

In-line Pump

Etaline

Installation/Operating Manual



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Installation/Operating Manual Etaline

Original operating manual

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Glossary

Back pull-out design

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

Back pull-out unit

Pump without pump casing; partly completed machinery

Close-coupled design

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

Discharge line

The line which is connected to the discharge nozzle

Hydraulic system

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

In-line design

Suction and discharge nozzle are arranged opposite each other on the same axis

Pool of pumps

Pumps which are purchased and stored independently of their later use

Pump

Machine without drive, additional components or accessories

Pump set

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

Suction lift line/suction head line

The line which is connected to the suction nozzle

1 General

1.1 Principles

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

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

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

Noise characteristics (⇒ Section 4.7 Page 19)

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 2.4 Page 9)

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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

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

1.5 Symbols

Table 2: Symbols used in this manual

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

¹⁾ If agreed upon in scope of supply

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

2 Safety



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

2.1 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 CAUTION	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EC Directive 94/9/EC (ATEX).
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

2.2 General

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

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

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

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

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

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

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

2.3 Intended use

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

- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model.

- Never operate the pump without the fluid handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- Observe the maximum flow rates indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

Prevention of foreseeable misuse

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

2.4 Personnel qualification and training

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

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

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

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

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

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

2.6 Safety awareness

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

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

2.7 Safety information for the operator/user

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

2.8 Safety information for maintenance, inspection and installation work

- Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that all maintenance, inspection and installation work is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- The pump casing must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.1.6 Page 30) (⇒ Section 6.3 Page 32)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3 Page 37)
- As soon as the work has been completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1 Page 28)

2.9 Unauthorised modes of operation

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

The warranty relating to the operating reliability and safety of the supplied pump (set) is only valid if the equipment is used in accordance with its intended use. (⇒ Section 2.3 Page 8)

2.10 Explosion protection

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

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

Special conditions apply to the operation of explosion-proof pump sets to EC Directive 94/9/EC (ATEX).

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections (⇒ Section 2.10.1 Page 11) to (⇒ Section 2.10.4 Page 12) .

The explosion-proof status of the pump set is only assured if the pump set is used in accordance with its intended use.



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

Prevent impermissible modes of operation at all times.

2.10.1 Marking

Pump The marking on the pump refers to the pump part only.
 Example of such marking: II 2 G c TX
 Refer to the Temperature Limits table for the temperatures permitted for the individual pump variants. (⇒ Section 2.10.2 Page 11)

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

Motor The motor has its own marking. The marking is maintained on the condition that the temperatures the pump causes to develop at the motor flange and motor shaft are permitted by the motor manufacturer.
 The motors used by KSB on pumps with ATEX certification meet this condition.

2.10.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected on the surface of the pump casing and at the shaft seal.

The surface temperature at the pump casing corresponds to the temperature of the fluid handled. If the pump is heated, the operator of the system is responsible for observing the specified temperature classes and fluid temperature (operating temperature).

The table below lists the temperature classes and the resulting theoretical temperature limits of the fluid handled. (A possible temperature rise in the shaft seal area has already been taken into account).

The temperature class specifies the maximum permissible temperature at the surface of the pump set during operation. For the permissible operating temperature of the pump in question refer to the data sheet.

Table 4: Temperature limits

Temperature class as per EN 13463-1	Max. permissible fluid temperature
T1	Temperature limit of the pump
T2	280 °C
T3	185 °C
T4	120 °C
T5	85 °C
T6	Only after consultation with the manufacturer

If the pump is to be operated at a higher temperature, the data sheet is missing or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

Motor supplied by the operator If a pump is supplied without motor (as part of a pool of pumps), the motor specified in the pump data sheet must meet the following conditions:

- The permissible temperature limits at the motor flange and motor shaft must be higher than the temperatures generated by the pump.
- Contact the manufacturer for the actual pump temperatures.

2.10.3 Monitoring equipment

The pump (set) must only be operated within the limits specified in the data sheet and on the name plate.

If the system operator cannot warrant compliance with these operating limits, appropriate monitoring devices must be used.

Check whether monitoring equipment is required to ensure that the pump set functions properly.

Contact KSB for further information on monitoring equipment.

2.10.4 Operating limits

The minimum flows indicated in (⇒ Section 6.2.3.1 Page 31) refer to water and water-like fluids handled. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures at the pump surface. However, if the physical properties of the fluids handled are different from water, it is essential to check whether an additional heat build-up may occur and if the minimum flow rate must therefore be increased. The calculation formula in (⇒ Section 6.2.3.1 Page 31) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

3 Transport/Temporary Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

	<p>⚠ DANGER</p>
	<p>The pump (set) could slip out of the suspension arrangement Danger to life from falling parts!</p> <ul style="list-style-type: none"> ▷ Always transport the pump (set) in the specified position. ▷ Never attach the suspension arrangement to the free shaft end or the motor eyebolt. ▷ Give due attention to the weight data and the centre of gravity. ▷ Observe the applicable local health and safety regulations. ▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

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

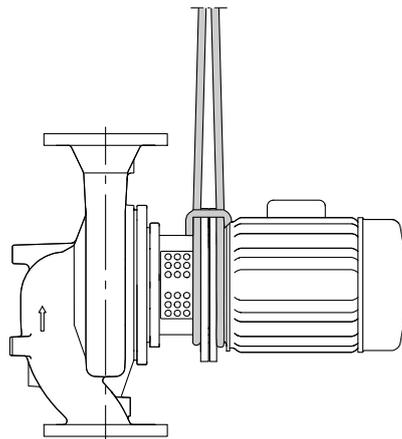


Fig. 1: Transporting the pump set

	<p>CAUTION</p>
	<p>Incorrect transport of the pump Damage to the shaft seal!</p> <ul style="list-style-type: none"> ▷ For transport, lock the pump shaft with a suitable transport lock to prevent any movement of the shaft.

When transporting the pump without motor, shaft 210 must be locked.

1. Remove the screws on cover plates 68-3, press the cover plates slightly together and remove from drive lantern 341.
2. Insert lock washer 931.95 into the shaft groove.
3. Tighten hexagon head bolt 901.50.

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

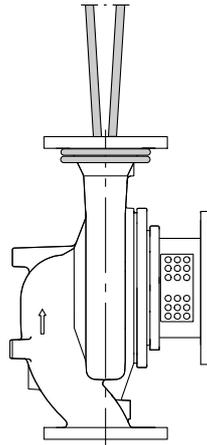


Fig. 2: Transporting the pump

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.

	<p style="background-color: yellow; margin: 0;">CAUTION</p> <p>Damage during storage by humidity, dirt, or vermin Corrosion/contamination of the pump (set)!</p> <ul style="list-style-type: none"> ▸ For outdoor storage cover the packed or unpacked pump (set) and accessories with waterproof material.
	<p style="background-color: yellow; margin: 0;">CAUTION</p> <p>Wet, contaminated or damaged openings and connections Leakage or damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Only remove caps/covers from the openings of the pump set at the time of installation.

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

Rotate the shaft by hand once a month, e.g. via the motor fan.

If properly stored indoors, the pump set is protected for a maximum of 12 months. New pumps/pump sets are supplied by our factory duly prepared for storage.

For storing a pump (set) which has already been operated, observe the instructions in (⇒ Section 6.3.1 Page 32) .

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3 Page 37)
2. Always flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump set has handled fluids whose residues could lead to corrosion in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump set must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump (set).
Always indicate any safety and decontamination measures taken.

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

3.5 Disposal

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

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

4 Description of the Pump (Set)

4.1 General

- Non-self-priming in-line pump

Pump for handling clean or aggressive fluids not chemically and mechanically aggressive to the pump materials.

4.2 Product Information as per Regulation No. 547/2012 (for Water Pumps with a Maximum Shaft Power of 150 kW) Implementing "Ecodesign" Directive 2009/125/EC

- Minimum efficiency index: see name plate, key to name plate
- The benchmark for most efficient water pumps is $MEI \geq 0.70$.
- Year of construction: see name plate, key to name plate
- Manufacturer's name or trade mark, commercial registration number and place of manufacture: see data sheet or order documentation
- Product's type and size identifier: see name plate, key to name plate
- Hydraulic pump efficiency (%) with trimmed impeller: see data sheet
- Pump performance curves, including efficiency characteristics: see documented characteristic curve
- The efficiency of a pump with a trimmed impeller is usually lower than that of a pump with full impeller diameter. Trimming of the impeller will adapt the pump to a fixed duty point, leading to reduced energy consumption. The minimum efficiency index (MEI) is based on the full impeller diameter.
- Operation of this water pump with variable duty points may be more efficient and economic when controlled, for example, by the use of a variable speed drive that matches the pump duty to the system.
- Information on dismantling, recycling and disposal after decommissioning: (⇒ Section 3.5 Page 15)
- Information on benchmark efficiency or benchmark efficiency graph for $MEI = 0.7$ (0.4) for the pump based on the model shown in the Figure are available at: <http://www.europump.org/efficiencycharts>

4.3 Designation

Example: ETL 050-050-160 GG X AA 06 D 2

Table 5: Key to the designation

Code	Description
ETL	Type series
	ETL = Etaline
050	Nominal suction nozzle diameter [mm]
050	Nominal discharge nozzle diameter [mm]
160	Nominal impeller diameter [mm]
G	Casing material
	G = grey cast iron
G	Impeller material if different from casing material
	G = grey cast iron
	C = stainless steel
	B = bronze
X	Additional code
	X = special design
A	Casing cover
	A = conical seal chamber
A	Sealing system
	A = conical seal chamber
	V = conical seal chamber with vent

Code	Description
06	Seal code
	06 = mechanical seal material U3BEGG (WS 25, 35)
	07 = mechanical seal material Q1Q1EGG
	09 = mechanical seal material U3U3VGG
	10 = mechanical seal material Q1Q1X4GG
	11 = mechanical seal material BQ1EGG
D	22 = mechanical seal material AQ1EGG (WS 55)
	D = pump with motor
2	A = pump without motor
	Shaft unit
	2 = WS 25
	3 = WS 35
	5 = WS 55

