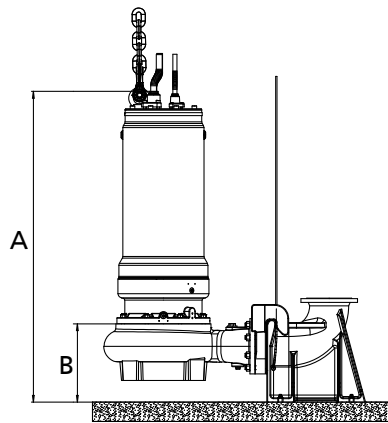


Fig. 43: Minimum fluid level



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 changes in proportion to the density of the fluid handled.



CAUTION

Impermissibly high density of fluid handled

Motor overload!

- ▷ Observe the information on 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 is 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 pump set

Risk of injury by moving components and shock currents!

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

	<p>! WARNING</p> <p>Fluids handled, consumables and operating supplies which are hot or pose a health hazard</p> <p>Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ 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.
	<p>CAUTION</p> <p>Danger of frost/freezing</p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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.
 - ✓ 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 items on commissioning/start-up.
(⇒ Section 6.1, Page 65)

Refer to and comply with the operating limits.

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

	<p>! WARNING</p> <p>Failure to re-install or re-activate protective equipment/devices</p> <p>Risk of personal injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> ▷ As soon as the work is completed, re-install and/or 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 all maintenance, all inspections and all installation work is performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.

	<div data-bbox="507 416 683 456"> DANGER</div> <p>Sparks produced during maintenance work Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Observe the safety regulations in force at the place of installation. ▷ Never open a pump set that is connected to the power supply. ▷ Always perform maintenance work on pump sets outside potentially explosive atmospheres.
	<div data-bbox="507 728 683 768"> DANGER</div> <p>Improperly serviced pump set Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants, power cable, bearing assembly and shaft seal.
	<div data-bbox="507 1005 683 1046"> DANGER</div> <p>Electrical connection work by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained electrician. ▷ Observe the EN 61557 regulations as well as any locally applicable regulations.
	<div data-bbox="507 1254 683 1294"> DANGER</div> <p>Risk of falling when working at great heights Danger to life by falling from great heights!</p> <ul style="list-style-type: none"> ▷ 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 occupational safety regulations and accident prevention regulations.
	<div data-bbox="507 1572 703 1612"> WARNING</div> <p>Unintentional starting of pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Make sure that the pump set cannot be started up unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

	<p>! WARNING</p> <p>Hands, other body parts or foreign objects in the impeller or intake area Risk of injury! Damage to the submersible motor pump!</p> <ul style="list-style-type: none"> ▷ Never insert your hands, other body parts or foreign objects into the impeller and/or impeller intake area. ▷ Always make sure that the electrical connections are disconnected before checking that the impeller can rotate freely.
	<p>! WARNING</p> <p>Fluids handled, consumables and operating supplies which are hot or pose a health hazard Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ 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.
	<p>! WARNING</p> <p>Hot surface Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Allow the pump set to cool down to ambient temperature.
	<p>! WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>! WARNING</p> <p>Insufficient stability Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ During assembly/dismantling, secure the pump (set)/pump parts against tilting or tipping over.

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

	<p>NOTE</p> <p>All maintenance work, service work and installation work can be carried out by KSB Service or authorized workshops. Find your contact in the attached "Addresses" booklet or on the Internet at "www.ksb.com/contact".</p>
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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 23: Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 4000 operating hours ¹⁵⁾	Insulation resistance measurement	(⇒ Section 7.2.2.4, Page 77)
	Checking the power cables	(⇒ Section 7.2.2.3, Page 76)
	Visual inspection of lifting chain / lifting rope	(⇒ Section 7.2.2.1, Page 76)
	Visual inspection of lifting accessories	(⇒ Section 7.2.2.2, Page 76)
Every 10,000 operating hours ¹⁶⁾	Checking the sensors	(⇒ Section 7.2.2.5, Page 77)
	Lubricating the bearings ¹⁷⁾	(⇒ Section 7.2.3, Page 81)
	Checking the mechanical seal leakage	(⇒ Section 7.2.2.6, Page 78)
Every 5 years	General overhaul (including coolant change)	e.g. (⇒ Section 7.2.4, Page 83)



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

Formation of a potentially explosive atmosphere inside the pump
Explosion hazard!

- ▷ The pump internals in contact with the fluid handled, including the seal chamber and auxiliary systems, must be filled with the fluid 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.

¹⁵⁾ At least once a year

¹⁶⁾ At least every three years

¹⁷⁾ For reinforced bearings only

While the system is in operation, observe and 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.

Checking the ground conductor



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

	<div style="background-color: #e67e22; color: white; padding: 5px;"> DANGER</div> <p>Defective ground conductor Electric shock!</p> <p>▷ Never switch on a pump set with a defective ground conductor.</p>
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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 maximum measuring voltage is 500 V (maximum permissible voltage 1000 V).
 1. Measure the winding to chassis ground.
To do so, connect all winding ends together.
 2. Measure the winding temperature sensor 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 24: Resistance measurement

Measurement between terminals ...	Resistance
	[Ω]
10 and 11	100 to 1000
31 and 32 ¹⁸⁾	100 to 120

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

If the tolerances are exceeded here, too, the motor part must 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.

Leakage sensor in the motor

Table 25: Resistance measurement of the leakage sensor in the motor

Measurement between terminals ...	Resistance
	[kΩ]
9 and ground conductor (PE)	> 60
8 and 9 ¹⁹⁾	> 60

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

Float switch (mechanical seal leakage)

Table 26: 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 sensors

Table 27: Resistance measurement of the bearing temperature sensor

Measurement between terminals ...	Resistance
	[Ω]
15 and 16 ²⁰⁾	100 to 120
16 and 17 ²⁰⁾	100 to 120

Vibration sensor




Table 28: Current measurement at the vibration sensor

Measurement between terminals ...	Current value
41 and 42 ²¹⁾	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 61)

7.2.2.6 Checking the mechanical seal leakage

	<div style="background-color: #f4a460; padding: 5px;">! WARNING</div> <p>Fluids handled, consumables and operating supplies which are hot or pose a health hazard</p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and properly dispose of the flushing fluid and of any residues of the fluid handled. ▷ Wear safety clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
	<div style="background-color: #f4a460; padding: 5px;">! WARNING</div> <p>Excess pressure inside the pump set</p> <p>Risk of injury when opening the pump set!</p> <ul style="list-style-type: none"> ▷ Be careful when opening the inner chambers.
	<div style="background-color: #2e75b6; color: white; padding: 5px;">NOTE</div> <p>Slight wear of the mechanical seal is unavoidable. This will be aggravated by abrasive substances contained in the fluid handled.</p>

¹⁹⁾ Only for pump sets with vibration sensor

²⁰⁾ Optional

²¹⁾ Optional

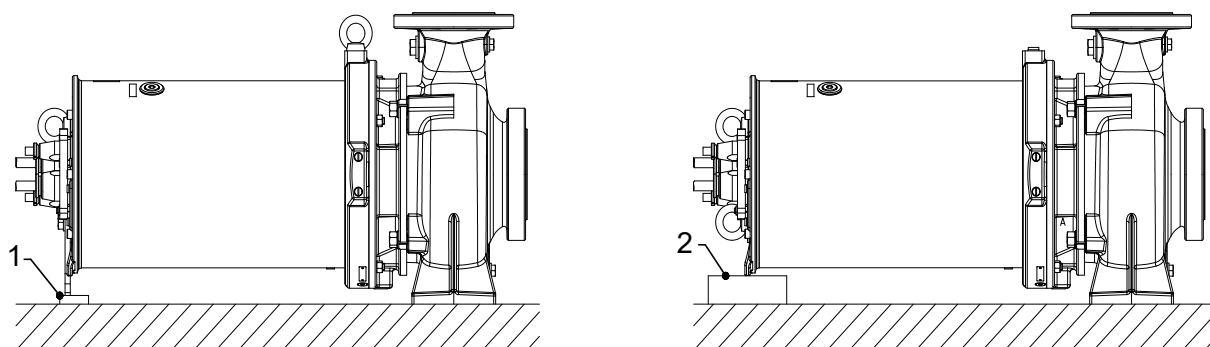


Fig. 44: Support options for placing down the pump

1	Support foot (for horizontal installation)
2	Wooden support

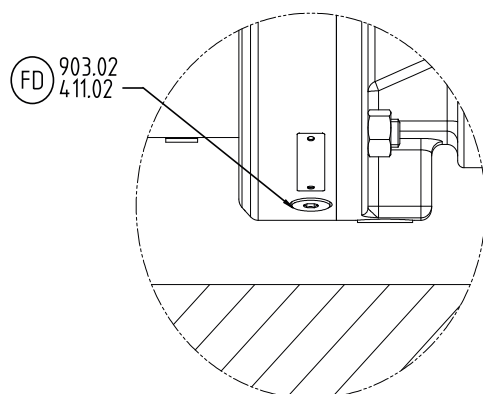


Fig. 45: Checking the mechanical seal leakage

Table 29: Key to the symbols

Symbol	Key
FD	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 0.32 quarts [0.3 liters] 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/or the impeller can be checked via the inspection hole.

	<p>⚠ WARNING</p> <p>Fluids handled, consumables and operating supplies which are hot or pose a health hazard</p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and properly dispose of the flushing fluid and of any residues of the fluid handled. ▷ Wear safety clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
	<p>⚠ WARNING</p> <p>Hands and/or foreign objects in the pump casing</p> <p>Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▷ 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:

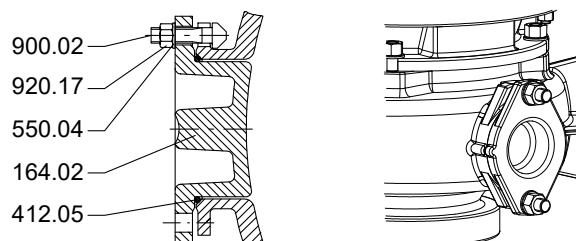


Fig. 46: Inspection hole in the casing

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 and 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.
- Place discs 550.04 and nuts 920.17 on screws 900.02 and tighten.
- 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 exceptions described below.

For a pump set with reinforced bearings (⇒ Section 9.3.1, Page 117) the pump-end rolling element bearings must be re-lubricated as part of the maintenance work.

7.2.3.1 Grease quality

	CAUTION
	<p>Mix of different grease types Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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 30: Lubricant characteristics

Base oil	Thickener	NLGI grade (DIN 51518)	Worked penetration at 25 °C, 0.1 mm (DIN 51818)	Pour 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, Fa. Klüber Lubrication, KG München



7.2.3.2 Grease quantity

Lubricate the rolling element bearings with 2.1 oz [60 g] of grease.

7.2.3.3 Re-lubrication

Pump sets with reinforced bearings

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

	DANGER
	<p>Dry running Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Re-lubricate explosion-proof pump sets outside potentially explosive atmospheres.
	<p>WARNING</p> <p>Hands inside the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▷ Never insert your hands or any other objects into the pump if the pump has not been de-energized and secured against unintentional start-up.

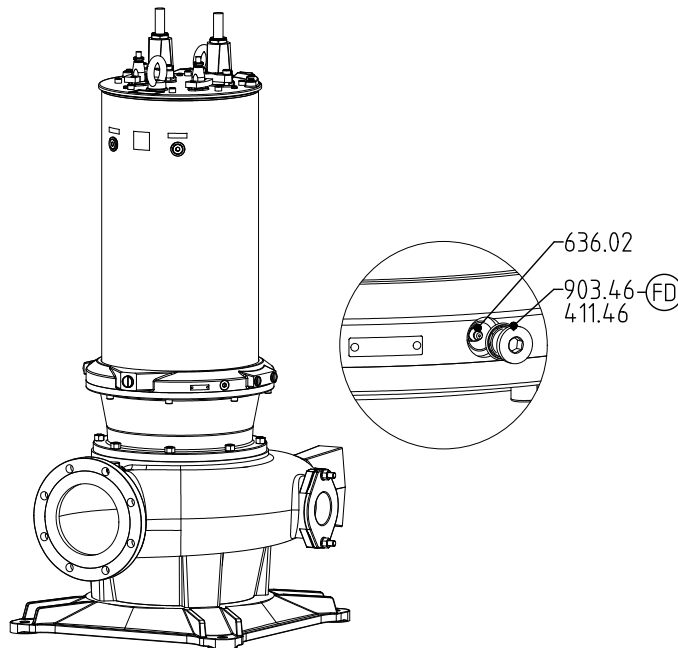





Table 31: Key to the symbols

Symbol	Key
	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 61)


	CAUTION
	Pump set running dry Increased vibrations! Damage to mechanical seals and bearings! ▶ Never operate the pump set without the fluid to be handled for more than 60 seconds.

- 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 -4 °F [-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 -4 °F [-20 °C]
(e.g. Tyfocor L²²)/water mixture, mixing ratio 62:38)

7.2.4.2 Coolant quantity

Table 32: Coolant quantity in quarts

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		
[quart]									
40-252	F, K, S	13,0	-	-	-	15,5	-	-	-
80-252	F	13,0	-	13,0	-	15,5	-	15,5	-
80-253	E, F, K	13,0	-	13,0	-	15,5	-	15,5	-
80-315	D	13,6	21,5	35,4	40,0	16,2	24,2	37,4	41,5
80-315	K	13,6	21,5	28,9	33,4	16,2	24,2	30,9	35,0
80-317	D	13,6	21,5	-	-	16,2	24,2	-	-
80-317	F	13,6	21,5	28,9	33,4	16,2	24,2	30,9	35,0
100-253	D	13,0	-	13,0	-	15,5	-	15,5	-
100-253	E, K	13,0	-	13,0	-	15,5	-	15,5	-
100-254	F	13,0	-	13,0	-	15,5	-	15,5	-
100-315	D	13,6	21,5	35,4	40,0	16,2	24,2	37,4	41,5
100-316	D	13,6	21,5	-	-	16,2	24,2	-	-
100-316	F, K	13,6	21,5	28,9	33,4	16,2	24,2	30,9	35,0
100-317	E	13,6	21,5	-	-	16,2	24,2	-	-
100-400	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
100-401	F, K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
100-403	D	-	28,4	33,9	38,5	-	30,7	35,8	40,0
150-253	D	13,0	-	13,0	-	15,5	-	15,5	-
150-315	D	13,6	21,5	-	-	16,2	24,2	-	-
150-315	F	13,6	21,5	28,9	33,4	16,2	24,2	30,9	35,0

²² 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		
[quart]									
150-317	E, K	13,6	21,5	28,9	33,4	16,2	24,2	30,9	35,0
150-400	D	-	28,4	36,4	40,9	-	30,7	38,4	42,5
150-400	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
150-401	D	-	28,4	36,4	40,9	-	30,7	38,4	42,5
150-401	E, F	-	28,4	33,9	38,5	-	30,7	35,8	40,0
150-403	D	-	28,4	33,9	38,5	-	30,7	35,8	40,0
150-403	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
151-403	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
200-315	D	13,6	21,5	-	-	16,2	24,2	-	-
200-315	K	13,6	21,5	-	-	16,2	24,2	-	-
200-316	K	13,6	21,5	-	-	16,2	24,2	-	-
200-317	K	13,6	21,5	28,9	33,4	16,2	24,2	30,9	35,0
200-318	K	13,6	21,5	28,9	33,4	16,2	24,2	30,9	35,0
200-400	D	-	28,4	36,4	40,9	-	30,7	38,4	42,5
200-401	E	-	28,4	33,9	38,5	-	30,7	35,8	40,0
200-402	D	-	28,4	33,9	38,5	-	30,7	35,8	40,0
200-402	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
200-403	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
200-405	D	-	28,4	33,9	38,5	-	30,7	35,8	40,0
250-400	D	-	28,4	36,4	40,9	-	30,7	38,4	42,5
250-401	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
250-402	D	-	28,4	33,9	38,5	-	30,7	35,8	40,0
250-403	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
300-400	D	-	28,4	36,4	40,9	-	30,7	38,4	42,5
300-400	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
300-401	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
300-402	D	-	28,4	33,9	38,5	-	30,7	35,8	40,0
300-403	K	-	28,4	33,9	38,5	-	30,7	35,8	40,0
300-400	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
300-401	K	-	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

Table 33: Coolant quantity in liters

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

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]									
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
300-400	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
300-401	K	-	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

	<p>! WARNING</p> <p>Coolants and supplies which pose a health hazard or are hot Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
	<p>! WARNING</p> <p>Cooling liquid spurting out due to excess pressure in the cooling liquid chamber at operating temperature! Risk of injuries by parts flying off and escaping cooling liquid!</p> <ul style="list-style-type: none"> ▷ Open the screw plug of the cooling liquid chamber very carefully.

Draining the coolant

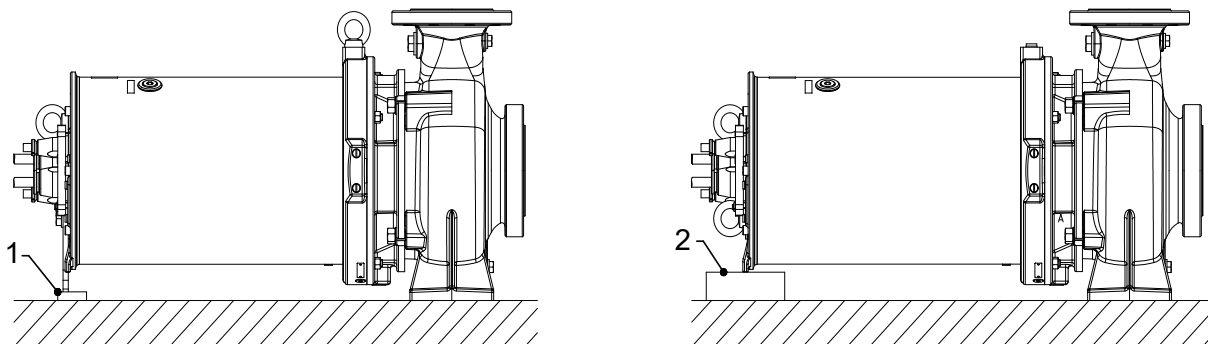


Fig. 47: Support options for placing down the pump

1	Support foot (for horizontal installation)
2	Wooden support

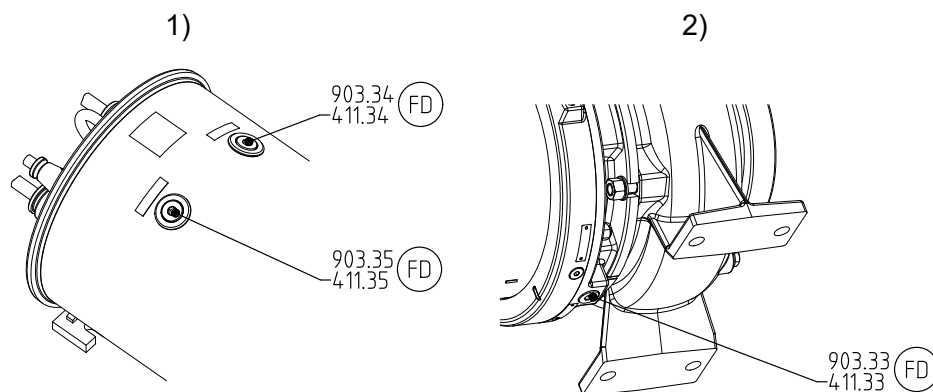


Fig. 48: Screw plugs

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

Table 34: Key to the symbols

Symbol	Key
	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 discoloration, 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.

