

Self-priming Pump

Etaprime B

Installation/Operating Manual



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Installation/Operating Manual Etaprime B

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.

Certificate of decontamination

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

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

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

Pool of pumps

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

Pump set

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

Self-priming ability

Ability of a filled pump to evacuate a suction line, i.e. to self-prime from an unfilled suction line.

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 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 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 centre 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. (⇒ Section 7.5.5, Page 45)

1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇒ Section 2.3, Page 8)

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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

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



2 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.

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

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

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

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

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents. (⇒ Section 1.4, Page 6)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Never operate the pump without the fluid to be handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

In addition to the safety information contained in this 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 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.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation 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.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.

- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.1.5, Page 29) (⇒ Section 6.3, Page 32)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3, Page 38)
- 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 24)

2.8 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 2.2, Page 8)

2.9 Explosion protection



Always observe the information on explosion protection given in this section when operating the product 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 EU Directive 2014/34/EU (ATEX).

Especially adhere to the sections in this manual marked with the symbol opposite and the following sections, (⇒ Section 2.9.1, Page 10) to (⇒ Section 2.9.4, Page 11)

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.

2.9.1 Marking

Pump The marking on the pump refers to the pump part only.

Example of such marking:

II 2 G c TX (EN 13463-1) or II 2G Ex h IIC T5-T1 Gb (ISO 80079-36)

Refer to the individual Temperature Limits table for the temperatures permitted for the individual pump variants.

The pump complies with the requirements of type of protection constructional safety "c" to ISO 80079-37.

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.

2.9.2 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 to EN 13463-1 or ISO 80079-36	Maximum 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

In the following cases and if ambient temperatures are higher, contact the manufacturer.

Temperature class T5 Compliance with temperature class T5 is warranted for the area of the rolling element bearings based on an ambient temperature of 40 °C, assuming that the pump set is properly serviced and operated and that the surfaces in the bearing area are freely exposed to the atmosphere.

Temperature class T6 If temperature class T6 has to be complied with, special measures may have to be taken with regard to the bearing temperature.

Misuse, malfunctions or non-compliance with the instructions may result in substantially higher temperatures.

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 on the motor flange and motor shaft must be higher than the temperatures generated by the pump.
- Contact the manufacturer for the actual pump temperatures.

2.9.3 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 about monitoring equipment.

2.9.4 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 and the insurer about the damage in writing immediately.

3.2 Transport

	! DANGER
	<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. ▷ Observe the information about weights, centre of gravity and fastening points. ▷ Observe the applicable local accident prevention regulations. ▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

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

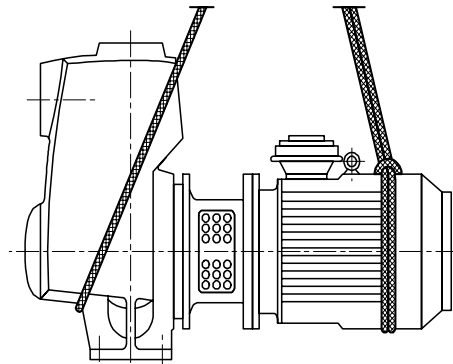


Fig. 1: Transporting the pump set

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
	<p>Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the pump (set)!</p> <ul style="list-style-type: none"> ▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.
	CAUTION
	<p>Wet, contaminated or damaged openings and connections Leakage or damage to the pump!</p> <ul style="list-style-type: none"> ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

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

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, the shutdown measures must be adhered to. (⇒ Section 6.3.1, Page 32)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 38)
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 also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 11, Page 57)

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

3.5 Disposal

	⚠ WARNING
<p>Fluids handled, consumables and supplies which are hot and/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 flushing fluid and any fluid residues. ▷ Wear safety clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard. 	

1. 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

- Self-priming pump

The pump is designed for handling clean or contaminated fluids in waste water management, on construction sites, in agriculture, in the general or chemical industry, in the petroleum, food processing and canning industry and for circulating solvents and cleaning agents with a viscosity of up to 50 mm²/s. A solids content of up to 3 % is permissible, but the fluid handled must not contain long fibres.

4.2 Designation

Table 5: Designation example

Position																															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
E	T	P	B	0	8	0	-	0	8	0	-	2	0	0		G	C	X	I	1	0	D	3	0	1	8	5	2			B
See name plate and data sheet																								See data sheet							

Table 6: Designation key

Position	Code	Description
1-4	Pump type	
	ETPB	Etaprime bloc
5-16	Pump size, e.g.	
	080	Nominal suction nozzle diameter [mm]
	080	Nominal discharge nozzle diameter [mm]
	200	Nominal impeller diameter [mm]
17	Pump casing material	
	G	Cast iron EN-GJL-250 / A48CL35
	C	Stainless steel 1.4408 / A743CF8M
18	Impeller material	
	G	Cast iron EN-GJL-250
	C	Stainless steel 1.4408
19	Design	
	_)2)	Standard
	X	Non-standard (BT3D, BT3)
20	Shaft seal type	
	I	Single mechanical seal, internal circulation (conical seal chamber only)
	D	Double mechanical seal in back-to-back arrangement
	T	Double mechanical seal in tandem arrangement with internal circulation
21-22	Seal code, single mechanical seal	
	01	Q1Q1VGG
	08	AQ1VGG ³⁾
	09	U3U3VGG
	10	Q1Q1X4GG
	11	BQ1EGG
	70	Q12Q1M1GG
23	Scope of supply	
	D	Pump with motor
24	Shaft unit	

2) Blank

3) For shaft unit 17: BQVGG

Position	Code	Description
24	1	Shaft unit 17
	2	Shaft unit 25
	3	Shaft unit 35
25-28	Motor size	
29	Number of motor poles	
30-31	Explosion protection	
	ex	With explosion-proof motor
	-2)	Without explosion-proof motor
32	Product generation	
	B	Etaprime Global Pump

4.3 Name plate

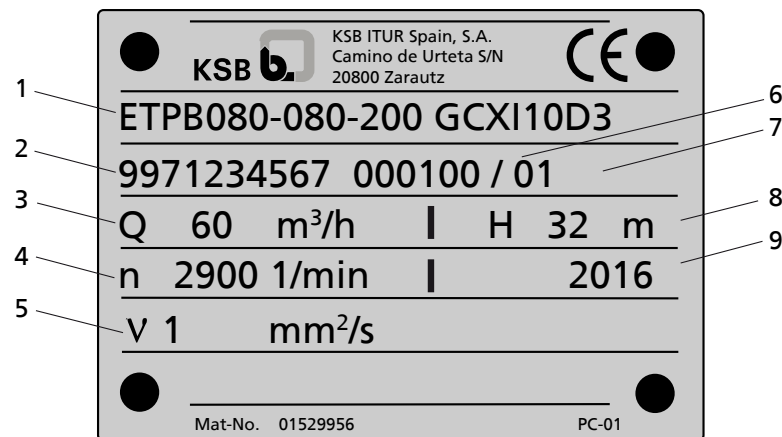


Fig. 2: Name plate (example)

1	Type series, size and version	2	KSB order number (ten digits)
3	Flow rate	4	Rotational speed
5	Kinematic viscosity of the fluid handled	6	Order item number (six digits)
7	Consecutive number (two digits)	8	Head
9	Year of construction		

4.4 Design details

Design

- Volute casing pump
- Back pull-out design (from size 40-40-140)
- Horizontal installation
- Self-priming
- Single-stage
- Single-entry
- Pump and motor connected by a stub shaft

Pump casing

- Radially split volute casing
- Volute casing with integrally cast pump feet (from pump size 40-40-140)

Drive

- KSB IEC frame standardised IE3 motor (from 0.75 kW)
- Type of construction B34 ≤ 1.1 kW
- Type of construction V1 1.1 to 4 kW
- Type of construction V15 > 4 kW
- 230/400 V up to 2.2 kW and 400/690 V from 3 kW
- Enclosure IP55
- Thermal class F
- 3 PTC thermistors

Shaft seal

- The shaft is fitted with a replaceable shaft sleeve in the shaft seal area (from pump size 40-40-140).
- Single mechanical seals and double mechanical seals to EN 12756

Impeller type

- Open multi-vane impeller

4.5 Design and function

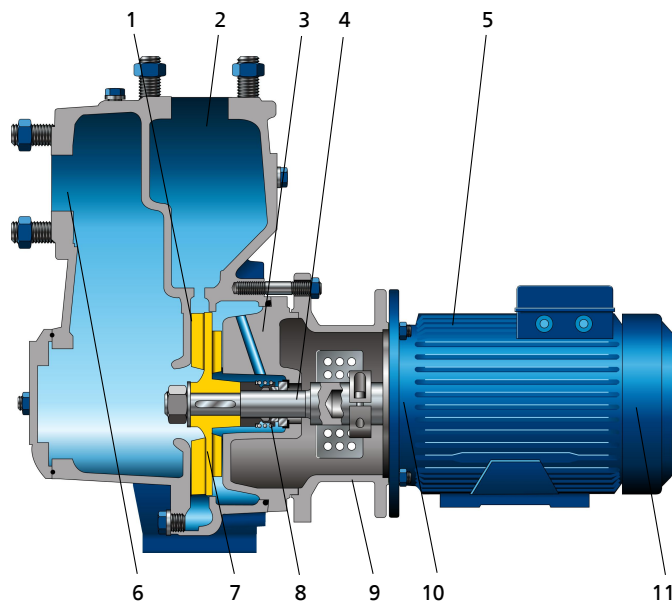


Fig. 3: Sectional drawing

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

Design The pump is designed with an axial fluid inlet and a radial outlet. The hydraulic system is rigidly connected to the motor via a stub shaft.