4.4 Name plate

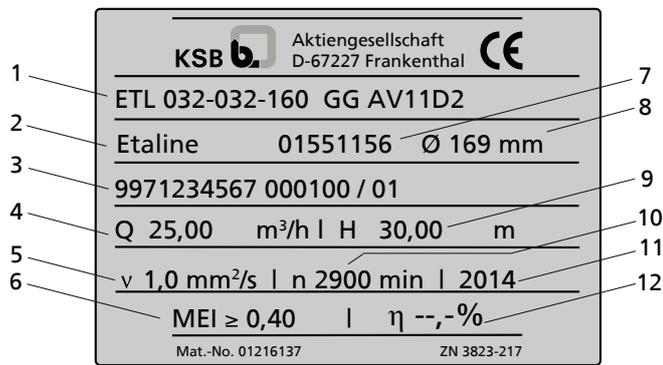


Fig. 3: Name plate (example)

1	Type series code, size and version	2	Type series
3	KSB order No., order item No. and consecutive No.	4	Flow rate
5	Kinematic viscosity of the fluid handled	6	Minimum efficiency index
7	Material number (if applicable)	8	Impeller diameter
9	Head	10	Speed
11	Year of construction	12	Efficiency (see data sheet)

4.5 Design details

Design

- Volute casing pump
- Close-coupled design/in-line design
- Single-stage
- Horizontal/vertical installation
- Pump and motor on a common shaft
- Rigid connection between pump and motor
- Complies with the 2009/125/EC Directive

Pump casing

- Radially split volute casing
- Replaceable casing wear rings
- In-line design

Impeller type

- Closed radial impeller with multiply curved vanes

Shaft seal

- Single mechanical seals to EN 12756
- Shaft equipped with a replaceable shaft sleeve in the shaft seal area

Bearings

- Radial ball bearings in the motor housing
- Grease lubrication

Drive

Table 6: General motor data

Characteristic	Description
Design	KSB surface-cooled IEC frame three-phase current squirrel-cage motor
Winding	50 Hz Up to 2.2 kW: 220-240 V / 380-420 V Up to 3 kW: 380-420 V / 660-725 V 60 Hz Up to 2.6 kW: 440-480 V Up to 3.6 kW: 440-480 V
Type of construction	Up to 4 kW: IM V1 From 5.5 kW: IM V15
Enclosure	IP55
Mode of operation	Continuous operation S1
Thermal class	F with temperature sensors: 3 thermistors
Explosion-proof version	
Design	KSB surface-cooled IEC three-phase current squirrel-cage motor
Winding	50 Hz Up to 1.85 kW: 220-240 V / 380-420 V Up to 2.5 kW: 380-420 V / 660-725 V
Type of construction	Up to 3.3 kW: IM V1 From 4.6 kW: IM V15
Enclosure	IP55 or IP54
Mode of operation	Continuous operation S1
Type of protection	EExe II
Temperature class	T3

4.6 Configuration and function

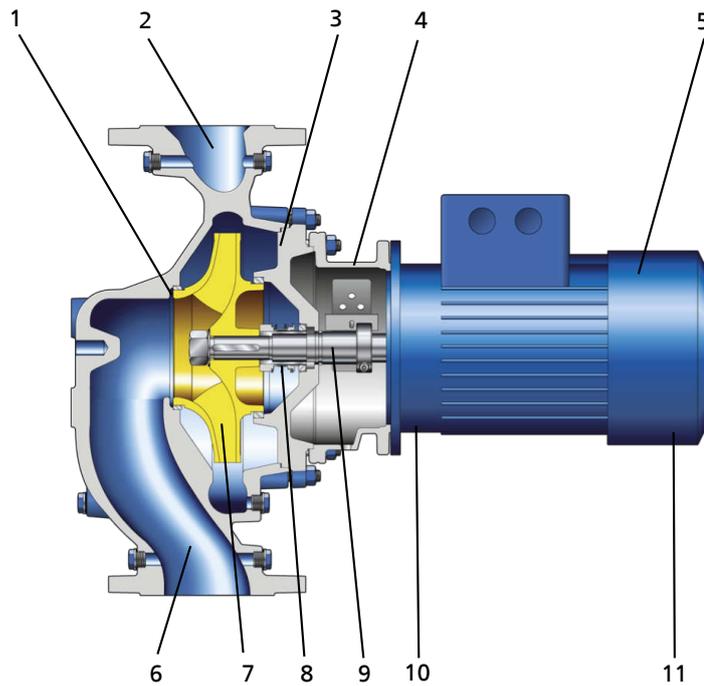


Fig. 4: Sectional drawing

1	Clearance gap	2	Discharge nozzle
3	Casing cover	4	Drive lantern
5	Motor housing	6	Suction nozzle
7	Impeller	8	Shaft seal
9	Shaft	10	Rolling element bearing
11	Rolling element bearing		

Design The pump is designed with a radial fluid inlet (suction nozzle) and a radial outlet (discharge nozzle) arranged on the same axis. The hydraulic system is rigidly connected to the motor by a shaft coupling.

Function The fluid enters the pump via the suction nozzle (6) and is accelerated outward by the rotating impeller (7). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the casing to the suction nozzle. At the rear side of the impeller, the shaft (9) enters the hydraulic system through the casing cover (3). The shaft passage through the cover is sealed to atmosphere with a shaft seal (8). The shaft runs in rolling element bearings (10 and 11), which are supported by a motor housing (5) linked with the pump casing and/or casing cover via the drive lantern (4).

Sealing The pump is sealed by a standardised mechanical seal.

4.7 Noise characteristics

Table 7: Surface sound pressure level $L_{pA}^{2)3)}$

Rated power input P_N (kW)	Pump set	
	1450 rpm	2900 rpm
0.25	53	-
0.37	54	-
0.55	55	-

2) Spatial average; as per ISO 3744 and EN 12639; valid for pump operation in the $Q/Q_{opt} = 0.80 - 1.1$ range and for non-cavitating operation. If noise levels are to be warranted: Add +3 dB for measuring and constructional tolerance.

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

Rated power input P_N (kW)	Pump set	
	1450 rpm	2900 rpm
0.75	56	66
1.1	57	66
1.5	58	67
2.2	59	67
3	60	68
4	61	68
5.5	62	70
7.5	64	71
11	65	73
15	67	74
18.5	68	75
22	69	76
30	70	77
37	71	78
45	73	78
55	74	-

4.8 Scope of supply

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

- Pump
- Drive
 - Surface-cooled IEC three-phase current squirrel-cage motor
- Accessories
 - Pump foot for vertical installation of the motor
 - Y-pipe for twin pumps (DN 40 to DN 100)
 - Switchgears for single and twin pumps

4.9 Dimensions and weights

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

5 Installation at Site

5.1 Safety regulations

 	⚠ DANGER
	<p>Improper installation in potentially explosive atmospheres Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Comply with the applicable local explosion protection regulations. ▷ Observe the information in the data sheet and on the name plates of pump and motor.

5.2 Checks to be carried out prior to installation

Place of installation

	⚠ WARNING
	<p>Installation on mounting surface which is unsecured and cannot support the load Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1. ▷ The mounting surface must have set and must be completely horizontal and even. ▷ Observe the weights indicated.

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

5.3 Installing the pump set

	CAUTION
	<p>Ingress of leakage into the motor Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Never install the pump set with the "motor below".

The pump set may be flanged directly into the piping. (⇒ Section 9.1 Page 50)

	NOTE
	<p>Motors from size 180 on pump sets with horizontal motor axis need to be supported without transmitting any stresses and strains. The foot fixing holes on the motor housing can be used for this purpose.</p>

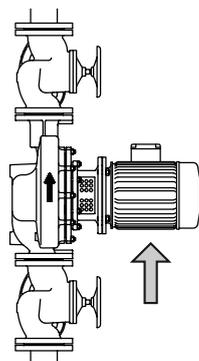


Fig. 5: Supporting the motor

1. Position the pump set on the foundation or in the piping and fasten it.
2. Place a spirit level on the discharge nozzle to align the pump set.
3. Change the position of the plugs for the condensation drain holes (if any) at the motor, depending on the installation position.

5.4 Piping

5.4.1 Connecting the piping

	⚠ DANGER
	<p>Excessive 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 without transmitting any stresses or strains. ▸ Take appropriate measures to compensate thermal expansion of the piping.

	CAUTION
	<p>Incorrect earthing during welding work at the piping Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> ▸ Never earth the electric welding equipment on the pump or baseplate. ▸ Prevent current flowing through the rolling element bearings.

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

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

	CAUTION
	<p>Welding beads, scale and other impurities in the piping Damage to the pump!</p> <ul style="list-style-type: none"> ▸ Free the piping from any impurities. ▸ If necessary, install a filter. ▸ Comply with the instructions set out in (⇒ Section 7.2.2.2 Page 37) .

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

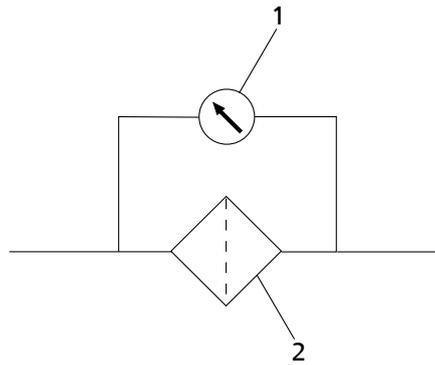


Fig. 6: Filter in the piping

1	Differential pressure gauge	2	Filter
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	NOTE
<p>Use a filter with laid-in wire mesh of 0.5 mm x 0.25 mm (mesh size x wire diameter) made of corrosion-resistant material. Use a filter with a filter area three times the cross-section of the piping. Conical filters have proved suitable.</p>	

5. Connect the pump nozzles to the piping.

	CAUTION
<p>Aggressive flushing and pickling agents Damage to the pump!</p> <ul style="list-style-type: none"> ▸ Match the cleaning operation mode and duration for flushing and pickling service to the casing and seal materials used. 	

