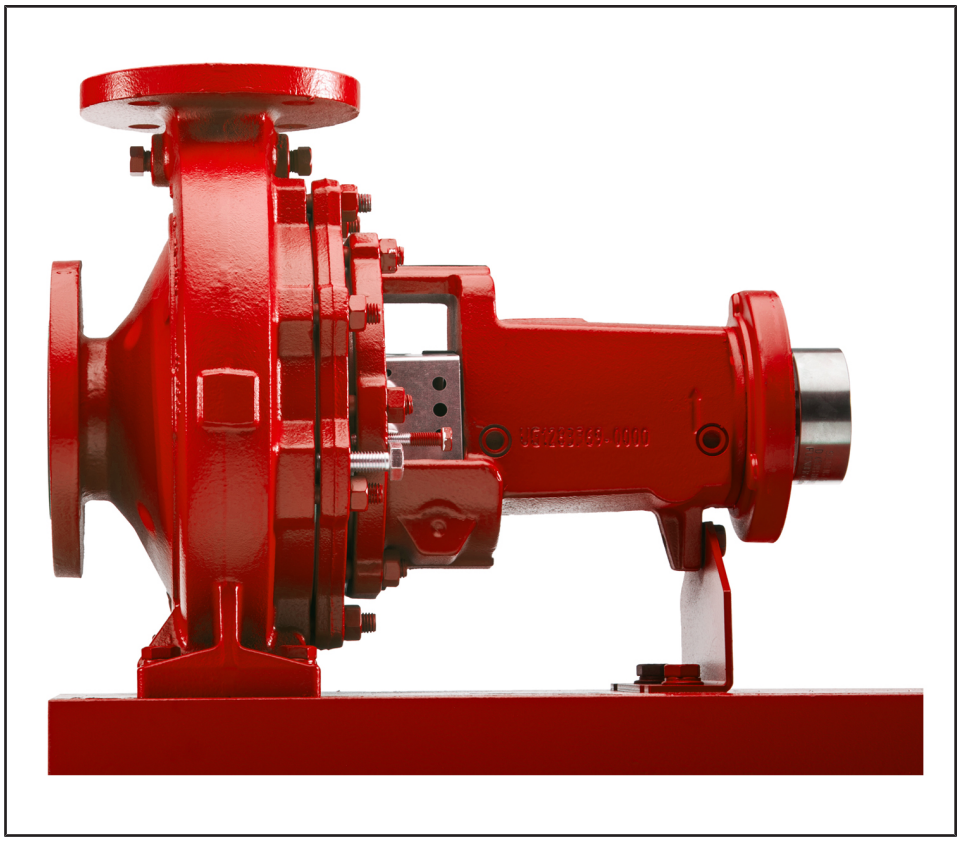
Sprinkler Pump

Etanorm FXV

Installation/Operating Manual



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Installation/Operating Manual Etanorm FXV

Original operating manual

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Contents

Glossary **5**

1 General **6**
1.1 Principles 6
1.2 Installation of partly completed machinery 6
1.3 Target group 6
1.4 Other applicable documents 6
1.5 Symbols 6
1.6 Key to safety symbols/markings 7

2 Safety **8**
2.1 General 8
2.2 Intended use 8
2.3 Personnel qualification and training 8
2.4 Consequences and risks caused by non-compliance with this manual 9
2.5 Safety awareness 9
2.6 Safety information for the operator/user 9
2.7 Safety information for maintenance, inspection and installation 9
2.8 Unauthorised modes of operation 10

3 Transport/Storage/Disposal **11**
3.1 Checking the condition upon delivery 11
3.2 Transport 11
3.3 Storage/preservation 12
3.4 Return to supplier 12
3.5 Disposal 13

4 Description of the Pump (Set) **14**
4.1 General description 14
4.2 Product information as per Regulation No. 1907/2006 (REACH) 14
4.3 Designation 14
4.4 Name plate 14
4.5 Design details 15
4.6 Configuration and function 16
4.7 Noise characteristics 16
4.8 Scope of supply 17
4.9 Dimensions and weights 17

5 Installation at Site **18**
5.1 Safety regulations 18
5.2 Checks to be carried out prior to installation 18
5.3 Installing the pump set 18
5.3.1 Installation on a foundation 18
5.4 Piping 19
5.4.1 Connecting the piping 19
5.4.2 Permissible forces and moments at the pump nozzles 21
5.4.3 Auxiliary connections 22
5.5 Enclosure/insulation 22
5.6 Checking the coupling alignment 22
5.7 Aligning the pump and motor 24
5.7.1 Levelling the pump set with adjusting screws 24
5.7.2 Levelling the pump set without adjusting screws 25
5.8 Electrical connection 26
5.9 Checking the direction of rotation 26

6 Commissioning/Start-up/Shutdown **28**
6.1 Commissioning/Start-up 28

6.1.1 Prerequisites for commissioning/start-up ... 28
6.1.2 Priming and venting the pump ... 28
6.1.3 Final check ... 28
6.1.4 Starting up for a test run ... 29
6.1.5 Checking the shaft seal ... 29
6.1.6 Switching the pump set off after testing ... 30
6.2 Operating limits ... 30
6.2.1 Ambient temperature ... 30
6.2.2 Frequency of starts ... 30
6.2.3 Fluid handled ... 31
6.3 Shutdown/storage/preservation ... 31
6.3.1 Measures to be taken for shutdown ... 31
6.4 Returning to service ... 32
7 Servicing/Maintenance ... 33
7.1 Safety regulations ... 33
7.2 Servicing/Inspection ... 33
7.2.1 Supervision of operation ... 33
7.2.2 Inspection work ... 35
7.2.3 Lubrication and lubricant change of rolling element bearings ... 35
7.3 Drainage/cleaning ... 37
7.4 Dismantling the pump set ... 37
7.4.1 General information/Safety regulations ... 37
7.4.2 Preparing the pump set ... 38
7.4.3 Removing the motor ... 38
7.4.4 Removing the back pull-out unit ... 38
7.4.5 Removing the impeller ... 39
7.4.6 Removing the shaft seal ... 39
7.4.7 Dismantling the bearing assembly ... 40
7.5 Reassembling the pump set ... 41
7.5.1 General information/Safety regulations ... 41
7.5.2 Installing the bearing assembly ... 42
7.5.3 Fitting the shaft seal ... 43
7.5.4 Fitting the impeller ... 46
7.5.5 Installing the back pull-out unit ... 46
7.5.6 Mounting the motor ... 46
7.6 Tightening torques ... 47
7.6.1 Tightening torque pump ... 47
7.6.2 Tightening torques for the pump set ... 48
7.7 Spare parts stock ... 49
7.7.1 Ordering spare parts ... 49
7.7.2 Recommended spare parts stock ... 49
8 Trouble-shooting ... 51
9 Related Documents ... 53
9.1 General assembly drawing with list of components ... 53
9.1.1 Etanorm FXV ... 53
10 EU Declaration of Conformity ... 57
11 Certificate of Decontamination ... 58
Index ... 59

Glossary

Back pull-out design

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

Back pull-out unit

Pump without pump casing; partly completed machinery

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

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 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

1311.83/06-EN

1 If agreed to be included in the 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.
	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 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 (set) to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the pump (set) without the fluid to be handled.
- 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).
- Always operate the pump (set) in the direction of rotation it is intended for.
- 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.

1311.83/06-EN

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.

1311.83/06-EN

- 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 7.3, Page 37)
- 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 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)

1311.83/06-EN

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.

To transport the pump/pump set or back pull-out unit suspend it from the lifting tackle as shown.

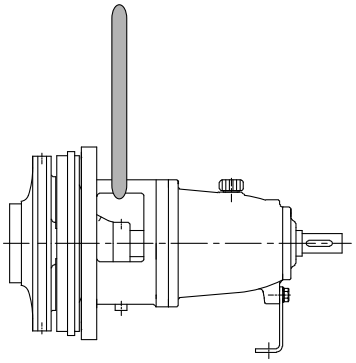

Fig. 1: Transporting the back pull-out unit

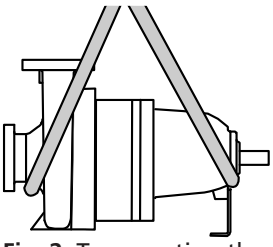

Fig. 2: Transporting the pump

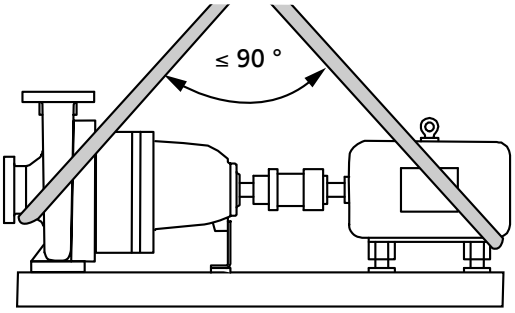

Fig. 3: Transporting the pump set

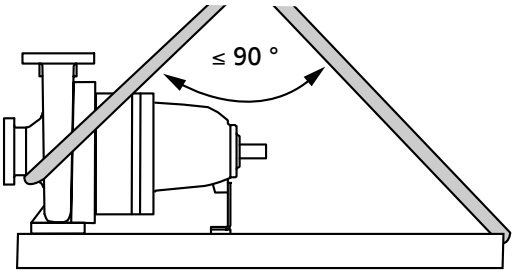

Fig. 4: Transporting the pump on the baseplate

3.3 Storage/preservation

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of the pump (set)!

- ▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.