Function The fluid enters the pump axially 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 (4) enters the hydraulic system via the casing cover (3). The shaft passage through the casing cover is sealed to atmosphere with a dynamic shaft

seal (8). The shaft runs in rolling element bearings (10 and 11), which are supported by a motor housing (5) linked with the casing cover (3) via the drive lantern (9). The filled pump is self-priming.

Sealing The pump is sealed by a standardised mechanical seal.

4.6 Noise characteristics

Table 7: Surface sound pressure level L_{pA} ⁴⁾

Rated power input P_N [kW]	Pump set			
	1450 rpm [dB]	1750 rpm [dB]	2900 rpm [dB]	3500 rpm [dB]
0,37	60	61	-	-
0,55	61	62	73	-
0,75	-	-	74	77
1,1	-	-	75	78
1,5	63	64	76	79
2,2	67	68	77	80
3	67	68	78	-
4	68	69	78	81
5,5	71	72	79	82
7,5	71	72	81	84
11	73	74	81	84
15	-	-	82	85
18,5	-	-	82	85
22	-	-	83	86
30	-	-	83	86

4.7 Scope of supply

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

- Pump
- Surface-cooled IEC three-phase current squirrel-cage motor
- Cover plates at drive lantern to EN 294

4.8 Dimensions and weights


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

4) Spatial average; as per ISO 3744 and EN 12639; valid for pump operation in the $Q/Q_{opt} = 0.8 - 1.1$ range and for non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance.

5 Installation at Site

5.1 Checks to be carried out prior to installation


Place of installation


	<p>⚠ WARNING</p>
	<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 be set, flat, and level. ▷ Observe the weights indicated.

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

5.2 Installing the pump set

Always install the pump set in a horizontal position.


	<p>⚠ DANGER</p>
	<p>Excessive temperatures due to improper installation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Install the pump in a horizontal position to ensure self-venting of the pump.

	<p>CAUTION</p>
	<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".

1. Align the pump set with the help of a spirit level placed on the discharge nozzle.

5.3 Piping

5.3.1 Connecting the piping

	<p>⚠ DANGER</p>
	<p>Impermissible loads acting on the pump nozzles Danger to life from escaping 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 pipes 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.

	<p style="background-color: #FFD700; margin: 0;">CAUTION</p> <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.
	<p style="background-color: #0070C0; color: white; margin: 0;">NOTE</p> <p>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.</p>
	<p style="background-color: #FFD700; margin: 0;">CAUTION</p> <p>When handling gaseous fluids or fluids which tend to froth, the pump will not be self-priming. Pump is running, but does not deliver!</p> <ul style="list-style-type: none"> ▷ Install a check valve in the suction line.

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
 - ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
 - ✓ The nominal diameters of the pipes 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.

	<p style="background-color: #FFD700; margin: 0;">CAUTION</p> <p>Welding beads, scale and other impurities in the piping Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Remove any impurities from the piping. ▷ If necessary, install a filter. ▷ Observe the information in (⇒ Section 7.2.2.2, Page 37) .
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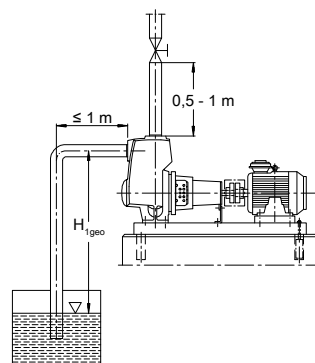


Fig. 4: Distances of suction and discharge lines

	NOTE
	<p>Use a filter with laid-in wire mesh (mesh width 0.5 mm, wire diameter 0.25 mm) 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>

3. Connect the pump nozzles to the piping.
Observe the dimensions stated above (see illustration: Distances of suction and discharge lines).

	CAUTION
	<p>Aggressive flushing liquid and pickling agent Damage to the pump! ▷ Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.</p>

5.3.2 Permissible forces and moments at the pump nozzles

The data on forces and moments apply to static pipelines only. The values are only applicable if the pump is installed on a baseplate and bolted to a rigid and level foundation.

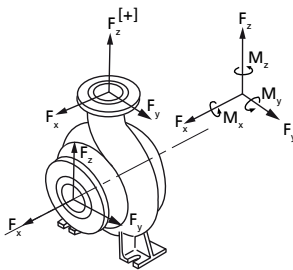


Fig. 5: Forces and moments at the pump nozzles

Table 8: Forces and moments at the pump nozzles for casing material G (EN-GJL-250/A48CL35B)



Size	Suction nozzle								Discharge nozzle							
	DN	F _x	F _y	F _z	∑F	M _x	M _y	M _z	DN	F _x	F _y	F _z	∑F	M _x	M _y	M _z
	[mm]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[mm]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
25-25-100	25	300	265	250	472	315	210	245	25	265	250	300	472	315	210	245
32-32-120	32	370	320	300	574	390	265	300	32	320	300	370	574	390	265	300
40-40-110	40	450	400	350	696	450	320	370	40	400	350	450	696	450	320	370
40-40-140	40	450	400	350	696	450	320	370	40	400	350	450	696	450	320	370
50-50-130	50	580	530	470	916	500	350	400	50	530	470	580	916	500	350	400
50-50-160	50	580	530	470	916	500	350	400	50	530	470	580	916	500	350	400
65-65-150	65	740	650	600	1153	530	390	420	65	650	600	740	1153	530	390	420
65-65-180	65	740	650	600	1153	530	390	420	65	650	600	740	1153	530	390	420
80-80-170	80	880	790	720	1385	560	400	460	80	790	720	880	1385	560	400	460
80-80-190	80	880	790	720	1385	560	400	460	80	790	720	880	1385	560	400	460
80-80-200	80	880	790	720	1385	560	400	460	80	790	720	880	1385	560	400	460
100-100-240.1	100	1180	1050	950	1843	620	440	510	100	1050	950	1180	1843	620	440	510


Table 9: Forces and moments at the pump nozzles for casing material C (1.4408/ A743 GR CF8M)

Size	Suction nozzle								Discharge nozzle							
	DN	F _x	F _y	F _z	∑F	M _x	M _y	M _z	DN	F _x	F _y	F _z	∑F	M _x	M _y	M _z
	[mm]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[mm]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
32-32-120	32	780	650	500	1132	415	230	320	32	650	500	780	1132	415	230	320
40-40-110	40	970	780	650	1404	500	280	410	40	780	650	970	1404	500	280	410
40-40-140	40	970	780	650	1404	500	280	410	40	780	650	970	1404	500	280	410
50-50-130	50	1240	1010	830	1802	650	320	500	50	1010	830	1240	1802	650	320	500
50-50-160	50	1240	1010	830	1802	650	320	500	50	1010	830	1240	1802	650	320	500


Size	Suction nozzle								Discharge nozzle							
	DN [mm]	Fx [N]	Fy [N]	Fz [N]	ΣF [N]	Mx [Nm]	My [Nm]	Mz [Nm]	DN [mm]	Fx [N]	Fy [N]	Fz [N]	ΣF [N]	Mx [Nm]	My [Nm]	Mz [Nm]
65-65-150	65	1600	1300	1050	2314	1050	550	780	65	1300	1050	1600	2314	1050	550	780
65-65-180	65	1600	1300	1050	2314	1050	550	780	65	1300	1050	1600	2314	1050	550	780
80-80-170	80	2000	1550	1300	2845	1330	690	1010	80	1550	1300	2000	2845	1330	690	1010
80-80-200	80	2000	1550	1300	2845	1330	690	1010	80	1550	1300	2000	2845	1330	690	1010


5.3.3 Auxiliary connections

 	<p>⚠ DANGER</p>
	<p>Risk of potentially explosive atmosphere by mixing of incompatible fluids in the auxiliary piping</p> <p>Risk of burns!</p> <p>Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.