5.4.2 Permissible forces and moments at the pump nozzles

No piping-induced forces and moments (from warped pipelines or thermal expansion, for example) must act on the pump.

5.4.3 Vacuum balance line

	NOTE
<p>Where fluid has to be pumped out of a vessel under vacuum, it is recommended to install a vacuum balance line.</p>	

The following rules apply to vacuum balance lines:

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

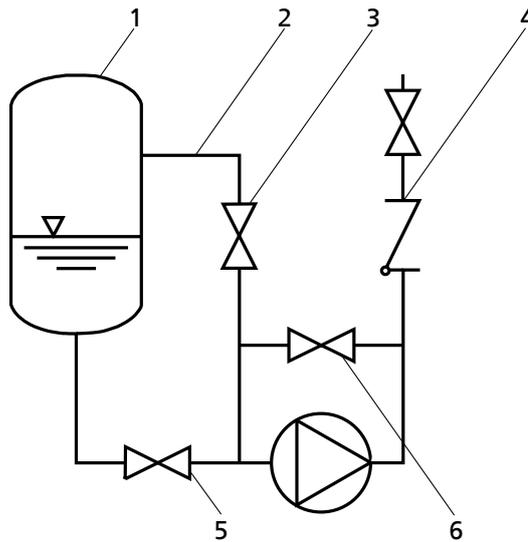


Fig. 7: Vacuum balance system

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



NOTE

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

5.4.4 Auxiliary connections



⚠ DANGER

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

Risk of burns!
Explosion hazard!

- ▷ Make sure that the barrier fluid and quench liquid are compatible with the fluid pumped.



⚠ WARNING

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

Risk of injury from escaping fluid!
Risk of burns!

Malfunction of the pump!

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

5.5 Enclosure/insulation

	<p>⚠ DANGER</p> <p>Explosive atmosphere forming due to insufficient venting Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure the space between the casing cover/discharge cover and the motor flange is sufficiently vented. ▷ Do not cover the perforated holes of the contact guards at the drive lantern (e.g. by insulation).
	<p>⚠ WARNING</p> <p>The volute casing and casing/discharge cover take on the same temperature as the fluid handled Risk of burns!</p> <ul style="list-style-type: none"> ▷ Insulate the volute casing. ▷ Fit protective equipment.
	<p>CAUTION</p> <p>Heat build-up inside the drive lantern Damage to the bearing!</p> <ul style="list-style-type: none"> ▷ Never insulate the casing cover and the drive lantern.

5.6 Electrical connection

	<p>⚠ DANGER</p> <p>Incorrect electrical installation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ For electrical installation, also observe the requirements of IEC 60079-14. ▷ Always use a motor protection switch for explosion-proof motors.
	<p>⚠ DANGER</p> <p>Work on the pump set 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 and qualified electrician. ▷ Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.
	<p>⚠ WARNING</p> <p>Incorrect connection to the mains Damage to the mains network, short circuit!</p> <ul style="list-style-type: none"> ▷ Observe the technical specifications of the local energy supply companies.
	<p>NOTE</p> <p>A motor protection device is recommended.</p> <ol style="list-style-type: none"> 1. Check the available mains voltage against the data on the motor name plate. 2. Select an appropriate start-up method.

5.6.1 Setting the time relay

	CAUTION
	<p>Switchover between star and delta on three-phase motors with star-delta starting takes too long. Damage to the pump (set)!</p> <ul style="list-style-type: none"> ▸ Keep switch-over intervals between star and delta as short as possible.

Table 8: Time relay settings for star-delta starting:

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

5.6.2 Earthing

	⚠ DANGER
	<p>Electrostatic charging Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Connect the PE conductor to the earthing terminal provided.

5.6.3 Connecting the motor

	NOTE
	<p>In compliance with IEC 60034-8, three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub). The pump's direction of rotation is indicated by an arrow on the pump.</p>

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

5.7 Checking the direction of rotation

	⚠ DANGER
	<p>Temperature increases resulting from contact between rotating and stationary components Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Never check the direction of rotation by starting up the unfilled pump.

	⚠ WARNING
	<p>Hands inside the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▸ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

	<p>CAUTION</p>
	<p>Incorrect direction of rotation with non-reversible mechanical seal Damage to the mechanical seal and leakage!</p> <ul style="list-style-type: none"> ▷ Check the direction of rotation by starting the pump set and stopping it again immediately.
	<p>CAUTION</p>
	<p>Drive and pump running in the wrong direction of rotation Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Refer to the arrow indicating the direction of rotation on the pump. ▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.

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

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

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been properly connected to the electric power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked.
- All auxiliary connections required are connected and operational.
- The lubricants have been checked.
- After prolonged shutdown of the pump (set), the activities required for returning the pump (set) to service have been carried out. (⇒ Section 6.4 Page 33)
- The lock washers have been pulled out of the shaft groove.

6.1.2 Filling in lubricants

Grease-lubricated bearings have been packed with grease at the factory.

6.1.3 Checking the shaft seal

Mechanical seal

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

6.1.4 Priming and venting the pump

	<p>⚠ DANGER</p> <p>Risk of potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Before starting up the pump, vent the suction line and the pump and prime them with the fluid to be handled.
	<p>CAUTION</p> <p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ 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.

1. Vent the pump and suction line and prime both with the fluid to be handled. Connection 6D can be used for venting (see drawing of auxiliary connections). For vertical installation with the motor on top, use connection 5B (if provided) for venting (see drawing of auxiliary connections) and .
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any.
4. Open the shut-off valve (3), if any, in the vacuum balance line (2) and close the vacuum-tight shut-off valve (6), if any. (⇒ Section 5.4.3 Page 23)

	<p>⚠ WARNING</p>
	<p>Hot water escaping under pressure when the vent plug is opened Risk of electric shock! Risk of scalding!</p> <ul style="list-style-type: none"> ▷ Protect the electric components against escaping fluid. ▷ Wear protective clothing (e.g. gloves).
	<p>NOTE</p>
	<p>For design-inherent reasons some unfilled volume in the hydraulic system cannot be excluded after the pump has been primed for commissioning/start-up. However, once the motor is started up the pumping effect will immediately fill this volume with the fluid handled.</p>

6.1.5 Start-up

 	<p>⚠ DANGER</p>
	<p>Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed. Explosion hazard! Leakage of hot or toxic fluids!</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 with the discharge-side shut-off element slightly or fully open.

 	<p>⚠ DANGER</p>
	<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.

	<p>CAUTION</p>
	<p>Abnormal noises, vibrations, temperatures or leakage Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Switch off the pump (set) immediately. ▷ Eliminate the causes before returning the pump set to service.

- ✓ The system piping has been cleaned.
- ✓ The pump, suction line and inlet tank, if any, have been vented and primed with the fluid to be pumped.
- ✓ The lines for priming and venting have been closed.

	<p>CAUTION</p>
	<p>Start-up against open discharge line Motor overload!</p> <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/suction lift line.

2. Close or 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.

6.1.6 Shutdown

	CAUTION
	<p>Heat build-up inside the pump Damage to the shaft seal!</p> <ul style="list-style-type: none"> ▸ Depending on the type of installation, the pump set requires sufficient after-run time – with the heat source switched off – until the fluid handled has cooled down.

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

	NOTE
	<p>If the discharge line is equipped with a check valve, the shut-off element in the discharge line may remain open, provided the site's requirements and regulations are taken into account and observed.</p>

For prolonged shutdown periods:

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

	CAUTION
	<p>Risk of freezing during prolonged pump shutdown periods Damage to the pump!</p> <ul style="list-style-type: none"> ▸ Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.

6.2 Operating limits

	⚠ DANGER
	<p>Non-compliance with operating limits for pressure, temperature, fluid handled and speed Explosion hazard! Hot or toxic fluid could escape!</p> <ul style="list-style-type: none"> ▸ Comply with the operating data indicated in the data sheet. ▸ Never use the pump for handling fluids it is not designed for. ▸ Avoid prolonged operation against a closed shut-off element. ▸ Never operate the pump at temperatures, pressures or rotational speeds exceeding those specified in the data sheet or on the name plate unless the written consent of the manufacturer has been obtained.

6.2.1 Ambient temperature

	CAUTION
	<p>Operation outside the permissible ambient temperature Damage to the pump (set)!</p> <ul style="list-style-type: none"> ▸ Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 9: Permissible ambient temperatures

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

6.2.2 Frequency of starts

	⚠ DANGER
	<p>Excessive surface temperature of the motor Explosion hazard! Damage to the motor!</p> <ul style="list-style-type: none"> ▸ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.

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

Table 10: Frequency of starts

Impeller material	Maximum No. of start-ups [Start-ups/hour]
G (JL1040/ A48CL35B)	15
B (CC480K-GS/B30 C90700) C (1.4408/ A743 GR CF8M)	6

	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 the pump rotor has come to a standstill.

6.2.3 Fluid handled

6.2.3.1 Flow rate

Table 11: Flow rate

Temperature range (t)	Minimum flow rate	Maximum flow rate
-30 to +70 °C	≈ 15 % of $Q_{Opt}^{4)}$	See hydraulic characteristic curves
> 70 to +140 °C	≈ 25 % of $Q_{Opt}^{4)}$	

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

⁴⁾ Best efficiency point

$$T_o = T_f + \Delta \vartheta$$

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

Table 12: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Gravitational constant	m/s ²
H	Pump discharge head	m
T _f	Fluid temperature	°C
T _o	Temperature at the casing surface	°C
η	Pump efficiency at duty point	-
Δϑ	Temperature difference	K

6.2.3.2 Density of the fluid handled

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

	CAUTION
	<p>Impermissibly high density of the fluid handled Motor overload!</p> <ul style="list-style-type: none"> ▷ Observe the information on fluid density indicated in the data sheet. ▷ Make sure the motor has sufficient power reserves.

6.2.3.3 Abrasive fluids

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

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

- ✓ Sufficient fluid is supplied for the operation check run of the pump.
- 1. Start up the pump (set) regularly between once a month and once every three months for approximately five minutes during prolonged shutdown periods. This will prevent the formation of deposits within the pump and the pump intake area.