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 7.3, Page 37)
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 58)

NOTE

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

1311.83/06-EN

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

- Volute casing pump for sprinkler installations to VdS CEA 4001

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

Example: Etanorm FXV 065-040-250 GB 10

Table 4: Designation key

Code	Description	
Etanorm	Type series	
FXV	Additional code	
	F	Fire-fighting pump
	X	Special design
	V	VdS-approved
065	Nominal suction nozzle diameter [mm]	
040	Nominal discharge nozzle diameter [mm]	
250	Nominal impeller diameter [mm]	
G	Casing material	
	G	Cast iron
	B	Bronze
	S	Nodular cast iron
B	Impeller material	
	B	Bronze
	C	Stainless steel
10	Shaft seal, e.g. Q1 Q1 X4GG	

4.4 Name plate

Fig. 5: Name plate (example)

1	KSB Code	2	Type series, size
3	KSB order number,KSB order item number and consecutive number	4	VdS-approved flow rate

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5	VdS-approved head	6	Required motor rating at 15 m NPSH
7	Nominal speed	8	Permissible nominal pressure
9	Year of construction	10	Impeller diameter [mm]
11	Maximum starting current[2)]	12	Switching current[2)]
13	VdS approval number		

4.5 Design details

Design

- Volute casing pump
- Horizontal installation
- Back pull-out design
- Single-stage

Pump casing

- Radially split volute casing
- Volute casing with integrally cast pump feet
- Replaceable casing wear rings

Impeller type

- Closed radial impeller with multiply curved vanes

Shaft seal

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

Bearings

- Grease-packed deep groove ball bearings

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2 Only for submersible borehole pumps

4.6 Configuration and function

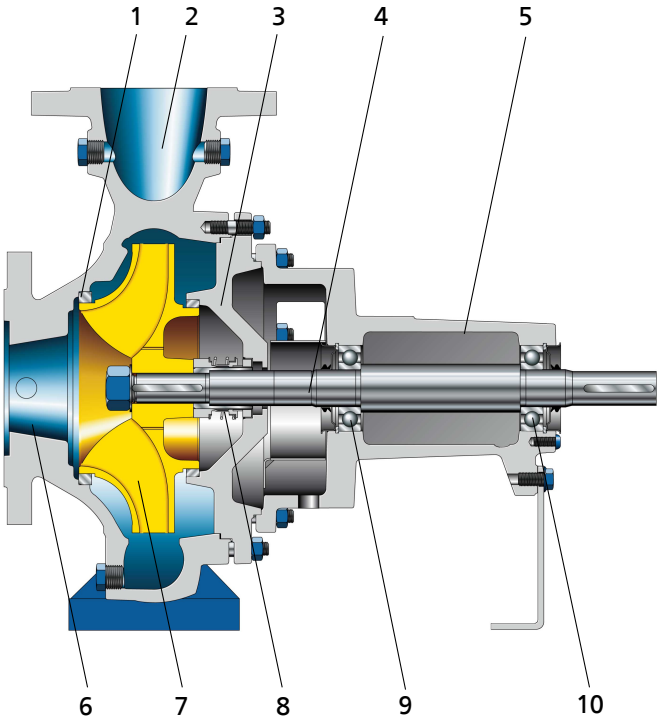

Fig. 6: Sectional drawing

1	Clearance gap	2	Discharge nozzle
3	Casing cover	4	Shaft
5	Bearing bracket	6	Suction nozzle
7	Impeller	8	Shaft seal
9	Rolling element bearing, pump end	10	Rolling element bearing, motor end

Design The pump is designed with an axial fluid inlet and a radial outlet. The hydraulic system runs in its own bearings and is connected to the motor by a shaft coupling.

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 casing via the casing cover (3). The shaft passage through the cover is sealed to atmosphere with a shaft seal (8). The shaft runs in rolling element bearings (9 and 10), which are supported by a bearing bracket (5) linked with the pump casing and/or casing cover.

Sealing The pump is sealed by a shaft seal (standardised mechanical seal or gland packing).

4.7 Noise characteristics

Table 5: Surface sound pressure level L_{pA} [3)]

Rated power input P_N [kW]	Pump		Pump set	
	1450 rpm [dB]	2900 rpm [dB]	1450 rpm [dB]	2900 rpm [dB]
15	64	66	67	74
18,5	65	67	68	75
22	66	68	69	76

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3 Surface sound pressure level as per ISO 3744 and DIN EN ISO 20361 ; 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.

Rated power input P_N [kW]	Pump		Pump set	
	1450 rpm [dB]	2900 rpm [dB]	1450 rpm [dB]	2900 rpm [dB]
30	67	70	70	77
37	68	71	71	78
45	69	72	73	78
55	70	73	74	79
75	72	75	75	80
90	73	76	76	81
110	74	77	77	81
132	76	78	77	83
160	77	79	78	84
200	78	80	79	84
250	78	-	81	-

4.8 Scope of supply

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

- Pump
- Baseplate
- Coupling
- Coupling guard
- Drive
- Supply system for double mechanical seal

4.9 Dimensions and weights

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

5 Installation at Site

5.1 Safety regulations

For positioning, installing and operating sprinkler pumps, always comply with the following fire protection standards and fire protection directives:

- VdS CEA 4001
- CEA 4001
- EN 12845
- NFPA 20

5.2 Checks to be carried out prior to installation

Place of installation

⚠ WARNING

Installation on a mounting surface which is unsecured and cannot support the load

Personal injury and damage to property!

- ▷ 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.

5.3 Installing the pump set

Always install the pump set in a horizontal position.

5.3.1 Installation on a foundation

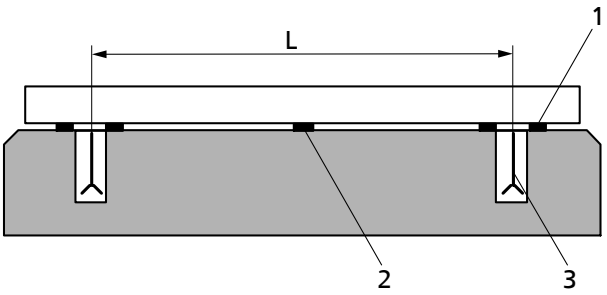

Fig. 7: Fitting the shims

L	Bolt-to-bolt distance	1	Shim
2	Shim if (L) > 800 mm	3	Foundation bolt

✓ The foundation has the required strength and characteristics.

✓ The foundation has been prepared in accordance with the dimensions given in the outline drawing/general arrangement drawing.

1. Position the pump set on the foundation and level it with the help of a spirit level placed on the shaft and discharge nozzle.
   Permissible deviation: 0.2 mm/m
2. Use shims (1) for height compensation, if necessary.
   Always fit shims, if any, immediately to the left and right of the foundation bolts (3) between the baseplate/foundation frame and the foundation.

1311.83/06-EN

For a bolt-to-bolt distance (L) > 800 mm fit additional shims (2) halfway between the bolt holes.
All shims must lie perfectly flush.

3. Insert the foundation bolts (3) into the holes provided.
4. Use concrete to set the foundation bolts (3) into the foundation.
5. Wait until the concrete has set firmly, then level the baseplate.
6. Tighten the foundation bolts (3) evenly and firmly.

NOTE

For optimum smooth running, baseplates should be grouted with low-shrinkage concrete in the following cases:
- For all vibration-critical applications
- Baseplates with a width > 400 mm
- Baseplates made of grey cast iron

NOTE

For low-noise operation contact the manufacturer to check whether the pump set can be installed on anti-vibration mounts.

NOTE

Expansion joints can be fitted between the pump and the suction/discharge line. (Only if permitted in accordance with the fire protection directives!)

5.4 Piping

5.4.1 Connecting the piping

DANGER

Impermissible loads acting on the pump nozzles

Danger to life from escaping 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.
- Observe the permissible forces and moments at the pump nozzles.
- Take appropriate measures to compensate for thermal expansion of the piping.

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

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

NOTE

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

NOTE

VdS-certified pumps must be connected in compliance with the current VdS CEA 4001 regulations.

- ✓ 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 pipelines are equal to or greater than the nominal diameters of the pump nozzles.
  The nominal diameter of the suction line shall be in compliance with VdS form 3003. The installation of check and shut-off valves is also defined by VdS form 3003.
- ✓ To prevent excessive pressure losses, adapters to larger diameters must be in accordance with the fire protection directives.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.

CAUTION

Welding beads, scale and other impurities in the piping

Damage to the pump!

- ▹ Remove any impurities from the piping.
- ▹ If necessary, install a filter.
- ▹ Observe the information in (⇨ Section 7.2.2.2, Page 35) .

3. Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
4. If required, install a filter in the piping (see drawing: Filter in the piping).
   Observe the regulations laid down in the fire protection directives!

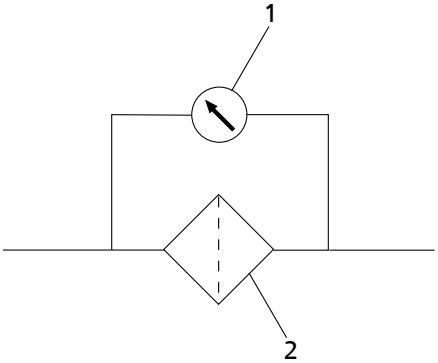

Fig. 8: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

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.

5. Connect the pump nozzles to the piping.

1311.83/06-EN

	CAUTION
	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.

5.4.2 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.