	<p>⚠ WARNING</p>
	<p>Failure to use or incorrect use of auxiliary connections (e.g. barrier fluid, flushing liquid, etc.)</p> <p>Risk of injury from escaping fluid!</p> <p>Risk of burns!</p> <p>Malfunction of the pump!</p> <ul style="list-style-type: none"> ▷ 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.

5.4 Casing/insulation

	<p>⚠ DANGER</p>
	<p>Explosive atmosphere forming due to insufficient venting</p> <p>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</p> <p>Risk of burns!</p> <ul style="list-style-type: none"> ▷ Insulate the volute casing. ▷ Fit protective equipment.

	CAUTION
	<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.

5.5 Electrical connection

	⚠ DANGER
	<p>Electrical connection work by unqualified personnel Risk of fatal injury due to 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.

	⚠ WARNING
	<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.

1. Check the available mains voltage against the data on the motor name plate.
2. Select an appropriate starting method.

	NOTE
	<p>A motor protection device is recommended.</p>

5.5.1 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 10: Time relay settings for star-delta starting:

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

5.5.2 Earthing



	⚠ DANGER
	<p>Electrostatic charging Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Connect the PE conductor to the earthing terminal provided. ▷ Provide for potential equalisation between the pump set and foundation.


5.5.3 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.

5.6 Checking the direction of rotation

 	⚠ DANGER
	<p>Temperature increases resulting from contact between rotating and stationary components Explosion hazard! Damage to the pump set! ▷ Never check the direction of rotation by starting up the unfilled pump.</p>

	⚠ WARNING
	<p>Hands inside the pump casing Risk of injuries, damage to the pump! ▷ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.</p>

	CAUTION
	<p>Drive and pump running in the wrong direction of rotation Damage to the pump! ▷ Refer to the arrow indicating the direction of rotation on the pump. ▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.</p>

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

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

6 Commissioning/Start-up/Shutdown




6.1 Commissioning/Start-up


6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇒ Section 5.5, Page 22)
- The pump has been primed with the fluid to be handled. The pump has been vented. (⇒ Section 6.1.2, Page 24)
- The direction of rotation has been checked. (⇒ Section 5.6, Page 23)
- 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 equipment to service have been carried out. (⇒ Section 6.4, Page 33)


6.1.2 Priming and venting the pump


	<p>⚠ DANGER</p> <p>Excessive temperatures due to dry running or excessive gas content in the fluid handled</p> <p>Explosion hazard! Damage to the pump set!</p> <p>▷ Prime the pump as per operating instructions.</p>
	<p>⚠ DANGER</p> <p>Risk of potentially explosive atmosphere by mixing of incompatible fluids in the auxiliary piping</p> <p>Risk of burns! Explosion hazard!</p> <p>▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.</p>
	<p>⚠ DANGER</p> <p>Shaft seal failure caused by insufficient lubrication</p> <p>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>


	CAUTION
	<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).
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.

6.1.3 Start-up

	⚠ DANGER
	<p>The permissible pressure and temperature limits will be exceeded if the pump is operated with the suction and discharge lines closed Risk of explosion! Leakage of hot or toxic fluids!</p> <ul style="list-style-type: none"> ▷ Never operate the pump with the shut-off valves in the suction line and/or discharge line closed. ▷ Never operate the pump against a closed swing check valve. ▷ Always wait until the pump has reached full rotational speed and priming has been completed before adjusting the shut-off valve in the discharge line to the duty point.

	⚠ 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. (⇒ Section 6.1.2, Page 24) ▷ Always operate the pump within the permissible operating range.

	⚠ DANGER
	<p>Formation of a potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▷ The fluid for priming the pump must not be combustible. ▷ When the fluid for priming the pump is taken from a potentially explosive atmosphere, make sure that no potentially explosive atmosphere can enter the pump.

	CAUTION
	<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 has been vented and primed with the fluid to be handled.
- ✓ The lines for priming and venting have been closed.
- ✓ **If a check valve is installed in the suction line:**
The volute casing and the suction line have been primed with the fluid to be handled.
- ✓ The pump can be started up against a closed valve.
- ✓ **If no check valve is installed in the suction line:**
The volute casing has been primed with the fluid to be handled.
- ✓ No back pressure on the discharge side.
- ✓ The shut-off element is open.

	CAUTION
	<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.

	⚠ DANGER
	<p>Seal leakage at operating temperature Hot or toxic fluid could escape!</p> <ul style="list-style-type: none"> ▷ Once the operating temperature has been reached, re-tighten the hexagon nuts between casing and casing cover.

1. When the operating temperature has been reached and/or in the event of leakage, switch off the pump set and re-tighten the screwed connections between lantern and casing.

Priming time

For a 1-metre horizontal length of the suction line and DN suction line = DN pump, the priming times are as follows.

Table 11: Priming time in [seconds] at a static suction lift H_{1geo} of ... m, depending on the speed, 50 Hz

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	40	145	415	-	-	-	130	-	-	-	-	-	-	-
032-032-120	17	30	90	135	190	255	360	100	210	-	-	-	-	-	-
040-040-110	17	60	100	215	420	-	-	120	-	-	-	-	-	-	-
040-040-140	25	30	70	125	220	355	600	130	-	-	-	-	-	-	-
050-050-130	25	50	120	195	260	345	440	210	410	-	-	-	-	-	-
050-050-160	25	30	70	105	170	265	430	210	430	-	-	-	-	-	-
065-065-150	25	60	120	165	260	375	570	190	350	540	-	-	-	-	-
065-065-180	35	30	50	75	100	145	200	90	140	220	370	-	-	-	-
080-080-170	35	50	100	135	180	225	310	110	180	280	480	-	-	-	-

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
080-080-190	35	40	70	105	160	185	240	100	110	200	310	-	-	-	-
080-080-200	35	30	50	75	105	155	200	70	110	190	270	320	420	-	-
100-100-240.1	35	30	70	95	120	150	190	130	150	220	300	440	-	-	-
100-100-240	35	35	70	85	110	160	-	110	160	270	480	-	-	-	-
125-125-260	35	35	80	105	130	160	190	60	70	110	160	200	330	430	610

Table 12: Priming time in [seconds] at a static suction lift H_{1geo} of ... m, depending on the speed, 60 Hz

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	30	85	135	-	-	-	70	170	-	-	-	-	-	-
032-032-120	17	20	60	105	140	175	250	80	150	260	-	-	-	-	-
040-040-110	17	30	85	125	200	265	470	90	180	-	-	-	-	-	-
040-040-140	25	25	50	85	120	145	230	80	150	200	-	-	-	-	-
050-050-130	25	30	90	140	190	245	300	130	240	380	-	-	-	-	-
050-050-160	25	25	55	75	150	215	280	130	260	480	-	-	-	-	-
065-065-150	25	40	80	125	170	225	370	140	260	350	430	-	-	-	-
065-065-180	35	20	40	65	90	105	150	80	110	170	220	330	-	-	-
080-080-170	35	30	80	105	130	165	220	90	130	200	320	480	-	-	-
080-080-190	35	30	55	75	100	125	160	80	100	130	160	210	390	-	-
080-080-200	35	25	40	55	80	125	160	60	100	160	230	280	350	-	-
100-100-240.1	35	25	60	85	115	145	180	90	110	140	210	260	400	-	-
100-100-240	35	25	70	85	100	155	360	80	100	140	200	300	-	-	-
125-125-260	35	-	-	-	-	-	-	50	60	80	115	170	220	300	400

Table 13: Priming time in [seconds] at a static suction lift H_{1geo} of ... m, depending on the speed, 50 Hz

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	40	145	415	-	-	-	130	-	-	-	-	-	-	-
032-032-120	17	30	90	135	190	255	360	100	210	-	-	-	-	-	-
040-040-110	17	60	100	215	420	-	-	120	-	-	-	-	-	-	-
040-040-140	25	30	70	125	220	355	600	130	-	-	-	-	-	-	-
050-050-130	25	50	120	195	260	345	440	210	410	-	-	-	-	-	-
050-050-160	25	30	70	105	170	265	430	210	430	-	-	-	-	-	-
065-065-150	25	60	120	165	260	375	570	190	350	540	-	-	-	-	-
065-065-180	35	30	50	75	100	145	200	90	140	220	370	-	-	-	-
080-080-170	35	50	100	135	180	225	310	110	180	280	480	-	-	-	-
080-080-190	35	40	70	105	160	185	240	100	110	200	310	-	-	-	-
080-080-200	35	30	50	75	105	155	200	70	110	190	270	320	420	-	-
100-100-240.1	35	30	70	95	120	150	190	130	150	220	300	440	-	-	-
100-100-240	35	35	70	85	110	160	-	110	160	270	480	-	-	-	-
125-125-260	35	35	80	105	130	160	190	60	70	110	160	200	330	430	610

