Vertical Low-pressure Pump

Etanorm V

Design D

Operating Manual

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Operating Manual Etanorm V

Original operating manual

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Glossary

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

Pump

Machine without drive, additional components or accessories

Pump set

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

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇨ Section 2.3, Page 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 dimensions 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
Assembly drawing[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 included in agreed scope of supply

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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.
	**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

DANGER

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

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

2.1 General

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

2.2 Intended use

- The product must not be used in potentially explosive atmospheres.
- 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.

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

2.7 Safety information for maintenance, inspection and installation

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

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- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.3, Page 31)
- Decontaminate pumps which handle fluids posing a health hazard. (⇨ Section 7.4, Page 36)
- 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 28)

2.8 Unauthorised modes of operation

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

The warranty relating to the operating reliability and safety of the pump (set) supplied is only valid if the equipment is used in accordance with its intended use. (⇨ Section 2.2, Page 8)

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3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

DANGER

The pump (set) could slip out of the suspension arrangement

Danger to life from falling parts!

- Always transport the pump (set) in the specified position.
- Never attach the suspension arrangement to the free shaft end 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.

CAUTION

Incorrect transport of the pump set

Damage to the tie bolts.

- Do not attach any ropes in the area of the tie bolts 905.
- Do not place or support the pump set on tie bolts 905.

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

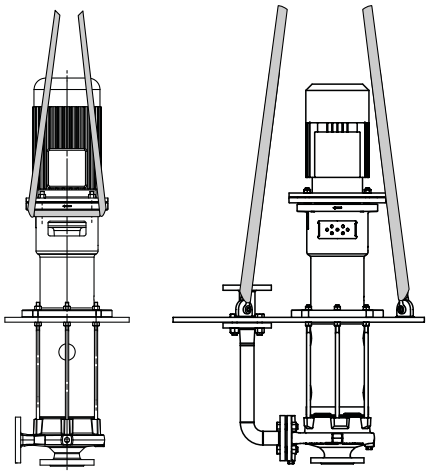

Fig. 1: Transporting the pump set without/with cover plate up to motor size 160

NOTE

For pump sets with motors of size 180 or larger the pump and motor are supplied separately as the motor weighs more than the pump. The motor is mounted on site. If required, screw eyebolts for attaching the lifting gear into the threaded holes of the lantern.

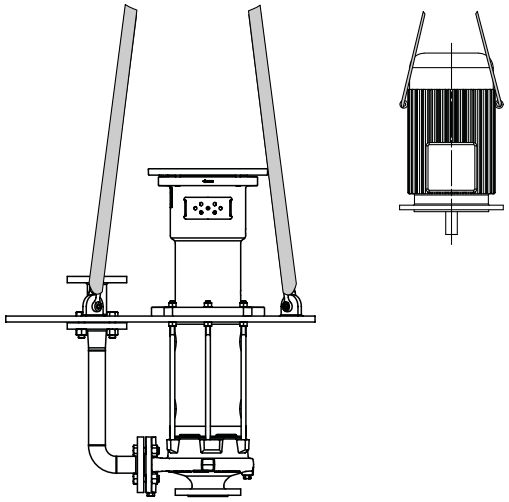

Fig. 2: Transporting the pump and motor from motor size 180 upwards

3.3 Storage/preservation

	**CAUTION** **Damage during storage due to humidity, dirt or vermin** Corrosion/contamination of pump (set)! ▷ For outdoor storage cover the pump (set) and accessories with waterproof material and protect against condensation.

	**CAUTION** **Wet, contaminated or damaged openings and connections** Leakage or damage to the pump! ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

If commissioning is to take place some time after delivery, we recommend that the following measures be taken for pump (set) 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 31)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇨ Section 7.4, Page 36)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids. (⇨ Section 6.5, Page 32)
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
   Indicate any safety measures and decontamination measures taken.
   (⇨ Section 11, Page 50)

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NOTE

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

3.5 Disposal

⚠ WARNING

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

Hazard to persons and the environment!

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

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

- Vertical low-pressure centrifugal pump

Pump for handling neutral degreasing and phosphating agents, wash water with degreasing agents and electrodeposition paints.

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

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see https://www.ksb.com/ksb-en/About-KSB/Corporate-responsibility/reach/ .

4.3 Designation

Table 4: 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	33	34	35	36
E	T	N	V	0	5	0	-	0	3	2	-	1	2	5	1	G	G	S	D	D	B	0	4	2	2	0	0	7	5	2	B	P	D	2	E
See name plate and data sheet																										See data sheet									

Table 5: Designation key

Position	Code	Description	
1-4	Pump type		
	ETNV	Etanorm V	
5-16	Size, e.g.		
	050	Nominal suction nozzle diameter [mm]	
	032	Nominal discharge nozzle diameter [mm]	
	1251	Nominal impeller diameter [mm]	
17	Pump casing material		
	C	Stainless steel	1.4408 / A743CF8M
	G	Cast iron	EN-GJL-250/A48 CL 35B
18	Impeller material		
	B	Bronze	CC480K-GS / B30 C90700
	C	Stainless steel	1.4408 / A743CF8M
	G	Cast iron	EN-GJL-250/A48 CL 35B
19	Design		
	S	Standard	
	X	Non-standard (BT3D, BT3)	
20	Shaft design		
	D	Dry	
	V	Vacuum	
	W	Wet	
21	Scope of supply		
	A	Pump only (Fig. 0 bare-shaft pump)	
	C	Pump, coupling	
	D	Pump set	
22	Cover plate		
	B	Cover plate	
	H	Halter	
23-25	Immersion depth [mm]		
	037	375	
	039	398	
	042	425	

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Position	Code	Description
23-25	044	448
	050	504
	052	529
	053	535
	075	750
	100	1000
	125	1250
	150	1500
	170	1750
	200	2000
26	Shaft unit	
	2	Shaft unit 25
	3	Shaft unit 35
	5	Shaft unit 55
27-30	Motor rating P_N [kW]	
	0007	0,75
	...	...
	1320	132,00
	----	Without motor
31	Number of motor poles	
	-	Without motor
32	Product generation	
	B	Etanorm V 2013
33-36	Variant	
	-	Fixed speed version (without PumpDrive)
	PD2	Variable speed version, with PumpDrive 2
	PD2E	Variable speed version, with PumpDrive 2 Eco

4.4 Name plate

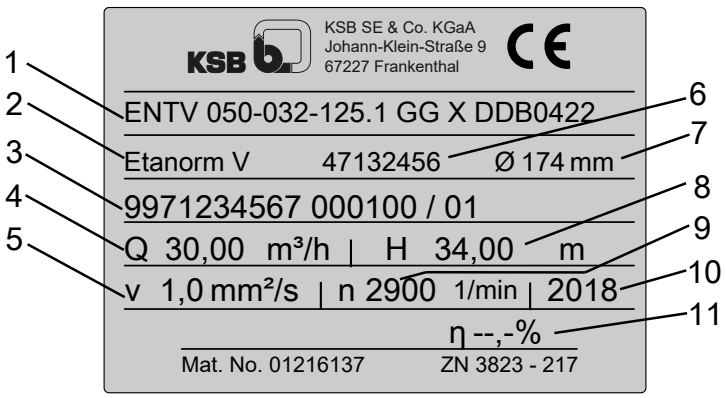

Fig. 3: Name plate (example)

1	Type series code, size and version	2	Type series
3	KSB order No., order item No. and consecutive No.	4	Flow rate
5	Kinematic viscosity of the fluid handled	6	Material number (if applicable)

7	Impeller diameter	8	Head
9	Speed	10	Year of construction
11	Efficiency (see data sheet)		

4.5 Design details

Design

- Volute casing pump
- For vertical installation in closed tanks under atmospheric pressure
- Single-stage
- Ratings to EN 733
- Rigid connection between pump and motor