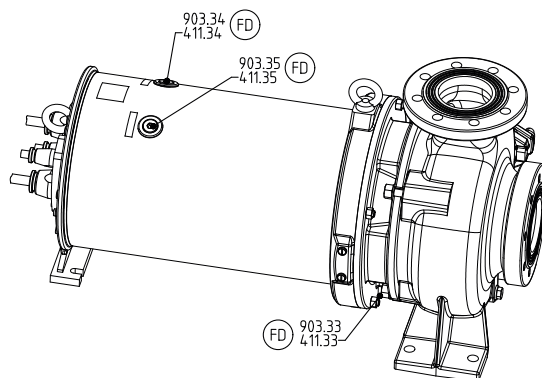


Fig. 49: Position during filling – installation type H

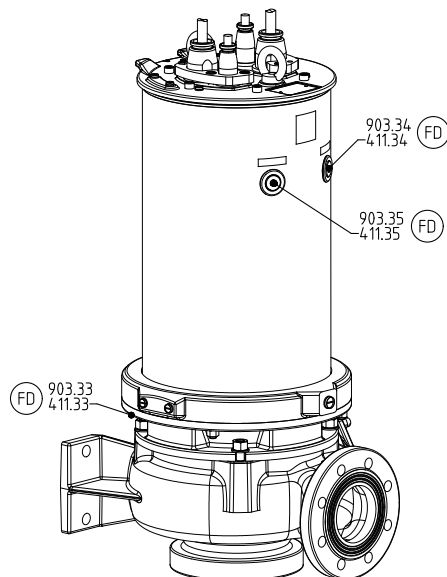


Fig. 50: Position during filling – installation types K and D


✓ 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 35: Key to the symbols

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




7.3 Drainage/cleaning

	⚠ WARNING
	<p>Fluids handled, consumables and operating supplies which are hot or pose a health hazard</p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and properly dispose of the flushing fluid and of any residues of the fluid handled. ▷ Wear safety clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. 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. Always complete and enclose a certificate of decontamination when returning the pump set. (⇒ Section 10, Page 144)

7.4 Dismantling the pump set


7.4.1 General information/Safety regulations


	⚠ WARNING
	<p>Unqualified personnel performing work on the pump (set)</p> <p>Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.
	⚠ WARNING
	<p>Hot surface</p> <p>Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Allow the pump set to cool down to ambient temperature.
	⚠ WARNING
	<p>Improper lifting/moving of heavy assemblies or components</p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ 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
	<p>Insufficient preparation of work on the pump (set)</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▷ 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! <ul style="list-style-type: none"> ▷ 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 90)
 1. De-energize the pump set and secure it against unintentional start-up.


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 removed from the piping, 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! <ul style="list-style-type: none"> ▷ Suspend or support the pump set.

- ✓ The pump set has been disconnected from the piping. (⇒ Section 7.4.2.2.1, Page 91)
 1. Suspend the pump set as specified for transport.
 2. Depending on the type of installation, loosen the bolts fastening the pump foot or soleplate to the foundation.

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.

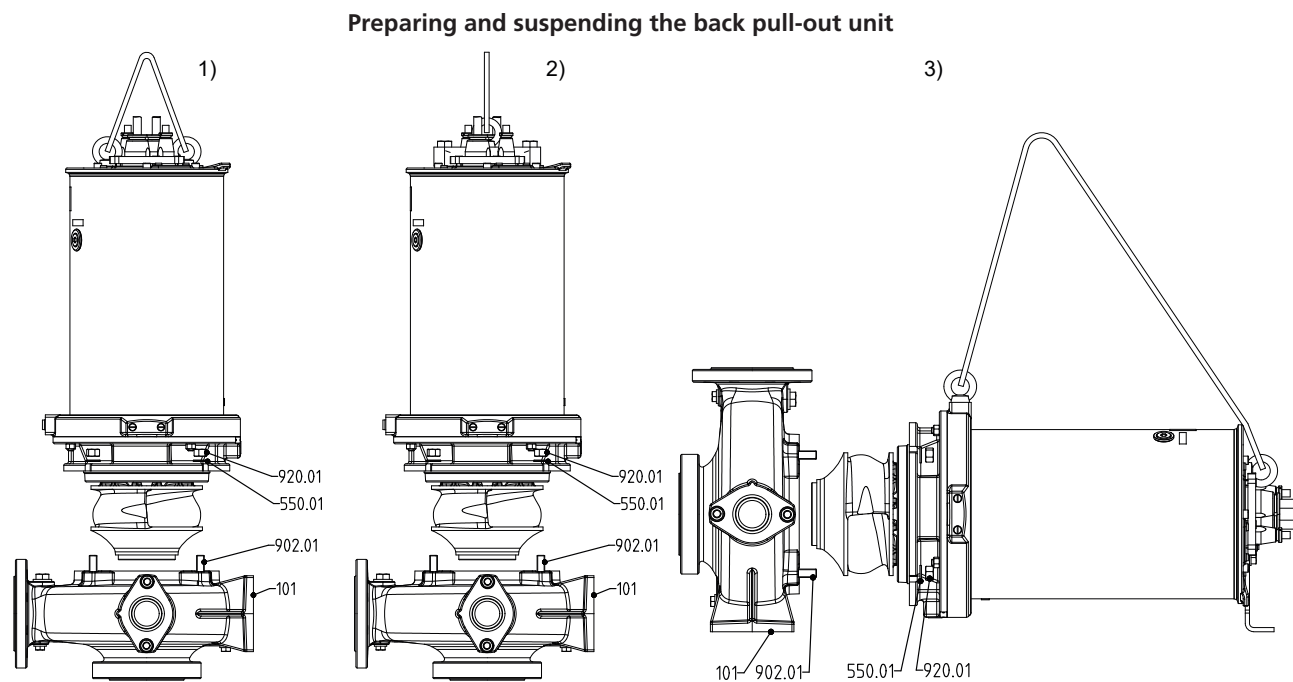


Fig. 51: Suspending the back pull-out unit

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

Preparing installation type K / guide cable 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 centered

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

- ✓ Opening of suspension arrangement: centered

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 connection 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 36: 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	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	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
150-400	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
200-402	D	M24	ADS 5

Size	Impeller type	Forcing screw	
		Thread	Code
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 Removing the mechanical seal

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

7.4.3.2.1 Removing the 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.

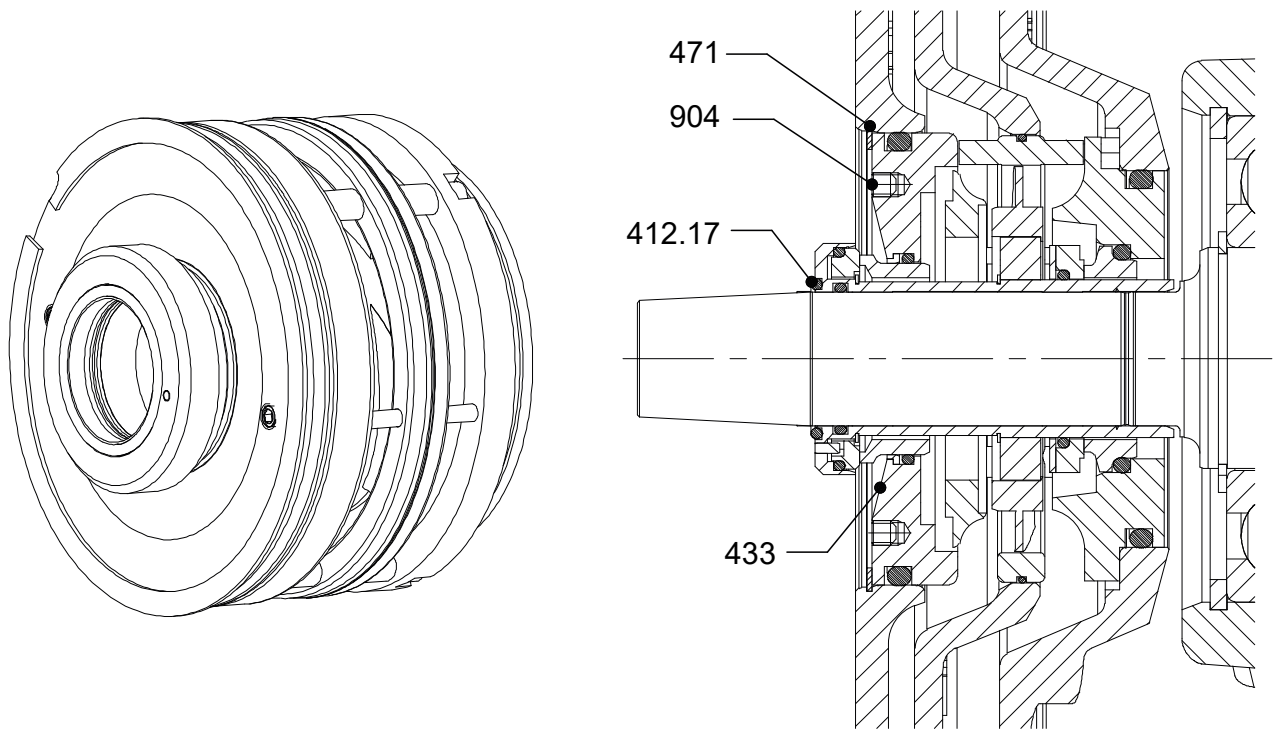


Fig. 52: Installing and removing the mechanical seal

- ✓ The back pull-out unit and impeller have been removed.
- 1. Remove grub screws 904 from the threaded holes for the puller.
- 2. Remove circlip 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)

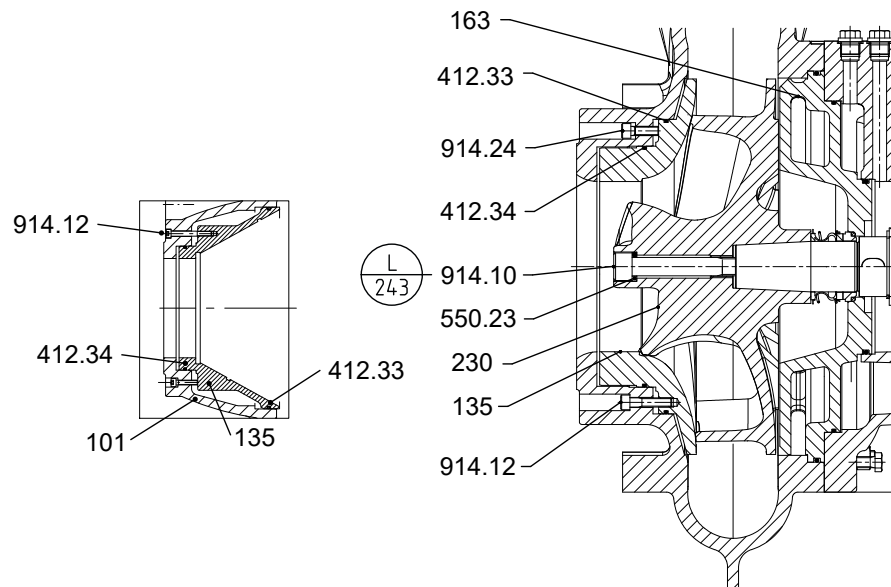


Fig. 53: Removing the wear plate

- ✓ 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

	<p>NOTE</p> <p>Special regulations apply to repair work on explosion-proof pump sets. Modifications or alteration of the pump sets can affect explosion protection and are only permitted after consultation with the manufacturer.</p>
	<p>NOTE</p> <p>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 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.</p>

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

	<p>! WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>! WARNING</p> <p>Components with sharp edges Risk of cutting or shearing injuries!</p> <ul style="list-style-type: none"> ▸ Always use appropriate caution for installation and dismantling work. ▸ Wear work gloves.
	<p>CAUTION</p> <p>Improper reassembly Damage to the pump!</p> <ul style="list-style-type: none"> ▸ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▸ Use original spare parts only.
	<p>NOTE</p> <p>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 flamepath positions specified in the Annex.</p>

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 mechanical seal

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

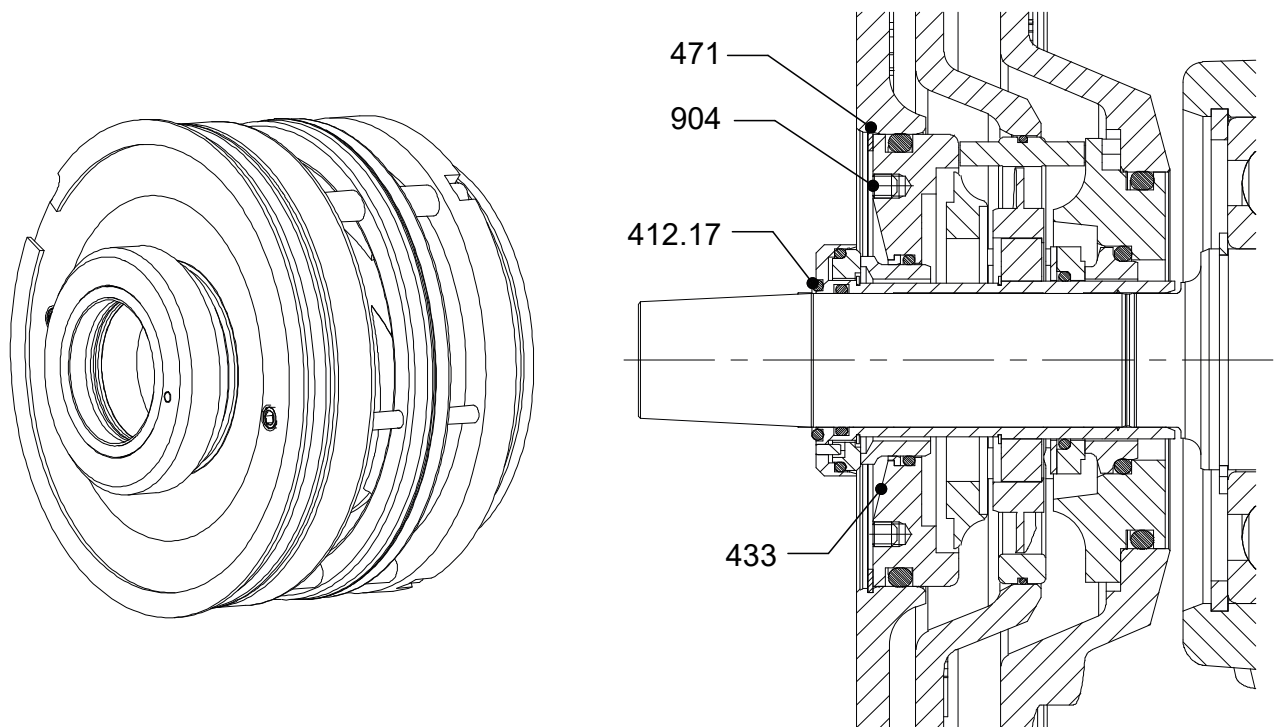


Fig. 54: Installing and removing the mechanical seal

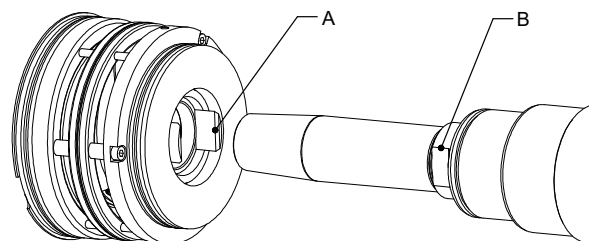




Fig. 55: A) Anti-rotation device of the mechanical seal B) Flat edge at the shaft

- 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
	<p>Use of grease or other permanent lubricants</p> <p>Torque transmission impeded / overheating of and damage to the pump!</p> <ul style="list-style-type: none"> ▷ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal. ▷ Use soft soap to reduce any friction caused during assembly. ▷ Never coat the mechanical seal faces with grease or oil.

- ✓ 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
	<p>For bearing brackets with tapered fit make sure that the tapered fit of impeller and shaft is undamaged and assembled free from grease.</p>

- ✓ 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 Loctite 243 as thread-locking agent 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.



Table 37: Tightening torques for the impeller screws

Size	Impeller type	Thread	Tightening torque	
			[Nm]	[ft lbf]
40-252	F, K, S	M10	35	25,8
80-252	F	M10	35	25,8
80-253	E, F, K	M16	150	110,6
80-315	D	M20	290	213,9
80-315	K	M16	150	110,6
80-317	D	M16	150	110,6
80-317	F	M16	150	110,6
100-253	D	M10	35	25,8
100-253	E, K	M16	150	110,6
100-254	F	M10	35	25,8
100-315	D	M20	290	213,9
100-316	D	M16	150	110,6
100-316	F, K	M16	150	110,6
100-317	E	M16	150	110,6
100-400	K	M20	290	213,9
100-401	F, K	M20	290	213,9
100-403	D	M20	290	213,9

Size	Impeller type	Thread	Tightening torque	
			[Nm]	[ft lbf]
150-253	D	M10	35	25,8
150-315	D	M16	150	110,6
150-315	F	M16	150	110,6
150-317	E, K	M16	150	110,6
150-400	D	M20	290	213,9
150-400	K	M20	290	213,9
150-401	D	M20	290	213,9
150-401	E, F	M20	290	213,9
150-403	D	M20	290	213,9
150-403	K	M20	290	213,9
151-403	K	M20	290	213,9
200-315	D	M16	150	110,6
200-315	K	M16	150	110,6
200-316	K	M16	150	110,6
200-317	K	M16	150	110,6
200-318	K	M16	150	110,6
200-400	D	M20	290	213,9
200-401	E	M20	290	213,9
200-402	D	M20	290	213,9
200-402	K	M20	290	213,9
200-403	K	M20	290	213,9
200-405	D	M20	290	213,9
250-400	D	M20	290	213,9
250-401	K	M20	290	213,9
250-402	D	M20	290	213,9
250-403	K	M20	290	213,9
300-400	D	M20	290	213,9
300-400	K	M20	290	213,9
300-401	K	M20	290	213,9
300-402	D	M20	290	213,9
300-403	K	M20	290	213,9


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 inner 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
	<p>Axial displacement of the rotor Damage to shaft seal and bearings!</p> <p>▷ Always adjust and check the axial clearance with the pump set in a vertical position.</p>

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

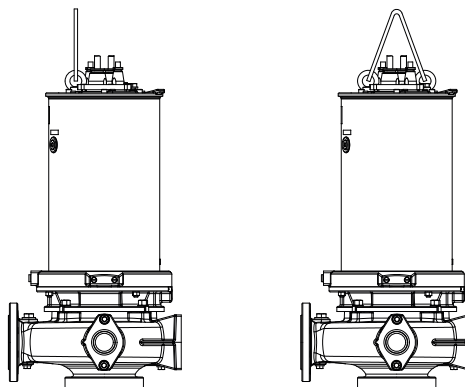


Fig. 56: Suspending the pump set

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 $A = 0.012 \pm 0.004$ in [0.3 ± 0.1 mm].

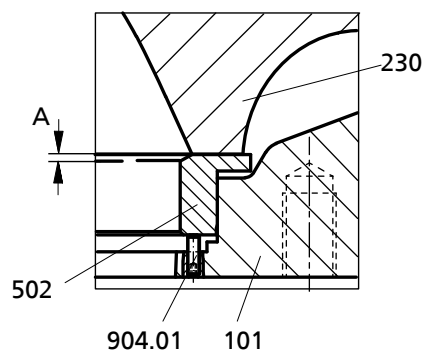


Fig. 57: Fitting the casing wear ring

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.

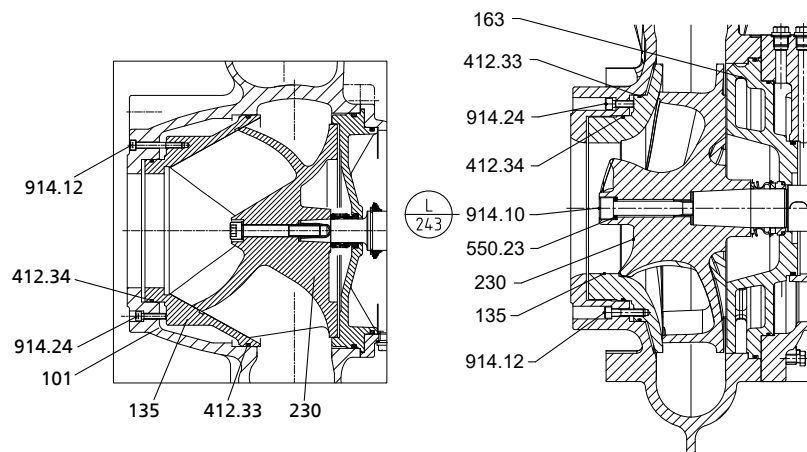


Fig. 58: Fitting the wear plate

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 $0.0164^{+0.008}$ in $[0.4^{+0.2} \text{ mm}]$ (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.