Table 14: Priming time in [seconds] at a static suction lift H_{1geo} of ... m, depending on the speed, 60 Hz

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	30	85	135	-	-	-	70	170	-	-	-	-	-	-
032-032-120	17	20	60	105	140	175	250	80	150	260	-	-	-	-	-
040-040-110	17	30	85	125	200	265	470	90	180	-	-	-	-	-	-
040-040-140	25	25	50	85	120	145	230	80	150	200	-	-	-	-	-
050-050-130	25	30	90	140	190	245	300	130	240	380	-	-	-	-	-

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
050-050-160	25	25	55	75	150	215	280	130	260	480	-	-	-	-	-
065-065-150	25	40	80	125	170	225	370	140	260	350	430	-	-	-	-
065-065-180	35	20	40	65	90	105	150	80	110	170	220	330	-	-	-
080-080-170	35	30	80	105	130	165	220	90	130	200	320	480	-	-	-
080-080-190	35	30	55	75	100	125	160	80	100	130	160	210	390	-	-
080-080-200	35	25	40	55	80	125	160	60	100	160	230	280	350	-	-
100-100-240.1	35	25	60	85	115	145	180	90	110	140	210	260	400	-	-
100-100-240	35	25	70	85	100	155	360	80	100	140	200	300	-	-	-
125-125-260	35	-	-	-	-	-	-	50	60	80	115	170	220	300	400

Table 15: Priming time in [seconds] at a static suction lift H_{1geo} of ... m, depending on the speed, 50 Hz

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	40	145	415	-	-	-	130	-	-	-	-	-	-	-
032-032-120	17	30	90	135	190	255	360	100	210	-	-	-	-	-	-
040-040-110	17	60	100	215	420	-	-	120	-	-	-	-	-	-	-
040-040-140	25	30	70	125	220	355	600	130	-	-	-	-	-	-	-
050-050-130	25	50	120	195	260	345	440	210	410	-	-	-	-	-	-
050-050-160	25	30	70	105	170	265	430	210	430	-	-	-	-	-	-
065-065-150	25	60	120	165	260	375	570	190	350	540	-	-	-	-	-
065-065-180	35	30	50	75	100	145	200	90	140	220	370	-	-	-	-
080-080-170	35	50	100	135	180	225	310	110	180	280	480	-	-	-	-
080-080-190	35	40	70	105	160	185	240	100	110	200	310	-	-	-	-
080-080-200	35	30	50	75	105	155	200	70	110	190	270	320	420	-	-
100-100-240.1	35	30	70	95	120	150	190	130	150	220	300	440	-	-	-
100-100-240	35	35	70	85	110	160	-	110	160	270	480	-	-	-	-
125-125-260	35	35	80	105	130	160	190	60	70	110	160	200	330	430	610

Table 16: Priming time in [seconds] at a static suction lift H_{1geo} of ... m, depending on the speed, 60 Hz

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	30	85	135	-	-	-	70	170	-	-	-	-	-	-
032-032-120	17	20	60	105	140	175	250	80	150	260	-	-	-	-	-
040-040-110	17	30	85	125	200	265	470	90	180	-	-	-	-	-	-
040-040-140	25	25	50	85	120	145	230	80	150	200	-	-	-	-	-
050-050-130	25	30	90	140	190	245	300	130	240	380	-	-	-	-	-
050-050-160	25	25	55	75	150	215	280	130	260	480	-	-	-	-	-
065-065-150	25	40	80	125	170	225	370	140	260	350	430	-	-	-	-
065-065-180	35	20	40	65	90	105	150	80	110	170	220	330	-	-	-
080-080-170	35	30	80	105	130	165	220	90	130	200	320	480	-	-	-
080-080-190	35	30	55	75	100	125	160	80	100	130	160	210	390	-	-
080-080-200	35	25	40	55	80	125	160	60	100	160	230	280	350	-	-
100-100-240.1	35	25	60	85	115	145	180	90	110	140	210	260	400	-	-
100-100-240	35	25	70	85	100	155	360	80	100	140	200	300	-	-	-
125-125-260	35	-	-	-	-	-	-	50	60	80	115	170	220	300	400

Table 17: Priming time in [seconds] at a static suction lift H_{1geo} of ... m, depending on the speed, 50 Hz

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	40	145	415	-	-	-	130	-	-	-	-	-	-	-
032-032-120	17	30	90	135	190	255	360	100	210	-	-	-	-	-	-
040-040-110	17	60	100	215	420	-	-	120	-	-	-	-	-	-	-
040-040-140	25	30	70	125	220	355	600	130	-	-	-	-	-	-	-
050-050-130	25	50	120	195	260	345	440	210	410	-	-	-	-	-	-
050-050-160	25	30	70	105	170	265	430	210	430	-	-	-	-	-	-
065-065-150	25	60	120	165	260	375	570	190	350	540	-	-	-	-	-
065-065-180	35	30	50	75	100	145	200	90	140	220	370	-	-	-	-
080-080-170	35	50	100	135	180	225	310	110	180	280	480	-	-	-	-
080-080-190	35	40	70	105	160	185	240	100	110	200	310	-	-	-	-
080-080-200	35	30	50	75	105	155	200	70	110	190	270	320	420	-	-
100-100-240.1	35	30	70	95	120	150	190	130	150	220	300	440	-	-	-
100-100-240	35	35	70	85	110	160	-	110	160	270	480	-	-	-	-
125-125-260	35	35	80	105	130	160	190	60	70	110	160	200	330	430	610

Table 18: Priming time in [seconds] at a static suction lift H_{1geo} of ... m, depending on the speed, 60 Hz

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	30	85	135	-	-	-	70	170	-	-	-	-	-	-
032-032-120	17	20	60	105	140	175	250	80	150	260	-	-	-	-	-
040-040-110	17	30	85	125	200	265	470	90	180	-	-	-	-	-	-
040-040-140	25	25	50	85	120	145	230	80	150	200	-	-	-	-	-
050-050-130	25	30	90	140	190	245	300	130	240	380	-	-	-	-	-
050-050-160	25	25	55	75	150	215	280	130	260	480	-	-	-	-	-
065-065-150	25	40	80	125	170	225	370	140	260	350	430	-	-	-	-
065-065-180	35	20	40	65	90	105	150	80	110	170	220	330	-	-	-
080-080-170	35	30	80	105	130	165	220	90	130	200	320	480	-	-	-
080-080-190	35	30	55	75	100	125	160	80	100	130	160	210	390	-	-
080-080-200	35	25	40	55	80	125	160	60	100	160	230	280	350	-	-
100-100-240.1	35	25	60	85	115	145	180	90	110	140	210	260	400	-	-
100-100-240	35	25	70	85	100	155	360	80	100	140	200	300	-	-	-
125-125-260	35	-	-	-	-	-	-	50	60	80	115	170	220	300	400

6.1.4 Checking the shaft seal

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

6.1.5 Shutdown

	CAUTION
	<p>Heat build-up inside the pump Damage to the shaft seal!</p> <p>▷ 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.</p>

	CAUTION
	<p>Backflow of fluid handled is not permitted Motor or winding damage! Mechanical seal damage!</p> <ul style="list-style-type: none"> ▷ Close the shut-off elements.

- ✓ 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 non-return or check valve, the shut-off element may remain open provided that the system conditions and system regulations are considered and observed.</p>

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Close any auxiliary lines.
 If the fluid to be 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.

	⚠ DANGER
	<p>Formation of a potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▷ When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring).

6.2.1 Ambient temperature

	CAUTION
	<p>Operation outside the permissible ambient temperature Damage to the pump (set)!</p> <p>▷ Observe the specified limits for permissible ambient temperatures.</p>

Observe the following parameters and values during operation:

Table 19: 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> <p>▷ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.</p>

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

Table 20: Frequency of starts

Shaft unit ⁵⁾	Maximum frequency of starts	
	Impeller material G (EN-GJL-250/A48CL35B)	Impeller material C (1.4408/A743 GR CF8M)
	[Starts/hour]	[Starts/hour]
17	6	6
25	12	6
35	12	6

	CAUTION
	<p>Re-starting while motor is still running down Damage to the pump (set)!</p> <p>▷ Do not re-start the pump set before the pump rotor has come to a standstill.</p>

6.2.3 Fluid handled

6.2.3.1 Flow rate

Table 21: Flow rate

Minimum flow rate	Maximum flow rate
≈ 15 % of Q _{opt.} ⁶⁾	See hydraulic characteristic curves

5) Shaft unit see data sheet.
 6) Duty point at maximum efficiency

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.