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

- ✓ The pump has been properly drained (⇒ Section 7.3 Page 37) and the safety instructions for dismantling the pump have been observed. (⇒ Section 7.4.1 Page 37)
- 1. Spray-coat the inside wall of the pump casing, and in particular the impeller clearance areas, with a preservative.
- 2. Spray the preservative through the suction and discharge nozzles. It is advisable to close the pump nozzles (e.g. with plastic caps or similar).
- 3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved if required) to protect them against corrosion. Observe the additional instructions (⇒ Section 3.3 Page 14) .

If the pump set is to be stored temporarily, only preserve the wetted components made of low-alloy materials. Commercially available preservatives can be used for this purpose. Observe the manufacturer's instructions for application/removal. Observe any additional instructions and information provided. (⇒ Section 3 Page 13)

6.4 Returning to service

For returning the pump to service observe the sections on commissioning/start-up (⇒ Section 6.1 Page 28) and the operating limits. (⇒ Section 6.2 Page 30) .

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7 Page 34)

	<p>⚠ WARNING</p> <p>Failure to re-install or re-activate protective devices Risk of personal injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> ▷ As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.
	<p>NOTE</p> <p>If the pump has been out of service for more than one year, replace all elastomer seals.</p>

7 Servicing/Maintenance

7.1 Safety regulations

	DANGER
	<p>Sparks produced during servicing work Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Observe the safety regulations in force at the place of installation! ▷ Always perform maintenance work at an explosion-proof pump (set) outside of potentially explosive atmospheres.

 	DANGER
	<p>Improperly serviced pump set Explosion hazard! 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, shaft seal and coupling.

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

	WARNING
	<p>Unintentional starting of pump set Risk of injury by moving parts!</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.

	WARNING
	<p>Fluids and supplies posing a health hazard and/or hot fluids or supplies Risk of 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.

	WARNING
	<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 to prevent tipping or falling over.

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

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

Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

7.2.1 Supervision of operation

	<p>⚠ DANGER</p> <p>Risk of potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▶ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems must be filled with the fluid to be handled at all times. ▶ Provide sufficient inlet pressure. ▶ Provide an appropriate monitoring system.
 	<p>⚠ DANGER</p> <p>Incorrectly serviced shaft seal Explosion hazard! Leakage of hot, toxic fluids! Damage to the pump set! Risk of burns! Fire hazard!</p> <ul style="list-style-type: none"> ▶ Regularly service the shaft seal.
 	<p>⚠ DANGER</p> <p>Excessive temperatures as a result of bearings running hot or defective bearing seals Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Regularly check the rolling element bearings for running noises.
 	<p>⚠ DANGER</p> <p>Incorrectly serviced barrier fluid system Explosion hazard! Fire hazard! Damage to the pump set! Leakage of hot and/or toxic fluids!</p> <ul style="list-style-type: none"> ▶ Regularly service the barrier fluid system. ▶ Monitor the barrier fluid pressure.
	<p>CAUTION</p> <p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ 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.
	<p>CAUTION</p> <p>Impermissibly high temperature of fluid handled Damage to the pump!</p> <ul style="list-style-type: none"> ▶ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid). ▶ Observe the temperature limits in the data sheet and in the section on operating limits. (⇒ Section 6.2 Page 30)

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

- The pump must run quietly and free from vibrations at all times.
- Check the shaft seal. (⇒ Section 6.1.3 Page 28)
- Check the static seals for leakage.
- Check the rolling element bearings for running noises.
Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
To make sure that the stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.
The bearing temperature must not exceed 90 °C (measured at the motor housing).

	CAUTION
	<p>Operation outside the permissible bearing temperature Damage to the pump!</p> <ul style="list-style-type: none"> ▸ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the motor housing).
	NOTE
	<p>After commissioning, increased temperatures may occur at grease-lubricated rolling element bearings due to the running-in process. The final bearing temperature is only reached after a certain period of operation (up to 48 hours depending on the conditions).</p>

7.2.2 Inspection work

	⚠ DANGER
	<p>Excessive temperatures caused by friction, impact or frictional sparks Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Regularly check the cover plates, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.

7.2.2.1 Checking the clearances

For checking the clearances remove the impeller, if required.
If the clearance is larger than permitted (see the following table), fit new casing wear ring 502.01 and, if applicable, 502.02.
The clearances given refer to the diameter.

Table 13: Clearances between impeller and casing and/or between impeller and casing cover

Impeller material	Permissible clearance	
	New	Maximum
G (JL1040/ A48CL35B) B (CC480K-GS/B30 C90700)	0.3 mm	0.9 mm
C (1.4408/ A743 GR CF8M)	0.5 mm	1.5 mm

7.2.2.2 Cleaning filters

	CAUTION
	<p>Insufficient inlet pressure due to clogged filter in the suction line Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge). ▷ Clean filter at appropriate intervals.

7.3 Drainage/cleaning

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

1. Use connection 6B to drain the fluid handled (see drawing of auxiliary connections).
2. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
Always flush and clean the pump before transporting it to the workshop.
Provide a cleaning record for the pump.

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

	⚠ WARNING
	<p>Unqualified personnel performing work on the pump (set) Risk of injury!</p> <ul style="list-style-type: none"> ▷ Always have repair and maintenance work performed by specially trained, qualified personnel.

	⚠ WARNING
	<p>Hot surface Risk of 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 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 general safety instructions and information. (⇒ Section 7.1 Page 34)

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

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

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

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

	⚠ DANGER
	<p>Insufficient preparation of work on the pump (set) Risk of injury!</p> <ul style="list-style-type: none"> ▷ Properly shut down the pump set. (⇒ Section 6.1.6 Page 30) ▷ Close the shut-off elements in suction and discharge line. ▷ Drain the pump and release the pump pressure. (⇒ Section 7.3 Page 37) ▷ Close any auxiliary connections. ▷ Allow the pump set to cool down to ambient temperature.

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

7.4.2 Preparing the pump set

1. De-energise the pump set and secure it against unintentional start-up.
2. Reduce pressure in the piping by opening a consumer installation.
3. Disconnect and remove all auxiliary pipework.

7.4.3 Dismantling the complete pump set

	NOTE
	The pump casing can remain installed in the piping for further dismantling.

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 37) to (⇒ Section 7.4.2 Page 38) have been observed/carried out.
1. Disconnect the discharge and suction nozzles from the piping.
 2. Depending on the pump/motor size, remove the supports from the pump set.
 3. Remove the complete pump set from the piping.

7.4.4 Removing the motor

	⚠ WARNING
	<p>Motor tipping over Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ Suspend or support the motor to prevent it from tipping over.

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 37) to (⇒ Section 7.4.3 Page 38) have been observed/carried out.
1. Remove the screws on cover plates 68-3, press the cover plates slightly together and remove from drive lantern 341.
 2. Undo hexagon nuts 920.11.
 3. Undo hexagon head bolts 901.50.

	CAUTION
	<p>Back pull-out unit knocking against the pump casing Damage to the shaft/back pull-out unit!</p> <ul style="list-style-type: none"> ▷ With the motor removed, push lock washers 931.95 into the shaft groove.

4. Insert both lock washers 931.95 into the groove in shaft 210.
5. Tighten hexagon head bolts 901.50.
6. Undo socket head cap screw 914.24.
7. Remove the motor.

7.4.5 Removing the back pull-out unit

	⚠ WARNING
	<p>Back pull-out unit tipping over Risk of squashing hands and feet!</p> <ul style="list-style-type: none"> ▷ Suspend or support the back pull-out unit at the pump end.

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 37) to (⇒ Section 7.4.4 Page 38) have been observed/carried out.
1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
 2. Undo hexagon nut 920.15 (on variant with bolted discharge cover) or 920.01 (on variant with clamped discharge cover) at the volute casing.
 3. Pull the back pull-out unit out of the volute casing.
 4. Remove and dispose of gasket 400.10.
 5. Place the back pull-out unit on a clean and level surface.

7.4.6 Removing the impeller

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 37) to (⇒ Section 7.4.5 Page 39) have been observed/carried out.
 - ✓ The back pull-out unit has been placed in a clean and level assembly area.
1. Undo impeller nut 920.95 (right-hand thread).
Take washer 930.95 and disc 550.95 off the impeller hub.
 2. Remove impeller 230 with an impeller removal tool.
 3. Place impeller 230 on a clean and level surface.
 4. Remove key 940.01 from shaft 210.

7.4.7 Removing the mechanical seal

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 37) to (⇒ Section 7.4.6 Page 39) have been observed/carried out.
 - ✓ The back pull-out unit has been placed in a clean and level assembly area.
1. Remove shaft sleeve 523 with the rotating assembly of the mechanical seal (primary ring) from shaft 210.
 2. Remove the rotating assembly of the mechanical seal (primary ring) from shaft sleeve 523.
 3. Undo hexagon nuts 920.15 and 914.22, if any, on drive lantern 341.
 4. Remove casing cover 161 from drive lantern 341.
 5. Remove the stationary assembly of the mechanical seal (mating ring) from casing cover 161.
 6. Remove and dispose of gasket 400.75.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

	⚠ DANGER
	<p>Wrong selection of motor Explosion hazard!</p> <ul style="list-style-type: none"> ▸ Use an original motor or a motor of identical design from the same manufacturer. ▸ The permissible temperature limits at the motor flange and motor shaft must be higher than the temperatures generated by the pump. (Contact KSB for temperatures.)
	⚠ WARNING
	<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.
	CAUTION
	<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.

Sequence	Always reassemble the pump in accordance with the corresponding general assembly drawing or exploded view.
Sealing elements	<p>Check O-rings for any damage and replace by new O-rings, if required.</p> <p>Always use new gaskets, making sure that they have the same thickness as the old ones.</p> <p>Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).</p>
Assembly adhesives	<p>Avoid the use of assembly adhesives, if possible.</p> <p>Should an assembly adhesive be required after all, use a commercially available contact adhesive (e.g. Pattex) or sealant (e.g. HYLOMAR or Eppl 33).</p> <p>Only apply adhesive at selected points and in thin layers.</p> <p>Never use quick-setting adhesives (cyanoacrylate adhesives).</p> <p>Coat the locating surfaces of the individual components with graphite or similar before reassembly.</p>
Tightening torques	For reassembly, tighten all screws and bolts as specified in this manual.