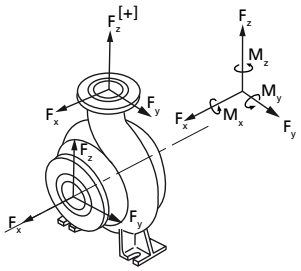

Fig. 9: Forces and moments at the pump nozzles

Table 6: Forces and moments at the pump nozzles for casing material G (JL1040/ A48 Cl. 35B)

Size	Suction nozzle								Discharge nozzle							
	DN	Fx [N]	Fy [N]	Fz [N]	∑F [N]	Mx [N]	My [N]	Mz [N]	DN	Fx [N]	Fy [N]	Fz [N]	∑F [N]	Mx [N]	My [N]	Mz [N]
065-040-250	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-040-315	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-050-200	65	740	650	600	1153	530	390	420	50	530	470	580	916	500	350	400
065-050-250	65	740	650	600	1153	530	390	420	50	530	470	580	916	500	350	400
065-050-315	65	740	650	600	1153	530	390	420	50	530	470	580	916	500	350	400
080-065-200	80	880	790	720	1385	560	400	460	65	650	600	740	1153	530	390	420
080-065-250	80	880	790	720	1385	560	400	460	65	650	600	740	1153	530	390	420
080-065-315	80	880	790	720	1385	560	400	460	65	650	600	740	1153	530	390	420
100-080-200	100	1180	1050	950	1843	620	440	510	80	790	720	880	1385	560	400	460
100-080-250	100	1180	1050	950	1843	620	440	510	80	790	720	880	1385	560	400	460
100-080-315	100	1180	1050	950	1843	620	440	510	80	790	720	880	1385	560	400	460
125-100-200	125	1400	1250	1120	2186	740	530	670	100	1050	950	1180	1843	620	440	510
125-100-315	125	1400	1250	1120	2186	740	530	670	100	1050	950	1180	1843	620	440	510
150-125-250	150	1750	1600	1400	2754	880	610	720	125	1250	1120	1400	2186	740	530	670
150-125-315	150	1750	1600	1400	2754	880	610	720	125	1250	1120	1400	2186	740	530	670
200-150-400	200	2350	2100	1900	3680	1150	800	930	150	1600	1400	1750	2754	880	610	720
250-150-400	250	3340	2980	2700	5227	1780	1260	1460	150	1600	1400	1750	2754	880	610	720

Correction coefficients depending on material and temperature (see diagram below).

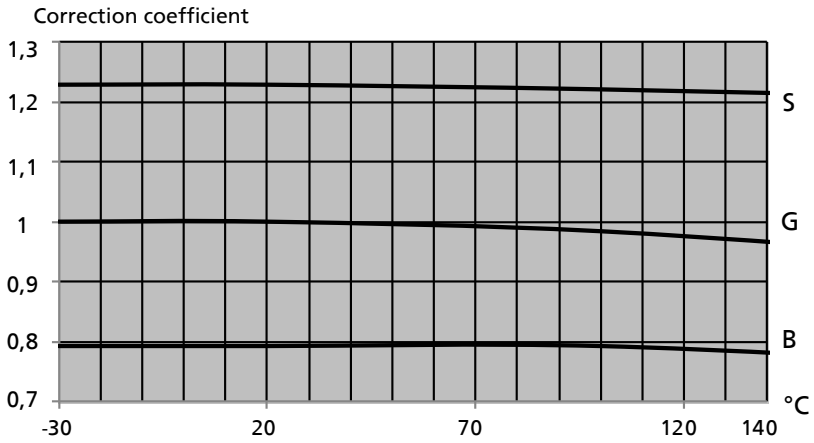

Fig. 10: Temperature/material correction diagram for casing materials G (EN-GJL-250/A48CL35B), S (EN-GJS-400-15/A536 GR 60-40-18) and B (CC480K-GS/B30 C90700)

5.4.3 Auxiliary connections

⚠ WARNING

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

Risk of injury from escaping fluid!

Risk of burns!

Malfunction of the pump!

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

5.5 Enclosure/insulation

CAUTION

Heat build-up in the bearing bracket

Damage to the bearing!

- ▷ Never insulate the bearing bracket, bearing bracket lantern and casing cover.

5.6 Checking the coupling alignment

CAUTION

Misalignment of pump and motor shafts

Damage to pump, motor and coupling!

- ▷ Always check the coupling after the pump has been installed and connected to the piping.
- ▷ Also check the coupling of pump sets supplied with pump and motor mounted on the same baseplate.

1311.83/06-EN

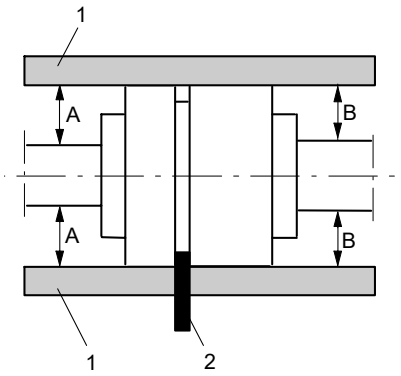

Fig. 11: Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

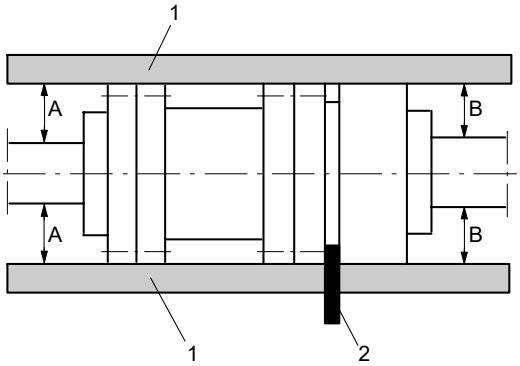

Fig. 12: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

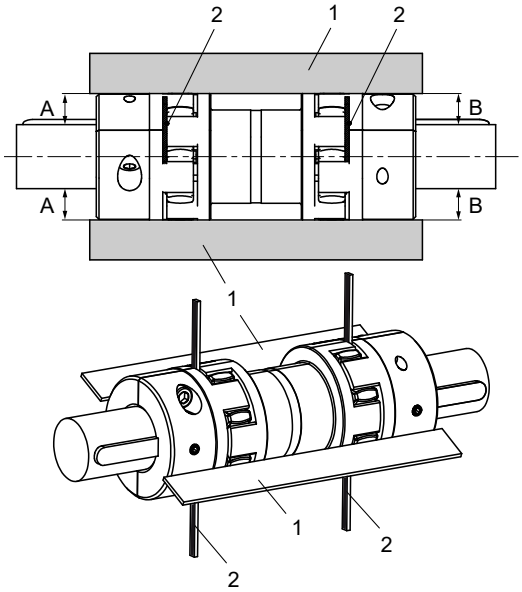

Fig. 13: Double Cardan spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

Table 7: Permissible alignment offset of coupling halves

Coupling type	Radial offset [mm]	Axial offset [mm]
Non-spacer-type coupling (⇨ Fig. 11)	≤ 0,1	≤ 0,1
Spacer-type coupling (⇨ Fig. 12)	≤ 0,1	≤ 0,1
Double Cardan coupling (⇨ Fig. 13)	≤ 0,5	≤ 0,5

✓ The coupling guard and its footboard, if any, have been removed.

1. Loosen the support foot and re-tighten it without transmitting any stresses and strains.
2. Place the straight edge axially on both coupling halves.
3. Leave the straight edge in this position and turn the coupling by hand.
   The coupling is aligned correctly if the distances A and B to the respective shafts are the same at all points around the circumference.
   Observe the permissible radial offset in coupling half alignment (⇨ Table 7) both during standstill and at operating temperature as well as under inlet pressure.
4. Check the distance (dimension see general arrangement drawing) between the two coupling halves around the circumference.
   The coupling is correctly aligned if the distance between the two coupling halves is the same at all points around the circumference.
   Observe the permissible axial offset in coupling half alignment (⇨ Table 7) both during standstill and at operating temperature as well as under inlet pressure.
5. If alignment is correct, re-install the coupling guard and its footboard, if any.

Checking the coupling alignment with a laser tool

Coupling alignment may also be checked with a laser tool. Observe the documentation provided by the manufacturer of the measuring instrument.

5.7 Aligning the pump and motor

After having installed the pump set and connected the piping, check the coupling alignment and, if required, re-align the pump set (at the motor).

5.7.1 Levelling the pump set with adjusting screws

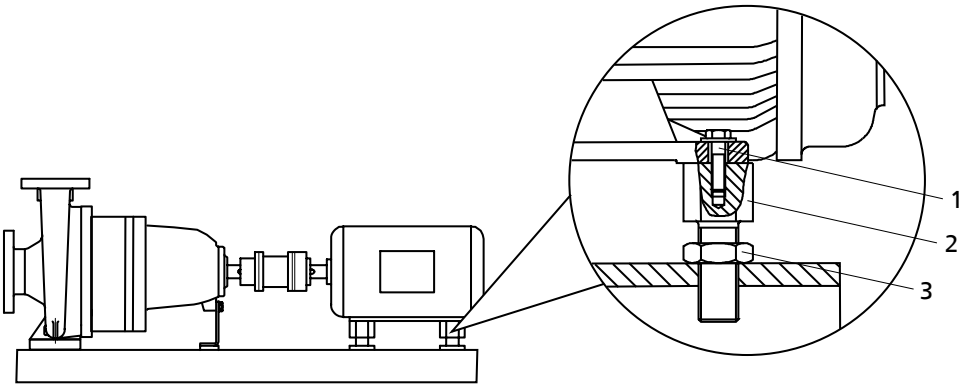

Fig. 14: Levelling the pump set with adjusting screws

1	Hexagon head bolt	3	Locknut
2	Adjusting screw		

✓ The coupling guard and the footboard for the coupling guard, if any, have been removed.

1. Check the coupling alignment.
2. Unscrew the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.

1311.83/06-EN

3. Turn the adjusting screws (2) by hand or by means of an open-end wrench until the coupling alignment is correct and all motor feet rest squarely on the baseplate.
4. Re-tighten the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
5. Check that the coupling and shaft can easily be rotated by hand.

⚠ WARNING

Unprotected rotating coupling

Risk of injury by rotating shafts!

- ▹ Always operate the pump set with a coupling guard.
  If the customer specifically requests not to include a coupling guard in KSB's delivery, then the operator must supply one!
- ▹ Observe all relevant regulations for selecting a coupling guard.

6. Re-install the coupling guard and the footboard for the coupling guard, if any.
7. Check the distance between coupling and coupling guard.
   The coupling and coupling guard must not come into contact.

5.7.2 Levelling the pump set without adjusting screws

Compensate any differences in shaft centreline heights of pump and motor by means of shims.

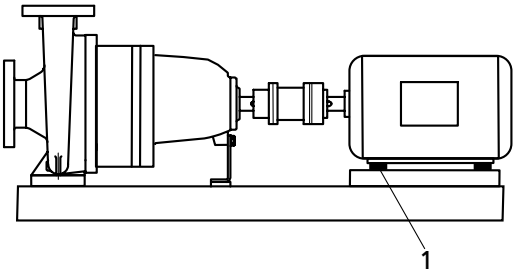

Fig. 15: Levelling the pump set without adjusting screws

1	Shim

✓ The coupling guard and its footboard, if any, have been removed.