Pump casing

- Radially split volute casing

Stainless steel variant / grey cast iron variant for design with shaft unit WS 55:

- Volute casing with integrally cast pump feet
- Replaceable casing wear rings

Drive

- KSB surface-cooled IEC three-phase current squirrel-cage motor
- Type of construction IM V1
- Rated voltage (50 Hz) 220-240 V / 380-420 V ≤ 2.20 kW
- Rated voltage (50 Hz) 380-420 V / 660 - 725 V ≥ 3.00 kW
- Rated voltage (60 Hz) 440-480 V ≤ 2.60 kW
- Rated voltage (60 Hz) 440-480 V ≥ 3.60 kW
- Enclosure IP55
- Thermal class F with temperature sensor, 3 PTC thermistors
- Duty type: continuous duty S1

Contact guard

Design D:

- Cover plates at bearing lantern to EN 294

Design W:

- Cover plates at drive lantern to EN 294

Shaft seal

- Controlled gap

Impeller type

- Closed radial impeller with multiply curved vanes

Bearings

Design D:

- Deep groove ball bearings greased for life in a bearing lantern above the cover plate, pump shaft cantilevered below the cover plate

Design W:

- Product-lubricated SiC/SiC plain bearing (pump end), rigid coupling between pump shaft and motor shaft

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Automation

Automation options:

- PumpDrive
- KSB SuPremE
- Efficiency class IE4/IE5 to IEC TS 60034-30-2:2016

For operating an Etanorm V on a frequency inverter which has not been configured via the KSB selection tool consultation with KSB is required.

For operating pump sets at immersion depths > 1000 mm with variable-speed system consultation with KSB is required for the selection.

4.6 Configuration and function

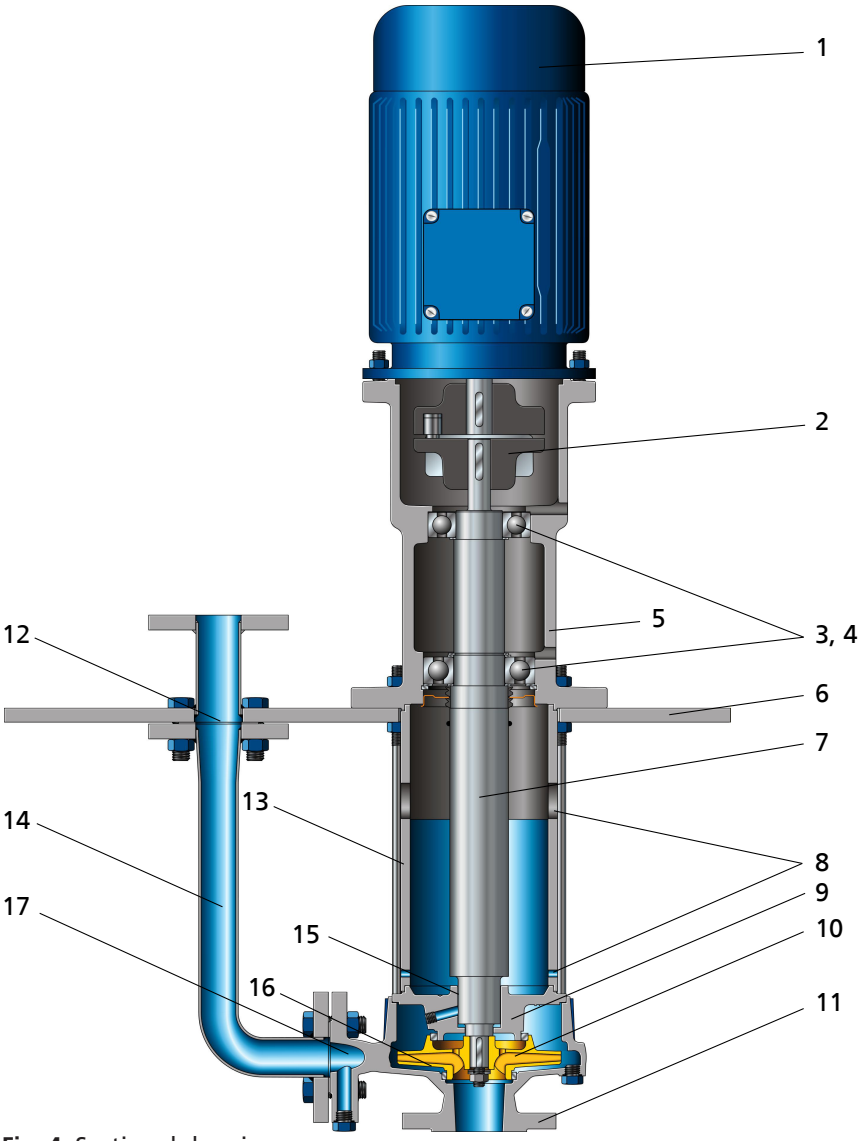

Fig. 4: Sectional drawing

1	Motor housing	2	Shaft coupling
3, 4	Rolling element bearing	5	Bearing lantern
6	Cover plate	7	Shaft
8	Overflow opening	9	Casing cover
10	Impeller	11	Suction nozzle
12	Discharge nozzle, cover plate	13	Support column

14	Riser	15	Shaft passage
16	Clearance gap	17	Discharge nozzle, volute casing

Design The pump is designed with an axial fluid inlet and a radial fluid outlet. The hydraulic system runs in its own bearings (3, 4) and is connected to the motor by a shaft coupling (2). Thanks to the graded lengths of support column (13) and shaft (7) the pump set can be matched to various immersion depths. The pump set is mounted on a cover plate (6). The discharge nozzle of the volute casing (17) is connected with the discharge nozzle (12) of the cover plate via a riser (14). If on request the pump set is supplied without cover plate and riser, it is supplied with a bracket.

Function The fluid enters the pump via the suction nozzle (11) and is accelerated outward by the rotating impeller (10). 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 (17), where it leaves the pump. The controlled gap seal (16) prevents any fluid from flowing back from the casing to the suction nozzle. At the rear side of the impeller, the shaft (7) enters the hydraulic system through the casing cover (9). The shaft runs in rolling element bearings (3 and 4), which are supported by a bearing lantern (5) linked with the pump casing and/or casing cover (9) via the support column (13).

Sealing The pump is seal-less with little leakage flowing into the support column (8) at the shaft passage (9) and then through the overflow opening (7) back to the tank.

4.7 Noise characteristics

Table 6: Surface sound pressure level L_{pA} [2)]

Rated power input P_N [kW]	Pump set:	
	1450 rpm [dB]	2900 rpm [dB]
2,2	64	69
3,0	64	71
4,0	62	73
5,5	68	72
7,5	68	72
11,0	69	75
15,0	69	75
18,5	70	75
22,0	72	78
30,0	71	79
37,0	71	79
45,0	73	79
55,0	74	79
75,0	75	82
90,0	76	82

In wet installation, the pump itself does not contribute to sound emission levels.

4.8 Scope of supply

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

- Pump
- Drive
- Cover plate
- Discharge line

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2 Surface sound pressure level to ISO 3744, valid for a pump operating range of Q/QBEP = 0.8 - 1.1 and non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance.