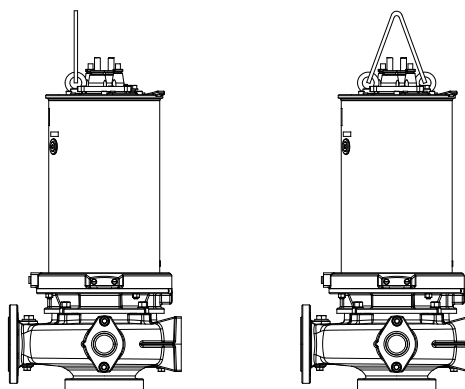


Fig. 59: Suspending the pump set

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

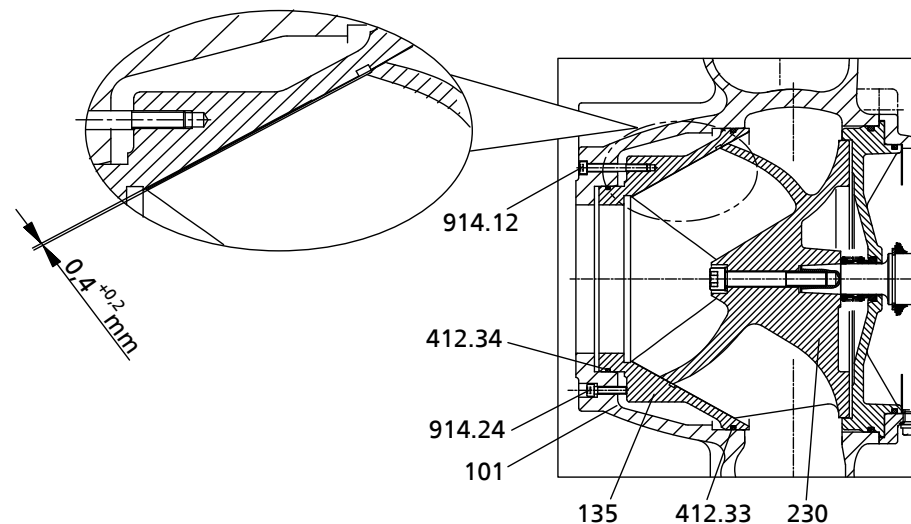


Fig. 60: Adjusting the wear plate

1. Adjust the clearance between impeller 230 and wear plate 135 by tightening and loosening screws 914.12 and 914.24.
 - ⇒ Screw 914.24 presses the wear plate in the direction of the impeller.
 - ⇒ The clearance equals $0.0164^{+0.008}$ in [$0.4^{+0.2}$ mm] (measured on the suction side from the outer surface of the impeller vane to the wear plate).

7.5.2.3.5 Reassembling the motor section

	NOTE
	<p>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 pump sets. Observe the flamepath positions specified in the Annex (Flamepaths on explosion-proof motors). (⇒ Section 9.4, Page 124) (⇒ Section 9.4, Page 124) Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).</p>
	⚠ DANGER
	<p>Wrong screws/bolts Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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:** 14.5 psi [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

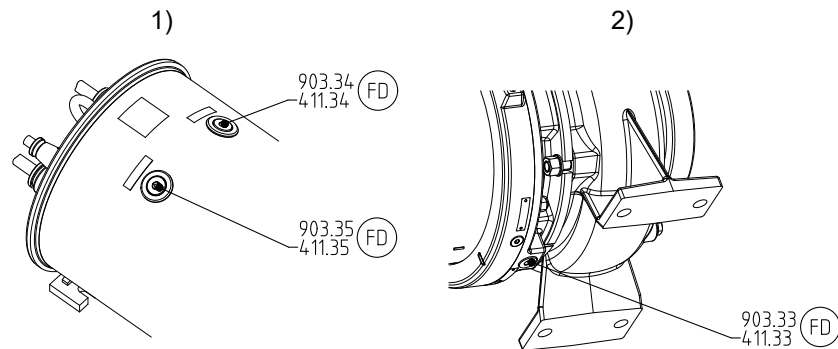


Fig. 61: Screw plugs

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

Table 38: Key to the symbols

Symbol	Key
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 Leak testing the motor

- **Test medium:** compressed air
- **Test pressure:** 12.3 psi [0.8 bar]
- **Test duration:** 2 minutes

Opening: control opening for mechanical seal leakage (903.02)

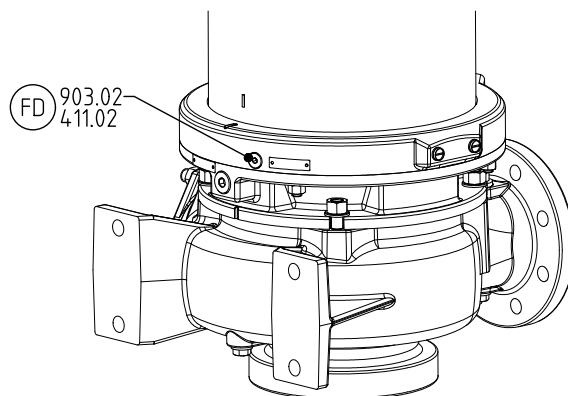



Fig. 62: Leak testing the motor

Table 39: Key to the symbols

Symbol	Key
	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 76)

7.6 Tightening torques

Table 40: Tightening torques [lbf ft] depending on thread, steel grade and property class

Thread	Material				
	A4-50	A4-70	A4-70	1.4462	8.8
	Property class Rp 0.2 ^N / _{mm²}				
	210	250	450	450	640
M5	-	-	3	3	4
M6	-	-	5	5	7
M8	-	-	13	13	18
M10	-	-	26	26	37
M12	-	-	44	44	63
M14	-	-	66	66	96
M16	-	-	111	111	155
M20	-	-	214	214	302
M24	170	205	-	369	516
M30	472	-	-	738	1033
M42	959	-	-	2028	2877
M48	436	-	-	3098	4425

Table 41: Tightening torques [Nm] depending on thread, material and property class

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

7.7 Spare parts stock

7.7.1 Ordering spare parts

Always quote the following data when ordering replacement parts 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 supply the following data:

- Part No. and description (⇒ Section 9.2, Page 110)
- 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 42: Quantity of spare parts for recommended spare parts stock²³⁾

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 %

²³⁾ 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 43: 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 base elbow and lowering it again. Installation types D/H: Vent / prime the pump via auxiliary vent connection 6D. Vent by lifting the pump off the base elbow 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/fibers 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 44: Key to the symbols

Symbol	Key
	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 assembly drawings with list of components

9.2.1 Amarex KRT - General assembly drawing

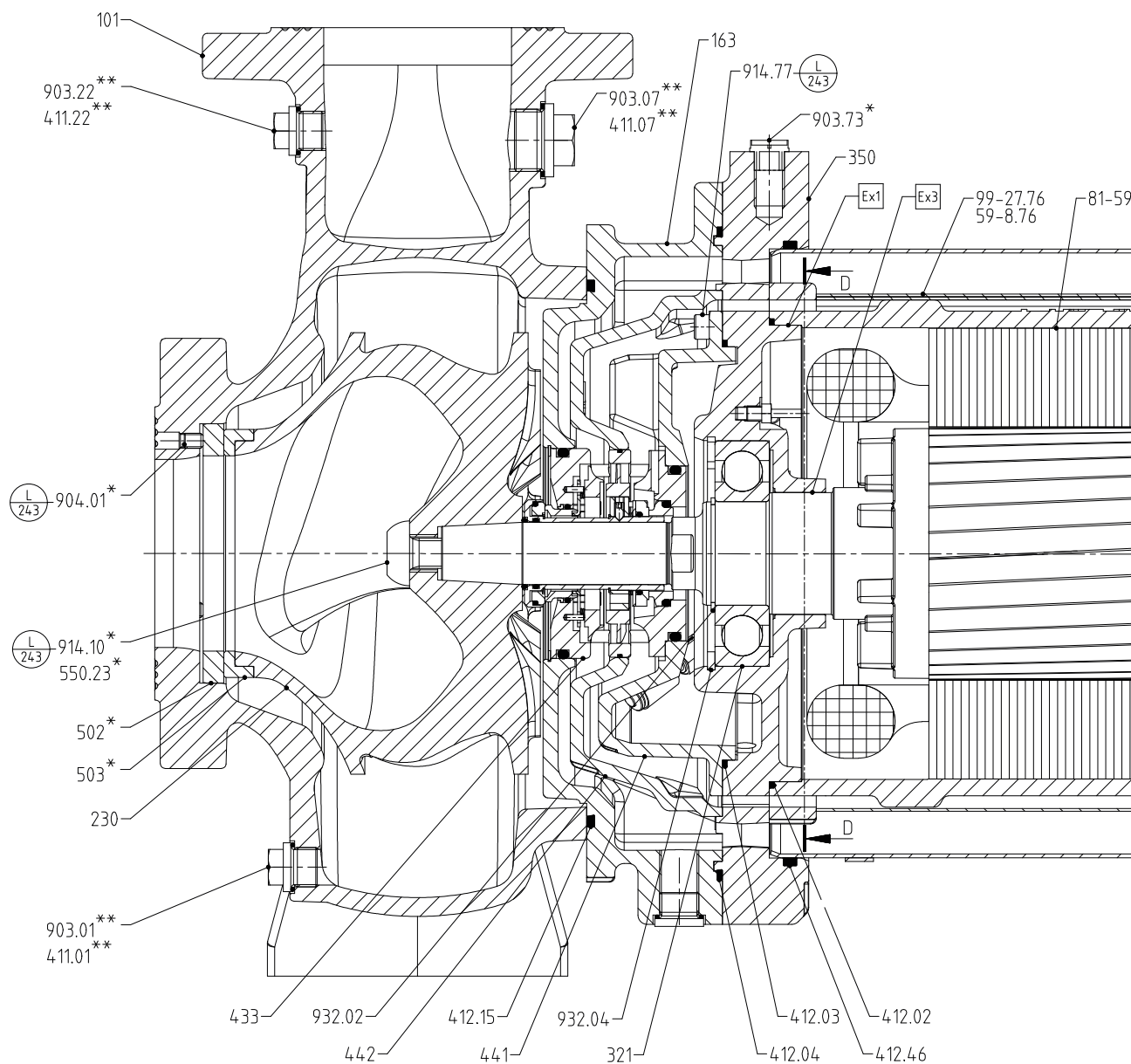


Fig. 63: General assembly drawing of Amarex KRT, part 1 of 2

*: On specific designs only

** : Only for dry installation types D and H

For the part numbers refer to the table (⇒ Section 9.1, Page 109) .

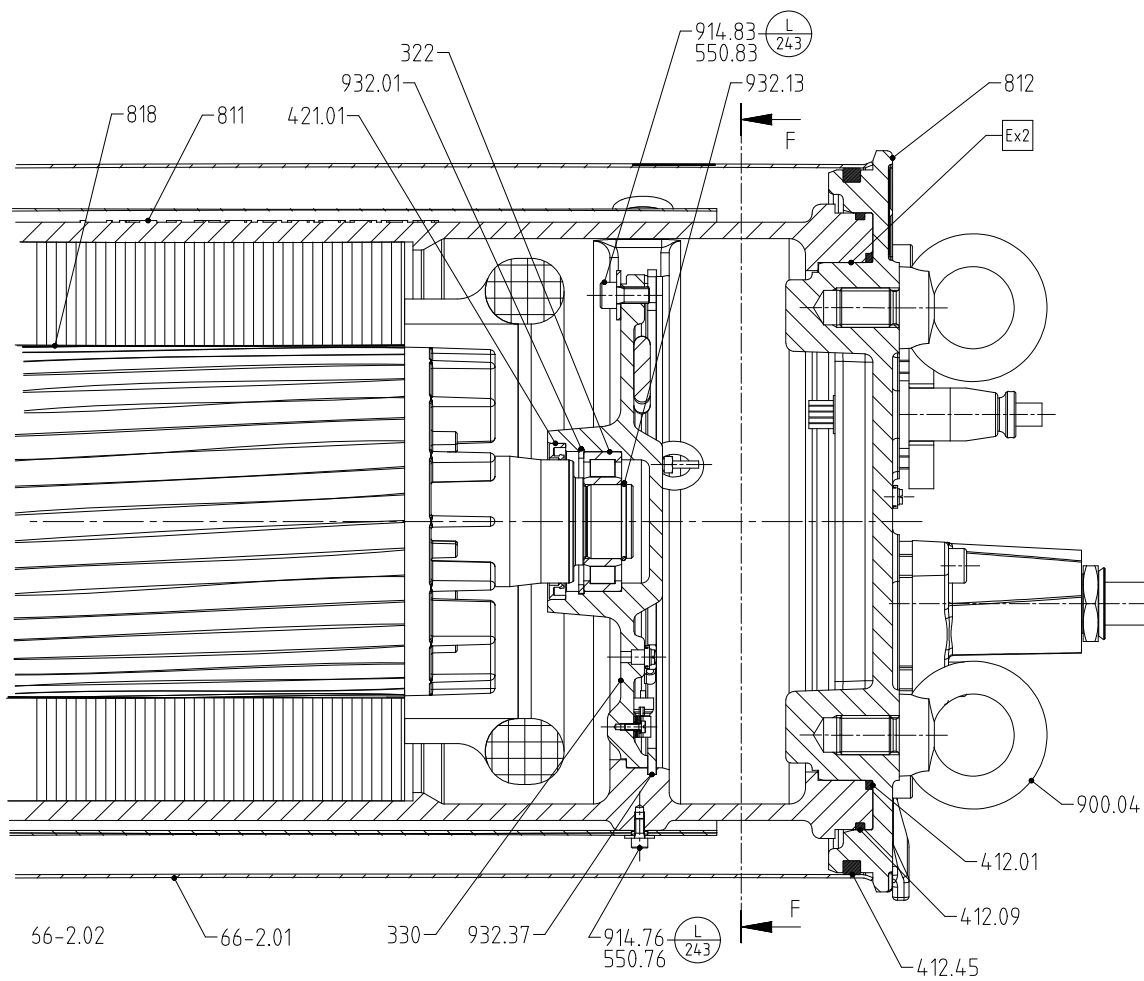


Fig. 64: General assembly drawing of Amarex KRT, part 2 of 2

For the part numbers refer to the table (⇒ Section 9.1, Page 109) .

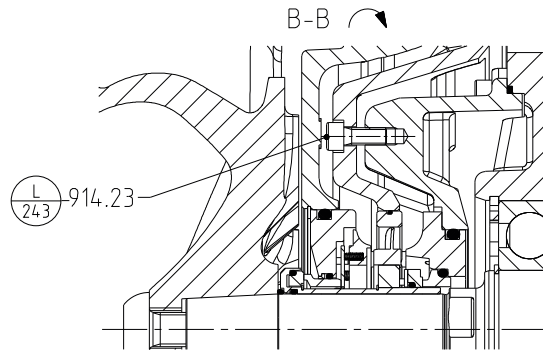


Fig. 65: General assembly drawing of Amarex KRT, mechanical seal and impeller

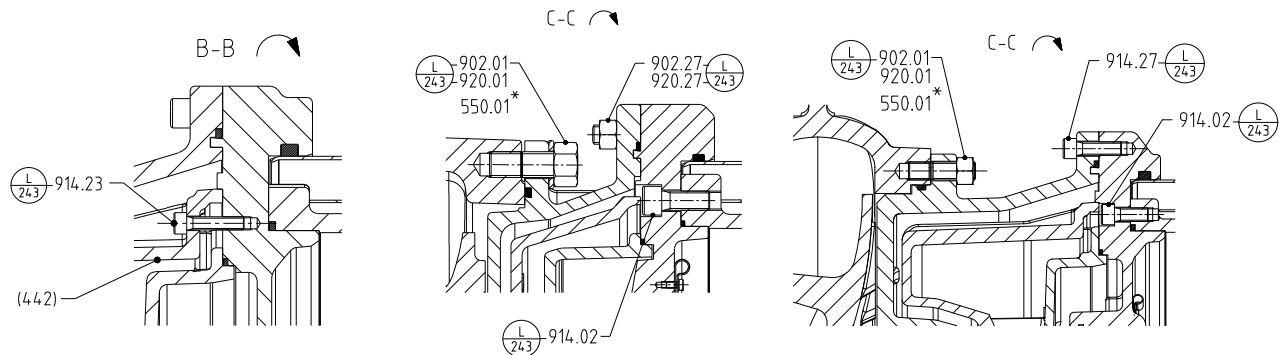


Fig. 66: General assembly drawing of Amarex KRT, fastening of cooling insert and discharge cover depending on the motor size

*: On specific designs only

For the part numbers refer to the table (⇒ Section 9.1, Page 109) .

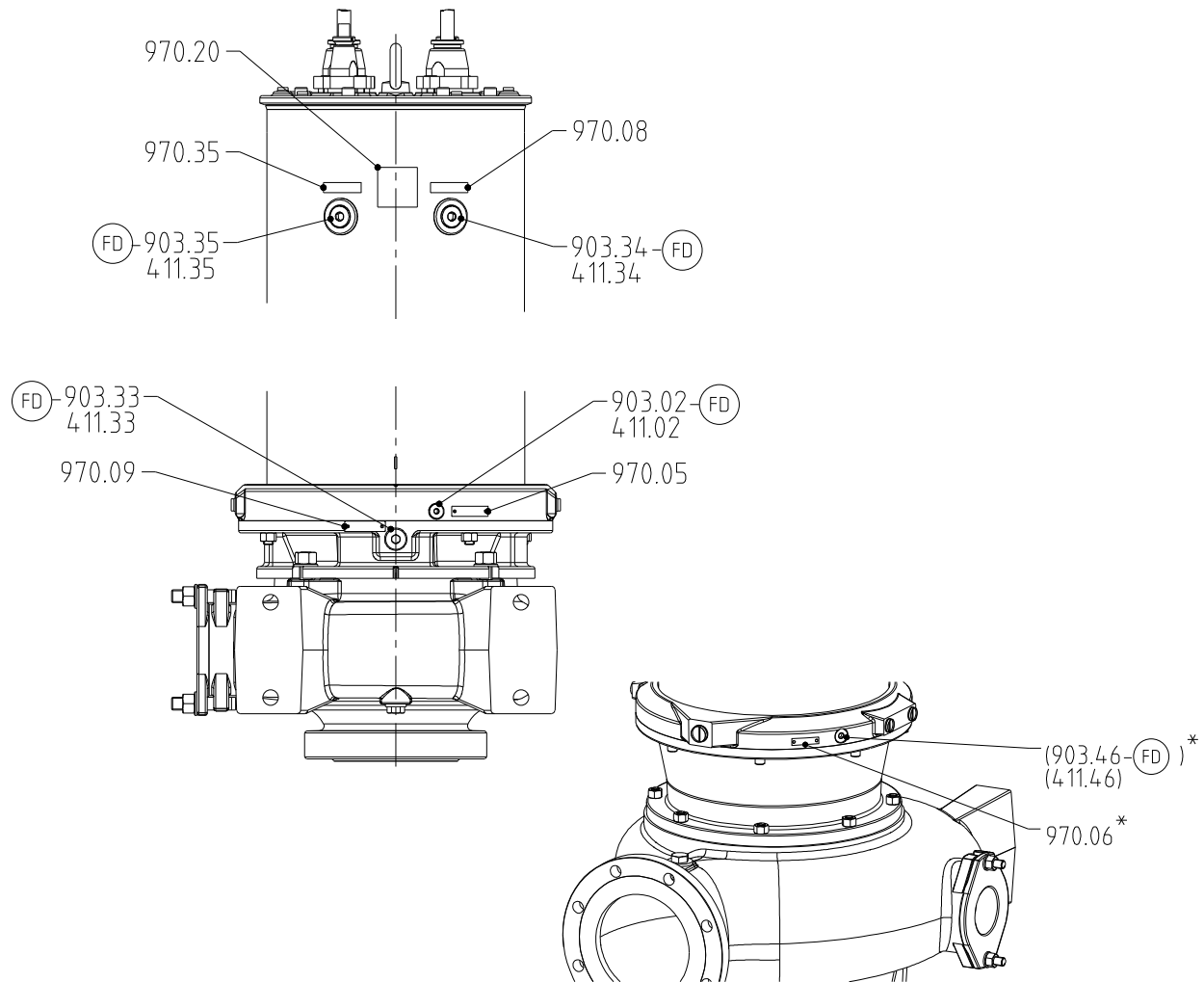


Fig. 67: General assembly drawing of Amarex KRT, filler and drain openings

*: For reinforced bearings only (⇒ Section 9.3.1, Page 117)

For the part numbers refer to the table (⇒ Section 9.1, Page 109) .