1. Check the coupling alignment.
2. Loosen the hexagon head bolts at the motor.
3. Insert shims underneath the motor feet until the difference in shaft centreline height has been compensated.
4. Re-tighten the hexagon head bolts.
5. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can easily be rotated by hand.

⚠ WARNING

Unprotected rotating coupling

Risk of injury by rotating shafts!

- ▹ Always operate the pump set with a coupling guard.
  If the customer specifically requests not to include a coupling guard in KSB's delivery, then the operator must supply one!
- ▹ Observe all relevant regulations for selecting a coupling guard.

6. Fit the coupling guard and its footboard, if any.
7. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

5.8 Electrical connection

⚠ DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

- ▹ Always have the electrical connections installed by a trained and qualified electrician.
- ▹ Observe regulations IEC 60364 .

⚠ WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

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

NOTE

Fitting a motor protection device is recommended.
However, this device must not trip the pump set; it must serve as an indicator only.

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. Check the available mains voltage against the data on the name plate.
2. Select an appropriate starting method.
3. Match the motor's direction of rotation to that of the pump.
4. Observe the manufacturer's product literature supplied with the motor.

5.9 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.

CAUTION

Incorrect direction of rotation with non-reversible mechanical seal

Damage to the mechanical seal and leakage!

- ▹ Separate the pump from the motor to check the direction of rotation.

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.

1311.83/06-EN

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

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

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked.
- 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 32)

6.1.2 Priming and venting the pump

CAUTION

Shaft seal failure caused by insufficient lubrication

Damage to the pump!

▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.

1. Vent the pump and suction line and prime both with the fluid to be handled.
2. Fully open the shut-off element in the suction line.

Connection 6D can be used for venting.

6.1.3 Final check

1. Remove the coupling guard and its footboard, if any.
2. Check the coupling alignment; re-align the coupling, if required. (⇨ Section 5.6, Page 22)
3. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can be easily rotated by hand.
4. Fit the coupling guard and its footboard, if any.
5. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

1311.83/06-EN

6.1.4 Starting up for a test run

⚠ WARNING

Non-compliance with the permissible pressure limits and temperature limits if the pump is operated with the suction line and/or discharge line closed

Risk of injury by escaping fluid handled!

- ▹ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.
- ▹ Only start up the pump set with the discharge-side shut-off element slightly or fully open.

1. Set the selector switch at the control cabinet to manual operation.
2. Start up the motor.
3. Open the shut-off element in the test pipe.

6.1.5 Checking the shaft seal

Shaft seals are fitted prior to delivery.
Observe the instructions on dismantling (⇨ Section 7.4.6, Page 39) or assembly (⇨ Section 7.5.3, Page 43) .

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

Gland packing The gland packing must drip slightly during operation.

(approx. 20 drops per minute)

CAUTION

Excessive leakage or no leakage at the gland packing

Damage to the pump!

- ▹ Excessive leakage: Re-tighten the gland follower until the required leakage rate is reached.
- ▹ No leakage: Switch off the pump set immediately.

Adjusting the leakage

Prior to commissioning

1. Only lightly tighten the nuts of the gland follower by hand.
2. Use a feeler gauge to verify that the gland follower is mounted centred and at a right angle to the shaft.

⇨ The gland must leak after the pump has been primed.

After five minutes of operation

⚠ WARNING

Unprotected rotating parts

Risk of personal injury!

- ▹ Do not touch rotating parts.
- ▹ When the pump is running, perform any work with utmost caution.

The leakage can be reduced.

1. Tighten the nuts on the gland follower by 1/6 turn.
2. Monitor the leakage for another five minutes.

Excessive leakage:
Repeat steps 1 and 2 until the minimum value has been reached.

Not enough leakage:
Slightly loosen the nuts at the gland follower.

No leakage:
Immediately switch off pump set!
Loosen the gland follower and repeat commissioning.

Checking the leakage

After the leakage has been adjusted, monitor the leakage for about two hours at maximum fluid temperature.
Check that enough leakage occurs at the gland packing at minimum fluid pressure.

6.1.6 Switching the pump set off after testing

1. Close the shut-off element in the test pipe.
2. Switch off the motor.
   Make sure it runs down smoothly to a standstill.
3. Set the selector switch to automatic.

6.2 Operating limits

⚠ WARNING

Non-compliance with operating limits for pressure and temperature

Risk of injuries by escaping fluid!

- ▷ Comply with the operating range indicated in the documentation.
- ▷ 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 8: Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	50 °C
Minimum	See data sheet.

6.2.2 Frequency of starts

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.

The frequency of starts is usually determined by the maximum temperature increase of the motor. This largely depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL, star-delta, moments of inertia, etc). If the start-ups are evenly spaced over the period indicated, the following limits serve as orientation for start-up with the discharge-side gate valve slightly open: The frequency of starts shall not exceed 6 start-ups per hour (h).

1311.83/06-EN

6.2.3 Fluid handled

6.2.3.1 Flow rate

Table 9: Flow rate

Temperature range (t)	Minimum flow rate	Maximum flow rate
4 to 40 °C	2 % or 5 % of $Q_{permissible}$ [4)]	See hydraulic characteristic curves

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 10: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Acceleration due to gravity	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	-
$\Delta\vartheta$	Temperature difference	K

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.

6.2.3.3 Abrasive fluids

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

Observe the water quality regulations laid down in VdS CEA 4001 and other applicable fire protection directives.

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.

4 VdS-approved flow rate

⇨ This will prevent the formation of deposits within the pump and the pump intake area.

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

✓ The pump has been properly drained. (⇨ Section 7.3, Page 37)

✓ The safety instructions for dismantling the pump have been observed. (⇨ Section 7.4.1, Page 37)

✓ 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 and 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.

1311.83/06-EN

7 Servicing/Maintenance

7.1 Safety regulations

CAUTION

Improperly serviced pump set

Damage to the pump set!

- Service the pump set regularly.
- Prepare a maintenance schedule with special emphasis on lubricants, shaft seal and coupling.

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

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 please 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

Excessive temperatures as a result of bearings running hot or defective bearing seals

Damage to the pump set!

- Regularly check the lubricant level.
- Regularly check the rolling element bearings for running noises.

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 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 bearing temperature.
  The bearing temperature must not exceed 90 °C (measured on the outside of the bearing bracket).

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 bearing bracket).

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).

False alarm pump operation

If the pump is started up due to false alarm with no fire-fighting water being drawn, it can be operated for a maximum of 48 hours. However, proper functioning of a by-pass line must be ensured through which a minimum flow is pumped in order to dissipate any excessive temperature rise.

After prolonged false-alarm operation, always dismantle the pump and inspect it for any signs of wear or damage; if necessary, repair it by replacing any affected components.

1311.83/06-EN

7.2.2 Inspection work

CAUTION

Excessive temperatures caused by friction, impact or frictional sparks

Damage to the pump set!

- ▷ Regularly check the coupling guard, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.

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 Cleaning filters

CAUTION

Insufficient inlet pressure due to clogged filter in the suction line

Damage to the pump!

- ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge).
- ▷ Clean filter at appropriate intervals.

7.2.3 Lubrication and lubricant change of rolling element bearings

CAUTION

Excessive temperatures as a result of bearings running hot or defective bearing seals

Damage to the pump set!

- ▷ Regularly check the condition of the lubricant.

7.2.3.1 Grease lubrication

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

7.2.3.1.1 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.

7.2.3.1.2 Grease quality

Optimum grease properties for rolling element bearings

Table 11: 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.

7.2.3.1.3 Grease quantity

Table 12: Grease quantity per grease-lubricated DIN 625 radial ball bearing

Size	Code	Grease quantity per bearing
		[g]
065-040-250	6305 2Z C3	5
065-040-315	6310 2Z C3	12
065-050-250	6305 2Z C3	5
065-050-200	6305 2Z C3	5
065-050-315	6310 2Z C3	12
080-065-200	6305 2Z C3	5
080-065-250	6307 2Z C3	10
080-065-315	6312 2Z C3	20
100-080-200	6307 2Z C3	10
100-080-250	6307 2Z C3	10
100-080-315	6312 2Z C3	20
125-100-315	6312 2Z C3	20
125-100-200	6307 Z C3	10
150-125-250	6312 2Z C3	10
150-125-315	6311 2Z C3	15
200-150-400	6311 2Z C3	15
250-150-400	6312 2Z C3	20

7.2.3.1.4 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. Remove the outer cover plate of each bearing with a suitable tool. Dispose of the cover plates.
2. Only half-fill the bearing cavities with grease.

Continue using the bearings without the outer cover plates (variant Z C3).

7.3 Drainage/cleaning

⚠ WARNING

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

Hazard to persons and the environment!

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

1. 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 58)

7.4 Dismantling the pump set

7.4.1 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 7.3, Page 37)
- ▹ Shut off any auxiliary connections.
- ▹ 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.

⚠ 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.

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 53)

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 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. Interrupt the power supply and secure the pump against unintentional start-up.
2. Disconnect and remove all auxiliary pipework.
3. Remove the coupling guard.
4. Remove the coupling spacer, if any.

7.4.3 Removing the motor

NOTE

On pump sets with spacer-type couplings, the back pull-out unit can be removed while the motor remains bolted to the baseplate.

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

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

1. Disconnect the motor from the power supply.
2. Unbolt the motor from the baseplate.
3. Shift the motor to separate it from the pump.

7.4.4 Removing the back pull-out unit

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 37) to (⇨ Section 7.4.3, Page 38) have been observed/carried out.

✓ On pump sets without spacer-type coupling, the motor has been removed.

⚠ WARNING

Back pull-out unit tilting

Risk of crushing hands and feet!

▹ Suspend or support the bearing bracket at the pump end.