4.9 Pump size / shaft unit combinations

Table 7: Sizes with shaft unit WS 25

Size	Casing cover design	
	Clamped	Bolted
050-032-125.1	✘	-
050-032-160.1	✘	-
050-032-200.1	-	✘
050-032-250.1	-	✘
050-032-125	✘	-
050-032-160	✘	-
050-032-200	-	✘
050-032-250	-	✘
065-040-125	✘	-
065-040-160	✘	-
065-040-200	-	✘
065-040-250	-	✘
065-050-125	✘	-
065-050-160	✘	-
065-050-200	-	✘
065-050-250	-	✘
080-065-125	✘	-
080-065-160	✘	-
080-065-200	-	✘
100-080-160	✘	-

Table 8: Sizes with shaft unit WS 35

Size	Casing cover design	
	Clamped	Bolted
065-040-315	-	✘
065-050-315	-	✘
080-065-250	-	✘
080-065-315	-	✘
100-080-200	✘	-
100-080-250	-	✘
100-080-315	-	✘
125-100-160	✘	-
125-100-200	✘	-
125-100-250	-	✘
125-100-315	-	✘
150-125-200	✘	-
150-125-250	-	✘
200-150-200	✘	-
200-150-250	-	✘

Table 9: Sizes with shaft unit WS 55

Size	Casing cover design	
	Clamped	Bolted
100-080-400	-	✘
125-100-400	-	✘
150-125-315	✘	-
150-125-400	-	✘

Size	Casing cover design	
	Clamped	Bolted
200-150-315	✗	-
200-150-400	-	✗

4.10 Dimensions and weights

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

5 Installation at Site

5.1 Safety regulations

DANGER

Installing electric equipment (motors) in potentially explosive atmospheres

Risk of explosion!

- Comply with the applicable local explosion protection regulations.
- Verify the test certificate of the motor.
- Keep the test certificate close to the location of operation (e.g. in the foreman's office).

5.2 Checks to be carried out prior to installation

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

5.3 Installing the pump set

Foundation

The sturdy cover plate 68-3.01 serves as a foundation on which the pump set is fastened. This cover plate covers the tank opening completely. If the pump set is supplied with cover plate and riser, the cover plate is supported by a sectional steel frame provided on the tank.

If ordered without cover plate and riser, the pump set is supplied with a bolted-on bracket 732. This bracket serves to mount the pump set on the tank.

Installing the pump

1. Carefully align the support for the cover plate or the base of the bracket.
2. Align the upper flange of the bearing/intermediate lantern with a spirit level.
3. Make adjustments between cover plate and tank edge, if required.
   If the pump is installed without a suction strainer, observe a minimum distance B to the tank floor.

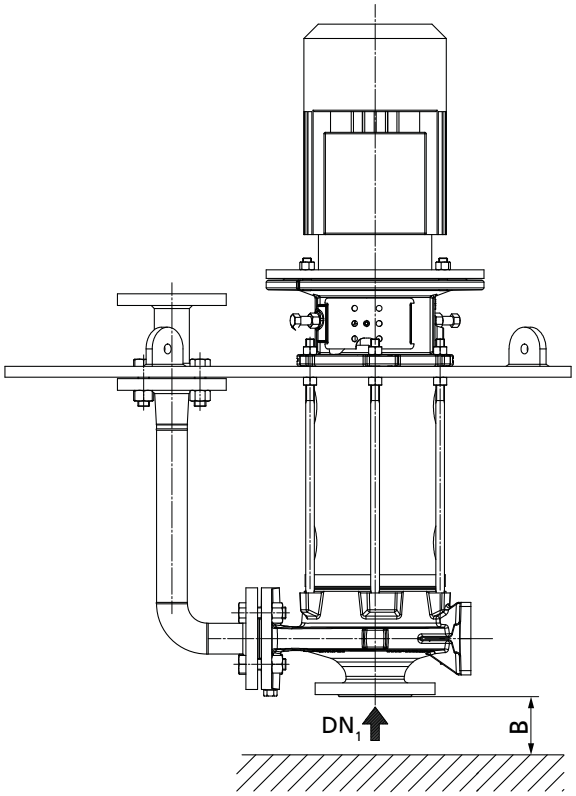

Fig. 5: Distance from the floor

Table 10: Distance from the floor in [mm]

DN_1	B
50	≥80
65	≥80
80	≥100
100	≥100
125	≥100
150	≥150
200	≥150

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Mounting the motor

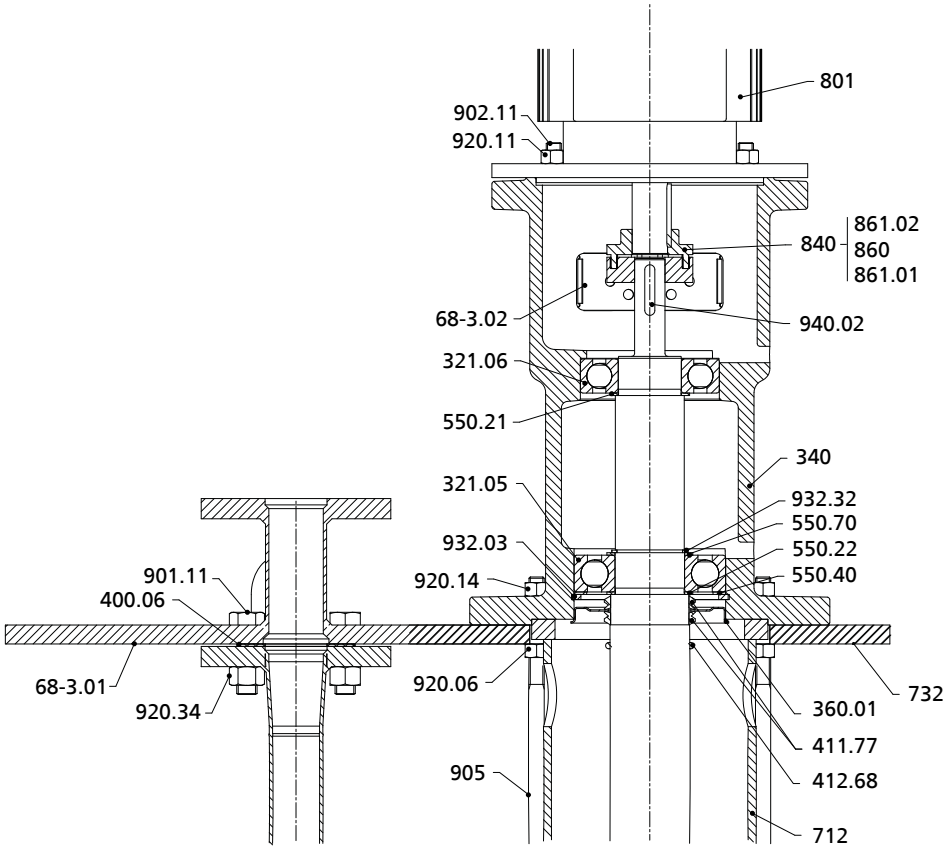

Fig. 6: Fastening the pump with motor

1. Tighten hexagon nuts 920.11 on studs 902.11.
   The motor and bearing/intermediate lantern are centred via the motor flange.

Securing the coupling

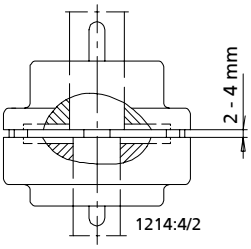

Fig. 7: Coupling clearance

✓ The coupling is torsionally flexible and dampens shock and vibrations.

✓ The motor has been mounted on the pump.

1. Secure both coupling halves flush with the shaft ends using a grub screw each.
   The clearance between the two coupling halves must range between 2 and max. 4 mm.

5.4 Piping

5.4.1 Connecting the piping

DANGER

Impermissible loads acting on the pump nozzles

Danger to life from leakage of hot, toxic, corrosive or flammable fluids!

- ▷ Do not use the pump as an anchorage point for the piping.
- ▷ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains.
- ▷ Take appropriate measures to compensate for thermal expansion of the piping.

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

- ▷ Never earth the electric welding equipment on the pump or baseplate.
- ▷ Prevent current flowing through the rolling element bearings.

NOTE

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

✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.

✓ To prevent excessive pressure losses, adapters to larger diameters have a diffuser angle of approx. 8°.

✓ The pipeline is anchored in close proximity to the discharge flange and connected without transmitting any stresses or strains. Its weight must not be carried by the pump discharge flange.