9.2.2 Amarex KRT - motor and fastening

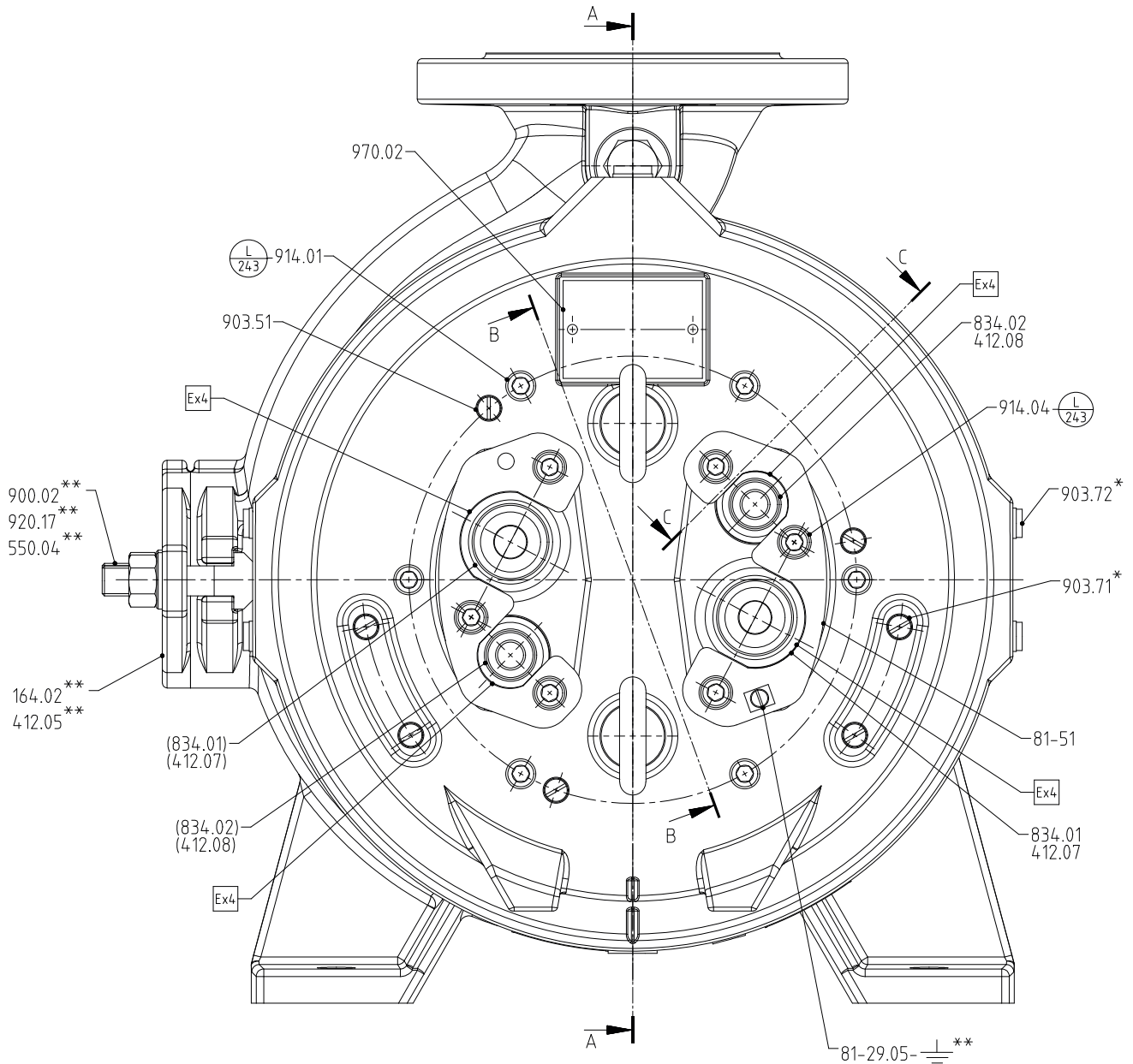


Fig. 68: Motor and fastening of cable glands

*: On specific designs only

**: Only for dry installation types D and H

Table 45: 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 109) .

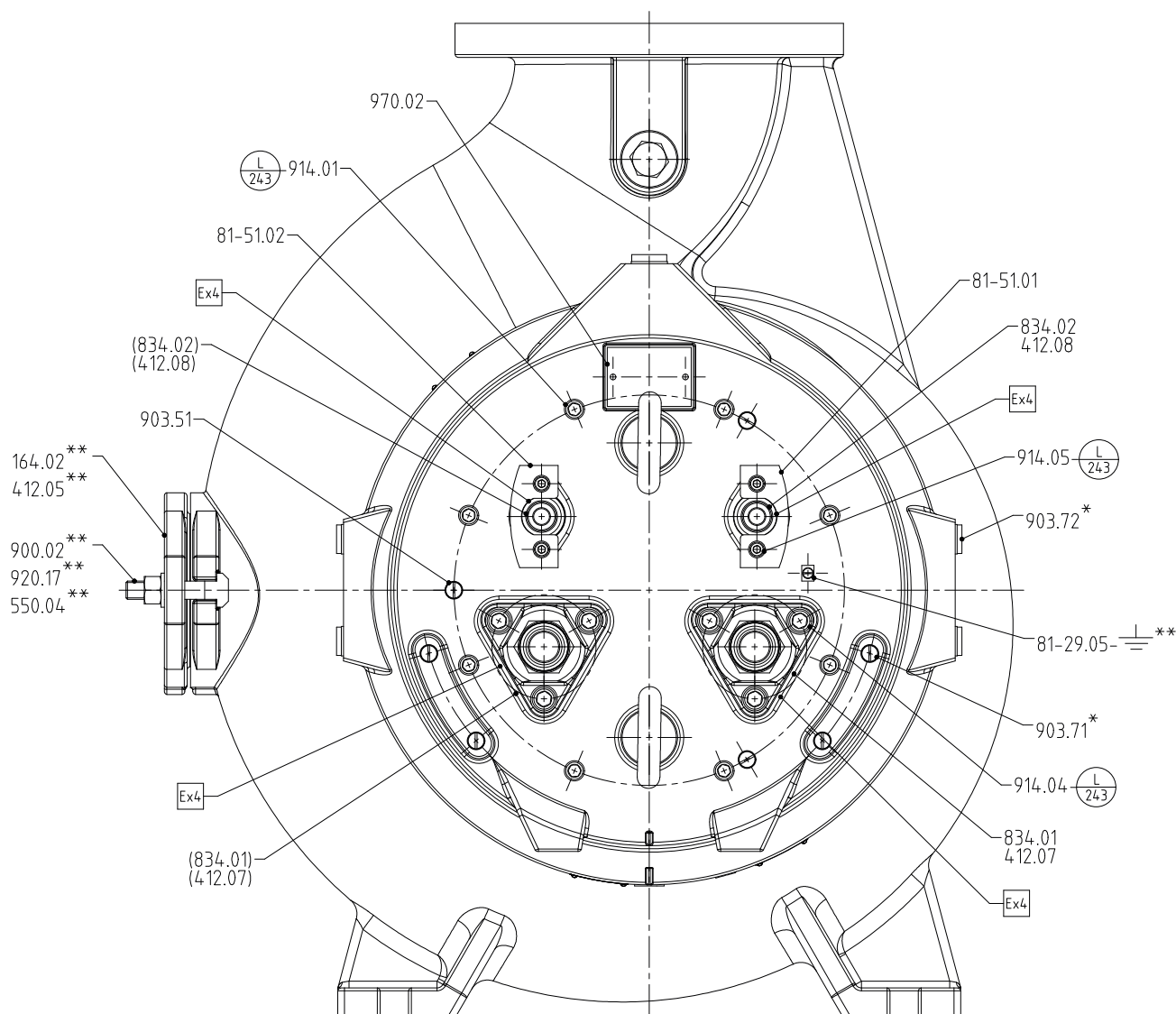


Fig. 69: Motor and fastening of cable glands

*: On specific designs only

** : Only for dry installation types D and H

Table 46: 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 109) .

Bearing bracket fastening

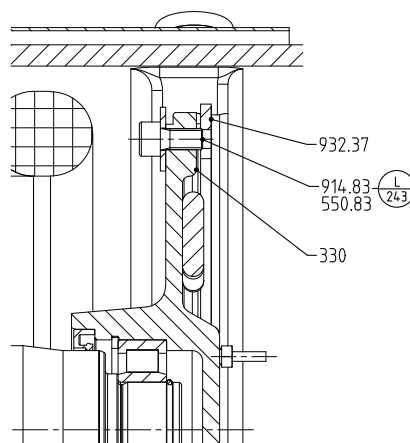


Fig. 70: Bearing bracket fastening of Amarex KRT

Table 47: 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 109) .

9.3 Detailed views

9.3.1 Reinforced bearings

Table 48: 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

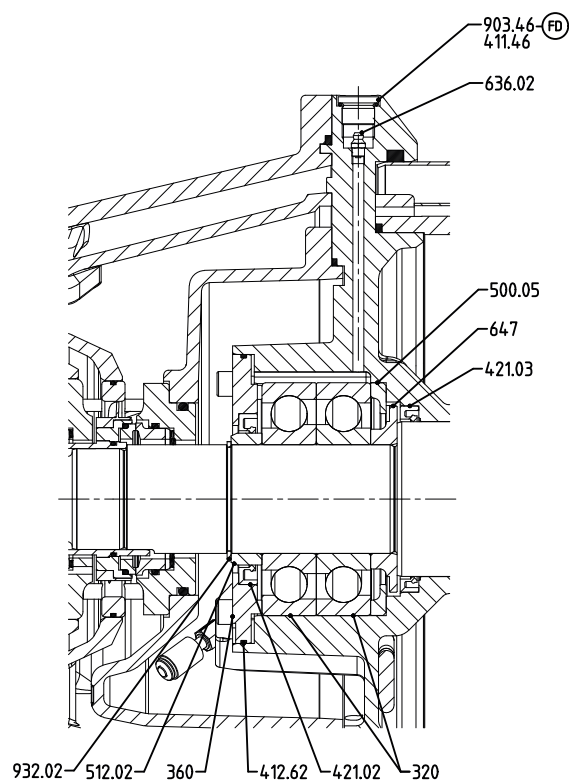


Fig. 71: Reinforced bearings

For the part numbers refer to the table (⇒ Section 9.1, Page 109) .

9.3.2 Impeller type E

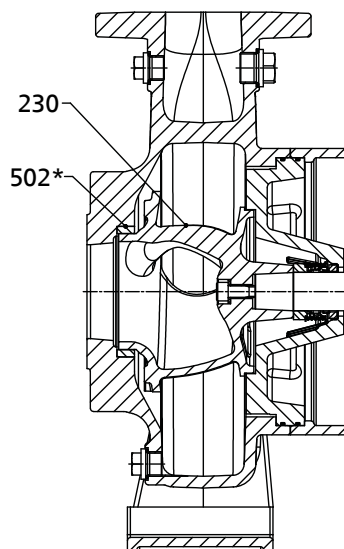


Fig. 72: Impeller type E

*: On specific designs only

Table 49: Impeller type E

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

9.3.3 Impeller type D

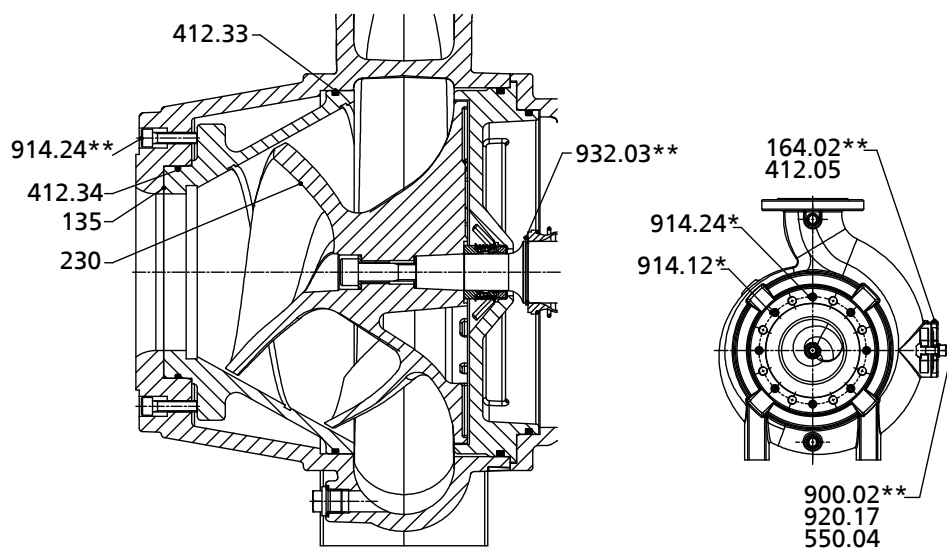


Fig. 73: Impeller type D

*: On specific designs only

** Only for installation types K, D and H

Table 50: 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-max

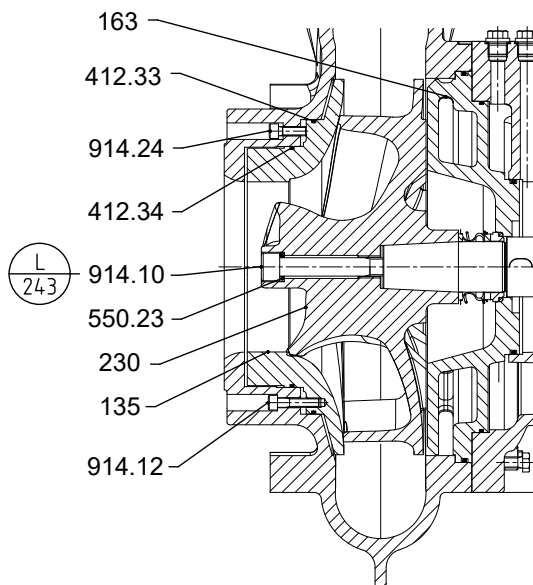


Fig. 74: Impeller type D-max

Table 51: 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

9.3.5 Impeller type K

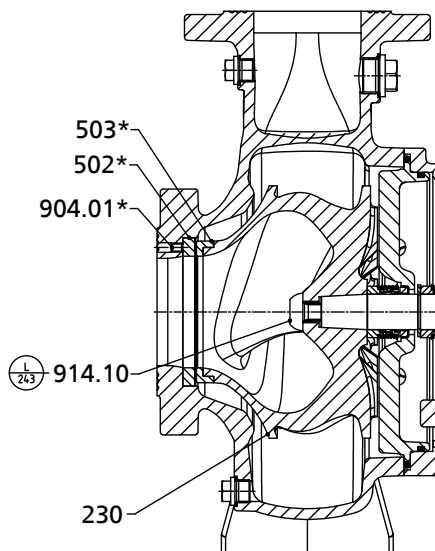


Fig. 75: Impeller type K

*: On specific designs only

Table 52: 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

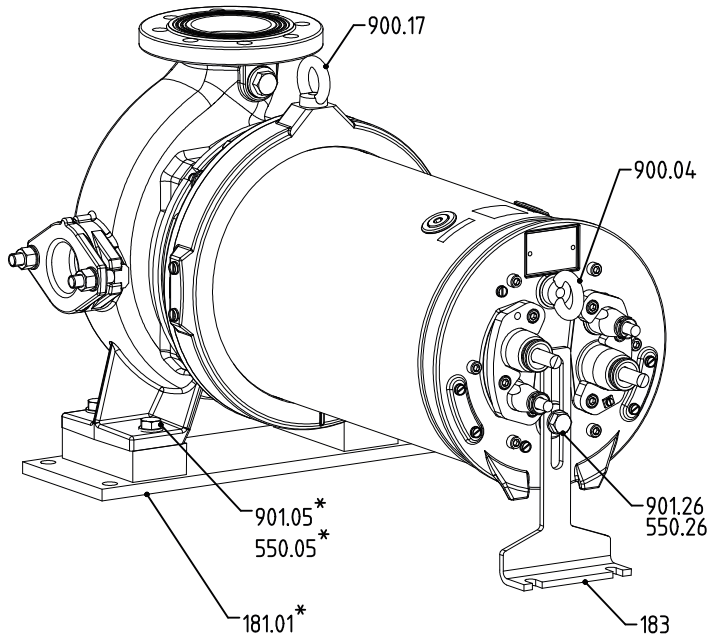


Fig. 76: Horizontal installation

*: On specific designs only

For the part numbers refer to the table (⇒ Section 9.1, Page 109) .

9.3.7 Vertical dry installation

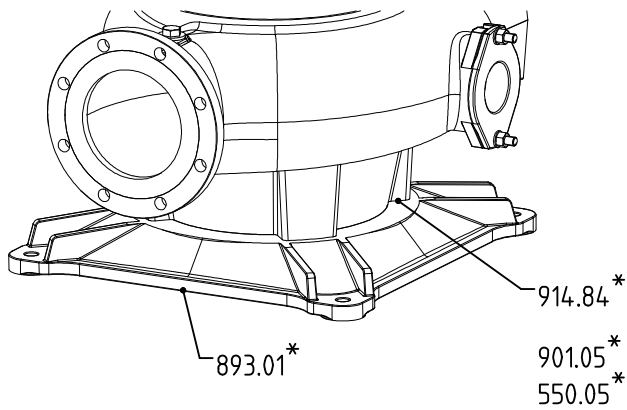


Fig. 77: Vertical dry installation

*: On specific designs only

For the part numbers refer to the table (⇒ Section 9.1, Page 109) .

9.3.8 Attachment elements

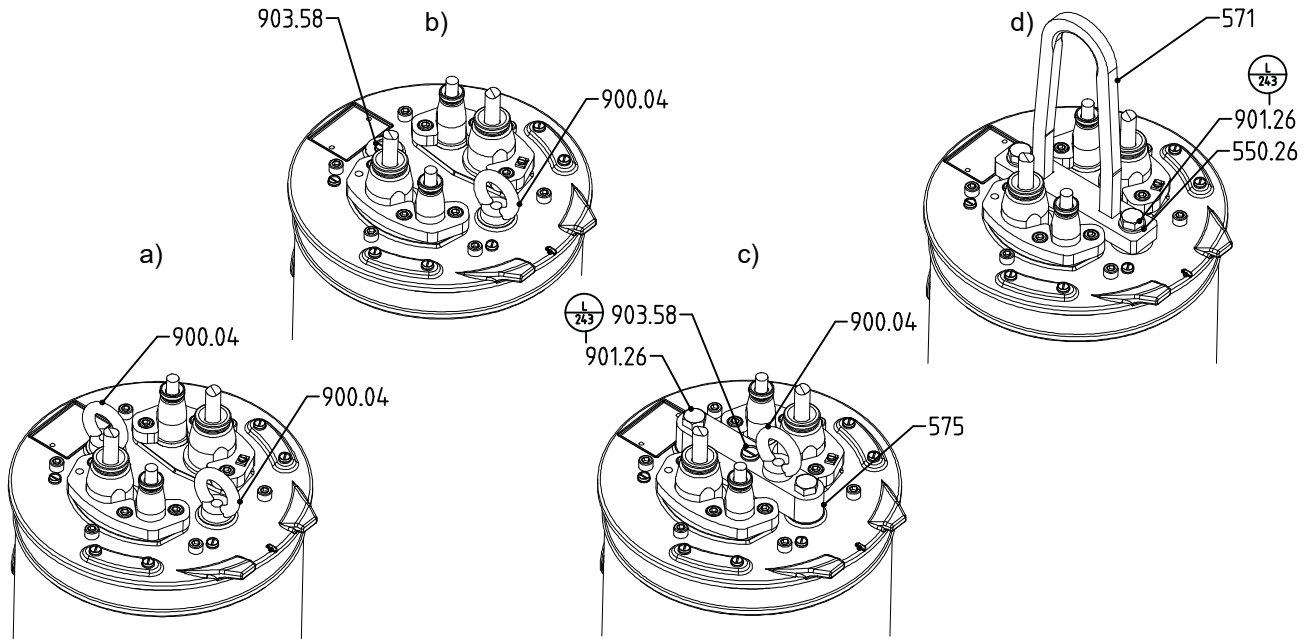


Fig. 78: Attachment elements a) Installation type D b) Installation type K (guide cable arrangement) c) Installation type K (guide rail arrangement) d) Installation types K and D (option: bail)

For the part numbers refer to the table (⇒ Section 9.1, Page 109) .