1. If required, suspend or support bearing bracket 330 to prevent it from tipping over.
2. Unbolt support foot 183 from the baseplate.
3. Undo nut 920.01 at the volute casing.

1311.83/06-EN

4. Use forcing screws 901.30 (for bolted casing covers) or 901.31 (for clamped casing covers) to remove the back pull-out unit from its seat in the volute casing. Pull the back pull-out unit completely out of the volute casing.
5. Remove and dispose of gasket 400.10.
6. Place the back pull-out unit on a clean and level surface.

7.4.5 Removing the impeller

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 37) to (⇨ Section 7.4.4, Page 38) have been observed/carried out.

✓ The back pull-out unit has been placed in a clean and level assembly area.

1. Bend open lockwasher 931.
2. Undo impeller nut 920.95 (right-hand thread).
3. Remove lockwasher 931. (For shaft unit 25 also remove disc 550.95.)
4. Remove impeller 230 with an impeller removal tool.
5. Place impeller 230 on a clean and level surface.
6. Remove keys 940.01 and 940.09 (if any) from shaft 210.

7.4.6 Removing the shaft seal

7.4.6.1 Removing a single mechanical seal

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 37) to (⇨ Section 7.4.5, Page 39) have been observed/carried out.

✓ The back pull-out unit has been placed in a clean and level assembly area.

1. 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 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 bolted casing cover: Use forcing screws 901.31 to remove casing cover 161 from bearing bracket 330.
4. Remove the stationary assembly of the mechanical seal (mating ring) from casing cover 161.
5. Pull shaft sleeve 523 off shaft 210.
6. Remove and dispose of gasket 400.75.

7.4.6.2 Dismantling the gland packing

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 37) to (⇨ Section 7.4.5, Page 39) have been observed/carried out.

✓ The back pull-out unit has been placed in a clean and level assembly area.

1. Undo nuts 920.02 at the gland follower and loosen gland follower 452.
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.
4. Remove gland follower 452 from casing cover 161 and remove the packing.
5. Remove stuffing box ring 454.
6. Remove packing rings 461 and lantern ring 458, if any.

7. Pull shaft protecting sleeve 524 off shaft 210.
8. Remove and dispose of gasket 400.75.

7.4.7 Dismantling the bearing assembly

Oil lubrication

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 37) to (⇨ Section 7.4.6, Page 39) have been observed and carried out.

✓ The bearing bracket has been placed in a clean and level assembly area.

1. Undo the grub screw in the coupling hub.
2. Pull the coupling hub off pump shaft 210 with a puller or, for split-hub coupling designs, undo the screws and take off the hub halves.
3. Remove key 940.02.
4. Remove thrower 507.01.
5. Undo hexagon head bolts 901.01 and 901.02.
6. Remove pump-end bearing cover 360.01 with gasket 400.01 and drive-end bearing cover 360.02 with gasket 400.02.
7. Press shaft 210 out of the shaft seat.
8. Remove radial ball bearings 321.01 and 321.02, and place them on a clean and level surface.
9. Dispose of gaskets 400.01 and 400.02.

Grease lubrication for shaft units 25, 35, 55 (standard bearing assembly)

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 37) to (⇨ Section 7.4.6, Page 39) have been observed and carried out.

✓ The bearing bracket has been placed in a clean and level assembly area.

1. Undo the grub screw in the coupling hub.
2. Pull the coupling hub off pump shaft 210 with a puller or, for split-hub coupling designs, undo the screws and take off the hub halves.
3. Remove key 940.02.
4. Remove axial seal rings 411.77 and 411.78.
5. Remove pump-end bearing cover 360.01 and drive-end bearing cover 360.02.
6. Remove circlips 932.01 and 932.02.
7. Press shaft 210 out of the bearing seats.
8. Remove radial ball bearings 321.01 and 321.02, and place them on a clean and level surface.

Grease lubrication for shaft units 50, 60, 60.1 (reinforced bearing assembly)

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 37) to (⇨ Section 7.4.6, Page 39) have been observed and carried out.

✓ The bearing bracket has been placed in a clean and level assembly area.

1. Undo the grub screw in the coupling hub.
2. Pull the coupling hub off pump shaft 210 with a puller or, for split-hub coupling designs, undo the screws and take off the hub halves.
3. Remove key 940.02.
4. Remove thrower 507.01.
5. Undo hexagon head bolts 901.01 and 901.02.
6. Remove pump-end bearing cover 360.01 and drive-end bearing cover 360.02.
7. Press shaft 210 out of the shaft seat.
8. Remove radial ball bearings 321.01 and 321.02, and place them on a clean and level surface.

1311.83/06-EN

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

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 re-assemble the pump in accordance with the corresponding general assembly drawing and/or exploded view.

Sealing elements

Gaskets

- 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).

O-rings

- Never use O-rings that have been made by cutting an O-ring cord to size and gluing the ends together.

Packing rings

- Always use pre-compressed packing rings.

CAUTION

Contact of O-ring with graphite or similar material

Fluid could escape!

- ▷ Do not coat O-ring with graphite or similar material.
- ▷ Use animal fats or lubricants based on silicone or PTFE.

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.

Tightening torques

For reassembly, tighten all screws and bolts as specified in this manual.
(⇨ Section 7.6, Page 47) (Also see general assembly drawing and data sheet.)

7.5.2 Installing the bearing assembly

Oil lubrication

- ✓ 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. Press radial ball bearings 321.01 and 321.02 onto shaft 210.
2. Slide the pre-assembled shaft into bearing bracket 330.
3. Insert new gaskets 400.01 and 400.02.
4. Fasten bearing covers 360.01 and 360.02 with hexagon head bolts 901.01 and 901.02. Watch lip seals 421.01 and 421.02.
5. Fit thrower 507.01.
6. Insert key 940.02.
7. Fit the coupling hub on pump shaft 210. For split-hub coupling designs, fit the hub halves on pump shaft 210. Fit and tighten the screws clamping the hub halves together. Observe the tightening torques. (⇨ Section 7.6, Page 47)
8. Secure the coupling hub with a grub screw.

Grease lubrication for shaft units 25, 35, 55 (standard bearing assembly)

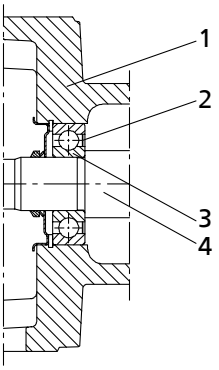

Fig. 16: Installing the radial ball bearing

1	Bearing bracket	2	Shield
3	Radial ball bearing	4	Shaft

- ✓ 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. Press radial ball bearings 321.01 and 321.02 onto shaft 210.
   Make sure the bearing side with the shield rests against the shaft shoulder (see illustration: Installing the radial ball bearings).
2. Slide the pre-assembled shaft into bearing bracket 330.
3. Fit circlips 932.01 and 932.02.
4. Fit bearing covers 360.01 and 360.02.
5. Fit axial seal rings 411.77 and 411.78.
6. Insert key 940.02.
7. Fit the coupling hub on pump shaft 210. For split-hub coupling designs, fit the hub halves on pump shaft 210. Fit and tighten the screws clamping the hub halves together. Observe the tightening torques. (⇨ Section 7.6, Page 47)
8. Secure the coupling hub with a grub screw.

1311.83/06-EN

Grease lubrication for shaft units 50, 60, 60.1 (reinforced bearing assembly)

✓ 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. Press radial ball bearings 321.01 and 321.02 onto shaft 210.
   Make sure the bearing side with the shield rests against the shaft shoulder (see illustration: Installing the radial ball bearings).
2. Slide the pre-assembled shaft into bearing bracket 330.
3. Fit circlips 932.01 and 932.02.
4. Fasten bearing covers 360.01 and 360.02 with hexagon head bolts 901.01 and 901.02.
5. Fit thrower 507.01.
6. Insert key 940.02.
7. Fit the coupling hub on pump shaft 210. For split-hub coupling designs, fit the hub halves on pump shaft 210. Fit and tighten the screws clamping the hub halves together. Observe the tightening torques. (⇨ Section 7.6, Page 47)
8. Secure the coupling hub with a grub screw.

7.5.3 Fitting the shaft seal

7.5.3.1 Installing a single 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 to have been observed and carried out.

✓ The bearings 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. Clean shaft sleeve 523 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.
2. Slide shaft sleeve 523 with new gasket 400.75 onto shaft 210.
3. Clean the mating ring location in casing cover 161.

CAUTION

Elastomers in contact with oil/grease

Shaft seal failure!

- ▷ Use water as assembly lubricant.
- ▷ Never use oil or grease as assembly lubricant.

4. Carefully insert the mating ring.
   Make sure to apply pressure evenly.
5. On variants with a bolted casing cover loosen forcing screws 901.31.
6. Place casing cover 161 into the locating fit of bearing bracket 330.

7. On variants with a clamped casing cover, fasten cover plates 81-92.01 and 81-92.02 with transport locks 901.98 and lock washers 554.98. The casing cover is now fastened to the bearing bracket.
8. Fit and tighten nuts 920.15, if any.