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Check that the coupling and shaft can easily be rotated by hand.

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5.4.2 Permissible forces and moments at the pump nozzles

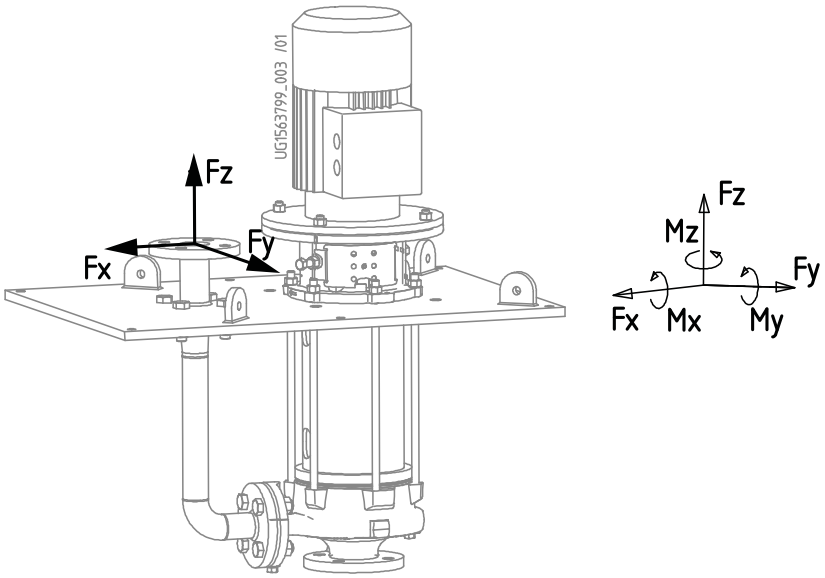

Fig. 8: Forces and moments at the pump nozzles

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

Table 11: Forces and moments at the pump nozzles

Size	Suction nozzle / discharge nozzle							
	DN_3	F_x	F_y	F_z	$\sum F$	M_x	M_y	M_z
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
050-032-125.1	40	780	640	1000	1421	500	280	415
050-032-160.1	40	780	640	1000	1421	500	280	415
050-032-200.1	40	780	640	1000	1421	500	280	415
050-032-250.1	40	780	640	1000	1421	500	280	415
050-032-125	40	780	640	1000	1421	500	280	415
050-032-160	40	780	640	1000	1421	500	280	415
050-032-200	40	780	640	1000	1421	500	280	415
050-032-250	40	780	640	1000	1421	500	280	415
065-040-125	50	1000	830	1250	1803	650	320	500
065-040-160	50	1000	830	1250	1803	650	320	500
065-040-200	50	1000	830	1250	1803	650	320	500
065-040-250	50	1000	830	1250	1803	650	320	500
065-040-315	50	1000	830	1250	1803	650	320	500
065-050-125	65	1300	1050	1600	2314	1050	550	790
065-050-160	65	1300	1050	1600	2314	1050	550	790
065-050-200	65	1300	1050	1600	2314	1050	550	790
065-050-250	65	1300	1050	1600	2314	1050	550	790
065-050-315	65	1300	1050	1600	2314	1050	550	790
080-065-125	80	1550	1300	1950	2810	1350	690	1000
080-065-160	80	1550	1300	1950	2810	1350	690	1000
080-065-200	80	1550	1300	1950	2810	1350	690	1000
080-065-250	80	1550	1300	1950	2810	1350	690	1000
080-065-315	80	1550	1300	1950	2810	1350	690	1000
100-080-160	100	2000	1600	2500	3579	1850	900	1400
100-080-200	100	2000	1600	2500	3579	1850	900	1400

Size	Suction nozzle / discharge nozzle							
	DN_3	F_x	F_y	F_z	$\sum F$	M_x	M_y	M_z
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
100-080-250	100	2000	1600	2500	3579	1850	900	1400
100-080-315	100	2000	1600	2500	3579	1850	900	1400
100-080-400	100	2000	1600	2500	3579	1850	900	1400
125-100-160	125	2700	2200	3400	4867	2550	1300	1900
125-100-200	125	2700	2200	3400	4867	2550	1300	1900
125-100-250	125	2700	2200	3400	4867	2550	1300	1900
125-100-315	125	2700	2200	3400	4867	2550	1300	1900
125-100-400	125	2700	2200	3400	4867	2550	1300	1900
150-125-200	150	3450	2850	4300	6206	3150	1600	2450
150-125-250	150	3450	2850	4300	6206	3150	1600	2450
150-125-315	150	3450	2850	4300	6206	3150	1600	2450
150-125-400	150	3450	2850	4300	6206	3150	1600	2450
200-150-200	200	5250	4300	6750	9572	4850	2450	3550
200-150-250	200	5250	4300	6750	9572	4850	2450	3550
200-150-315	200	5250	4300	6750	9572	4850	2450	3550
200-150-400	200	5250	4300	6750	9572	4850	2450	3550

5.5 Electrical connection

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

- Always have the electrical connections installed by a trained electrician.
- Observe regulations IEC 60364 and, for explosion-proof versions, BS 60079 .

WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

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

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

NOTE

Installing a motor protection device is recommended.

5.5.1 Setting the time relay

CAUTION

Switchover between star and delta on three-phase motors with star-delta starting takes too long.

Damage to the pump (set)!

- Keep switch-over intervals between star and delta as short as possible.

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Table 12: Time relay settings for star-delta starting:

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

5.5.2 Connecting the motor

NOTE

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.

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

⚠ WARNING

Hands inside the pump casing

Risk of injuries, damage to the pump!

- ▹ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

⚠ WARNING

Reaching into the bearing lantern opening

Risk of injury!

- ▹ When the cover plate is removed, never reach into the uncovered opening.

CAUTION

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.

The correct direction of rotation of the motor and pump is clockwise (seen from the motor 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 drive lantern / bearing lantern.
3. If the motor is running 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 properly connected to the power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled. The pump has been vented. (⇨ Section 6.1.3, Page 28)
- The direction of rotation has been checked. (⇨ Section 5.6, Page 27)
- 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 31)

6.1.2 Shaft seal

Shaft unit 25/35 (⇨ Section 4.9, Page 19)

Shaft seal by bearing cover 360.01 with a joint ring 411.77 each at the top and at the bottom.

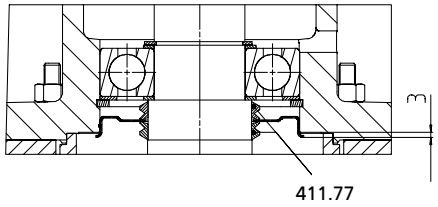

Fig. 9: Shaft seal for shaft units 25 and 35

Shaft unit 55 (⇨ Section 4.9, Page 19)

Shaft sealing is effected by lip seal 421 and joint ring 411.77 fitted beneath the radial ball bearing, preventing the fluid handled from entering the bearing and the grease from contaminating the fluid handled.

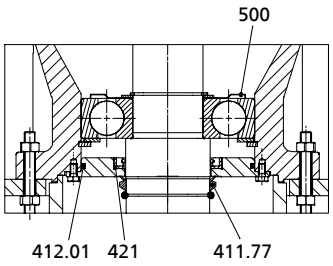

Fig. 10: Shaft seal for shaft unit 55

6.1.3 Priming and venting the pump

	**CAUTION** **Increased wear due to dry running** Damage to the pump set! ▷ Never operate the pump set without liquid fill.
	**CAUTION** **Fluid entering the bearings** Damage to the pump! ▷ Never allow the fluid level to rise above the cover plate/bracket.

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During pump start-up and operation, the fluid level must be within 130 mm above the volute casing centreline and 50 mm below the cover plate/bracket.

6.1.4 Start-up

CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

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

- ✓ The system piping has been cleaned.
- ✓ Pump, suction line and inlet tank, if any, have been vented and primed with the fluid to be handled.
- ✓ The fluid level has been checked.