9.3.9 Sensors and terminals

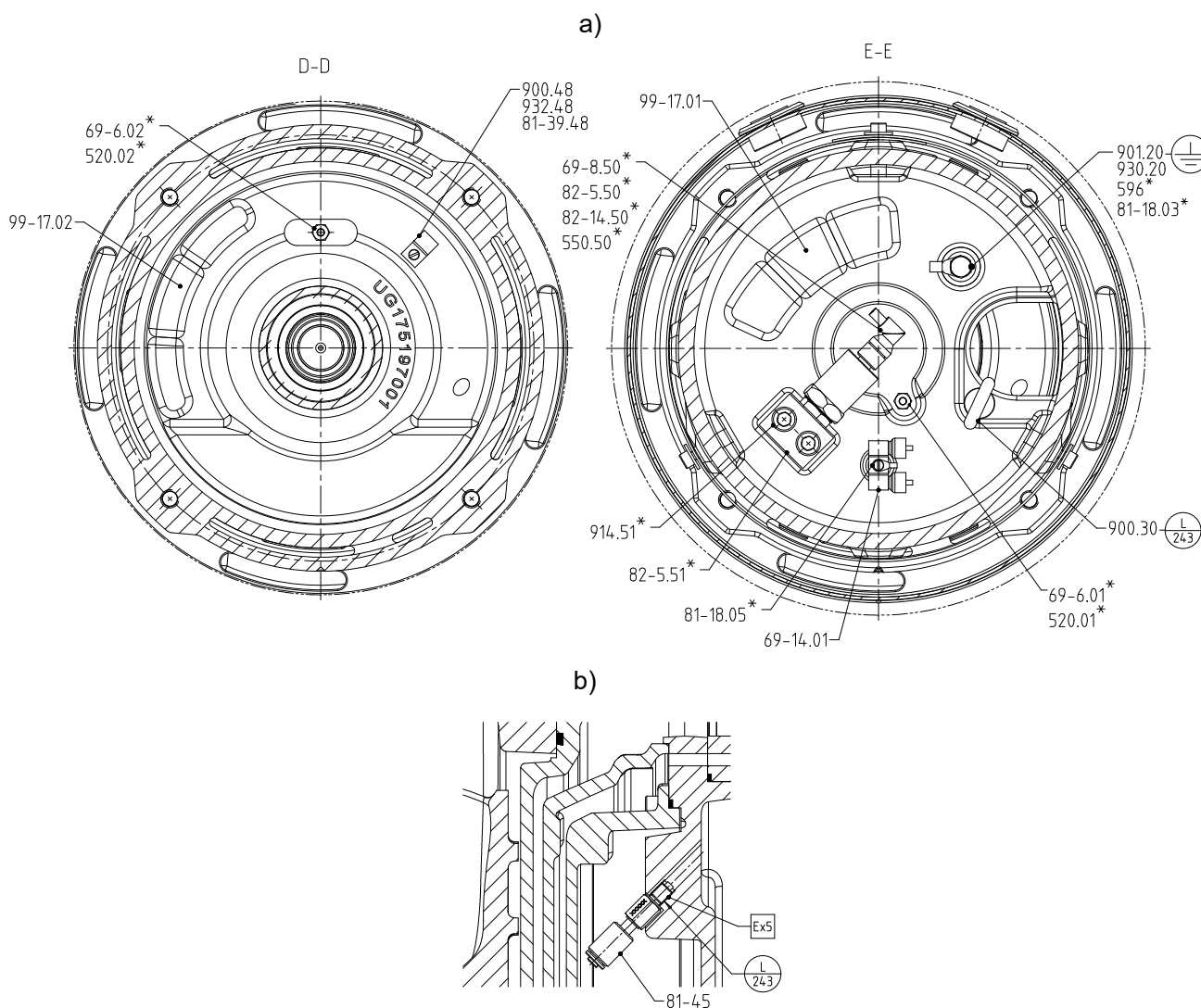


Fig. 79: Amarex KRT a) Sensors and terminals depending on the motor size b) Detailed view of the float switch

*: On specific designs only

Table 53: 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 109) .

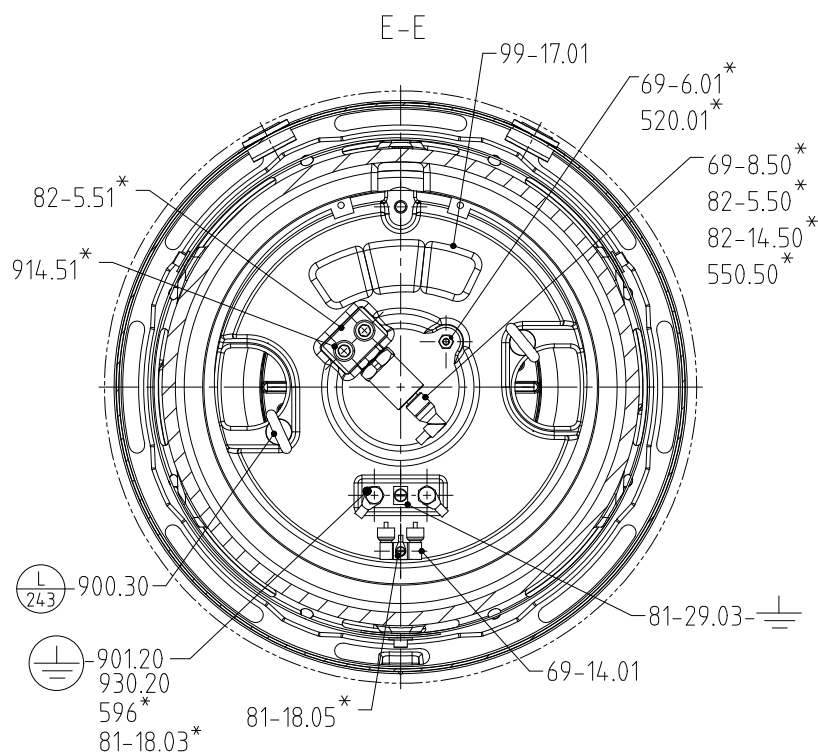


Fig. 80: Amarex KRT - Sensors and terminals depending on the motor size

*: On specific designs only

Table 54: 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 109) .

9.4 Flamepaths on explosion-proof motors

9.4.1 Amarex KRT

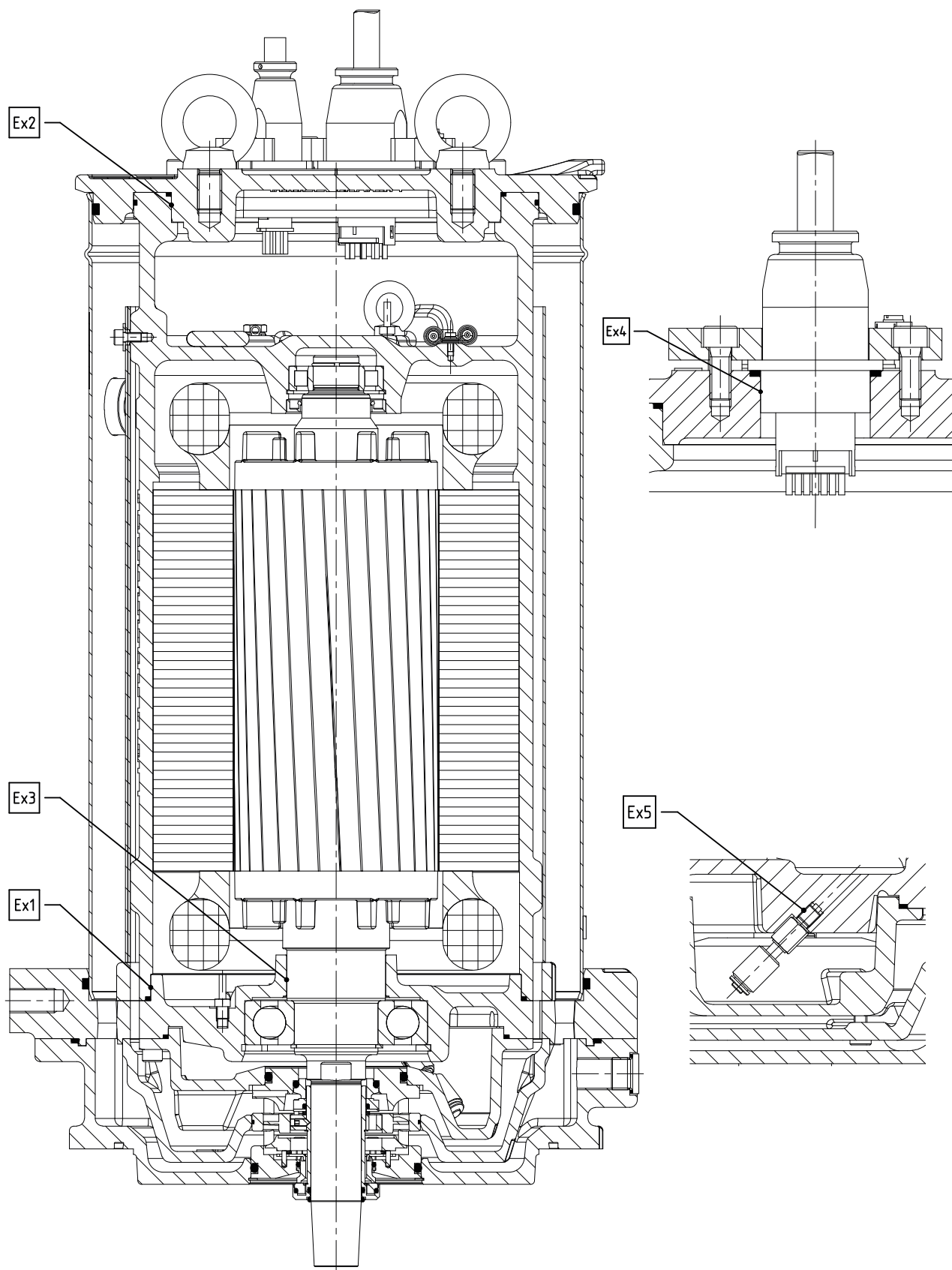


Fig. 81: Flamepaths Amarex KRT

9.5 Illustration of the mechanical seal

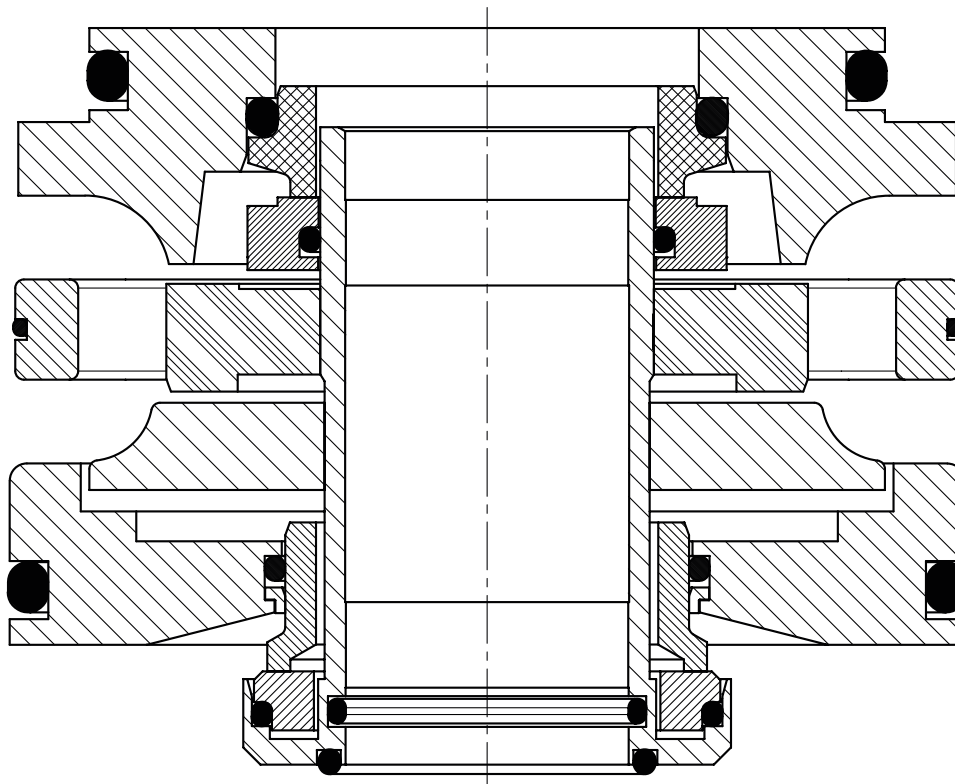


Fig. 82: Double cartridge seal

9.6 Wiring diagrams

9.6.1 Planning the control system

For the electrical connection observe the wiring diagrams (⇒ Section 9.6, Page 125) in the Annex and the information for planning the control system (⇒ Section 5.4.1, Page 55) .

A distinction is made between different types of electrical connection based on:

1. Single voltage or dual voltage²⁴⁾
2. Sensor package
3. Type of power cables

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

²⁴ For 60 Hz only

9.6.2 Single voltage

Single voltage for the sensor packages: (⇒ Section 5.4.1.5, Page 56)

- Basic/Basic+
- Premium

9.6.2.1 Sensor package Basic/Basic+

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

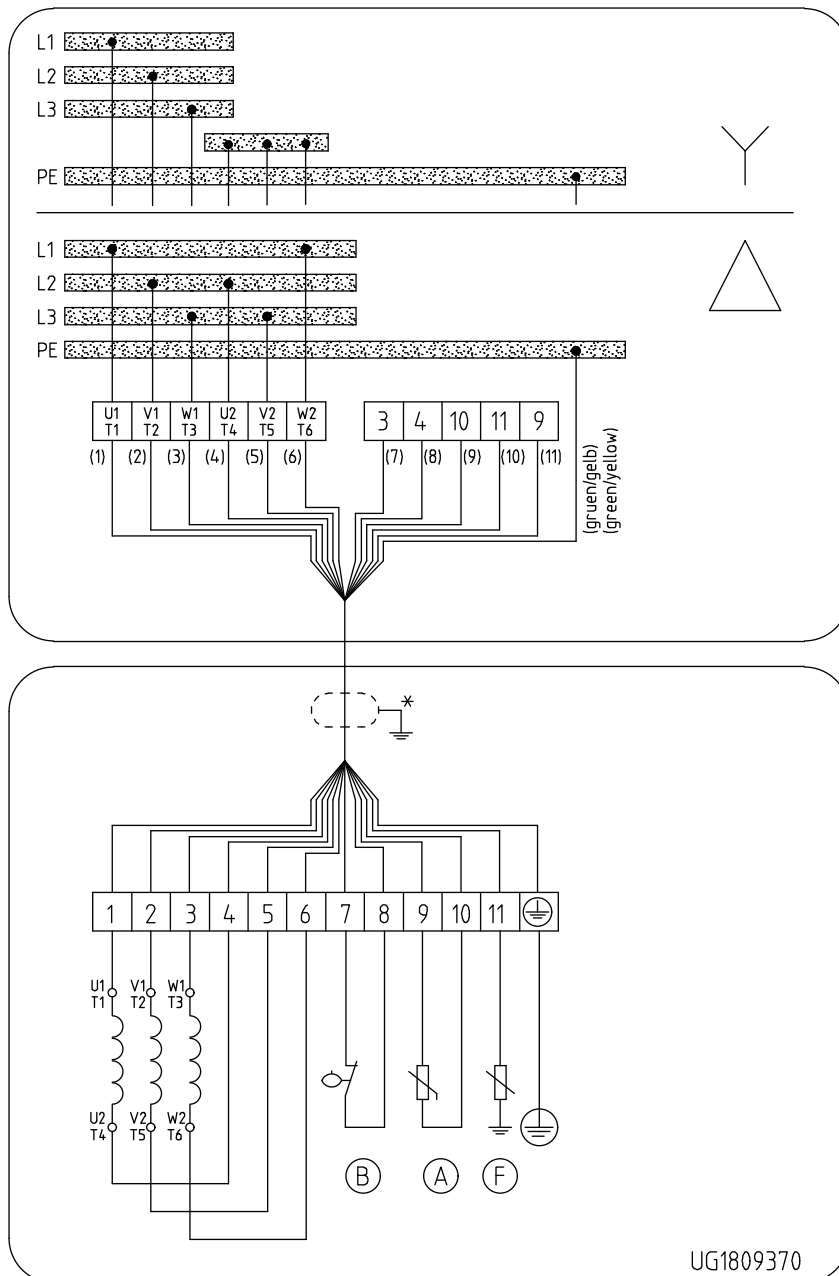


Fig. 83: Single voltage / Sensor package Basic / Power cable 12G1.5 / 12G2.5 (AWG 15-12 / 13-12)

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

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

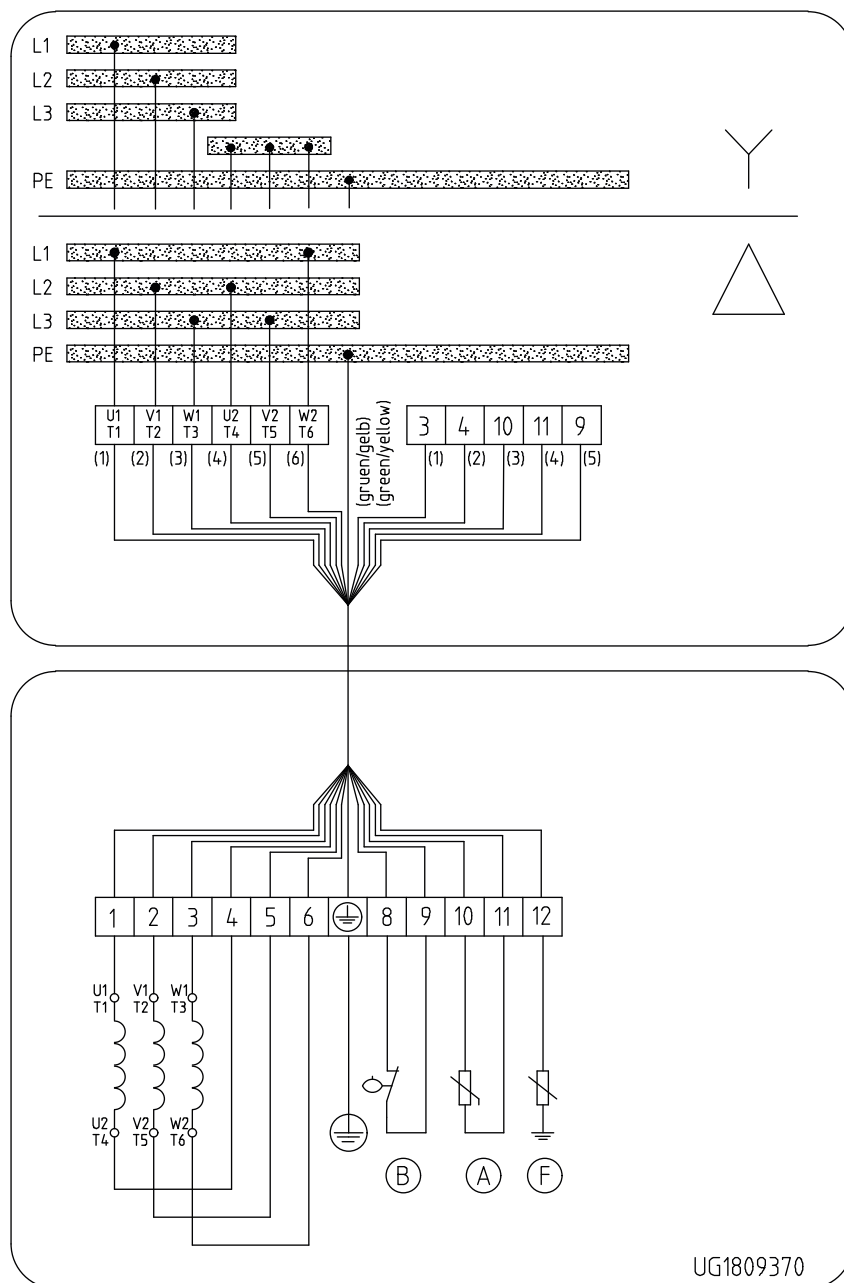


Fig. 84: Single voltage / Sensor package Basic / Power cable 7GX+5×1.5 (AWG X-7+15-5)