NOTE

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

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

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

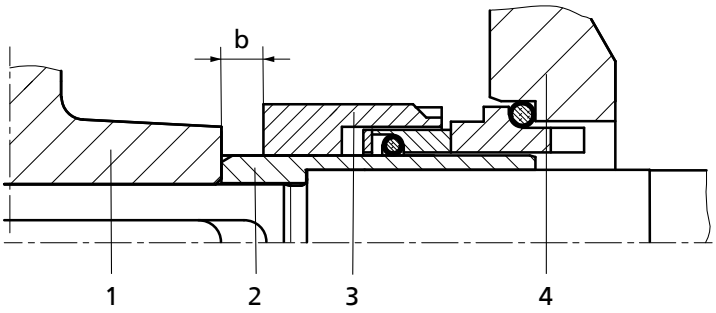

Fig. 17: Installation dimension b of mechanical seal

1	Impeller	2	Shaft sleeve
3	Mechanical seal	4	Casing cover

Table 13: Installation dimensions of the mechanical seal

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

7.5.3.2 Fitting the gland packing

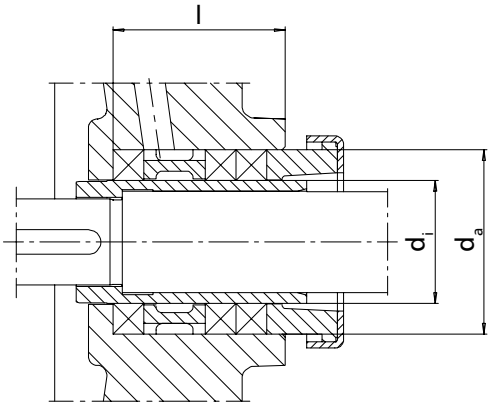

Fig. 18: Gland packing chamber

1311.83/06-EN

5 Shaft unit see data sheet.

Table 14: Gland packing chamber

Size	Gland packing chamber			Packing cross-section	Packing rings[6)]
	Ø d_i	Ø d_a	l		
065-040-250	30	46	45	□ 8 x 126	3 packing rings, 1 lantern ring
065-040-315	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
065-050-200	30	46	45	□ 8 x 126	3 packing rings, 1 lantern ring
065-050-250	30	46	45	□ 8 x 126	3 packing rings, 1 lantern ring
065-050-315	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
080-065-200	30	46	45	□ 8 x 126	3 packing rings, 1 lantern ring
080-065-315	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
080-065-250	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
100-080-200	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
100-080-250	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
100-080-315	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
125-100-200	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
125-100-315	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
125-125-250	40	60	56	□ 10 x 165	3 packing rings, 1 lantern ring
150-125-315	50	70	56	□ 10 x 196	3 packing rings, 1 lantern ring
200-150-400	50	70	56	□ 10 x 196	3 packing rings, 1 lantern ring
250-150-400	50	70	56	□ 10 x 196	3 packing rings, 1 lantern ring

✓ The notes and steps stated in to have been observed/carried out.
✓ The bearing assembly 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.

Fig. 19: Packing ring cut to size

Model with packing ring cut to size

1. Clean the gland packing chamber.
2. Insert packing ring 461 into the gland packing chamber of casing cover 161.
3. Use stuffing box ring 454 to tamp down packing ring 461.
4. Slide the shaft protecting sleeve (chamfered side first) into the gland packing chamber from the pump end.
5. Insert lantern ring 458, if any (see drawing above).
   Insert subsequent packing rings one at a time, with their joints staggered at 90°. Use stuffing box ring 454 to seat each individual packing ring in the gland packing chamber. Once each packing ring is in place, slide shaft protecting sleeve 524 back into position.
6. Position gland follower 452 on studs 902.2. Fasten by tightening nuts 920.2 lightly and evenly.
   Do not pack down packing rings 461 yet.
7. Use a feeler gauge to verify that gland follower 452 is fitted centred and at a right angle to the shaft.
8. Slide new gasket 400.75 onto shaft 210.
9. On models with a bolted casing cover loosen forcing screws 901.31.
10. Place casing cover 161 into the locating fit of bearing bracket 330. Verify that shaft 210 and shaft protecting sleeve 524 are aligned properly.
11. On models with a clamped casing cover, fasten cover plates 81-92.01 and 81-92.02 with transport locks 901.98 and lock washers 554.98. The casing cover is now fastened to the bearing bracket.

6 For operation with positive suction head and suction pressure > 0.5 bar, the lantern ring is replaced by 2 additional packing rings.

12. Fit and tighten nuts 920.15, if any.
13. Tighten gland follower 452 lightly and evenly.
    The pump rotor must be easy to rotate.

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 and 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. Insert key 940.01 and, if applicable, key 940.09. Slide impeller 230 onto shaft 210.
2. Bend back one of the tabs of lockwasher 931 and slide the lockwasher onto shaft 210. (For shaft unit 25: also slide disc 550.95 onto shaft 210). Position the lockwasher with the folded tab in the keyway of impeller 230.
3. Fasten impeller nut 920.95, spring washer 930.95 and disc 550.01, if any. (See table: Tightening torques of screwed connections at the pump).

7.5.5 Installing the back pull-out unit

⚠ WARNING

Back pull-out unit tilting

Risk of crushing hands and feet!

- ▹ Suspend or support the bearing bracket at the pump end.

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 41) to (⇨ Section 7.5.4, Page 46) have been observed and carried out.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- ✓ For back pull-out units without coupling, fit the coupling in accordance with the manufacturer's instructions.

1. Insert new gasket 400.10 into volute casing 102.
2. Loosen forcing screws 901.30 or 901.31.
3. Suspend or support the back pull-out unit to prevent it from tipping over. Guide back pull-out unit over studs 902.01. Then slide it into volute casing 102.
4. Tighten nut 920.01 at the volute casing. Observe the tightening torques.
5. Bolt support foot 183 to the baseplate.

7.5.6 Mounting the motor

NOTE

Steps 1 and 2 do not apply to versions with spacer-type coupling.

1. Shift the motor to connect it to the pump via the coupling.
2. Fasten the motor to the baseplate.
3. Align pump and motor. (⇨ Section 5.7, Page 24)
4. Connect the motor to the power supply (refer to manufacturer's product literature).

1311.83/06-EN

7.6 Tightening torques

7.6.1 Tightening torque pump

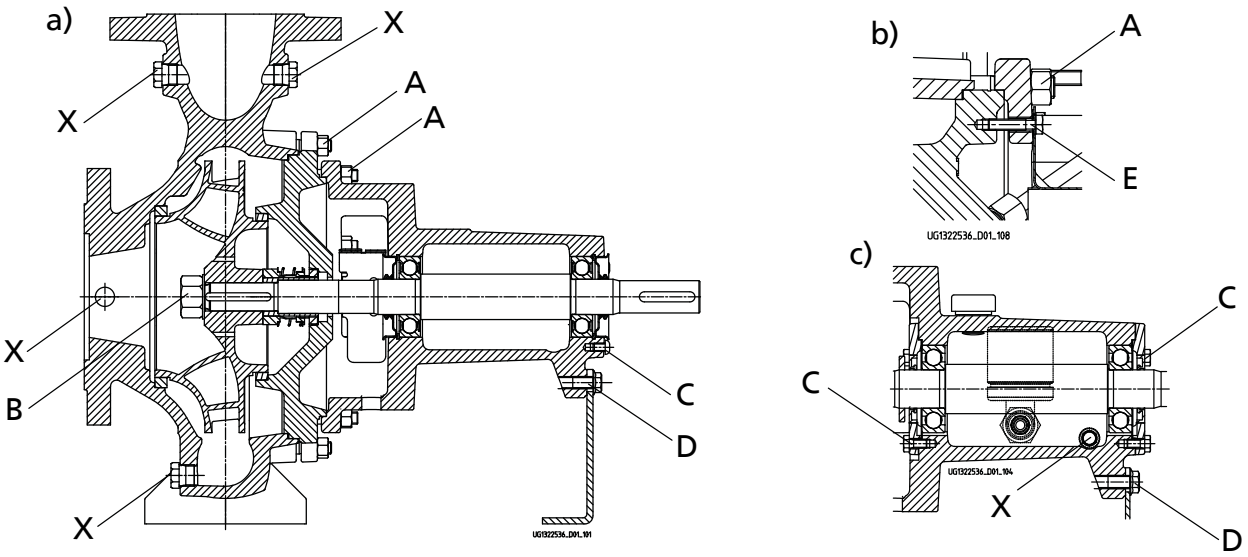

Fig. 20: Tightening points: model with bolted casing cover and grease lubrication (a), model with clamped casing cover (b) and oil lubrication (c)

Table 15: Tightening torques

Position	Thread	Tightening torques [Nm]
A	M12	55
	M16	130
B	M12 × 1,5	55
	M24 × 1,5	130
	M30 × 1,5	170
C	M8	20
	M10	38
D	M12	90
E	M6	5
X	1/8	25
	1/4	55
	3/8	80
	1/2	130
	3/4	220

7.6.2 Tightening torques for the pump set

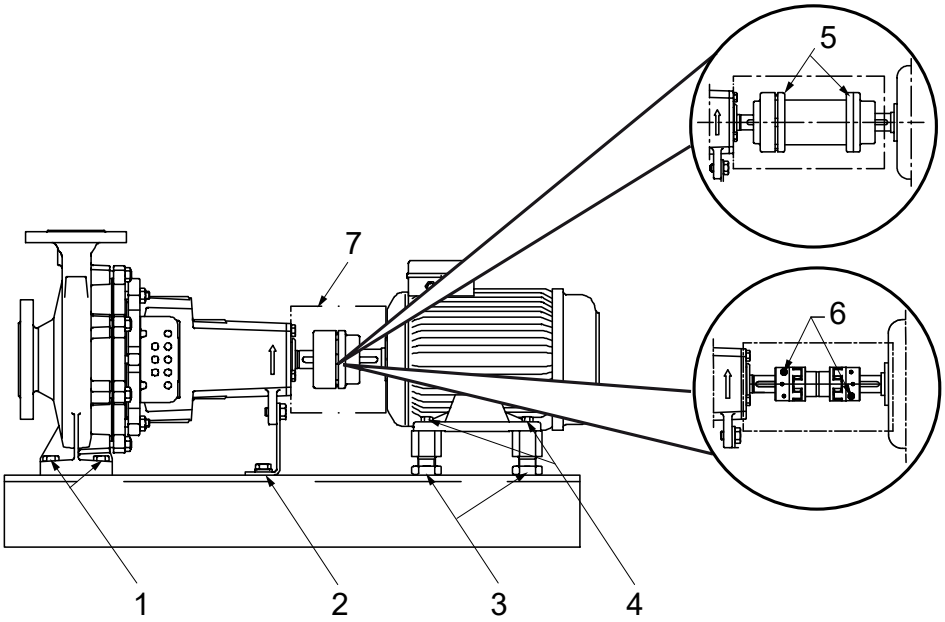

Fig. 21: Position of bolts/screws at the pump set

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

Position	Thread size	Tightening torque [Nm]	Notes
1	M12	30	Pump on baseplate
	M16	75	
	M20	75	
2	M12	30	
3	M24 × 1,5	140	Adjusting screws in baseplate
	M36 × 1,5	140	
4	M6	10	Motor on baseplate or motor on adjusting screws or bases
	M8	10	
	M10	15	
	M12	30	
	M16	75	
	M20	140	
	M24	140	
5	M6	13	Coupling (only for spacer-type coupling made by Flender)
	M8	18	
	M10	44	
6	M8	34	Coupling (only for double Cardan spacer-type coupling and split-hub coupling design, make: KTR)
	M10	67	
	M12	115	
	M16	290	
	M20	560	
7	M6	10	Coupling guard