1. Close or slightly open the shut-off element in the discharge line.
2. Start up the motor.
3. Immediately after the pump has reached full rotational speed, slowly open the shut-off element in the discharge line and adjust it to comply with the duty point.

6.1.5 Shutdown

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

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.

CAUTION

Risk of freezing during prolonged pump shutdown periods

Damage to the pump!

- ▹ Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.

6.2 Operating limits

DANGER

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

Explosion hazard!

Leakage of hot or toxic fluid handled!

- ▹ Comply with the operating data indicated in the data sheet.
- ▹ Never use the pump to handle fluids it is not designed for.
- ▹ Avoid prolonged operation against a closed shut-off element.
- ▹ Never operate the pump at temperatures exceeding those specified in the data sheet or on the name plate unless the written consent of the manufacturer has been obtained.

6.2.1 Ambient temperature

CAUTION

Operation outside the permissible ambient temperature

Damage to the pump (set)!

- ▷ Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 13: Permissible ambient temperatures

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

6.2.2 Frequency of starts

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

To prevent high temperature increases in the motor and excessive loads on the pump, coupling, motor, seals and bearings, do not exceed 10 start-ups per hour [h].

CAUTION

Re-starting while motor is still running down

Damage to the pump (set)!

- ▷ Do not re-start the pump set before the pump rotor has come to a standstill.

6.2.3 Fluid handled

6.2.3.1 Flow rate

Table 14: Flow rate

	Minimum flow rate	Maximum flow rate
For a short period (approximately 2 minutes)	≈ 15 % of Q_{Opt} [3)]	See hydraulic characteristic curves
Continuous duty	$Q_{Teillast}$ ≥ 50 % of Q_{Opt} [3)]	

6.2.3.2 Density of the fluid handled

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

CAUTION

Impermissibly high density of the fluid handled

Motor overload!

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

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3 Best efficiency point

6.2.3.3 Temperature of the fluid handled

CAUTION

Evaporated fluid washes lubricant out of the bearing

Damage to the bearings!

- ▹ Never exceed the fluid temperature of 70 °C.
- ▹ The fluid temperature must remain at least 5 °C below the boiling point.

6.2.3.4 Abrasive fluids

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.

The fluid handled may contain abrasive particles up to a maximum content of 5 g/dm^3 and a maximum particle size of 0.5 mm.

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 7.4, Page 36)

✓ The safety instructions for dismantling the pump have been observed. (⇨ Section 7.5.1, Page 36)

✓ The permissible ambient temperature for storing the pump is observed.

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 28)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 33)

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

- ▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.

NOTE

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

6.5 Cleaning the pump set

CAUTION

Cleaning the pump set

Damage to the coupling and bearing!

- ▷ Never allow spray water to enter the coupling and bearing area through the bearing lantern's cover plate.

NOTE

For the electric motor observe the manufacturer´s product literature.

7 Servicing/Maintenance

7.1 Safety regulations

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

⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

⚠ WARNING

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

Risk of injury!

- Observe all relevant laws.
- When draining the fluid take appropriate measures to protect persons and the environment.
- Decontaminate pumps which handle fluids posing a health hazard.

⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

- During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.

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

NOTE

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

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/Inspection

7.2.1 Supervision of operation

CAUTION

Increased wear due to dry running

Damage to the pump set!

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

CAUTION

Impermissibly high temperature of fluid handled

Damage to the pump!

- ▷ 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.

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.
- Check the static seals for leakages.
- 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 stand-by pump.
  To make sure that the stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.
  The bearing temperature must not exceed 90 °C (measured on the outside of the motor housing).

CAUTION

Operation outside the permissible bearing temperature

Damage to the pump!

- ▷ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the motor housing).

NOTE

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).

7.2.2 Inspection work

7.2.2.1 Checking the coupling

Check the flexible elements of the coupling. Replace the relevant parts in due time if there is any sign of wear and check the alignment.

7.2.2.2 Checking the clearances

If the clearances need to be checked, remove the impeller. If the clearance gap is larger or smaller than permitted (see the following table), replace casing wear rings 502.01 and/or 502.02.
The clearances given refer to the diameter.

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Table 15: Clearances between impeller and casing / between impeller and casing cover depending on the material variant

Clearances	Material variant	
	GG	CC
As-new	0,3 mm	0,5 mm
Maximum permissible enlargement	0,9 mm	1,5 mm

7.3 Lubrication and lubricant change of rolling element bearings

7.3.1 Grease lubrication

The bearings are supplied packed with high-quality lithium-soap grease.

7.3.1.1 Intervals

Under normal conditions the grease-lubricated bearings will run for 15,000 operating hours or 2 years. Under unfavourable operating conditions (e.g. high room temperature, high atmospheric humidity, dust-laden air, aggressive industrial atmosphere etc.), check the bearings earlier and clean and relubricate them if required.

7.3.1.2 Grease quality

Optimum grease properties for rolling element bearings

Table 16: Grease quality to DIN 51825

Soap basis	NLGI grade	Worked penetration at 25° C in mm/10	Drop point
Lithium	2 to 3	220-295	≥ 175 °C

- Free of resin and acid
- Not liable to crumble
- Rust-preventive characteristics

If required, the bearings may be lubricated with greases of other soap bases. Make sure to remove any old grease and rinse the bearings thoroughly.

7.3.1.3 Grease quantity

Shaft unit[4)]	Pump end		Motor end	
	Code	Grease per bearing (approx. qty. in grams)	Code	Grease per bearing (approx. qty. in grams)
25	63112ZC3	22	63102ZC3	22
35	63112ZC3	22	63102ZC3	22
55	6413C3[5)]	65	63112ZC3	65

4 Shaft unit see data sheet.
5 Axial sealing ring (Nilos ring)

7.3.1.4 Changing the grease

CAUTION

Mixing greases of differing soap bases

Changed lubricating qualities!

- ▷ Thoroughly clean the bearings.
- ▷ Adjust the re-lubrication intervals to the grease used.

✓ The pump has been dismantled for changing the grease.

1. Only half-fill the bearing cavities with grease.

7.4 Drainage/cleaning

⚠ WARNING

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

Hazard to persons and the environment!

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

1. 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 50)

7.5 Dismantling the pump set

7.5.1 General information/Safety regulations

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- ▷ Properly shut down the pump set.
- ▷ Close the shut-off elements in the suction line and discharge line.
- ▷ Drain the pump and release the pump pressure. (⇨ Section 7.4, Page 36)
- ▷ Shut off any auxiliary feed lines.
- ▷ Allow the pump set to cool down to ambient temperature.

⚠ WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

- ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.

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⚠ WARNING

Hot surface

Risk of injury!

▹ Allow the pump set to cool down to ambient temperature.

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

Always observe the safety instructions and information. (⇨ Section 7.1, Page 33)

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

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

In the event of damage you can always contact our service departments.

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details 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.

7.5.2 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.

7.5.3 Removing the complete pump set from the piping

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 36) to (⇨ Section 7.5.2, Page 37) have been observed/carried out.

1. Unbolt the discharge nozzle from the pipeline.
2. Undo the bolts fastening the cover plate.
3. Remove the complete pump set with the cover plate from the tank opening.

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7.5.4 Removing the motor

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

▹ Suspend or support the motor to prevent it from tipping over.

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 36) to (⇨ Section 7.5.3, Page 37) have been observed/carried out.

✓ The removed pump with cover plate 68-3.01 is placed horizontally on a suitable base in a clean and level assembly area.

✓ A drip pan collecting any fluid escaping has been placed under the pump along the latter's entire length.

1. Remove cover plates 68-3.02 from bearing lantern 340.
2. Undo hexagon nuts 920.11.
3. Pull motor 801 off bearing lantern 340.

7.5.5 Removing the riser

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 36) to (⇨ Section 7.5.4, Page 38) have been observed/carried out.