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

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

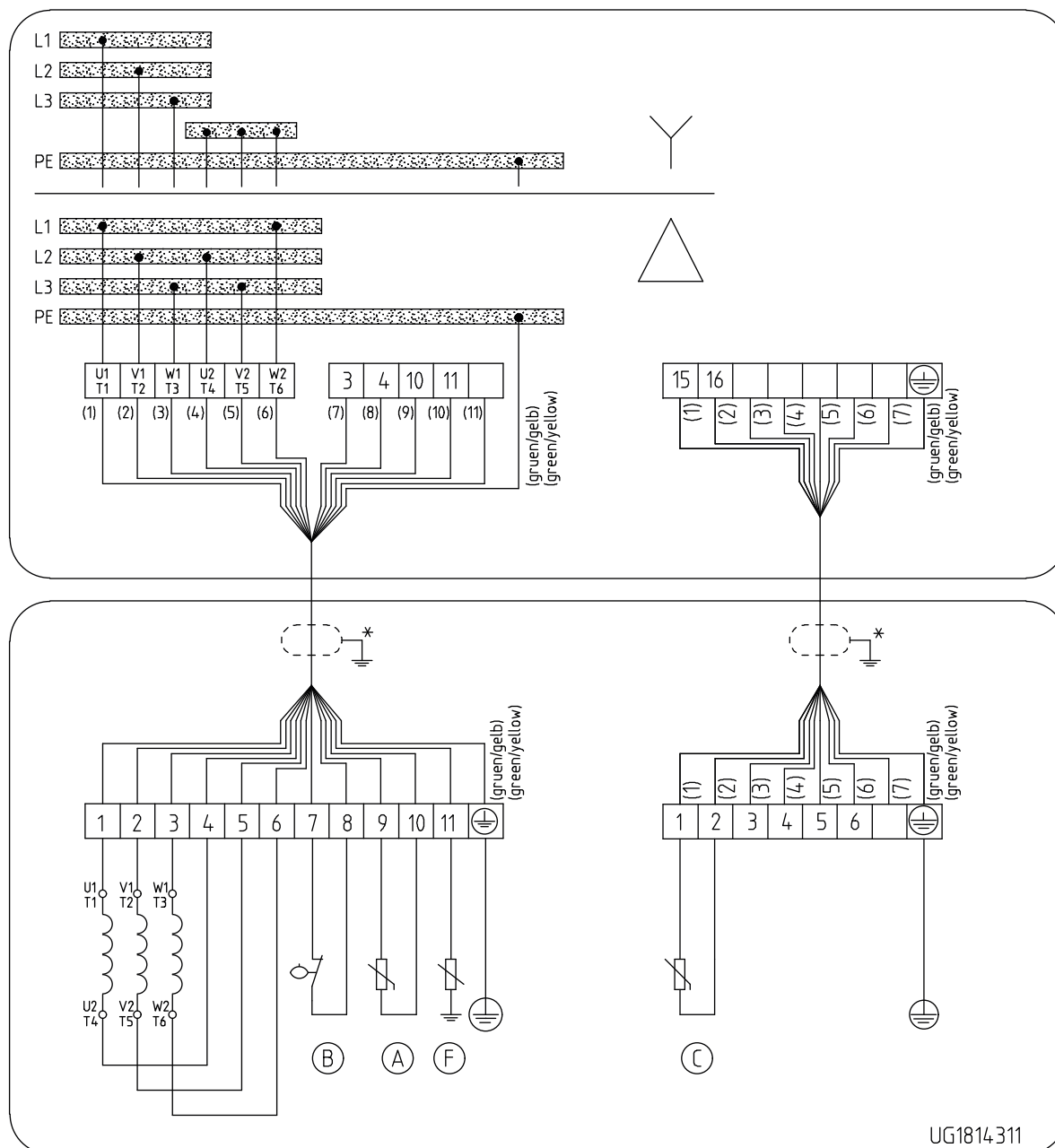


Fig. 85: Single voltage / Sensor package Basic+ / Power cable 12G1.5 / 12G2.5 plus 8G1.5 (AWG 15-12 / 13-12 plus 15-8)

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

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

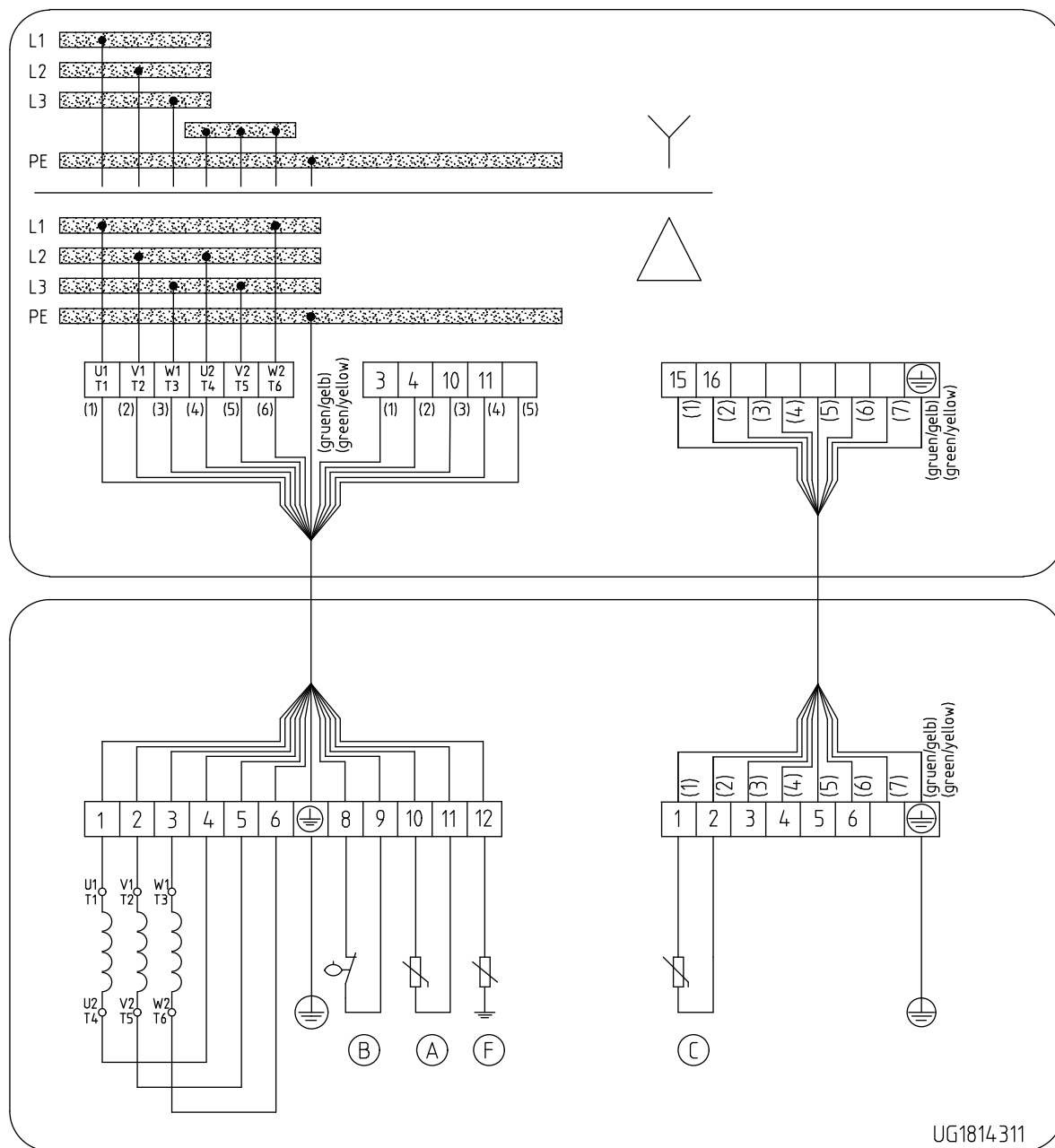
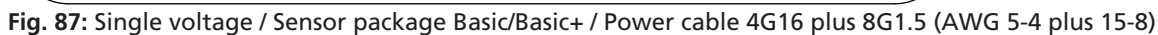


Fig. 86: Single voltage / Sensor package Basic+ / Power cable 7GX+5×1.5 plus 8G1.5 (AWG X-7+15-5 plus 15-8)

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

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

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

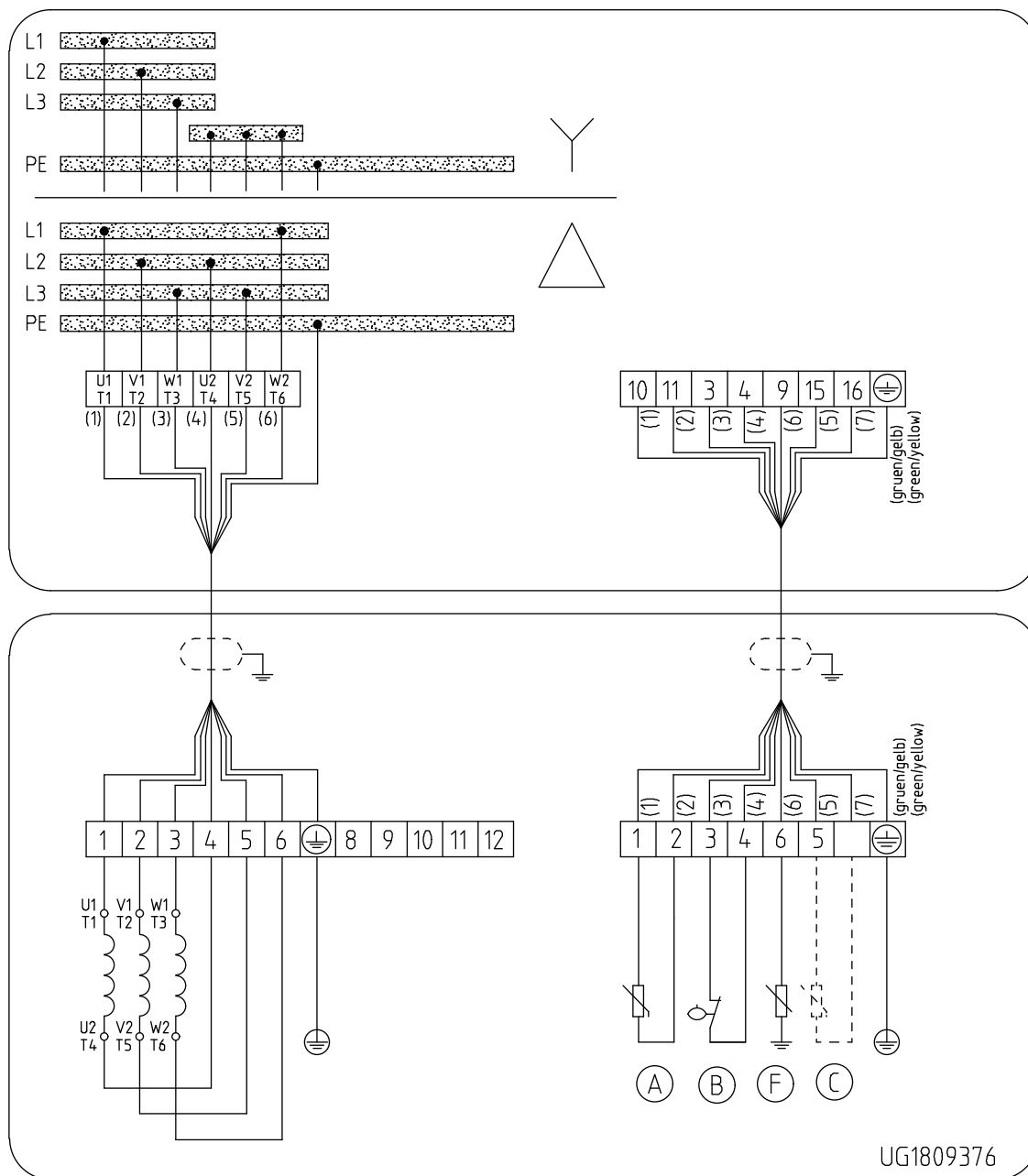


Fig. 88: Single voltage / Sensor package Basic/Basic+ / Power cables 7G6 plus 8G1.5 (AWG 9-7 plus 15-5)

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

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

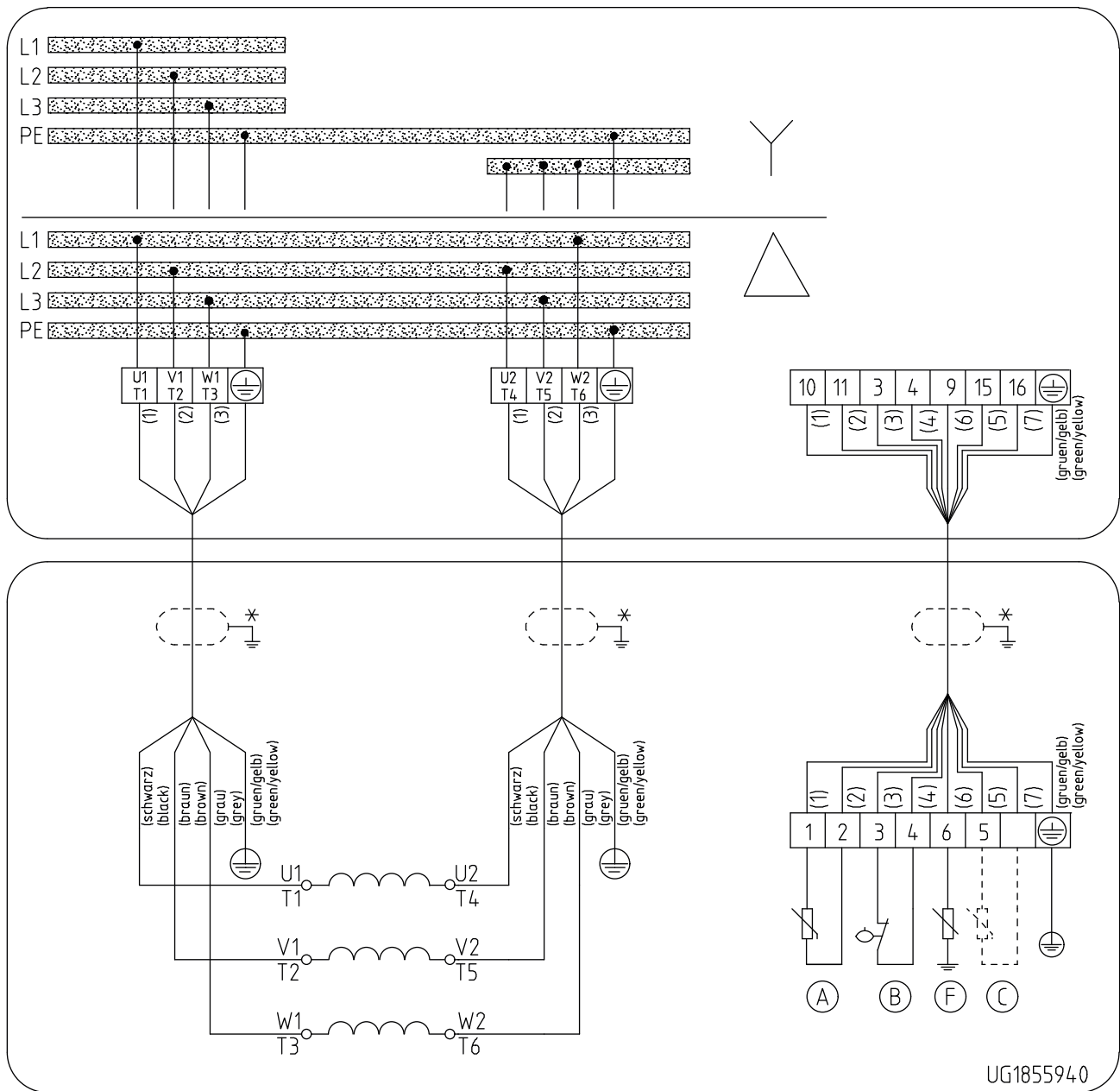


Fig. 89: Single voltage / Sensor package Basic/Basic+ / Power cables 2x4GX plus 8G1.5 (2xAWG X-4 plus 15-8)

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

9.6.2.2 Sensor package Premium

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

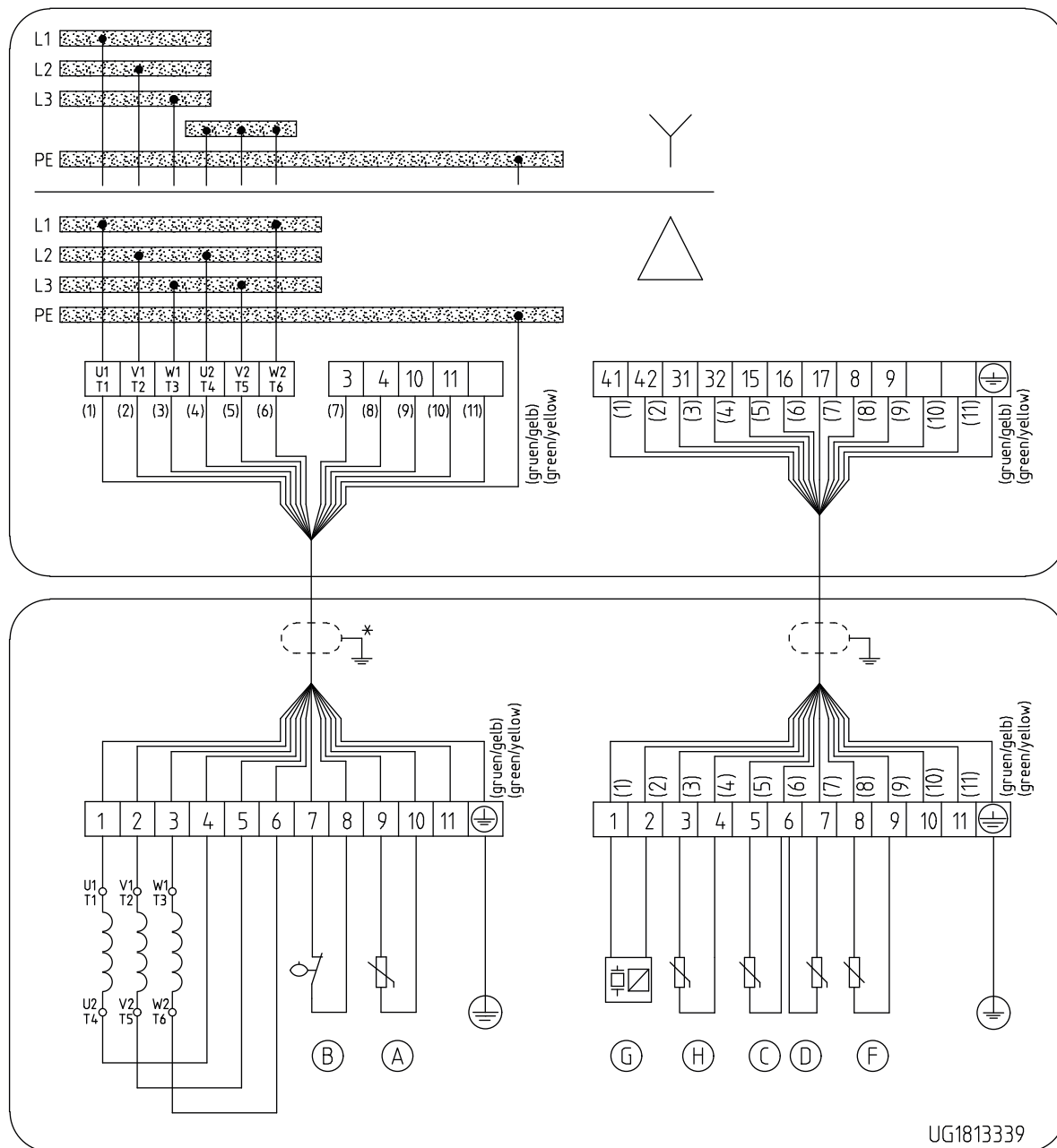


Fig. 90: Single voltage / Sensor package Premium / Power cable 12G1.5 / 12G2.5 plus 12G1.5 (AWG 15-12 / 13-12 plus 15-12)