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


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

Table 22: 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</p> <p>Motor overload!</p> <ul style="list-style-type: none"> ▷ Observe the information about fluid density in the data sheet. ▷ Make sure the motor has sufficient power reserves.

6.2.3.3 Abrasive fluids

The fluid handled may contain abrasive particles up to a maximum content of 5 g/dm³ and a maximum particle size of 0.5 mm. When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system and the shaft seal are to be expected. In this case, 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 functional check run of the pump.
- 1. For prolonged shutdown periods, start up the pump (set) regularly between once a month and once every three months for approximately five minutes.
 - ⇒ 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 38)
- ✓ The safety instructions for dismantling the pump have been observed. (⇒ Section 7.4.1, Page 38)
 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 or grease, food-approved if required) to protect them against corrosion.
Observe the additional instructions on preservation. (⇒ Section 3.3, Page 12)

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

6.4 Returning to service






For returning the equipment to service observe the sections on commissioning/start-up and the operating limits. (⇒ Section 6.1, Page 24) (⇒ 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 style="background-color: #f4a460; padding: 2px;">⚠ WARNING</p> <p>Failure to re-install or re-activate protective devices Risk of injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> ▸ As soon as the work is completed, re-install and re-activate any safety-relevant devices and protective devices.
	<p style="background-color: #0070c0; color: white; padding: 2px;">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

	<p>⚠ DANGER</p> <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 on explosion-proof pump sets outside potentially explosive atmospheres.
	<p>⚠ DANGER</p> <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 and shaft seal.
<p>The operator ensures that maintenance, inspection and installation is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.</p>	
	<p>⚠ WARNING</p> <p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.
	<p>⚠ DANGER</p> <p>Improper cleaning of coated pump surfaces Explosion hazard by electrostatic discharge!</p> <ul style="list-style-type: none"> ▷ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.
	<p>⚠ WARNING</p> <p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard 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 tilting or tipping over.

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

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

Never use force when dismantling and reassembling the pump set.




7.2 Servicing/Inspection

7.2.1 Supervision of operation

	DANGER
	<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.


 	DANGER
	<p>Incorrectly serviced shaft seal Explosion hazard! Hot, toxic fluid escaping! Damage to the pump set! Risk of burns! Fire hazard!</p> <ul style="list-style-type: none"> ▷ Regularly service the shaft seal.

 	DANGER
	<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! Hot and/or toxic fluids escaping!</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 6.1.4, Page 29)
- Check the static sealing elements 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 stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.
The bearing temperature must not exceed 90 °C (measured on the motor housing).

	<p>CAUTION</p> <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).
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	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 coupling guard, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.

	! DANGER
	<p>Static charging due to insufficient potential equalisation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure that the connection between pump and baseplate is electrically conductive.

7.2.2.1 Checking the clearances

For checking the clearances remove the impeller, if required.

(⇒ Section 7.4.6, Page 40)

If the axial clearance is larger or smaller than permitted (see the following table), re-adjust it in accordance with the table below.

The clearance gaps indicated refer to the axial clearance between the impeller vanes and the pump casing.

Table 23: Clearance gap between impeller face and volute casing wall



Impeller material	Permissible clearance	
	New	Maximum
G (EN-GJL-250/A48CL35B)	0.2 mm	0.5 mm
C (1.4408/A743 GR CF8M)	0.2 - 0.3 mm	0.7 mm

If the maximum clearance is exceeded, insert a disc with a thickness of 0.1 mm and adjust the clearance to the as-new value.

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 handled, consumables and supplies which are hot and/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 flushing fluid and any fluid residues. ▸ Wear safety clothing and a protective mask if required. ▸ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Use connection 6B to drain the fluid handled (see drawing of auxiliary connections).
2. Always flush the system 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 certificate of decontamination for the pump. (⇒ Section 11, Page 57)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

	 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. (⇒ Section 6.1.5, Page 29) ▸ Close the shut-off elements in the suction line and discharge line. ▸ Drain the pump and release the pump pressure. (⇒ Section 7.3, Page 38) ▸ Shut off any auxiliary feed lines. ▸ Allow the pump set to cool down to ambient temperature.
	 WARNING
	<p>Unqualified personnel performing work on the pump (set)</p> <p>Risk of 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 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.


Always observe the 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. (⇒ Section 9.1, Page 51)

In case of damage you can always contact KSB Service.


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

	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 38) to (⇒ Section 7.4.2, Page 39) have been observed/carried out.

1. Disconnect the discharge and suction nozzle from the piping.
2. Depending on the pump/motor size, unscrew the bolts that fix the support foot and/or motor foot to the foundation.
3. Remove the complete pump set from the piping.

7.4.4 Dismantling the motor

	NOTE
	If only the motor 801 is to be removed, the volute casing and rotating parts can remain in the piping.



	⚠ WARNING
	<p>Motor tilting Risk of crushing hands and feet!</p> <p>▸ Suspend or support the motor to prevent it from tilting.</p>

✓ The notes and steps stated in (⇒ Section 7.4.1, Page 38) to (⇒ Section 7.4.3, Page 39) have been observed/carried out.

1. Depending on the pump size / motor size, unscrew the bolts that fix the motor foot to the foundation.
2. Undo bolts of cover plates 68-3.01/02.
3. Remove cover plates 68-3.01/02 from drive lantern 341.

4. Undo hexagon head bolt 901.4 (shaft unit 17) or hexagon nuts 920.11 (shaft units 25, 35).
5. Remove the motor.

7.4.5 Removing the back pull-out unit

	 WARNING
	<p>Back pull-out unit tilting 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 38) to (⇒ Section 7.4.4, Page 39) have been observed/carried out.
 1. If required, suspend or support the back pull-out unit to prevent it from tilting.
 2. Undo hexagon nut 920.01 at the volute casing.
 3. Pull the back pull-out unit out of the volute casing.
 4. Remove and dispose of O-ring 412.35.
 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 38) to (⇒ Section 7.4.5, Page 40) 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).
 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.
 5. Pull spacer discs 550.02/550.04 off the shaft.

7.4.7 Removing the mechanical seal

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 38) to (⇒ Section 7.4.6, Page 40) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
 1. Remove the rotating assembly of the mechanical seal (primary ring) from shaft sleeve 523.
 2. Undo nuts 920.15 (if any) at casing cover 161.
 3. **For models with a clamped casing cover:** Undo transport locks 901.98 and remove cover plates 81-92.01 and 81-92.02 with transport locks 901.98 and lock washers 554.98. Remove casing cover 161 from bearing bracket 330.
For models with a bolted casing cover: Use forcing screws 901.31 to remove casing cover 161 from bearing bracket 330.
 For the casing cover of variant C a commercially available eye nut (DIN 582) can be fitted on stud 902.99 to facilitate dismantling.
 The eye nut must be removed again after the casing cover has been reassembled.

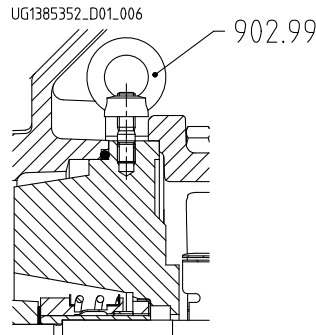





Fig. 6: Eye nut as dismantling aid

4. Remove the stationary assembly of the mechanical seal (mating ring) from casing cover 161 or drive lantern 341 (shaft unit 17).
5. Pull shaft sleeve 523 (if any) off shaft 210.
6. Remove and dispose of gasket 400.75.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

	<p>⚠ DANGER</p>
	<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).
	<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>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.

Sequence Always reassemble the pump in accordance with the corresponding general assembly drawing or exploded view.

Sealing elements Check O-rings for any damage and replace by new O-rings if required.
Always use new gaskets, making sure that they have the same thickness as the old ones.

Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).

Assembly adhesives Avoid the use of assembly adhesives if possible.

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

Only apply adhesive at selected points and in thin layers.



Never use quick-setting adhesives (cyanoacrylate adhesives).