1. Remove nuts 920.34/920.19 and bolts 901.11/901.39.
2. Remove riser 711.
3. Remove gaskets 400.06/400.16.

7.5.6 Removing the volute casing and support column

Clamped casing cover 161 - combination see (⇨ Section 4.9, Page 19)

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 36) to (⇨ Section 7.5.5, Page 38) have been observed/carried out.

1. Undo and remove nuts 920.14/920.06.
2. Remove volute casing 102 with tie bolts 905.
3. Dispose of gasket 400.10.
4. Remove impeller nut 920.95 with disc 550.95 (shaft unit 25 only), safety device 930.95 and impeller 230.
5. Separate casing cover 161, support column 712 and cover plate 68-3.01 or bracket 732.

Bolted casing cover 161 - combination see (⇨ Section 4.9, Page 19)

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 36) to (⇨ Section 7.5.5, Page 38) have been observed/carried out.

1. Undo and remove nuts 920.01.
2. Remove volute casing 102.
3. Dispose of gasket 400.10.
4. Remove impeller nut 920.95 with disc 550.95 (shaft unit 25 only), safety device 930.95 and impeller 230.
5. Undo and remove nuts 920.14/920.06.
6. Remove casing cover 161 and tie bolts 905.
7. Separate support column 712, cover plate 68-3.01 and/or bracket 732.

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7.5.7 Removing the bearing lantern with shaft

Shaft unit 25/35 (⇨ Section 4.9, Page 19)

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 36) to (⇨ Section 7.5.6, Page 38) have been observed/carried out.

✓ O-ring 412.68 and joint ring 411.77 have been removed from the shaft.

1. Pull bearing cover 360.01 off with a suitable tool.
2. Remove joint ring 411.77.

Shaft unit 55 (⇨ Section 4.9, Page 19)

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 36) to (⇨ Section 7.5.6, Page 38) have been observed/carried out.

✓ O-ring 412.68 and joint ring 411.77 have been removed from the shaft.

1. Remove bolts 901.36.
2. Remove bearing cover 360.01 with lip seal 421 and O-ring 412.01.
3. Undo the grub screw on coupling half 861.01.
4. Pull off coupling half 861.01 using a puller.
5. Remove key 940.02 from the keyway in shaft 210.
6. Remove circlip 932.03 and spacer disc 550.40 from the bearing lantern.
7. Carefully press the shaft with ball bearing out of the bearing lantern.
8. Pull deep groove ball bearing 321.06 off shaft 210.
9. Remove disc 550.21.
10. Remove circlip 932.32 with disc 550.70.
11. Pull deep groove ball bearing 321.05 off shaft 210.
12. Remove disc 550.22 from the shaft.

7.6 Reassembling the pump set

7.6.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

CAUTION

Improper reassembly

Damage to the pump!

▹ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.

▹ Use original spare parts only.

Sequence

Always reassemble the pump in accordance with the corresponding general assembly drawing or 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 aids

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 7.7, Page 42)

7.6.2 Fitting the bearing lantern with shaft

Shaft unit 25/35
(⇨ Section 4.9, Page 19)

- ✓ The individual parts are kept in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Slide disc 550.22 onto the shaft.
2. Slide radial ball bearing 321.05 onto shaft 210.
3. Fit disc 550.70 with circlip 932.32.
4. Slide disc 550.21 upwards.
5. Slide radial ball bearing 321.06 onto shaft 210.
6. Carefully press the shaft with ball bearing into bearing lantern 340.
7. Fasten spacer disc 550.40 and circlip 932.03 in the bearing lantern.
8. Press key 940.02 into the keyway of shaft 210.
9. Fit coupling half 861.01.
10. Tighten the grub screw on coupling half 861.01.
11. Fit joint ring 411.77.
12. Press in bearing cover 360.01 with a suitable tool. Distance 3 mm
    (⇨ Section 6.1.2, Page 28)
13. Slide joint ring 411.77 and O-ring 412.68 onto shaft 210.

Shaft unit 55
(⇨ Section 4.9, Page 19)

- ✓ The individual parts are kept in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Slide radial ball bearing 321.05 onto shaft 210.
2. Fit axial sealing ring 500 (Nilos ring) and disc 550.70 with circlip 932.32.
3. Slide disc 550.21 upwards.
4. Slide radial ball bearing 321.06 onto shaft 210.
5. Carefully press the shaft with ball bearing into bearing lantern 340.
6. Fasten spacer disc 550.40 and circlip 932.03 in the bearing lantern.
7. Press key 940.02 into the keyway of shaft 210.
8. Fit coupling half 861.01.
9. Tighten the grub screw on coupling half 861.01.
10. Fit bearing cover 360.01 with lip seal 421.01.
11. Tighten bolts 901.36.
12. Slide joint ring 411.77 and O-ring 412.68 onto the shaft.

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7.6.3 Installing the volute casing and support column

Clamped casing cover 161 - combination see (⇨ Section 4.9, Page 19)

✓ The notes and steps stated in (⇨ Section 7.6.1, Page 39) to (⇨ Section 7.6.2, Page 40) have been observed / carried out.

✓ Bearing lantern 340 has been placed in a clean and level assembly area and is protected against tipping over.

1. Place cover plate 68-3.01 or bracket 732 on bearing lantern 340 and support it to make sure it lies flush.
2. Fit support column 712 on bearing lantern 340.
3. Place casing cover 161 on the support column.
4. Fit gasket 400.10 on casing cover 161. (⇨ Section 7.6.1, Page 39)
5. Fit key 940.01 in shaft 210.
6. Fit impeller 230 on shaft 210 with disc 550.95 (shaft unit 25 only), safety device 930.95 and impeller nut 920.95.
7. When screwing on tie bolts 905 use the shorter thread end to screw them to volute casing 102. Screw nuts 920.06 to tie bolts 905, then guide the tie bolts through support column 712 into the drilled holes of cover plate 68-3.01 and bearing lantern 340.
8. Tighten nuts 920.14.
   Nuts 920.06 must remain accessible. (⇨ Section 7.7, Page 42)
9. Use nuts 920.06 to clamp cover plate 68-3.01 to bearing lantern 340.

Bolted casing cover 161 - combination see (⇨ Section 4.9, Page 19)

✓ The notes and steps stated in (⇨ Section 7.6.1, Page 39) to (⇨ Section 7.6.2, Page 40) have been observed / carried out.

✓ Bearing lantern 340 has been placed in a clean and level assembly area and is protected against tipping over.

1. Place cover plate 68-3.01 or bracket 732 on bearing lantern 340 and support it to make sure it lies flush.
2. Fit support column 712 on bearing lantern 340.
3. Fit key 940.01 in shaft 210.
4. When screwing on tie bolts 905 use the shorter thread end to screw them into casing cover 161. Screw nuts 920.06 to tie bolts 905, then guide the tie bolts through support column 712 into the drilled holes of cover plate 68-3.01 and bearing lantern 340.
5. Tighten nuts 920.14.
   Nuts 920.06 must remain accessible. (⇨ Section 7.7, Page 42)
6. Use nuts 920.06 to clamp cover plate 68-3.01 to bearing lantern 340.
7. Fit gasket 400.10 on casing cover 161. (⇨ Section 7.6.1, Page 39)
8. Fit impeller 230 on the shaft with disc 550.95 (shaft unit 25 only), safety device 930.95 and impeller nut 920.95.
9. Place volute casing 102 on discharge cover 161.
10. Bolt volute casing to casing cover 161 with nuts 920.01.
    (⇨ Section 7.7, Page 42)

7.6.4 Installing the riser

✓ The notes and steps stated in (⇨ Section 7.6.1, Page 39) to (⇨ Section 7.6.3, Page 41) have been observed/carried out.