1311.83/06-EN

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 53)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

7.7.2 Recommended spare parts stock

Table 17: Quantity of spare parts for recommended spare parts stock for commissioning

Part No.	Description	Number of pumps									
		1	2	3	4	5	6	7	8	9	10 and more
433	Mechanical seal	1	1	1	2	2	2	2	3	3	25 %
433.01/.02	Mechanical seal[7)]	1	1	1	2	2	2	2	3	3	25 %
400.10	Gasket	2	4	6	8	8	9	9	12	12	150 %
400.75	Gasket	2	4	6	8	8	9	9	12	12	150 %
400.15	Gasket[7)]	2	4	6	8	8	9	9	12	12	150 %
411.15	Joint ring[7)]	2	4	6	8	8	9	9	12	12	150 %
412.15	O-ring[7)]	2	4	6	8	8	9	9	12	12	150 %

Table 18: Quantity of spare parts for recommended spare parts stock for 2 years' operation to DIN 24296

Part No.	Description	Number of pumps									
		1	2	3	4	5	6	7	8	9	10 and more
210	Shaft	1	1	1	1	2	2	2	2	2	20 %
230	Impeller	1	1	1	1	2	2	2	2	2	20 %
321.01/.02	Rolling element bearing (set)	1	1	1	2	2	2	2	3	3	25 %
433	Mechanical seal	1	1	1	2	2	2	2	3	3	25 %
433.01/.02	Mechanical seal	1	1	1	2	2	2	2	3	3	25 %
502.01/.02	Casing wear ring[8)] (set)	1	2	2	2	3	3	3	4	4	50 %
523	Shaft sleeve	1	2	2	2	3	3	3	4	4	50 %
524	Shaft protecting sleeve	1	2	2	2	3	3	3	4	4	50 %
461	Gland packing (set)	2	4	4	6	6	6	6	8	8	100 %
458	Lantern ring[8)]	2	4	4	6	6	6	8	8	8	100 %
400.10	Gasket	2	4	6	8	8	9	9	12	12	150 %
400.15	Gasket	2	4	6	8	8	9	9	12	12	150 %

7 For double mechanical seal
8 If fitted

Part No.	Description	Number of pumps									
		1	2	3	4	5	6	7	8	9	10 and more
400.75	Gasket	2	4	6	8	8	9	9	12	12	150 %
411.15	Joint ring	2	4	6	8	8	9	9	12	12	150 %
412.15	O-ring	2	4	6	8	8	9	9	12	12	150 %

1311.83/06-EN

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 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 19: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy[9]
✗	-	-	-	-	-	-	-	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).
✗	-	-	-	-	-	✗	✗	Pump or piping are not completely vented or primed.	Vent and/or prime.
✗	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
✗	-	-	-	-	-	-	-	Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
✗	-	-	-	-	-	✗	✗	Suction lift is too high/NPSHavailable (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.
✗	-	-	-	-	-	-	-	Air intake at the shaft seal	Supply external barrier fluid, if necessary, or increase barrier fluid pressure. Replace shaft seal.
✗	-	-	-	-	-	-	-	Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
✗	-	-	-	-	-	-	-	Speed is too low. - Operation with frequency inverter - Operation without frequency inverter	 - Increase voltage/frequency at the frequency inverter in the permissible range. - Check voltage.
✗	-	-	-	-	-	✗	-	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.[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)]
-	✗	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact the manufacturer.
-	-	-	-	-	✗	-	-	Use of unsuitable shaft seal materials	Change the material combination. [10)]
-	✗	-	-	-	✗	-	-	Gland follower over-tightened or cocked	Adjust.
-	✗	✗	-	-	-	-	-	Speed is too high.	Reduce speed.[10)]
-	-	-	-	✗	-	-	-	Tie bolts/sealing element defective	Fit new sealing element between volute casing and casing cover. Re-tighten the bolts.
-	-	-	-	-	✗	-	-	Worn shaft seal	Fit new shaft seal. Check flushing liquid/barrier fluid.
✗	-	-	-	-	✗	-	-	Score marks or roughness on shaft protecting sleeve / shaft sleeve	Replace shaft protecting sleeve/shaft sleeve. Fit new shaft seal.
-	-	-	-	-	✗	-	-	Dismantle to find out.	Correct. Fit new shaft seal, if required.
-	-	-	-	-	✗	-	-	Vibrations during pump operation	Correct the suction conditions. Re-align the pump set. Re-balance the impeller. Increase pressure at the pump suction nozzle.
-	-	-	✗	-	✗	✗	-	Pump set is misaligned.	Re-align pump set.
-	-	-	✗	-	✗	✗	-	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.
-	-	-	✗	-	-	-	-	Increased axial thrust[10)]	Clean balancing holes in the impeller. Replace the casing wear rings.
-	-	-	✗	-	-	-	-	Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
-	-	-	✗	-	-	-	-	Non-compliance with specified coupling distance	Correct the distance according to general arrangement drawing.
✗	✗	-	-	-	-	-	-	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 bearing(s)	Replace.
-	-	-	✗	-	-	✗	✗	Flow rate is too low.	Increase the minimum flow rate.
-	-	-	-	-	✗	-	-	Incorrect inflow of circulation liquid	Increase the free cross-section.