7.5.2 Installing the mechanical seal

Installing the mechanical seal

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

- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.
- ✓ The notes and steps stated in (⇒ Section 7.5.1 Page 40) have been observed/ carried out.
- ✓ The bearing assembly as well as the individual parts are kept in a clean and level assembly area.

- ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Clean shaft sleeve 523, and touch up any score marks or scratches with a polishing cloth, if necessary.
If score marks or scratches are still visible, fit new shaft sleeve 523.
 2. Slide shaft sleeve 523 with new gasket 400.75 onto shaft 210.
 3. Clean the mating ring location in casing cover 161.

	CAUTION
	<p>Elastomers in contact with oil/grease Shaft seal failure!</p> <ul style="list-style-type: none"> ▷ Use water as assembly lubricant. ▷ Never use oil or grease as assembly lubricant.

4. Carefully insert the mating ring. Make sure to apply pressure evenly.
5. **On variants with a bolted casing cover** undo forcing screws 901.31 without removing them.
6. Place casing cover 161 into the locating fit of drive lantern 341.
7. Fit and tighten hexagon nuts 920.01 and/or 920.15, if any.

	NOTE
	<p>To reduce friction forces when assembling the seal, wet the shaft sleeve and the location of the stationary ring with water.</p>

8. Fit the rotating assembly of the mechanical seal (primary ring) on shaft sleeve 523.

Observe the following installation dimension b for mechanical seals with installation length L_{1k} to EN 12756 (design KU):

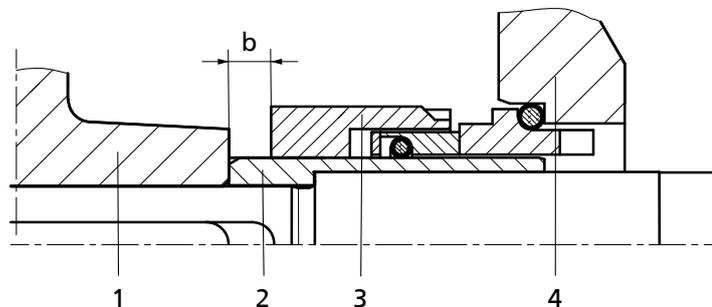


Fig. 8: Installation dimension b of mechanical seal

1	Impeller	2	Shaft sleeve
3	Mechanical seal	4	Casing cover

Table 14: Installation dimensions of the mechanical seal

Shaft unit ⁵⁾	Installation dimension b
25	7,5 mm
35	10 mm
55	15 mm

⁵⁾ Shaft unit see data sheet.

7.5.3 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 7.5.1 Page 40) to (⇒ Section 7.5.2 Page 40) have been observed/carried out.
 - ✓ The pre-assembled unit (motor, shaft, drive lantern, casing cover) as well as the individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Insert key 940.01 and slide impeller 230 onto shaft 210.
 2. Fasten impeller nut 920.95, safety device 930.95 and disc 550.95, if any. (⇒ Section 7.6 Page 44)

7.5.4 Installing the back pull-out unit

	<p>⚠ WARNING</p>
	<p>Back pull-out unit tipping over Risk of squashing hands and feet!</p> <ul style="list-style-type: none"> ▸ Suspend or support the back pull-out unit at the pump end.

- ✓ The notes and steps stated in (⇒ Section 7.5.1 Page 40) to (⇒ Section 7.5.3 Page 42) have been observed/carried out.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
 2. Fit new gasket 400.10 into the recess of volute casing 102.
 3. **On variants with a bolted casing cover** undo forcing screws 901.31 without removing them.
 4. Insert the back pull-out unit into volute casing 102.
 5. Depending on the pump size and motor size, fit support foot 183.
 6. Tighten hexagon nut 920.15 (on variant with a bolted casing cover) or 920.01 (on variant with a clamped casing cover) at volute casing 102.

7.5.5 Mounting the motor

	<p>⚠ DANGER</p>
	<p>Incorrect shaft connection Explosion hazard!</p> <ul style="list-style-type: none"> ▸ Connect the shafts between pump and motor as described in this manual.

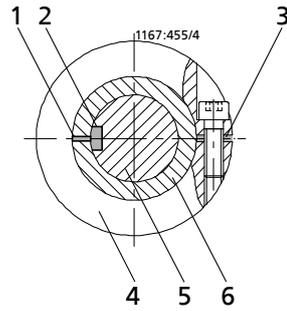


Fig. 9: Fitting the motor shaft stub on the shaft

1	Shaft slot	2	Keyway of the motor shaft end
3	Slot of the taper lock ring	4	Taper lock ring
5	Motor shaft	6	Shaft

✓ The notes and steps stated in (⇒ Section 7.5.1 Page 40) to (⇒ Section 7.5.4 Page 42) have been observed/carried out.

1. Fit the motor shaft stub on shaft 210 and make sure that the keyway of the motor shaft end aligns with the slot in shaft 210 and that both are located opposite the slot of taper lock ring 515 (see illustration: Fitting the motor shaft stub on the shaft).
2. Tighten hexagon socket head cap screws 914.24.
3. Undo hexagon head bolts 901.50.

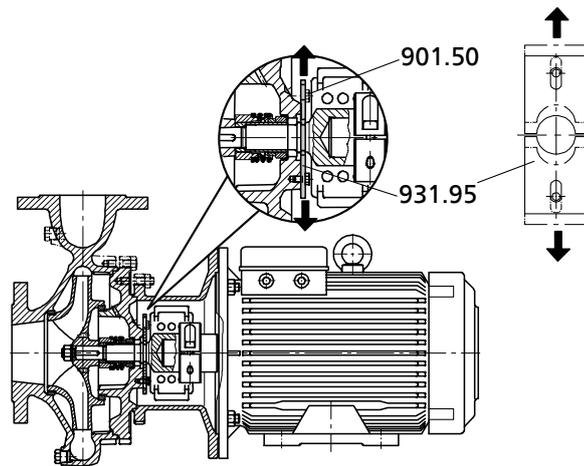


Fig. 10: Removing the lock washers

901.50	Hexagon head bolts	931.95	Lock washer
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4. Pull both lock washers 931.95 out of the groove in shaft 210.
5. Tighten hexagon head bolts 901.50.
6. Fit and tighten hexagon nuts 920.11.

7.6 Tightening torques

Table 15: Tightening points

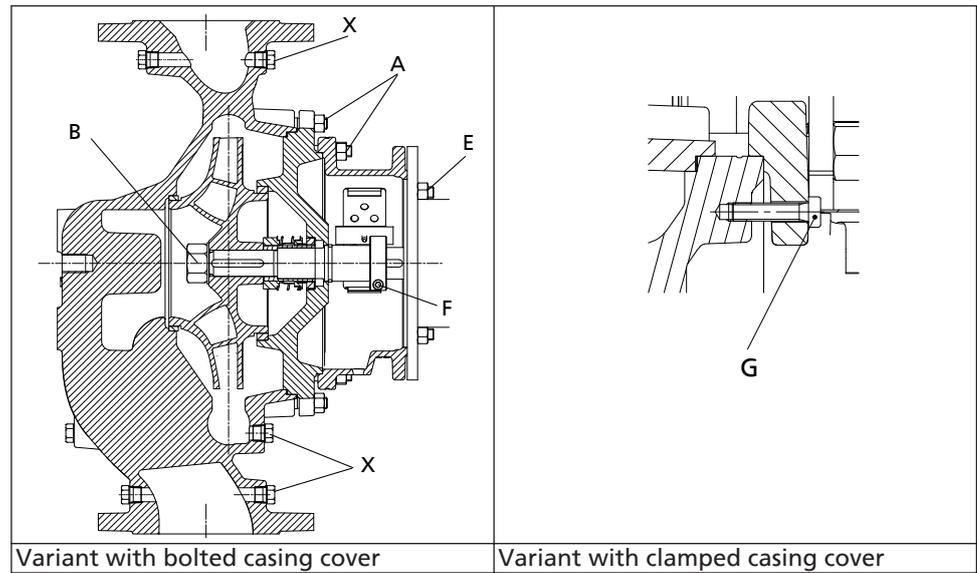


Table 16: Tightening torques for bolted/screwed connections at the pump

Position	Thread	Nominal value [Nm]
A	M12	55
	M16	130
B	M12 x 1.5	55
	M24 x 1.5	130
	M30 x 1.5	170
C	M8	20
	M10	38
D	M12	90
E	M8	20
	M10	38
	M12	55
	M16	130
F	M6	15
	M8	38
	M10	38
	M12	55
G	M6	5
X	1/8	25
	1/4	55
	3/8	80
	1/2	130
	3/4	220

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also specify the following data:

- Part No. and description
- 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 17: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
210	Shaft	1	1	1	2	2	2	20 %
230	Impeller	1	1	1	2	2	2	20 %
	Gaskets (set)	4	6	8	8	9	10	100 %
433	Mechanical seal	1	1	2	2	2	3	25 %
502.1	Casing wear ring	2	2	2	3	3	4	50 %
502.2	Casing wear ring	2	2	2	3	3	4	50 %
523	Shaft sleeve	2	2	2	3	3	4	50 %

7.7.3 Interchangeability of Etaline and Etabloc pump components

Components featuring the same number in a column are interchangeable.