1. Fit new gaskets 400.06/400.16 at the flanges connecting it to the pump and to the cover plate. (⇨ Section 7.6.1, Page 39)
2. Fasten riser 711 with nuts 920.19/920.34 and bolts 901.11/901.39.
   (⇨ Section 7.7, Page 42)

7.6.5 Mounting the motor

✓ The notes and steps stated in (⇨ Section 7.6.1, Page 39) to (⇨ Section 7.6.4, Page 41) have been observed and carried out.

1. Fit coupling half 861.02 on the motor shaft end.

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

▷ Suspend or support the motor to prevent it from tipping over.

2. Place the motor onto bearing lantern 340.
   Make sure that coupling part 860 engages in coupling half 861.02.
   (⇨ Section 5.3, Page 21)
3. Tighten hexagon nuts 920.11 on studs 902.11.
   The motor and bearing/intermediate lantern are centred via the motor flange.

7.7 Tightening torques

7.7.1 Tightening torques for the pump

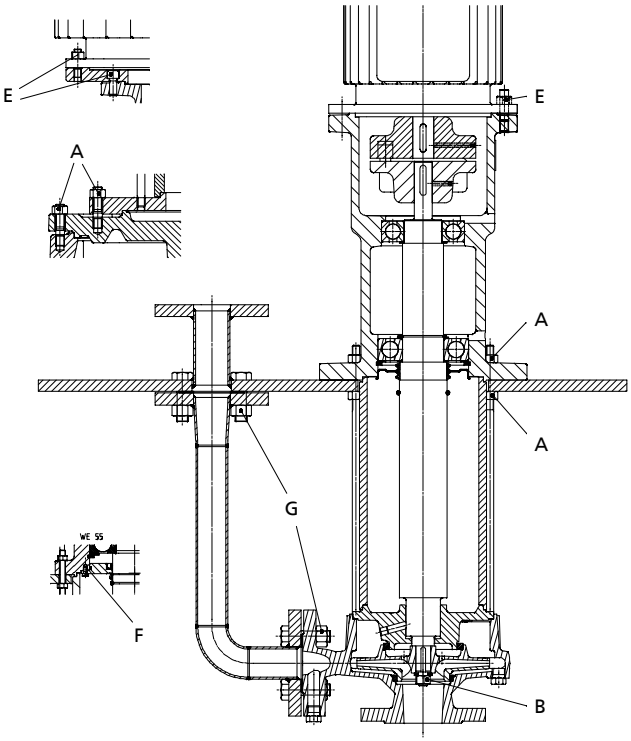

Fig. 11: Tightening points

Table 17: Tightening torques for bolted/screwed connections at the pump

Position	Thread	Tightening torque
		[Nm]
A	M12	55
B	M12 × 1,5	55
	M16 × 1,5	55
	M24 × 1,5	130
	M30 × 1,5	170
E	M12	55
	M16	130
F	M6	15

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Position	Thread	Tightening torque [Nm]
G	M12	40
	M16	100
	M20	180

7.8 Spare parts stock

7.8.1 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 4.4, Page 15)

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 46)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 18: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 - 7	8 - 9	10 and more
		Quantity of spare parts						
210	Shaft, complete	1	1	2	2	2	3	30 %
230	Impeller	1	1	2	2	2	3	30 %
321.05/321.06	Radial ball bearing per size	1	1	2	2	2	3	30 %
400.10	Gasket	4	6	8	8	9	12	150 %
411.77	Joint ring	4	6	8	10	12	16	100 %
412.01	O-ring (shaft unit 55)	2	3	4	5	6	7	90 %
421	Lip seal (shaft unit 55)	2	3	4	5	6	8	100 %
502.01/502.02	Casing wear ring	2	2	2	3	3	4	50 %

7.8.3 Sets of spare parts

Table 19: Overview of spare parts sets

Spare parts set	Part No.	Description
210 - shaft	210	Shaft
	550.95[6)]	Disc
	920.95	Nut

6 For shaft unit 25 only

Spare parts set	Part No.	Description
210 - shaft	930.95	Safety device
	940.01	Key
	940.02	Key
102 - volute casing	102	Volute casing
	502.01	Casing wear ring
	902.01[7)]	Stud
	903.01	Screw plug
	903.03	Screw plug
	920.01[7)]	Nut

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7 For bolted casing cover only

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

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

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

A Pump delivers insufficient flow rate

B Motor is overloaded

C Increased bearing temperature

D Vibrations during pump operation

Table 20: Trouble-shooting

A	B	C	D	Possible cause	Remedy[8]
✘	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Fit a larger impeller.
✘	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
✘	-	-	✘	Suction lift is too high/$NPSH_{available}$ (positive suction head) is too low.	Check/alter liquid level. Check any strainers installed/suction opening.
✘	-	-	-	Wrong direction of rotation	Interchange two of the phases of the power cable.
✘	-	-	-	Speed is too low.[9]	Increase speed.
✘	-	-	✘	Wear of internal components	Replace worn components by new ones.
-	✘	-	✘	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point. In the case of persistent overloading, turn down impeller.[9]
-	✘	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
-	-	✘	-	Increased axial thrust[9]	Clean balancing holes in the impeller. Replace the casing wear rings.
-	-	✘	✘	Defective motor deep groove ball bearing	Replace.
✘	✘	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	✘	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	✘	Defective plain bearing	Replace.
-	-	-	✘	Flow rate is too low.	Increase the minimum flow rate.