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

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

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual. (⇒ Section 7.6, Page 46)

7.5.2 Connecting the shaft to the motor shaft

	 DANGER
	<p>Incorrect shaft connection Explosion hazard!</p> <p>▷ Connect the shafts between pump and motor as described in this manual.</p>

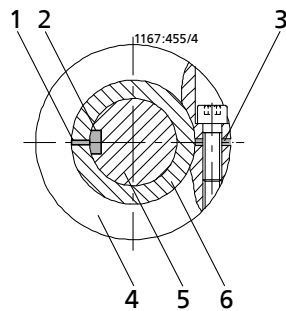


Fig. 7: Connecting the shaft to the motor shaft end

1	Shaft slot	2	Keyway of the motor shaft end
3	Slot of the locking ring	4	Locking ring
5	Motor shaft	6	Shaft

1. Slide locking ring 515 onto shaft 210.
2. Connect shaft 210 to the motor shaft end. Make sure that the keyway of the motor shaft end is aligned with the slot in shaft 210. The slot in locking ring 515 is located on the opposite side (see figure: Connecting the shaft to the motor shaft end).
3. Insert hexagon socket head cap screw 914.24 into locking ring 515 and tighten it. (⇒ Section 7.6.1, Page 46)

7.5.3 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 41) to (⇒ Section 7.5.2, Page 42) have been observed/carried out.
- ✓ The bearing assembly (motor and shaft) 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. Fit drive lantern 341 into the locating fit of motor 801.
 2. Tighten hexagon head bolt 901.4 (shaft unit 17) or hexagon nuts 920.11 (shaft units 25, 35).
 3. Clean shaft sleeve 523, if any, and touch up any score marks or scratches with a polishing cloth.
If score marks or scratches are still visible, fit new shaft sleeve 523.
 4. Slide shaft sleeve 523, if any, onto shaft 210 with new gasket 400.75.
 5. Clean the mating ring location in casing cover 161 / drive lantern 341 (shaft unit 17).

	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.

6. Carefully insert the mating ring.
Make sure to apply pressure evenly.
7. Fit casing cover 161 (shaft units 25, 35) into the locating fit of drive lantern 341.
For models with a clamped casing cover: Use hexagon socket head cap screws 914.22 to connect casing cover 161 and drive lantern 341.
For models with a bolted casing cover: Fit and tighten hexagon nut 920.15. For the casing cover of variant C a commercially available eye nut (DIN 582) can be fitted on stud 902.99 to facilitate assembly.
 The eye nut must be removed again after the casing cover has been reassembled.

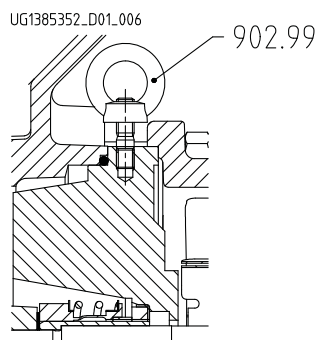


Fig. 8: Eye nut as assembly aid

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

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

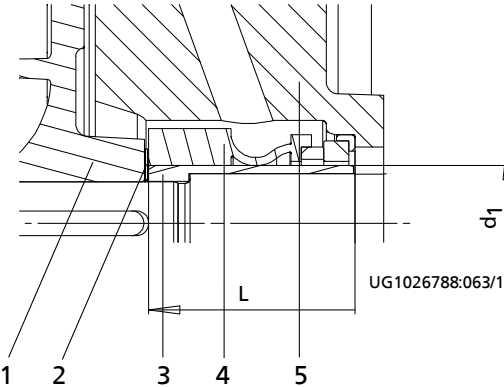


Fig. 9: Mechanical seal chamber

1	Impeller	2	Spacer discs
3	Shaft sleeve	4	Mechanical seal
5	Casing cover		




Table 24: Installation dimensions of the mechanical seal

Shaft unit ⁷⁾	Installation dimension d ₁	Installation dimension L
17	16 mm	l _{1K} = 35
25	28 mm	l _{1N} = 50
35	38 mm	l _{1N} = 55


7.5.4 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 41) to (⇒ Section 7.5.3, Page 43) have been observed/carried out.
 - ✓ The assembled bearing bracket 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. Slide the spacer discs onto the shaft. (Always use the same number and type of spacer discs as originally fitted at the factory!)
 2. Insert key 940.01 and slide impeller 230 onto shaft 210.
 3. Fasten impeller nut 920.95, spring washer 930.95 and disc 550.95, if any. (See table: Tightening torques of screwed connections at the pump (⇒ Section 7.6, Page 46)).
 4. Observe, check and re-adjust the axial clearance. (⇒ Section 7.2.2.1, Page 37)

7) Shaft unit see data sheet.

	<p>⚠ DANGER</p> <p>Excessive temperatures caused by mechanical contact Risk of explosion! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Check correct seating of axial joint rings mounted on the shaft. Only gentle contact shall be established between the sealing lip and the shaft. ▷ Observe, check and re-adjust the axial clearance. (⇒ Section 7.2.2.1, Page 37)
	<p>CAUTION</p> <p>Rubbing contact between impeller and volute casing Damage to the impeller, casing, mechanical seal and bearing!</p> <ul style="list-style-type: none"> ▷ Observe, check and re-adjust the axial clearance. (⇒ Section 7.2.2.1, Page 37)
	<p>NOTE</p> <p>Always check the clearance gap.</p>

7.5.5 Re-installing the back pull-out unit

	<p>⚠ WARNING</p> <p>Back pull-out unit tilting 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 41) to (⇒ Section 7.5.4, Page 44) 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, prevent the back pull-out unit from tipping over, e.g. by suspending or supporting it. Then guide it into volute casing 102 with new O-ring 412.35.
 2. Tighten nut 920.01 at the volute casing.

7.6 Tightening torques

7.6.1 Tightening torques for the pump

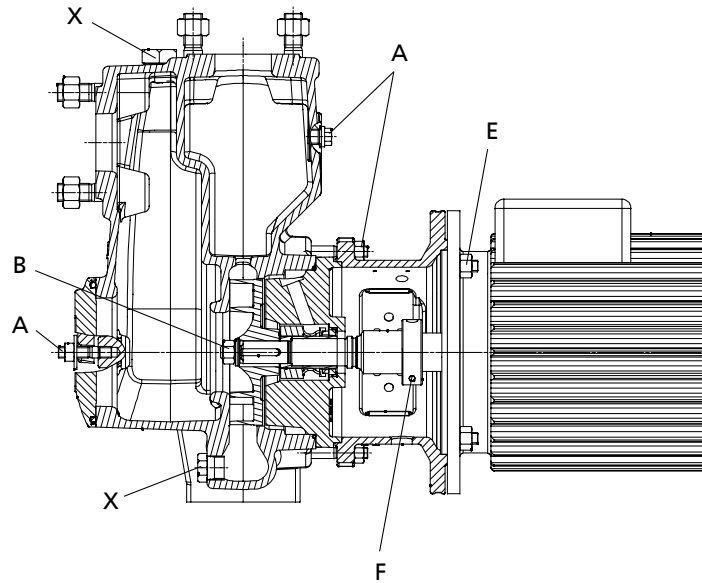


Fig. 10: Tightening points

Table 25: Tightening torques for bolted/screwed connections at the pump

Position	Thread size	Rated torque [Nm]
A	M8	20
	M12	55
B	M12 x 1,5	55
	M24 x 1,5	130
	M30 x 1,5	170
E	M8	20
	M10	38
	M12	55
	M16	130
F	M6	15
	M8	38
	M10	38
	M12	55
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:

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

Refer to the name plate for all data. (⇒ Section 4.3, Page 15)

Also specify the following data:

- Part number and description (⇒ Section 9.1, Page 51)
- 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 26: 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 %
400.75 ⁸⁾	Gasket	1	2	2	3	3	4	50 %
412.35/65	O-ring	4	6	8	8	9	10	100 %
433	Mechanical seal	1	1	2	2	2	3	25 %
523 ⁸⁾	Shaft sleeve	2	2	2	3	3	4	50 %

7.7.3 Interchangeability of Etaprime B and Etaprime L pump components

Components featuring the same number in a column are interchangeable.