Etaline ⁶⁾	Shaft unit	Description															Etabloc		
		Volute casing	Casing cover	Shaft (with taper lock ring)										Impeller	Mechanical seal	Casing wear ring (suction side)		Casing wear ring (discharge side)	Shaft sleeve
				Part No.															
		102	163	210										230	433	502.1		502.2	523
		Motor																	
		71	80	90	100/112	132	160	180	200	225	250								
32-160/...	25	○	1*	1*	2*	3*	4*	□	□	□	■	■	1*	1*	1*	1*	1*	32-160.1/...	
32-200/...	25	○	12*	□	2*	3*	4*	5*	□	□	□	■	■	○*	1*	1*	1*	1*	32-200.1/...
40-160/...	25	○	1*	1*	2*	3*	4*	□	□	□	□	■	■	1*	1*	1*	1*	1*	32-160/...
40-250/...	25	○	2*	□	2*	3*	4*	5*	6*	□	□	■	■	○*	1*	1*	2*	1*	32-250/...
50-160/...	25	○	1*	1*	2*	3*	4*	5*	□	□	□	■	■	○*	1*	2*	1*	1*	40-160/...
50-250/...	25	○	2*	□	□	3*	4*	5*	6*	7*	□	■	■	○*	1*	2*	2*	1*	40-250/...
65-160/...	25	○	1*	1*	2*	3*	4*	5*	6*	□	□	■	■	○*	1*	3*	1*	1*	50-160/...
65-250/...	25	○	2*	□	□	3*	4*	5*	6*	7*	16*	■	■	○*	1*	3*	2*	1*	50-250/...
80-160/...	25	○	11*	□	2*	3*	4*	5*	6*	□	□	■	■	2*	1*	4*	3*	1*	65-160/...
80-210/...	25	○	9*	□	□	3*	4*	□	6*	7*	16*	■	■	○*	1*	4*	3*	1*	65-200/...
80-250/...	35	○	7*	■	■	■	8*	9*	□	□	□	■	■	○*	2*	5*	4*	2*	65-250/...
100-125/...	25	○	10*	□	2*	3*	4*	5*	6*	□	□	■	■	○*	1*	4*	1*	1*	65-125/...
100-160/...	25	○	3*	□	□	3*	4*	□	6*	□	□	■	■	2*	1*	4*	3*	1*	65-160/...
100-170/...	25	○	3*	□	□	3*	4*	□	□	7*	□	■	■	○*	1*	6*	3*	1*	80-160/...
100-200/...	35	○	4*	■	■	■	8*	9*	□	□	□	□	■	○*	2*	6*	5*	2*	80-200/...
100-250/...	35	○	5*	■	■	■	□	9*	10*	□	□	□	■	○*	2*	6*	5*	2*	80-250/...
125-160/...	35	○	4*	■	■	■	8*	□	□	11*	□	□	■	○*	2*	7*	5*	2*	100-160/...
125-200/...	35	○	4*	■	■	■	□	9*	□	□	12*	17*	■	○*	2*	7*	5*	2*	100-200/...
125-250/...	35	○	5*	■	■	■	□	□	10*	□	□	□	■	○*	2*	7*	5*	2*	100-250/...
150-200/..	35	○	8*	■	■	■	□	9*	10*	□	□	□	■	○*	2*	8*	6*	2*	125-200/...
150-250/...	35	○	6*	■	■	■	□	□	10*	11*	□	□	■	○*	2*	8*	6*	2*	125-250/...
200-250/...	35	○	13*	■	■	■	□	□	10*	11*	12*	□	■	○*	2*	9*	6*	2*	150-250/...
200-315/...	55	○	14*	■	■	■	■	■	■	■	13*	14*	15*	○*	3*	9*	7*	3*	150-315/...

Table 18: Key to the symbols

Symbol	Description
*	Component interchangeable with Etabloc
○	Components differ
□	When other frequencies or power reserves are required for this pump/motor combination, please contact KSB.
■	This pump/motor combination is not possible.

⁶⁾ The components of Etaline single and twin pumps are identical except for the volute casing.

Table 19: Motor / power

Motor	Power
71	.../024, .../034
80	.../054, .../074, .../072, .../112
90	.../114, .../154, .../152, .../222
100	.../224, .../304, .../302
112	.../404, .../402
132	.../554, .../754, .../552, .../752
160	.../1104, .../1504, .../1102, .../1502, .../1852
180	.../1854, .../2204, .../2202
200	.../3004, .../3002, .../3702
225	.../3704, .../4504, .../4502
250	.../5504

8 Trouble-shooting

	⚠ WARNING
	<p>Improper work to remedy faults Risk of injury!</p> <p>▸ For any work to remedy faults observe the relevant information in this manual or in the relevant accessory manufacturer's documentation.</p>

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

- A Pump delivers insufficient flow rate
- B Motor is overloaded
- C Motor protection switch / thermistor trip device trips the unit
- D Increased bearing temperature
- E Leakage at the pump
- F Excessive leakage at the shaft seal
- G Vibrations during pump operation
- H Impermissible temperature increase in the pump

Table 20: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy ⁷⁾
X								Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller. ⁷⁾ Increase the speed (frequency inverter).
X						X	X	Pump and/or piping are not completely vented or primed.	Vent and/or prime.
X								Supply line or impeller clogged	Remove deposits in the pump and/or piping.
X								Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
X						X	X	Suction lift is too high/NPSH _{available} (positive suction head) is too low.	Check/alter liquid level (open system). Increase system pressure (closed system). Install pump at a lower level. Fully open the shut-off element in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall.
X								Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
X								Speed is too low. - Operation with frequency inverter - Operation without frequency inverter	- Increase voltage/frequency at the frequency inverter in the permissible range. - Check voltage.
X						X		Wear of internal components	Replace worn components by new ones.
	X					X		Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point. In the case of persistent overloading, turn down impeller. ⁷⁾
	X							Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
					X			Use of unsuitable shaft seal materials	Change the material combination. ⁷⁾
	X	X						Speed is too high.	Reduce speed. ⁷⁾

⁷⁾ Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

A	B	C	D	E	F	G	H	Possible cause	Remedy ⁷⁾
				X				Tie bolts/sealing element defective	Fit new sealing element between volute casing and casing cover. Re-tighten the bolts.
					X			Worn shaft seal	Fit new shaft seal.
X					X			Score marks or roughness on shaft sleeve	Fit new shaft sleeve. Fit new shaft seal.
					X			Dismantle to find out.	Correct. Fit new shaft seal, if required.
					X			Vibrations during pump operation	Correct the suction conditions. Re-balance the impeller. Increase pressure at the pump suction nozzle.
			X		X	X		Pump is warped or sympathetic vibrations in the piping.	Check the piping connections and secure fixing of pump; if required, reduce distances between the pipe clamps. Fix the pipelines using anti-vibration material.
			X					Increased axial thrust	Clean balancing holes in the impeller. Replace the casing wear rings.
			X					Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
X	X							Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections. Check the motor winding.
						X		Rotor out of balance	Clean the impeller. Re-balance the impeller.
						X		Defective bearing(s)	Fit new bearing(s).
			X			X	X	Flow rate is too low.	Increase the minimum flow rate.
		X						Incorrect setting of motor protection switch	Check setting. Fit new motor protection switch.
	X	X						Transport lock has not been removed from the shaft groove.	Remove.

⁷⁾ Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

9 Related Documents

9.1 Typical installation positions

Etaline

Table 21: Horizontal installation

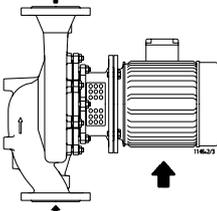
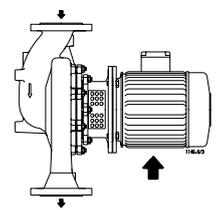
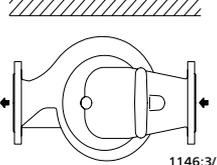
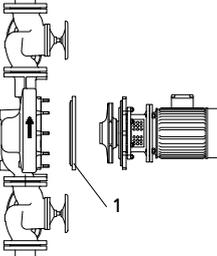
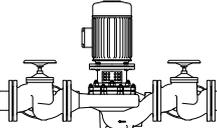
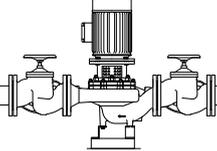
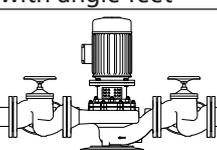
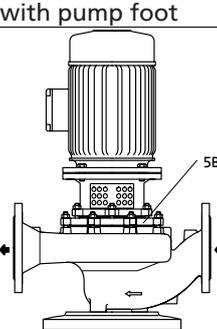
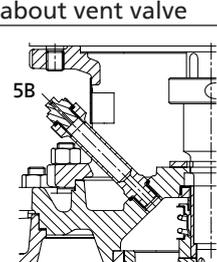
Example drawing	Particularities
 <p data-bbox="491 656 708 707">Direction of flow from bottom to top</p>	<p data-bbox="719 427 1442 454">Direction of flow from bottom to top</p> <p data-bbox="719 465 1442 577">Note: Motors of size 180 (18.5 kW) and above on pump sets with horizontal motor axis require adequate support! The foot fastening holes on the motor housing can be used for this purpose.</p>
 <p data-bbox="491 943 708 994">Direction of flow from top to bottom</p>	<p data-bbox="719 714 1442 741">Direction of flow from top to bottom</p> <p data-bbox="719 752 1442 835">The volute casing and/or back pull-out unit must be turned by 180° so that the terminal box remains in its current position on the top.</p> <p data-bbox="719 846 1442 958">Note: Motors of size 180 (18.5 kW) and above on pump sets with horizontal motor axis require adequate support! The foot fastening holes on the motor housing can be used for this purpose.</p>
 <p data-bbox="491 1184 708 1236">Horizontal installation</p>	<p data-bbox="719 1001 1442 1028">Horizontal installation (for example under the ceiling)</p> <p data-bbox="719 1039 1442 1122">The volute casing and/or back pull-out unit must be turned by 90° so that the terminal box remains in its current position on the top.</p>
 <p data-bbox="491 1516 708 1568">Installation with blind flange</p>	<p data-bbox="719 1243 1442 1270">1 = Blind flange (accessories)</p> <p data-bbox="719 1281 1442 1364">If one of the pumps needs to be serviced, the pump chamber can be shut off by a blind flange so that the system remains operational.</p>