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

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

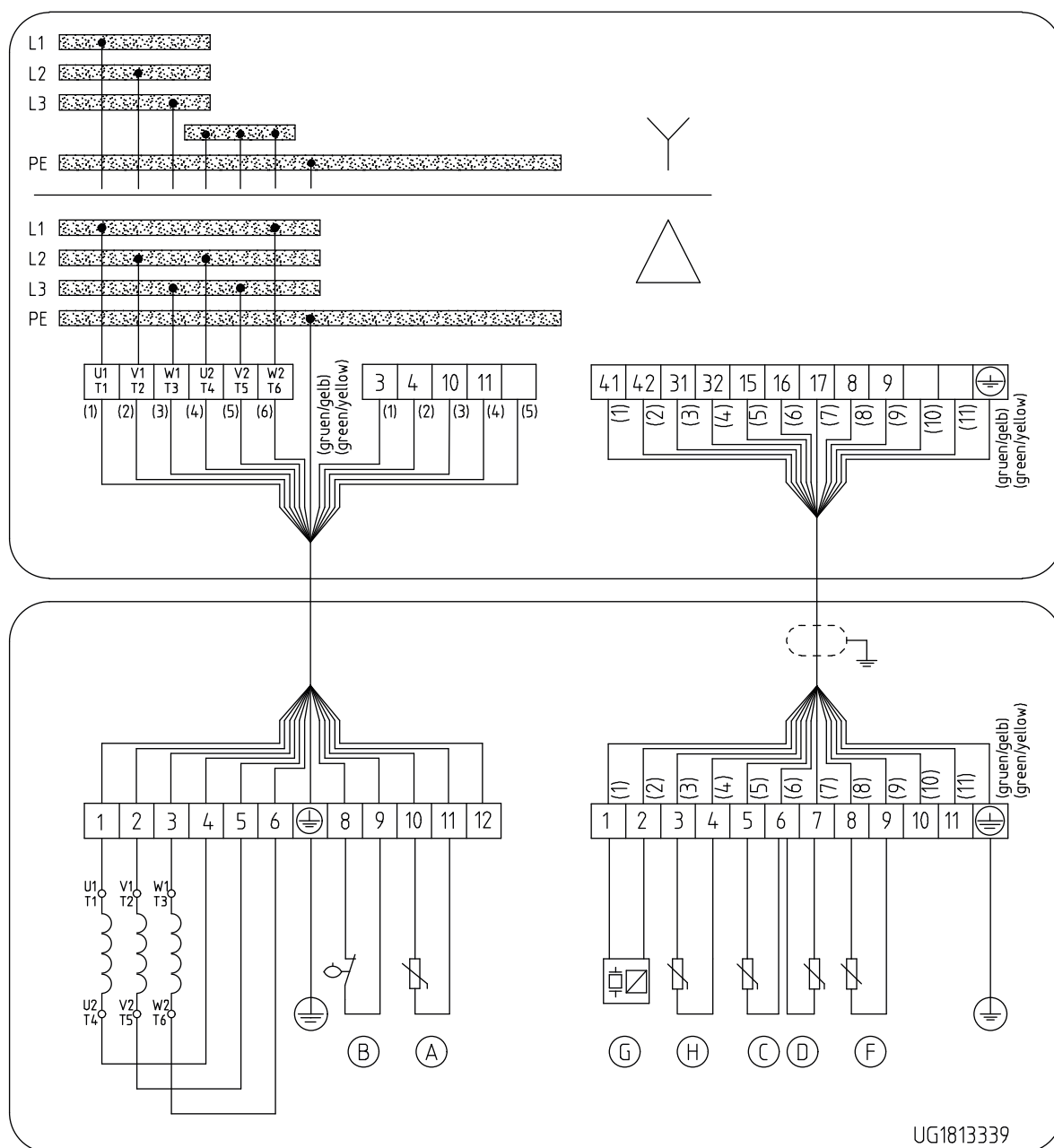


Fig. 91: Single voltage / Sensor package Premium / Power cable 7GX+5×1.5 plus 12G1.5 (AWG X-7+15-5 plus 15-12)

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

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

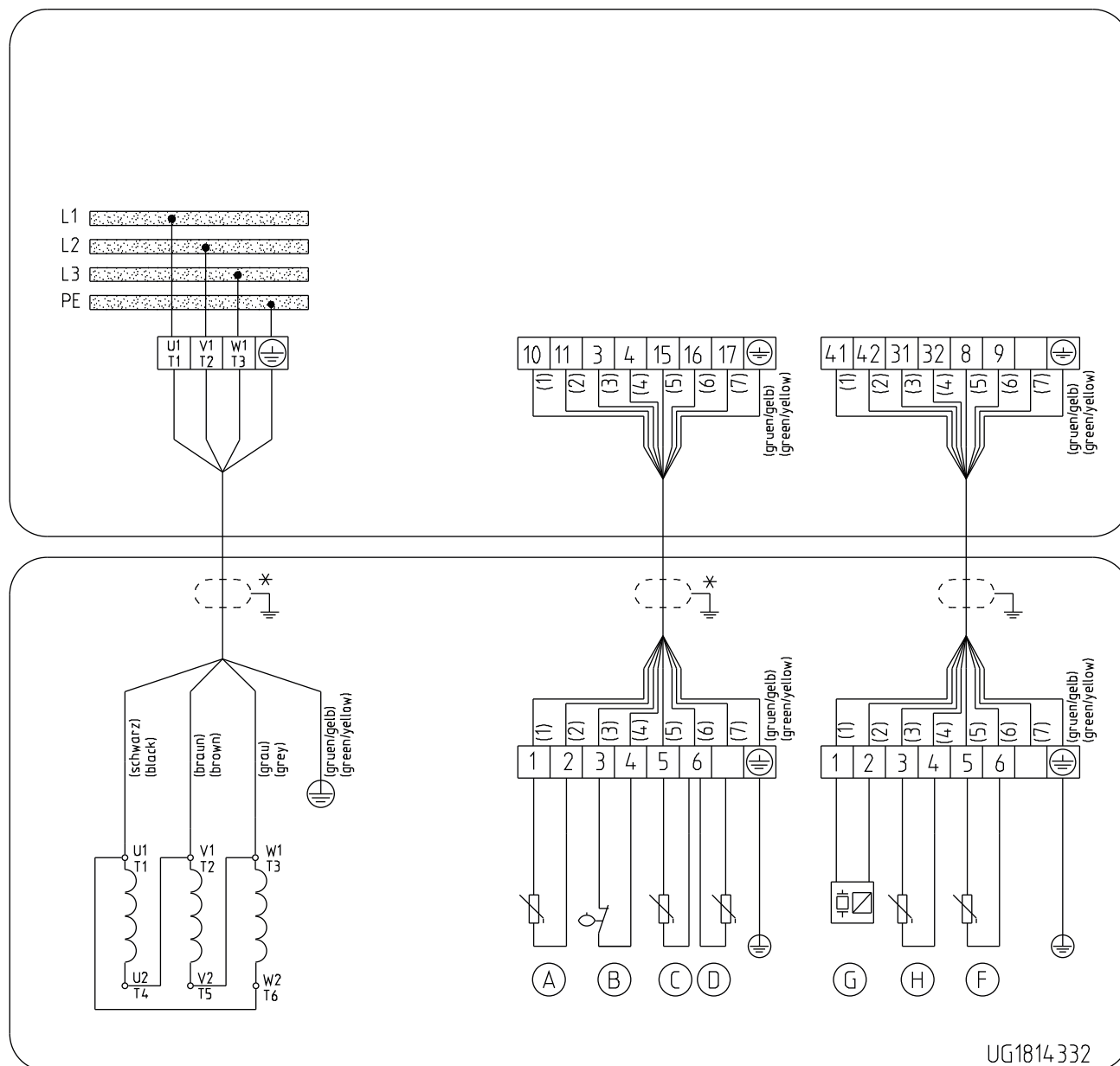


Fig. 92: Single voltage / Sensor package Premium / Power cables 4G16 plus 8G1.5 plus 8G1.5 (AWG 5-4 plus 15-8 plus 15-8)

(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

9.6.2.2.4 Single voltage - Sensor package Premium - 7G6 plus 8G1.5 plus 8G1.5 (AWG 9-7 plus 15-5 plus 15-8)

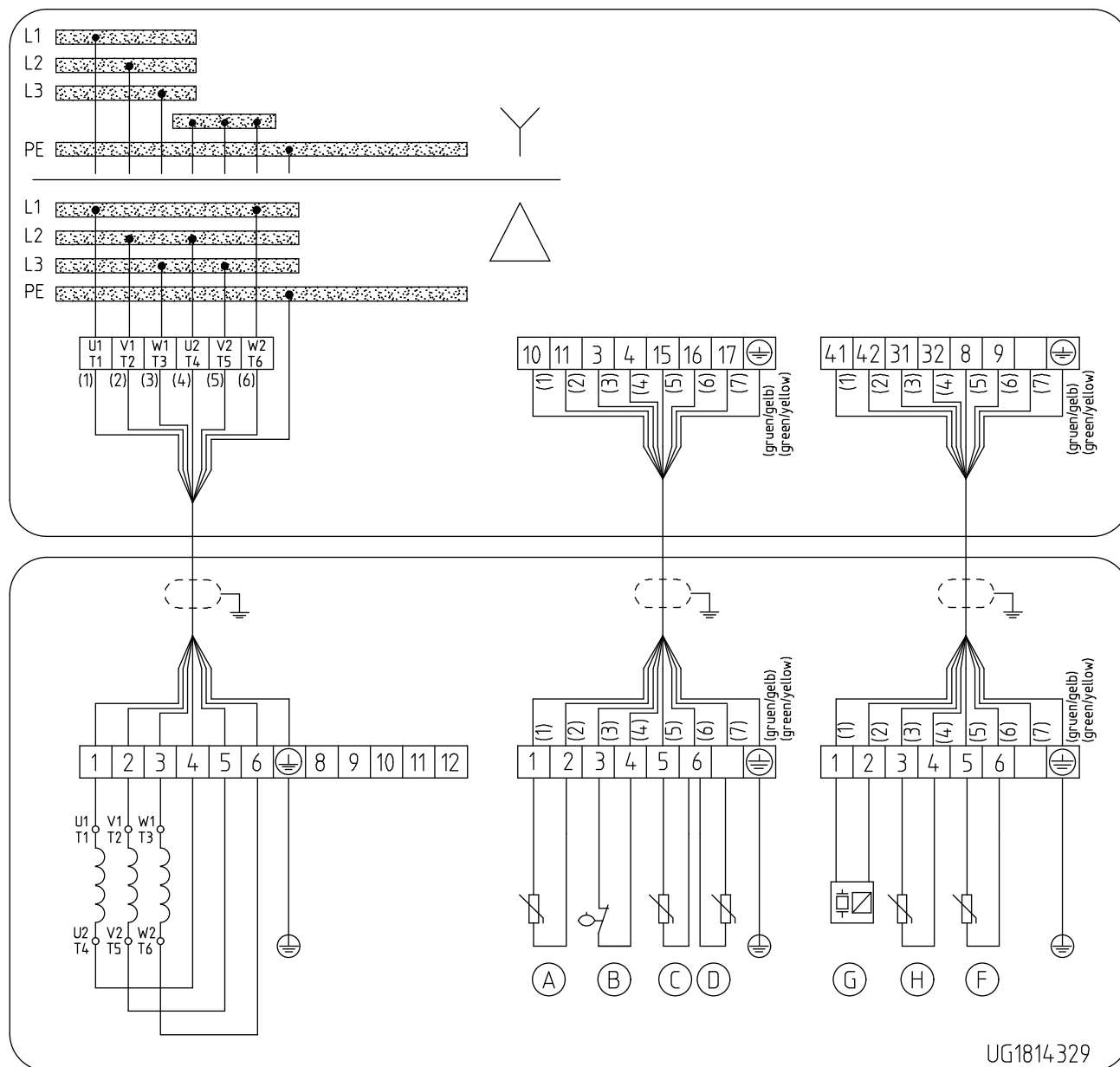
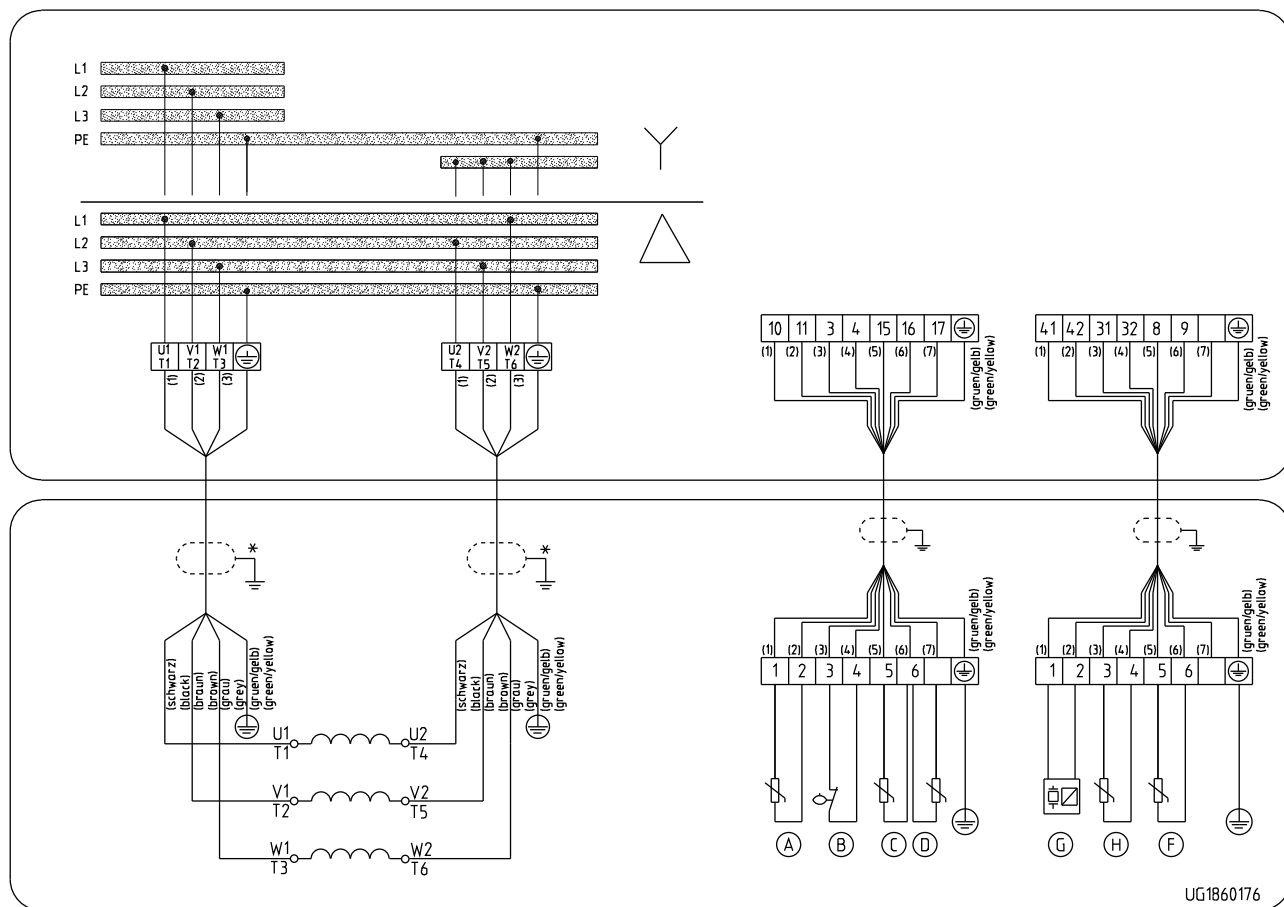


Fig. 93: Single voltage / Sensor package Premium / Power cable 7G6 plus 8G1.5 plus 8G1.5 (AWG 9-7 plus 15-5 plus 15-8)

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

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



UG1860176

Fig. 94: 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

9.6.3 Dual voltage

Dual voltage for the sensor packages: (⇒ Section 5.4.1.5, Page 56)

- Basic/Basic+
- Premium

9.6.3.1 Sensor package Basic/Basic+

9.6.3.1.1 Dual voltage - Sensor package Basic/Basic+ - 12G1.5 / 12G2.5 (AWG 15-12 / 13-12)

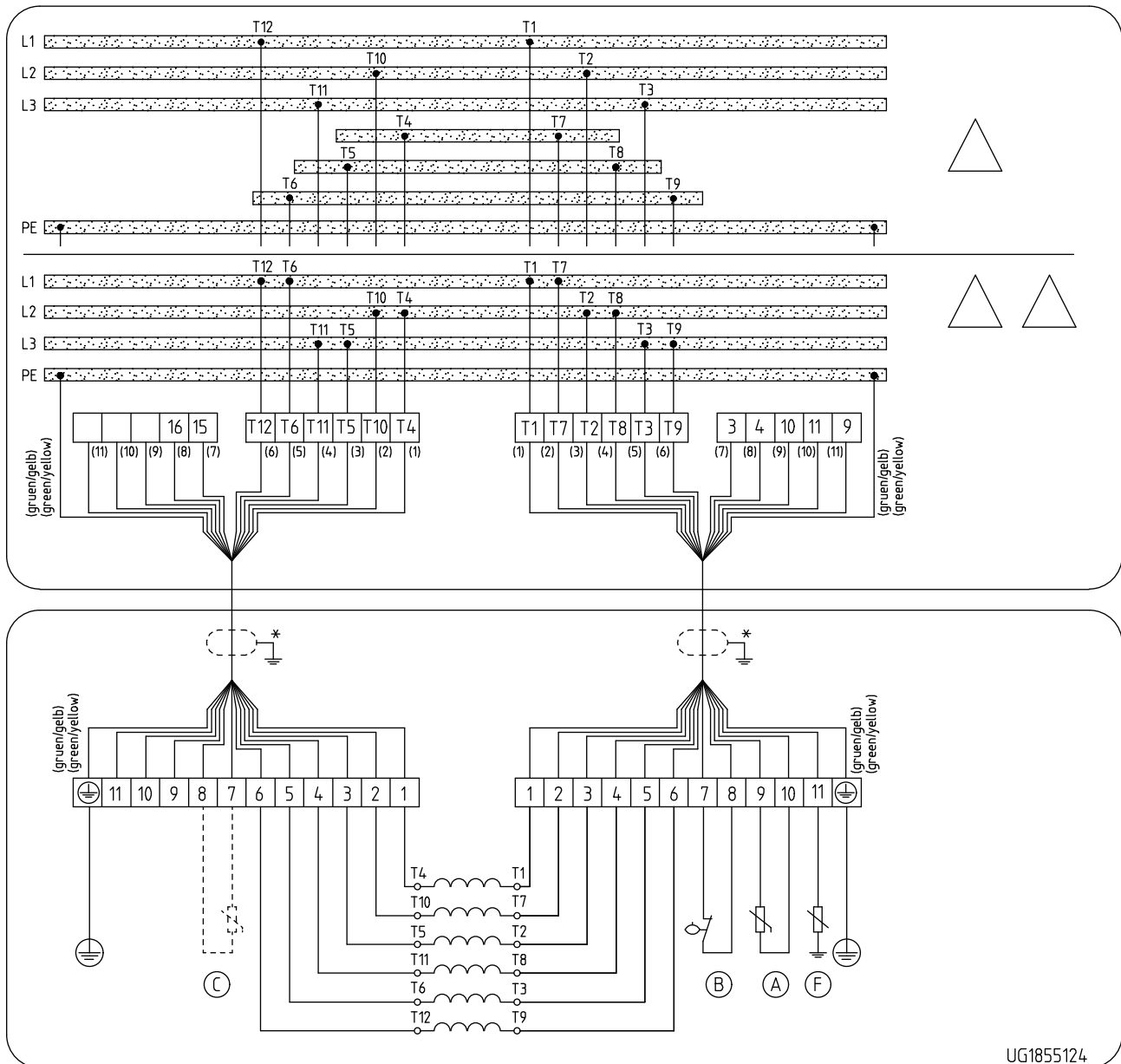
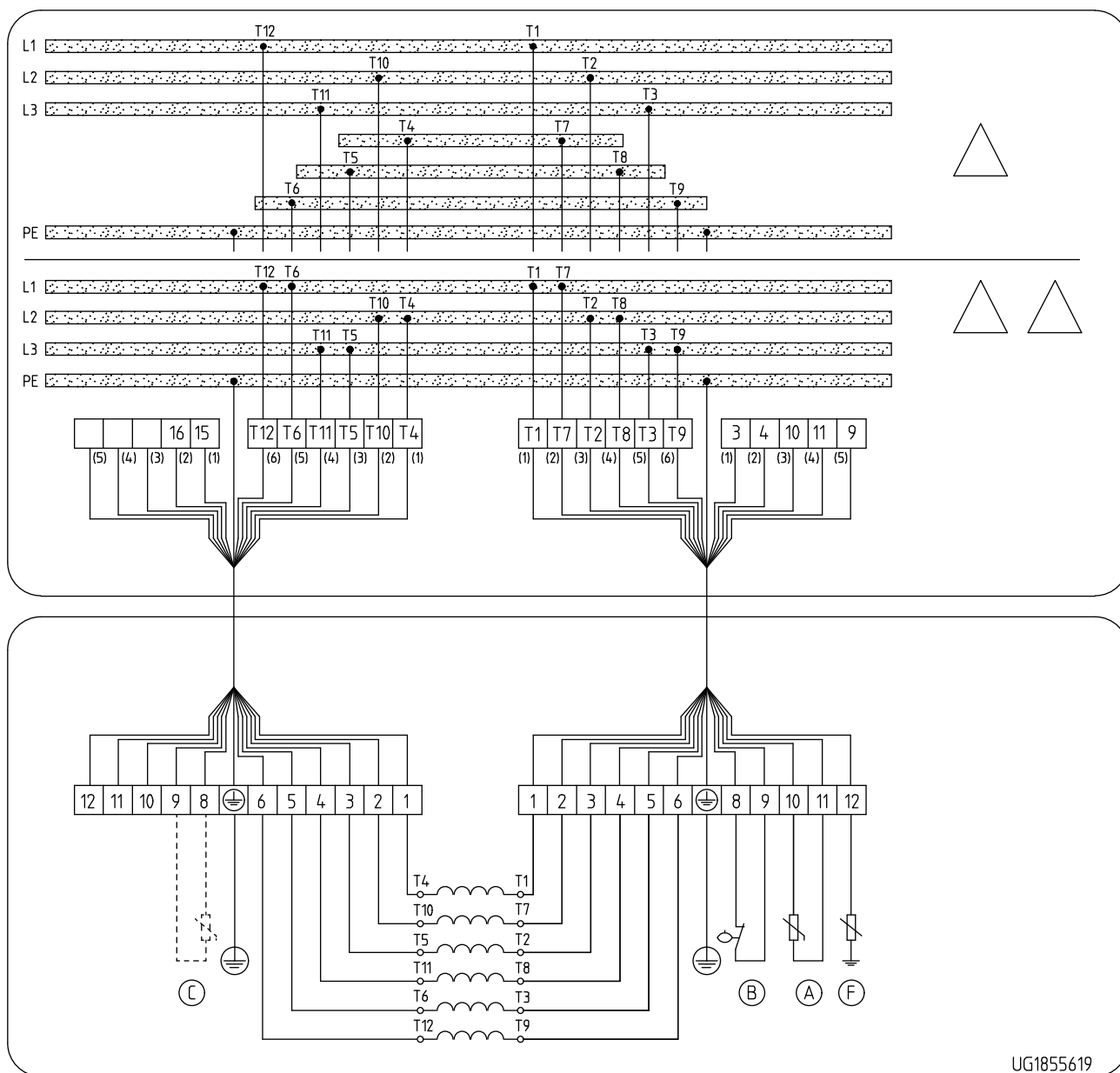