Table 27: Symbols key

Symbol	Description
*	Component interchangeable with Etaprime L
o	Components differ
x	Component not fitted

8) For shaft units 25 and 35 (shaft unit see data sheet)

Table 28: Interchangeability of Etaprime B and Etaprime L pump components and interchangeability of components among each other

Size	Shaft unit	Description					
		Volute casing	Casing cover	Shaft	Impeller	Mechanical seal	Shaft sleeve
		Part No.					
		102	161	210	230	433	523
025-025-100	17	○*	✗	1	○*	1*	✗
032-032-120	17	○*	✗	1	○*	1*	✗
040-040-110	17	○*	✗	1	○*	1*	✗
040-040-140	25	○*	○*	2	○*	2*	1*
050-050-130	25	○*	○*	2	○*	2*	1*
050-050-160	25	○*	1*	2	○*	2*	1*
065-065-150	25	○*	1*	2	○*	2*	1*
065-065-180	35	○*	○*	3	○*	3*	2*
080-080-170	35	○*	○*	3	○*	3*	2*
080-080-190	35	○*	○*	3	○*	3*	2*
080-080-200	35	○*	○*	3	○*	3*	2*
100-100-240.1	35	○*	○*	3	○*	3*	2*

8 Trouble-shooting

	WARNING
	<p>Improper work to remedy faults Risk of injury!</p> <p>▷ For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.</p>

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

- A Pump delivers insufficient flow rate
- B Motor is overloaded
- C Excessive discharge pressure
- 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 29: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy ⁹⁾
X	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller. ¹⁰⁾ Increase the speed (turbine, I.C. engine).
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 fluid level. 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	-	-	-	-	-	-	-	Air intake at the shaft seal	Clean flushing liquid duct, supply external flushing liquid, if necessary, or increase flushing liquid pressure. Replace shaft seal.
X	-	-	-	-	-	-	-	Wrong direction of rotation	Interchange two of the phases of the power cable.
X	-	-	-	-	-	-	-	Speed is too low ¹⁰⁾ - 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. ¹⁰⁾

9) Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.
10) Contact the manufacturer.

A	B	C	D	E	F	G	H	Possible cause	Remedy ⁹⁾
-	X	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact the manufacturer.
-	-	-	-	-	X	-	-	Use of unsuitable shaft seal materials	Change the material combination. ¹⁰⁾
-	X	X	-	-	-	-	-	Speed is too high.	Reduce speed. ¹⁰⁾
-	-	-	-	X	-	-	-	Tie bolts/sealing element defective	Fit new sealing element between pump casing and casing cover / discharge cover. Re-tighten the bolts.
-	-	-	-	-	X	-	-	Worn shaft seal	Fit new shaft seal. Check flushing liquid/barrier fluid.
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-align the pump set. Re-balance the impeller. Increase pressure at the pump suction nozzle.
-	-	-	X	-	X	X	-	Pump set is misaligned.	Re-align pump set.
-	-	-	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	-	-	-	-	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.
-	X	-	-	-	-	-	-	Operating voltage is too low.	Increase the voltage.
-	-	-	-	-	-	X	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	X	-	Defective bearing(s)	Replace.
-	-	-	X	-	-	X	X	Flow rate is too low.	Increase the minimum flow rate.
-	-	-	-	-	X	-	-	Incorrect inflow of circulation liquid	Increase the free cross-section.

9 Related Documents

9.1 Sectional drawing and list of components

9.1.1 Etaprime B and C with threaded connection (SU 17)

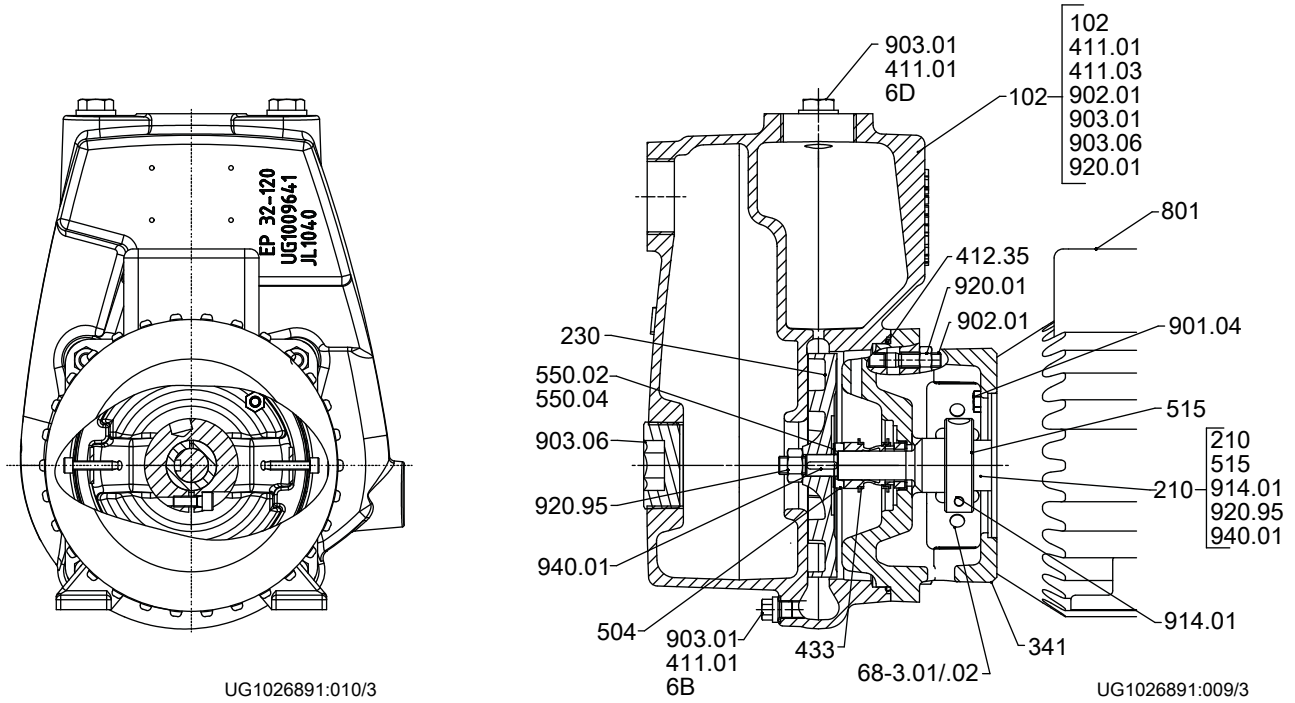


Fig. 11: Variant with a single mechanical seal

[Supplied in packaging units only

Table 30: List of components

Part No.	Description	Part No.	Description
102	Volute casing	550.02/.04	Disc
210	Shaft	68-3.01/.02	Cover plate
230	Impeller	801	Flanged motor
341	Drive lantern	901.04	Hexagon head bolt
411.01/.03	Joint ring	902.01	Stud
412.35	O-ring	903.01/.03/.06	Screw plug
433	Mechanical seal	914.01	Hexagon socket head cap screw
504	Spacer ring	920.01/.95	Nut
515	Locking ring	940.01	Key

Table 31: Connections

Part No.	Description	Part No.	Description
6B	Fluid drain	6D	Fluid priming and venting

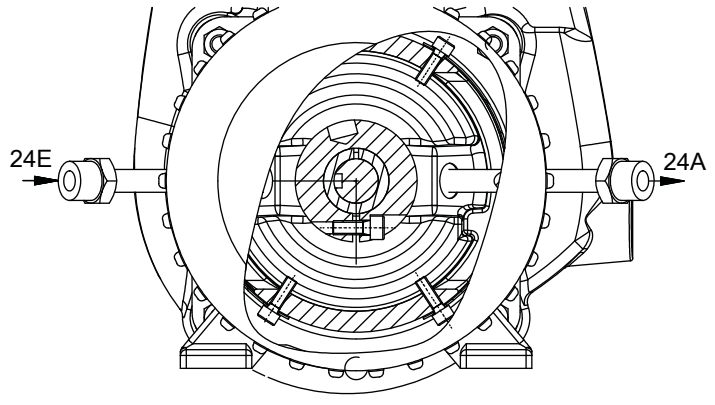
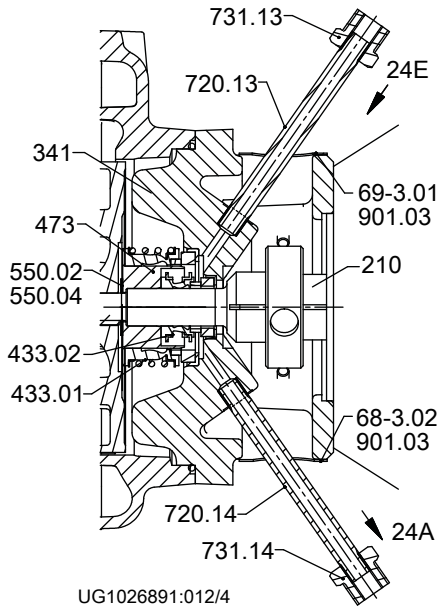