Table 22: Vertical installation

Example drawing	Particularities
 <p data-bbox="485 394 715 450">Vertical installation without feet</p>	<p data-bbox="722 255 1444 315">Fastening without feet Anchor the piping in close proximity to the pump.</p>
 <p data-bbox="485 618 715 651">Vertical installation with angle feet</p>	<p data-bbox="722 456 1444 510">Fasten sizes 32-32-160 to 100-100-125 with three angle feet (St 37, accessories).</p>
 <p data-bbox="485 842 715 853">Vertical installation with pump foot</p>	<p data-bbox="722 658 1444 719">Fasten sizes 100-100-160 to 200-200-315 with pump foot (grey cast iron, accessories).</p>
 <p data-bbox="485 1200 715 1256">Vertical installation - Information about vent valve</p>	<p data-bbox="722 860 1444 920">Provide a vent valve to prevent dry running of the mechanical seal. (Pumps which have been ordered for vertical installation are supplied with a vent valve.) For vertical installation with the motor on top, use connection 5B for venting.</p>
 <p data-bbox="485 1559 715 1597">Vent, mechanical seal chamber</p>	<p data-bbox="722 1263 1444 1323">The mechanical seal chamber can be vented with the vent valve 5B.</p>

9.2 Exploded view and list of components

9.2.1 Variant with bolted casing cover

[Supplied in packaging units only

Table 23: This view applies to the following pump sizes:

32-32-200	40-40-250	50-50-250	65-65-250	80-80-200	100-100-250	125-125-250	150-150-250	200-200-250
				80-80-250				200-200-315

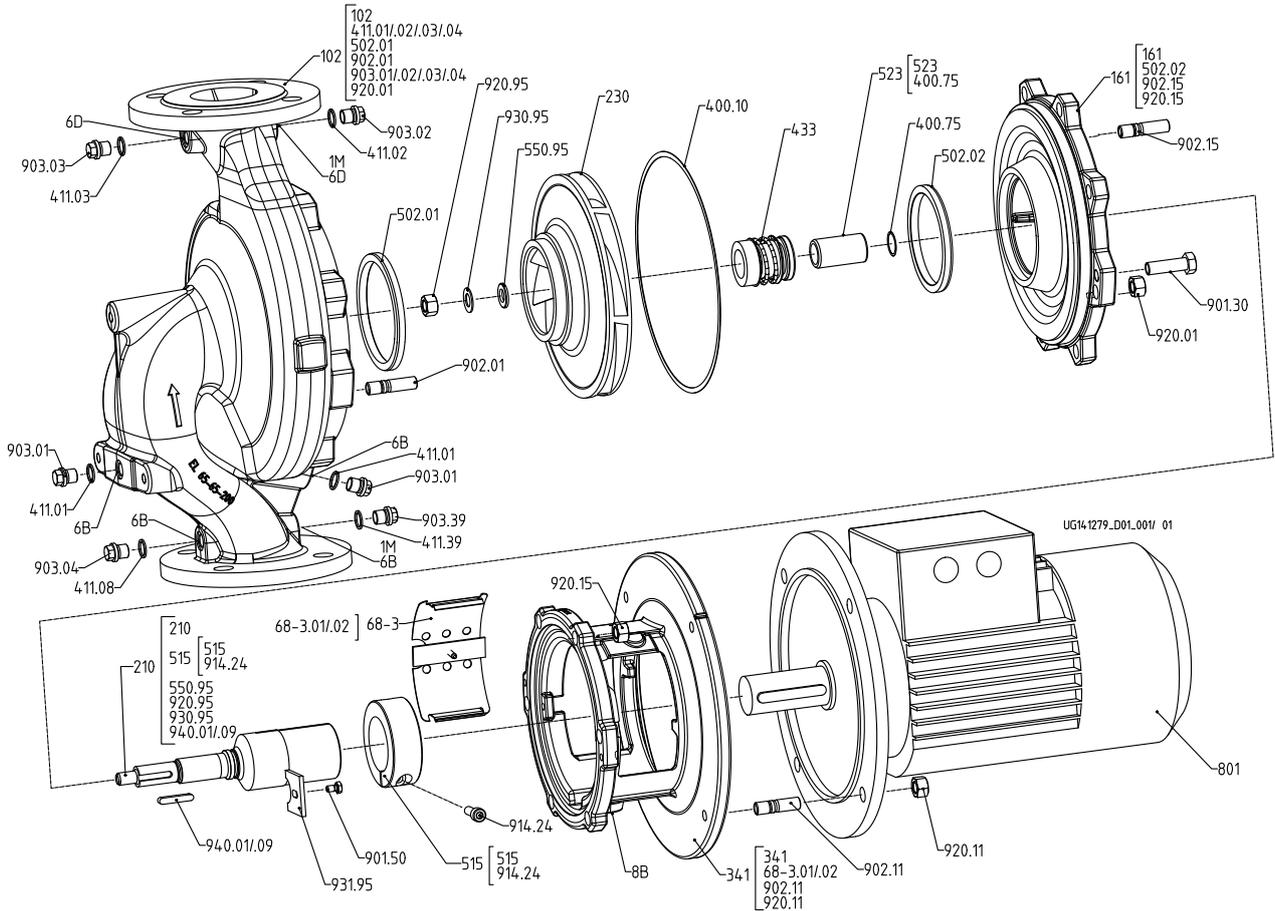


Fig. 11: Variant with bolted casing cover

Table 24: List of components

Part No.	Description	Part No.	Description
102	Volute casing	901.30/50	Hexagon head bolt
161	Casing cover	902.01/11/15	Stud
210	Shaft	903.01/02/03/04/08/39	Screw plug
230	Impeller	914.24	Hexagon socket head cap screw
341	Drive lantern	920.01/11/15/95	Hexagon nut
400.10/75	Gasket	930.95	Safety device
411.01/02/03/04/08/39	O-ring	931.95	Lock washer
433	Mechanical seal	940.01/09	Key
502.01/02	Casing wear ring		
515	Taper lock ring	Auxiliary connections	
523	Shaft sleeve	1M	Pressure gauge
550.95	Disc ⁸⁾	6B	Fluid drain

⁸⁾ For shaft unit 25 only

Part No.	Description	Part No.	Description
68-3.01/02	Cover plate	6D	Fluid priming and venting
801	Flanged motor	8B	Leakage drain

9.2.2 Variant with clamped casing cover

[Supplied in packaging units only

Table 25: This view applies to the following pump sizes:

32-32-160	40-40-160	50-50-160	65-65-160	80-80-160	100-100-125 100-100-160 100-100-200	125-125-160 125-125-200	150-150-200
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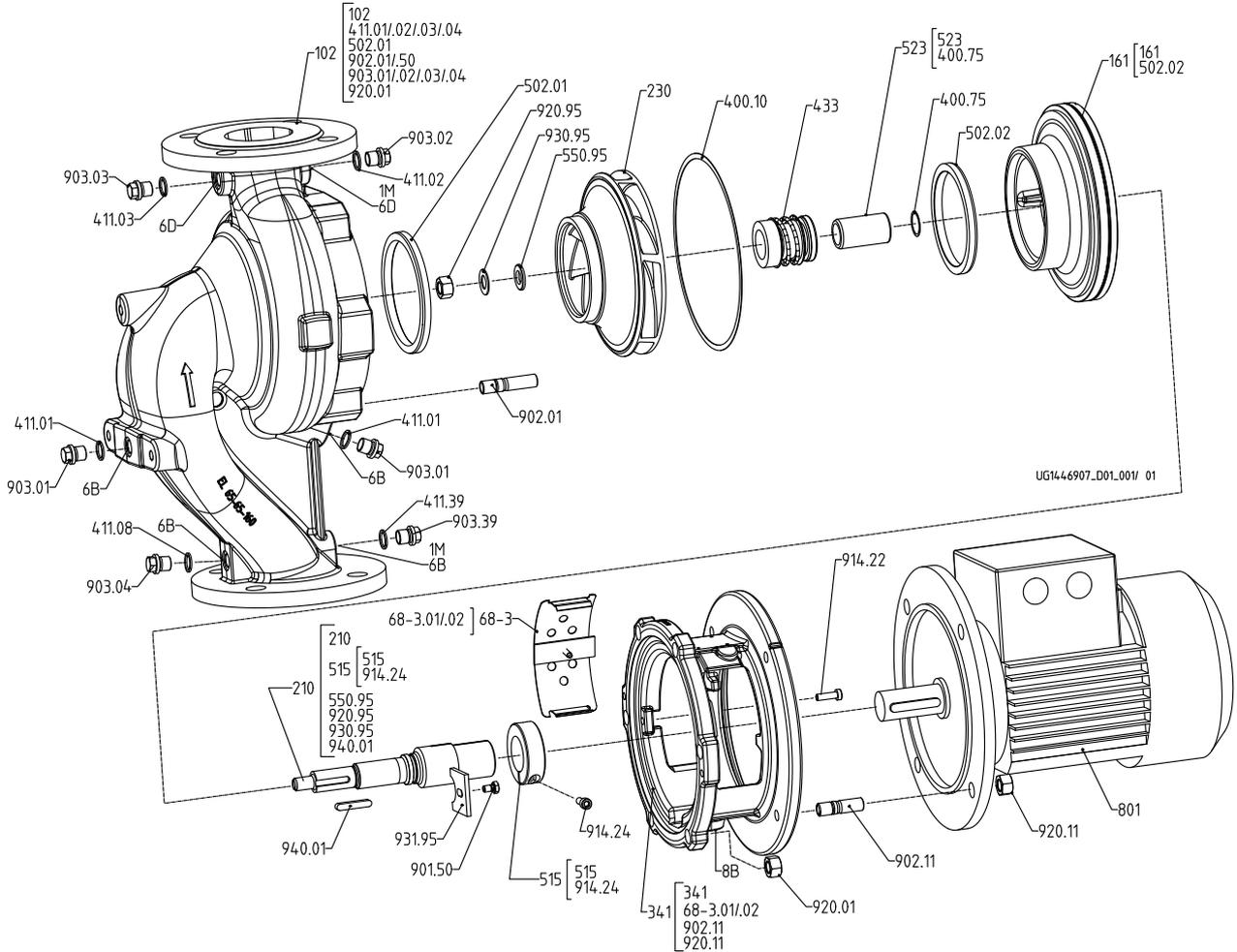