Fig. 95: Dual voltage / Sensor package Basic/Basic+ / Power cables 12G1.5 / 12G2.5 (AWG 15-12 / 13-12)

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

9.6.3.1.2 Dual voltage - Sensor package Basic/Basic+ - 7GX+5×1.5 (AWG X-7+15-5)



UG1855619

Fig. 96: Dual voltage / Sensor package Basic/Basic+ / Power cables 7GX+5×1.5 (AWG X-7+15-5)

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

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

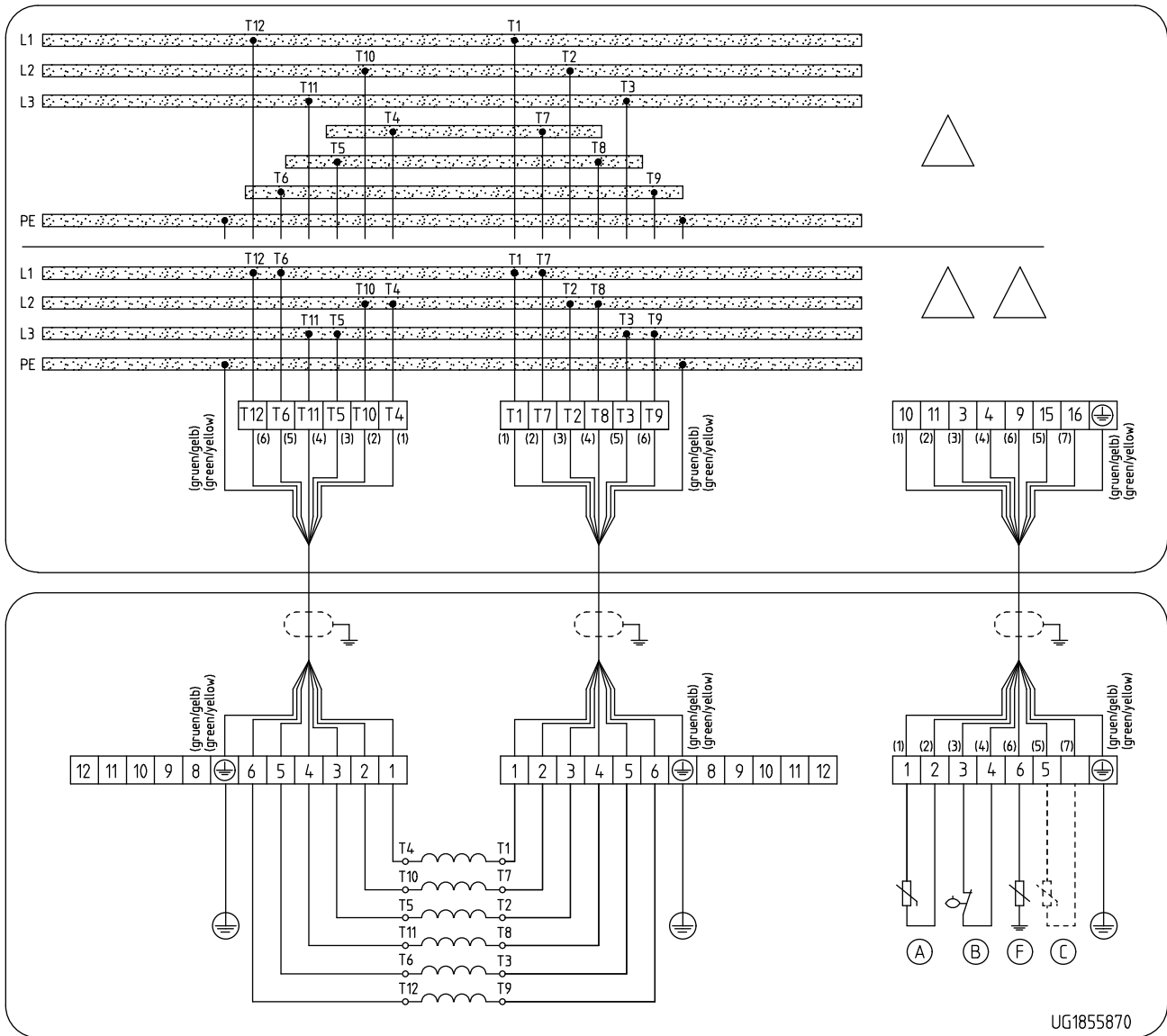
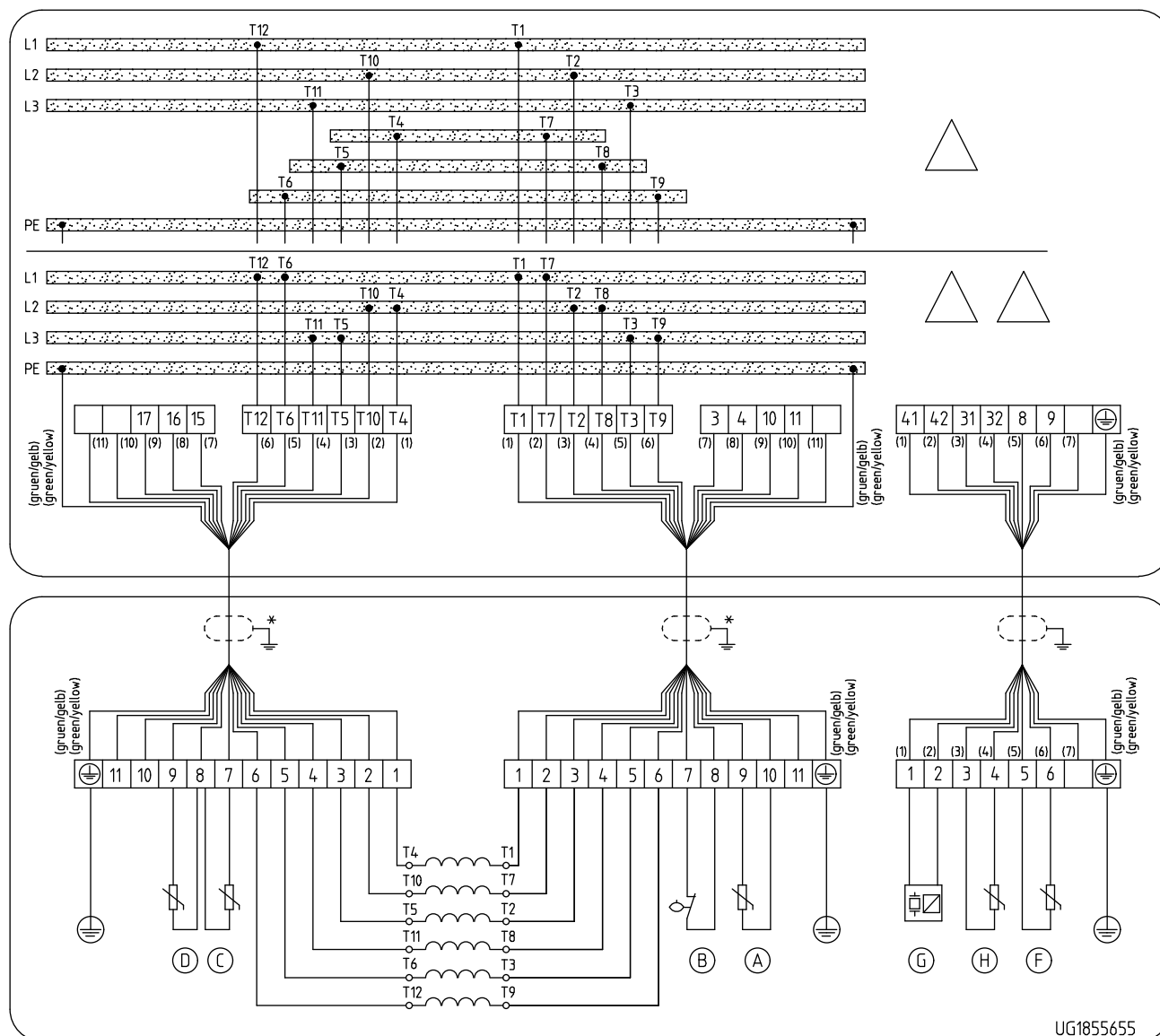


Fig. 97: Dual voltage / Sensor package Basic/Basic+ / Power cables 7G6 plus 8G1.5 (AWG 9-7 plus 15-5)

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

9.6.3.2 Sensor package Premium

9.6.3.2.1 Dual voltage - Sensor package Premium - 12G1.5 / 12G2.5 plus 8G1.5 (AWG 15-12 / 13-12 plus 15-8)

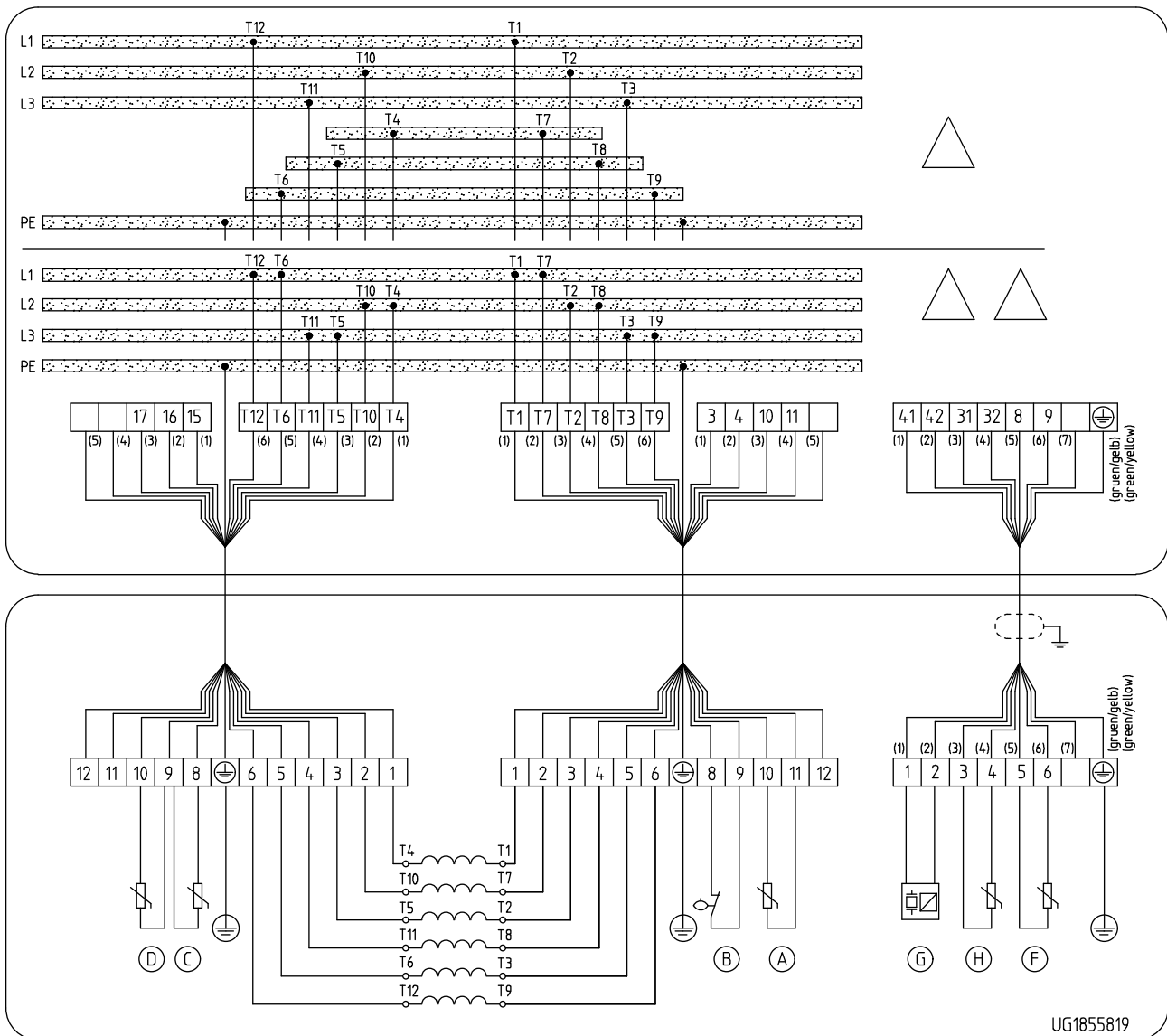


UG1855655

Fig. 98: Dual voltage / Sensor package Premium / Power cables 12G1.5 / 12G2.5 plus 8G1.5 (AWG 15-12 / 13-12 plus 15-8)

(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

9.6.3.2.2 Dual voltage - Sensor package Premium - 7GX+5×1.5 plus 8G1.5
(AWG X-7+15-5 plus 15-8)



UG1855819

Fig. 99: Dual voltage / Sensor package Premium / Power cables 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)
(D)	Bearing temperature (motor end)
(F)	Leakage inside the motor
(G)	Vibration sensor
(H)	Motor temperature (Pt100)

9.6.3.2.3 Dual voltage - Sensor package Premium - 7G6 plus 8G1.5 (AWG 9-7 plus 15-5)

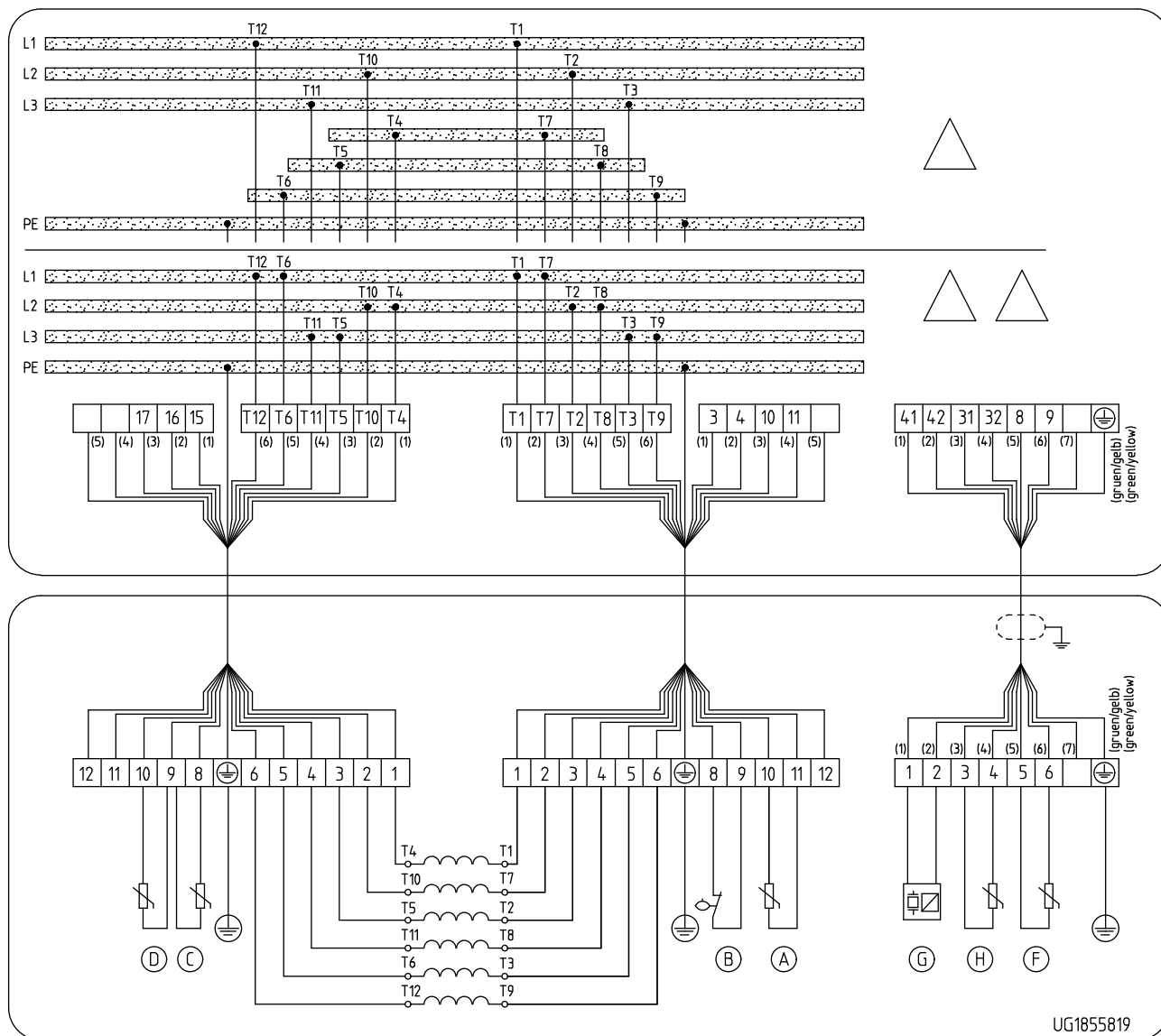


Fig. 100: Dual voltage / Sensor package Premium / Power cables 7G6 plus 8G1.5 (AWG 9-7 plus 15-5)

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

10 Certificate of Decontamination

Type:
Order number/
Order item number²⁵⁾:
Delivery date:
Field of application:
Fluid handled²⁵⁾:

Please check where applicable²⁵⁾:



Corrosive



Oxidizing



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Hazardous to the environment



Safe

Reason for return²⁵⁾:
Comments:
.....

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

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

For mag-drive pumps, the inner rotor unit (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) has been removed from the pump and cleaned. In cases of 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.

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 shipping is effected in accordance with the relevant legal provisions.

.....
Place, date and signature

.....
Address

.....
Company stamp

²⁵⁾ Required field

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