Fig. 12: Variant with double mechanical seal in tandem arrangement

Table 32: List of components

Part No.	Description	Part No.	Description
210	Shaft	550.02/04	Disc
341	Drive lantern	68-3.01/02	Cover plate
433.01	Mechanical seal (inboard)	720.13/14	Fitting
433.02	Mechanical seal (outboard)	731.13/14	Reducing nipple
473	Primary ring carrier	901.03	Hexagon head bolt

Table 33: Connections

Part No.	Description	Part No.	Description
24A	Quench liquid outlet	24E	Quench liquid inlet

Table 35: Connections

Part No.	Description	Part No.	Description
6B	Fluid drain	6D	Fluid priming and venting

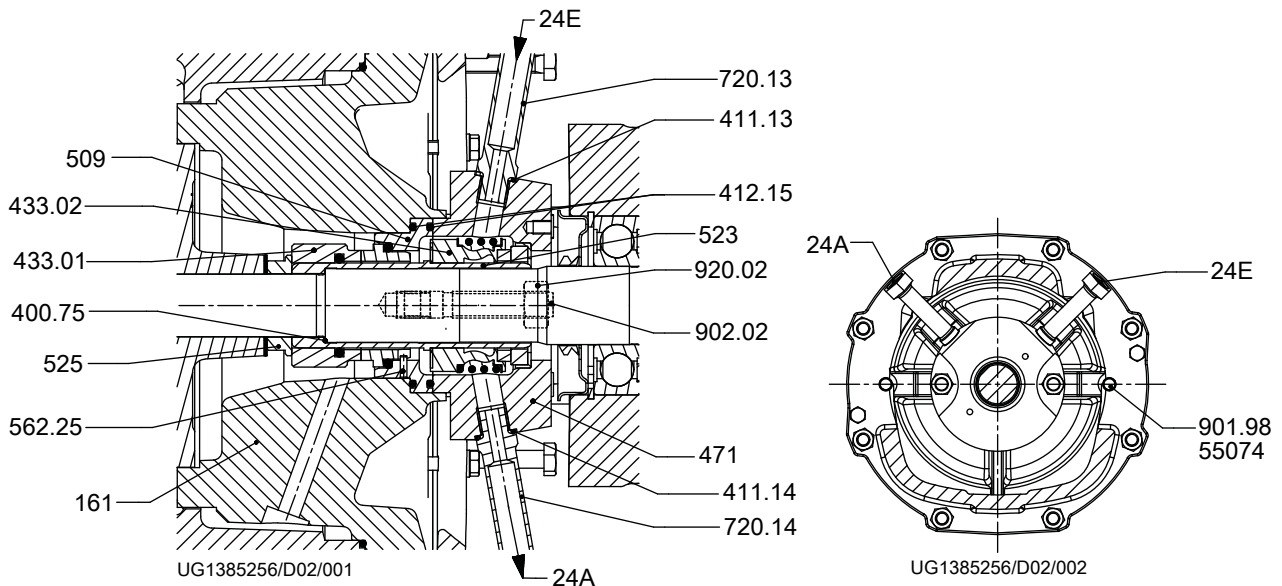


Fig. 15: Variant with double mechanical seal in tandem arrangement

Table 36: List of components

Part No.	Description	Part No.	Description
161	Casing cover	509	Intermediate ring
400.75	Gasket	523	Shaft sleeve
411.13/.14	Joint ring	525 ¹³⁾	Spacer sleeve
412.15	O-ring	562.25	Parallel pin
433.01	Mechanical seal (inboard)	720.13/.14	Fitting
433.02	Mechanical seal (outboard)	902.02	Stud
471	Seal cover	920.02	Nut

Table 37: Connections

Part No.	Description	Part No.	Description
24A	Quench liquid outlet	24E	Quench liquid inlet

13) For shaft unit 35 only; shaft unit see data sheet.

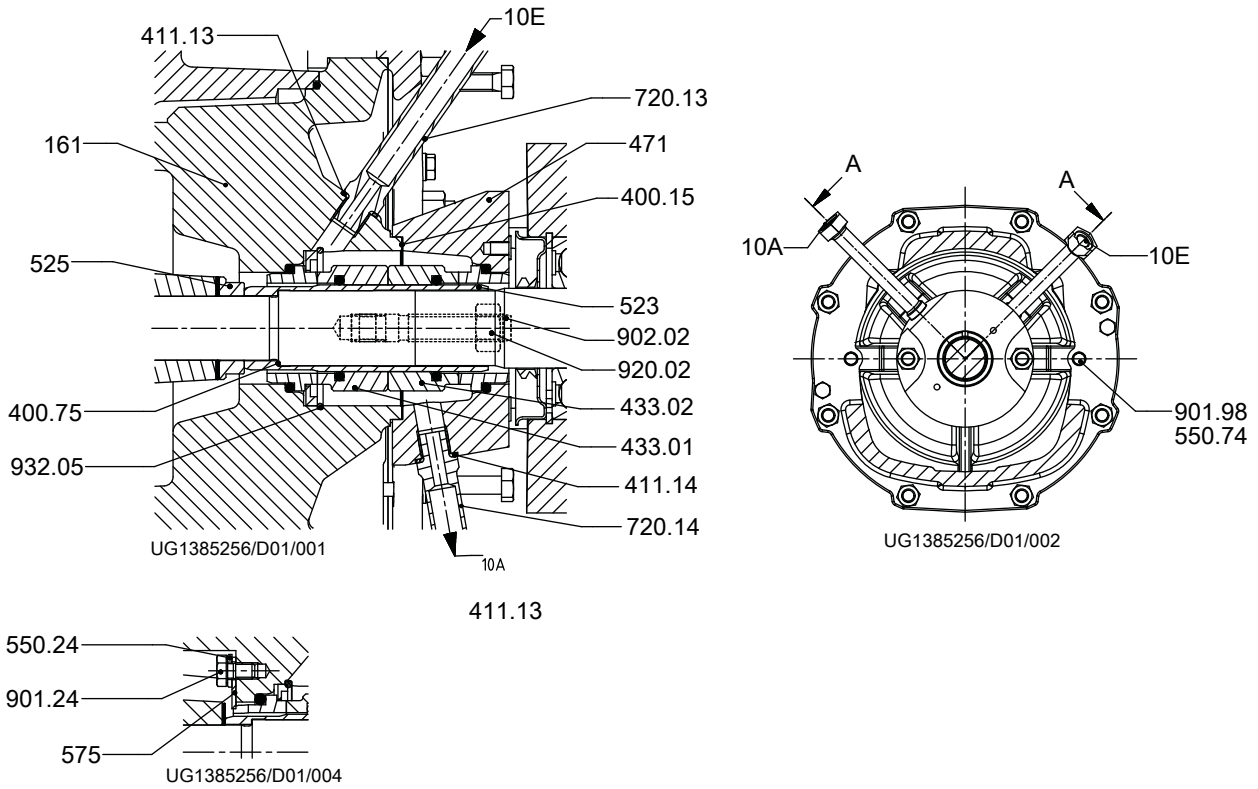


Fig. 16: Variant with double mechanical seal in back-to-back arrangement

Table 38: List of components

Part No.	Description	Part No.	Description
161	Casing cover	550.24	Disc
400.15 ¹⁴⁾ /75	Gasket	575	Lug
411.13/.14	Joint ring	720.13/.14	Fitting
433.01	Mechanical seal (inboard)	901.24	Hexagon head bolt
433.02	Mechanical seal (outboard)	902.02	Stud
471	Seal cover	920.02	Nut
523	Shaft sleeve	932.05	Circlip
525 ¹⁵⁾	Spacer sleeve		

Table 39: Connections

Part No.	Description	Part No.	Description
10A	Barrier fluid outlet	10E	Barrier fluid inlet

14) Only for shaft unit 25: joint ring 411.15
 15) For shaft unit 35 only; shaft unit see data sheet.

10 EU Declaration of Conformity

Manufacturer: **KSB ITUR Spain, S.A.**
Camino de Urteta, s/n
20800 Zarautz (Spain)

The manufacturer herewith declares that the product:

Etaprime L, Etaprime B

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 EU Declaration of Conformity was issued in/on:

Place, date

.....¹⁶⁾.....

Name
Function
Company
Address

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

11 Certificate of Decontamination

Type:

Order number/

Order item number¹⁷⁾:

Delivery date:

Field of application:

Fluid handled¹⁷⁾:

Please tick where applicable¹⁷⁾:



Radioactive



Explosive



Corrosive



Toxic



Harmful



Bio-hazardous



Highly flammable



Safe

Reason for return¹⁷⁾:

Comments:

.....

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

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

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

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

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

.....

.....

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

.....

Place, date and signature

.....

Address

.....

Company stamp

17) Required fields

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