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

9 Contact KSB.

9 Related Documents

9.1 General drawings with list of components

9.1.1 General assembly drawing with list of components for D design

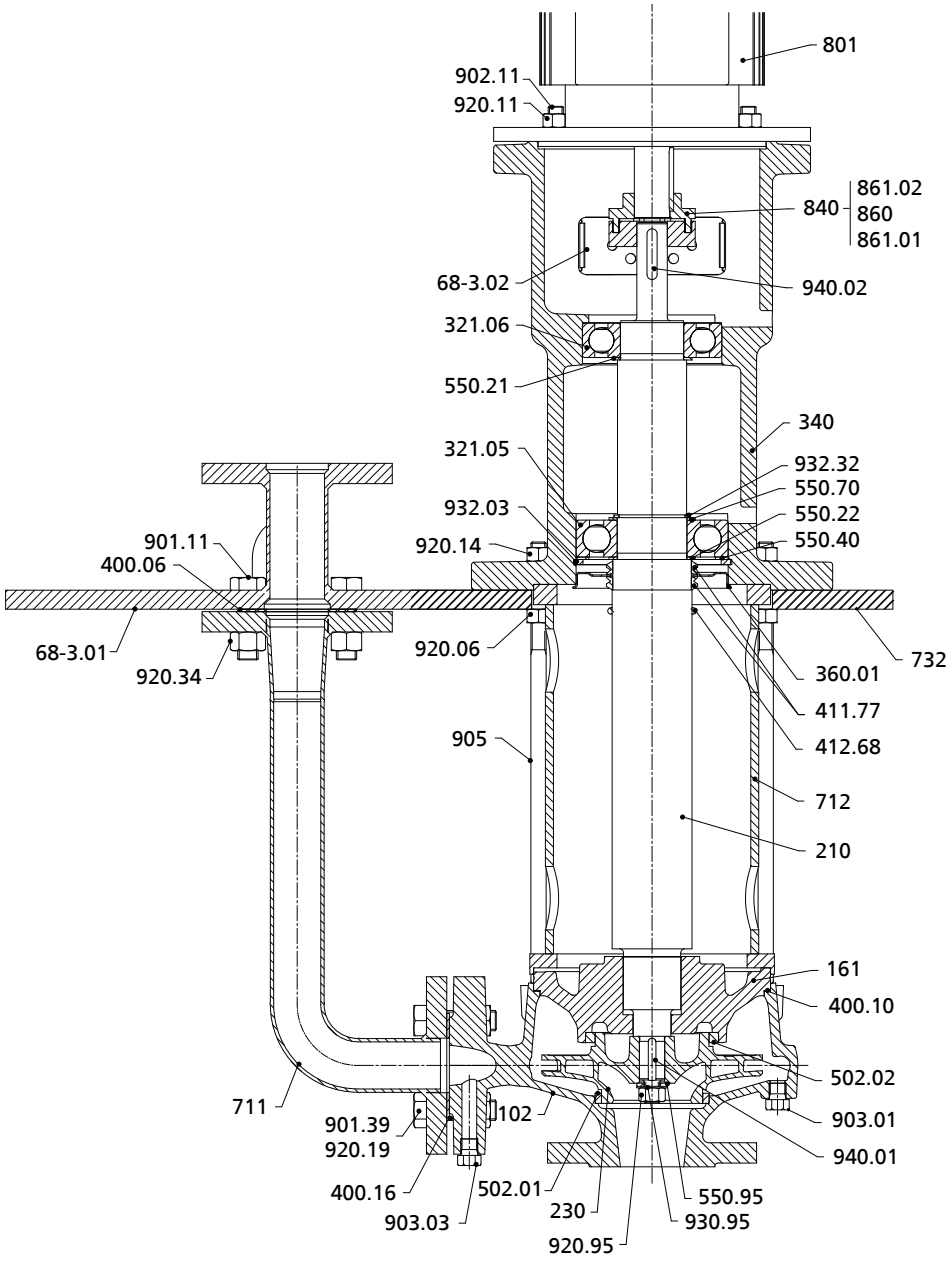

Fig. 12: General assembly drawing Etanorm V, design D

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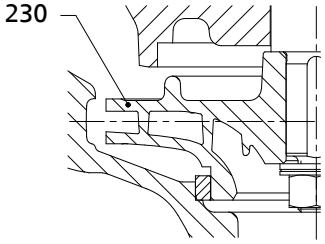
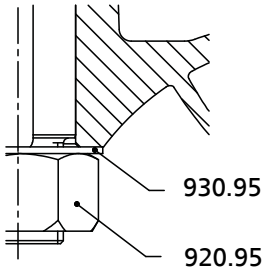
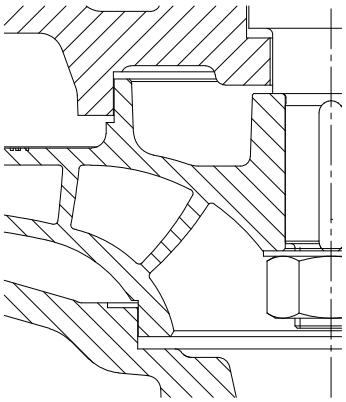
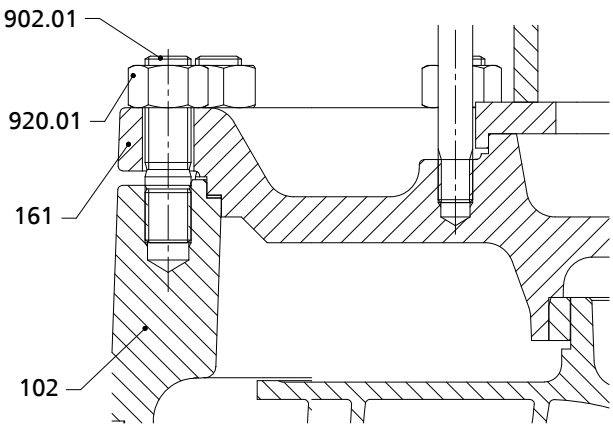
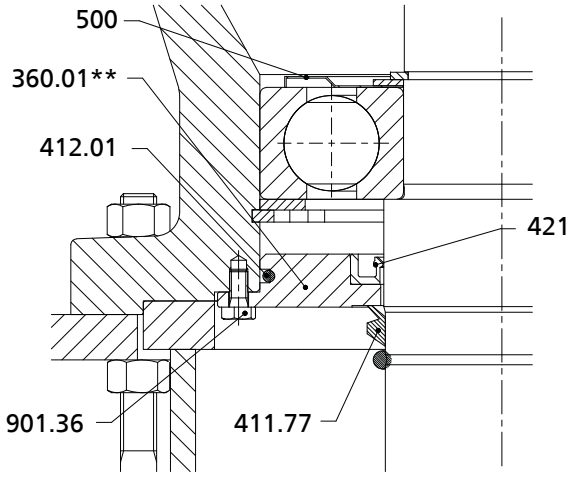
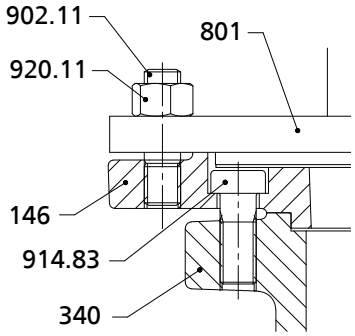
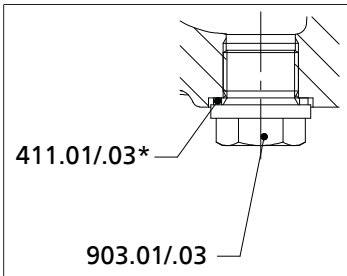
Table 21: Detail drawings Etanorm V, design D

	
Impeller, unbalanced 50-32-125.1 50-32-160.1 50-32-125 65-40-125	Impeller fastening Material variants GG / CC; shaft units WS 35 / 55
	
Drawing without casing wear ring Material variant CC	Bolted casing cover Material variants GG / CC; shaft units WS 25 / 35 / 55
	
Ball bearing Material variants GG / CC; ** Only for shaft unit WS 55	Intermediate lantern, for the following shaft units: WS_25: motor 132 / 160 / 180 WS_35: motor 132 / 160 / 180 / 200 / 225 WS_55: motor 225 (4 poles) / 250 (4 poles) / 280 (4 poles)



Drain plug
* For material variant CC only

Table 22: List of components

Part No.	Description	Part No.	Description
68-3.01/.02	Cover plate	711	Column pipe
102	Volute casing	712	Support column
146	Intermediate lantern	732[10)]	Holder
161	Casing cover	801	Flanged motor
210	Shaft	840	Coupling
230	Impeller	860	Coupling part
321.05/.06	Radial ball bearing	861.01/.02	Half coupling
340	Bearing lantern	901.11/.36/.39	Hexagon head bolt
360.01	Bearing cover	902.01/.11	Stud
400.06/.10/.16	Gasket	903.01/.03	Screw plug
411.01/.03/.77	Joint ring	905	Tie bolt
412.01[11)]/.68	O-ring	914.83	Hexagon socket head cap screw
421[11)]	Lip seal	920.01/.06/.11/.14/.19/.34/.95	Nut
500[11)]	Ring	930.95	Safety device
502.01/.02	Casing wear ring	932.03/.32	Circlip
550.21/.22/.40/.70/.95[12)]	Disc	940.01[13)]/.02	Key

10 On pumps without cover plate only
11 For WS_55 only
12 For WS_25 only
13 2x for WS_55

10 UK Declaration of Conformity

Manufacturer:

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

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

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

Etabloc, Etabloc SYT, Etaline, Etaline SYT, Etaline Z, Etachrom B, Etachrom L, Etanorm, Etanorm SYT, Etanorm V, Etaprime L, Etaprime B

KSB order number: .....

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): Supply of Machinery (Safety) Regulations 2008
  - Electrical components[14]: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- the following harmonised international standards[15] 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)

Place, date

.....[16].....

Name

Function

Company
Address

14 Where applicable

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

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

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[17]: .....

Delivery date: .....

Application: .....

Fluid handled[17]: .....

Please tick where applicable[17]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[17]: .....

Comments: .....

.....

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

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

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

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

☐ No special safety precautions are required for further handling.

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

.....

.....

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

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

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17 Required field

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