Fig. 12: Pump set with single mechanical seal and clamped casing cover

Table 26: List of components

Part No.	Description	Part No.	Description
102	Volute casing	901.50	Hexagon head bolt
161	Casing cover	902.01/11/50	Stud
210	Shaft	903.01/02/03/04/08/39	Screw plug
230	Impeller	914.22/24	Hexagon socket head cap screw
341	Drive lantern	920.01/11/95	Hexagon nut
400.10/75	Gasket	930.95	Safety device
411.01/02/03/04/08/39	O-ring	931.95	Lock washer
433	Mechanical seal	940.01	Key
502.01/02	Casing wear ring		
515	Taper lock ring	Auxiliary connections	
523	Shaft sleeve	1M	Pressure gauge
550.95	Disc ⁹⁾	6B	Fluid drain
68-3.01/02	Cover plate	6D	Fluid priming and venting
801	Flanged motor	8B	Leakage drain

⁹⁾ For shaft unit 25 only

9.2.3 Variant with pump feet for vertical installation

Table 27: This view applies to the following pump sizes:

32-32-160 40-40-160 50-50-160 65-65-160 80-80-160 100-100-125

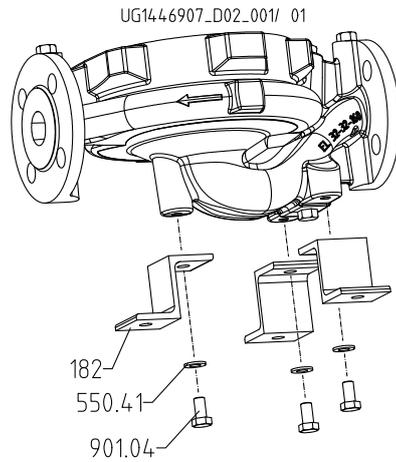


Fig. 13: Vertical installation with angle feet

Table 28: This view applies to the following pump sizes:

100-100-160 100-100-250 125-125-250 150-150-250 200-200-250
200-200-315

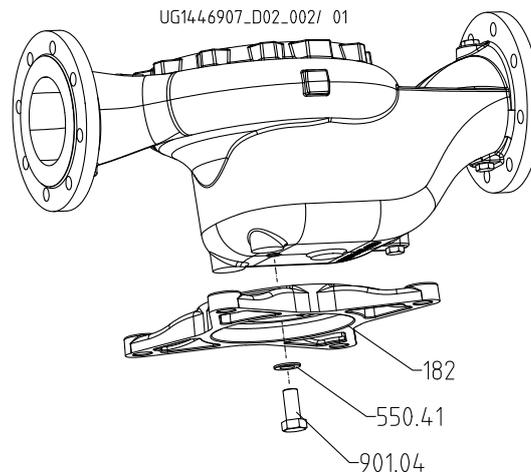


Fig. 14: Vertical installation with pump foot

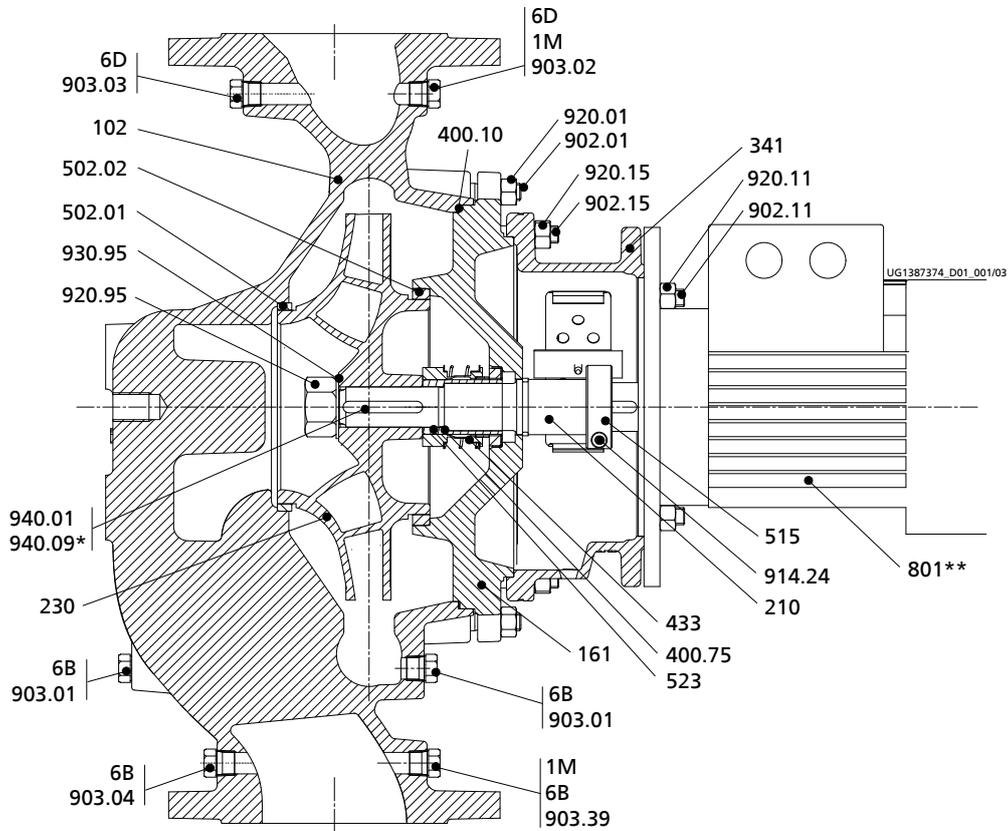
Table 29: List of components

Part No.	Description
182	Foot
550.41	Disc
901.04	Hexagon head bolt

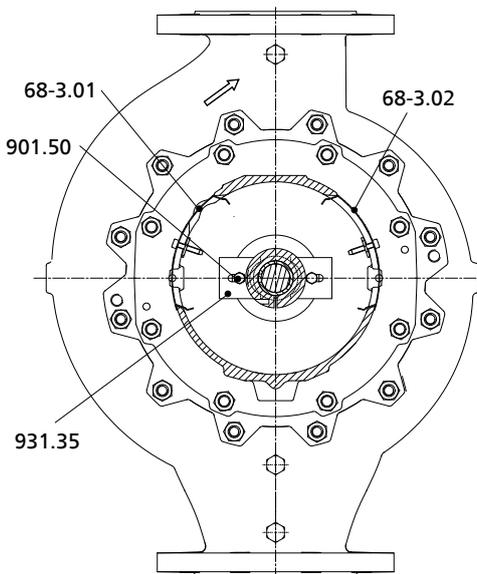
9.3 General assembly drawing with list of components

Table 30: This view applies to the following pump sizes with bolted casing cover:

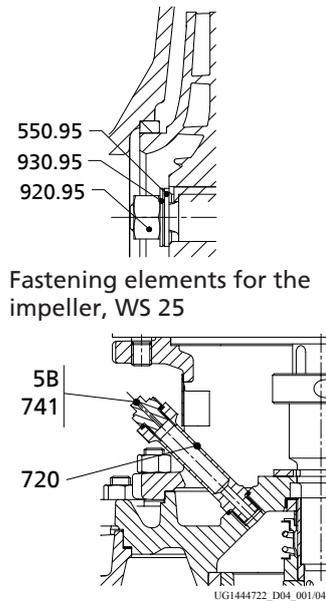
32-32-200	40-40-250	50-50-250	65-65-250	80-80-200 80-80-250	100-100-250	125-125-250	150-150-250	200-200-250 200-200-315
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General assembly drawing, * Second key only for WS 55; ** With motor foot from motor size 132



General assembly drawing: side view



Fastening elements for the impeller, WS 25

Vent valve 5B for vertical installation

Table 31: This view applies to the following pump sizes with clamped casing cover:

32-32-160	40-40-160	50-50-160	65-65-160	80-80-160	100-100-125	125-125-160	150-150-200
					100-100-160	125-125-200	
					100-100-200		

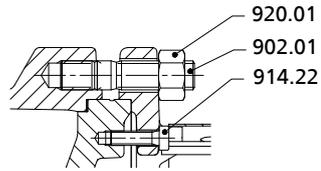


Fig. 15: Fastening elements for the clamped casing cover

Table 32: List of components

Part No.	Description	Part No.	Description
102	Volute casing	801	Flanged motor
161	Casing cover	901.50	Hexagon head bolt
		902.01/.11/.15	Stud
210	Shaft	903.01/.02/.03/.39	Screw plug
230	Impeller	914.22/.24	Hexagon socket head cap screw
341	Drive lantern	920.01/.11/.15/.95	Hexagon nut
400.10/.75	Gasket	930.95	Safety device
433	Mechanical seal	931.95	Lock washer
502.01/.02	Casing wear ring	940.01/.09	Key
515	Taper lock ring		
523	Shaft sleeve	Auxiliary connections	
550.95	Disc ¹⁰⁾	1M	Pressure gauge
68-3.01/.02	Cover plate	5B ¹¹⁾	Vent, mechanical seal chamber
720	Fitting ¹¹⁾	6B	Fluid drain
741	Vent valve	6D	Fluid priming and venting

¹⁰⁾ For shaft unit 25 only

¹¹⁾ Only for vertically installed pump sets

10 EC Declaration of Conformity

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

The manufacturer herewith declares that the product:

**Etabloc, Etabloc SYT, Etaline, Etaline SYT, Etaline Z,
Etachrom NC, Etachrom BC, Etanorm, Etanorm SYT,
Etanorm GPV/CPV, Etaprime L, Etaprime B/BN, Vitachrom**

KSB order number:

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

The manufacturer also declares that

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

Person authorised to compile the technical file:

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

The EC Declaration of Conformity was issued in/on:

Place, date

.....¹²⁾.....

Name
Function
Company
Address

¹²⁾ A signed, legally binding declaration of conformity is supplied with the product.

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