1311.83/06-EN

9 Related Documents

9.1 General assembly drawing with list of components

9.1.1 Etanorm FXV

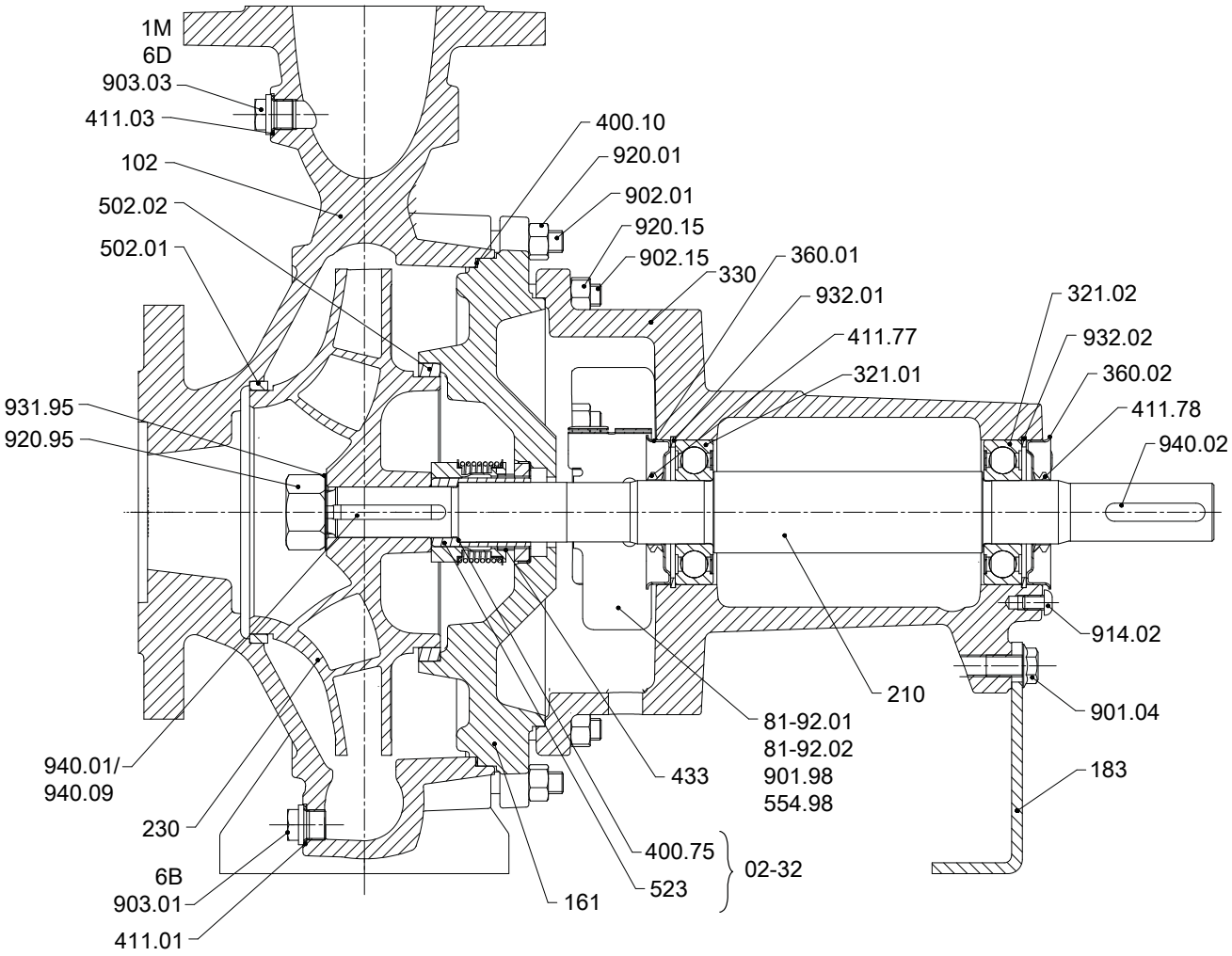

Fig. 22: General assembly drawing of version with mechanical seal

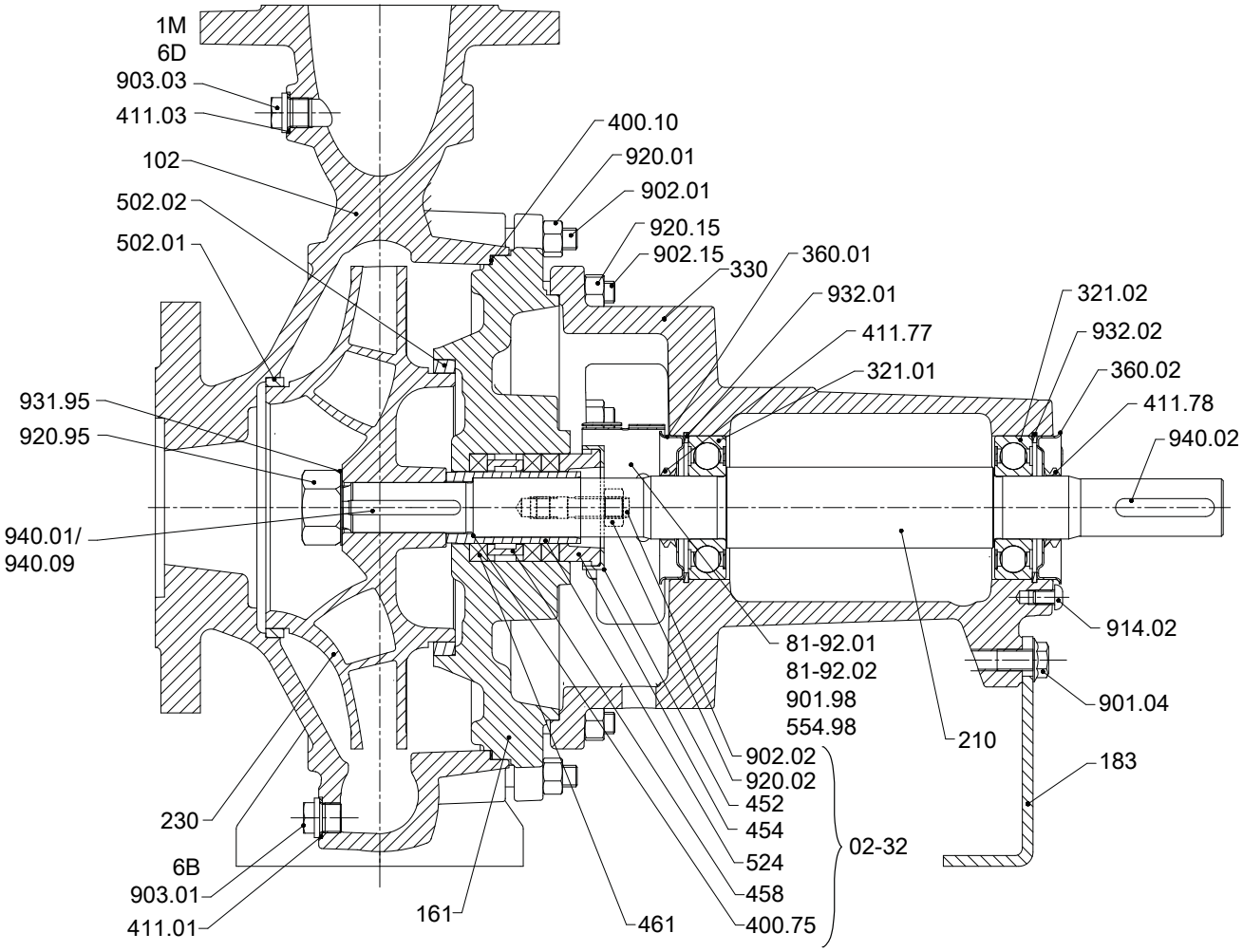

Fig. 23: General assembly drawing of version with gland packing, type P1 - Na

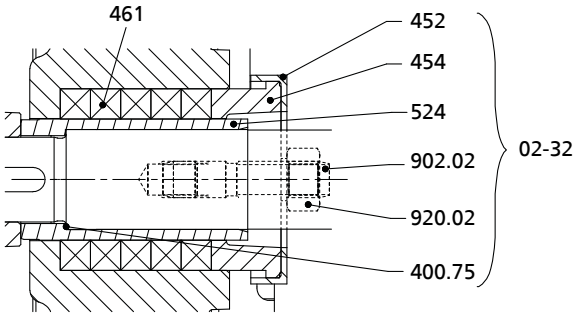

Fig. 24: Version with gland packing, type P2 - Nb

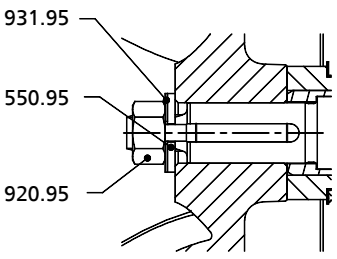

Fig. 25: Impeller fastening elements WS_25

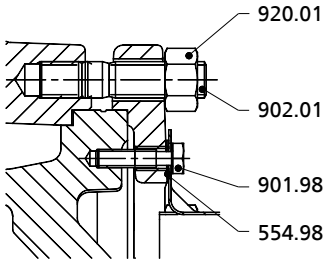

Fig. 26: Version with clamped discharge cover

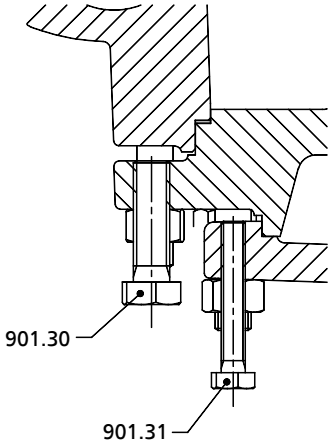

Fig. 27: Forcing screw

Table 20: List of components

Part No.	Description	Part No.	Description
102	Volute casing	524[11)]	Shaft protecting sleeve
161	Casing cover	550.95[12)]	Disc
183	Support foot	554.98	Lock washer
210	Shaft	81-92.01/.02	Cover plate
230	Impeller	901.04/.30/.31/.98	Hexagon head bolt
321.01/.02	Deep groove ball bearing	902.01/.02[11)]-15[13)]	Stud
330	Bearing bracket	903.01/.03	Screw plug
360.01/.02	Bearing cover	914.02	Hexagon socket head cap screw
400.10/.75	Gasket	920.01/.02[11)]/.15[13)]/.95	Hexagon nut
411.01/.03/.77/.78	Joint ring	931.95	Lock washer
433[14)]	Mechanical seal	932.01/.02	Circlip
452[11)]	Gland follower	940.01/.02/.09 [15)]	Key
454[11)]	Stuffing box ring	**Connection:**	
458[11)]	Lantern ring	1M	Connection for pressure gauge
461[11)]	Gland packing	6B	Fluid drain
502.01/.02	Casing wear ring	6D	Fluid filling and venting
523[14)]	Shaft sleeve	8B	Leakage drain

11 For versions with gland packing only
12 For sizes 65-40-250, 65-50-200, 65-50-250 and 80-65-200 only
13 Not for sizes 100-80-200 and 125-100-200
14 For versions with mechanical seal only
15 For sizes 80-65-315, 100-80-315, 125-100-315, 150-125-315, 200-150-400, 250-150-400 only

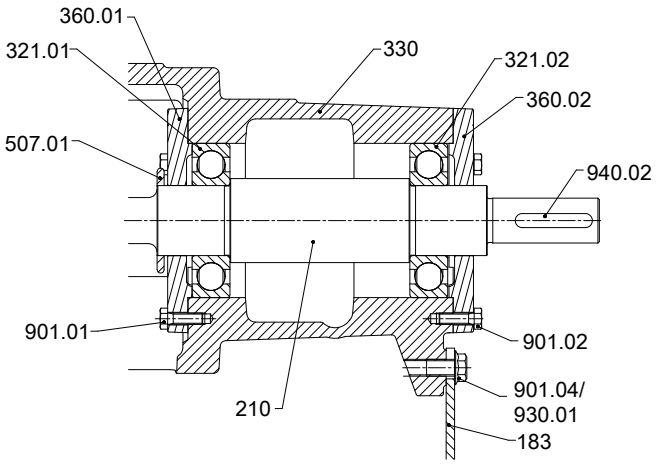

Fig. 28: Version with bearing brackets WS 50, WS 60 and WS 60.1

Table 21: List of components for version with reinforced bearing assembly (shaft units 50, 60, 60.1)

Part No.	Description	Part No.	Description
183	Support foot	507.01	Thrower
210	Shaft	901.01/.02/.04	Hexagon head bolt
330	Bearing bracket	930.01	Lock washer
321.01/.02	Deep groove ball bearing	940.02	Key
360.01/.02	Bearing cover		

10 EU Declaration of Conformity

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

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

Etanorm FXV, Etanorm FXM

KSB order number: .....

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): 2006/42/EC Machinery Directive
  - Electrical components[16]: 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

The manufacturer also declares that

- the following harmonised international standards[17] 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

.....[18].....

Name

Function

Company
Address

16 Where applicable

17 Apart from the standards listed here referring to the Machinery Directive, further standards are observed for explosion-proof versions (ATEX Directive) as applicable and are listed in the legally binding EU Declaration of Conformity.

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

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[19]: .....

Delivery date: .....

Application: .....

Fluid handled[19]: .....

Please tick where applicable[19]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[19]: .....

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

1311.83/06-EN

19 Required field

Index

A
Abrasive fluids 31
Applications 8
Auxiliary connections 22

B
Bearing temperature 34
Bearings 15

C
Certificate of Decontamination 58
Commissioning 28
Configuration 16
Coupling 35
Coupling alignment 23

D
Design 15
Designation 14
Direction of rotation 27
Dismantling 38
Disposal 13

E
Event of damage 6
  Ordering spare parts 49

F
Faults
  Causes and remedies 51
Filter 20, 35
Final check 28
Fluid handled
  Density 31
Frequency of starts 30
Function 16

G
Gland packing 29
Grease lubrication
  Grease quality 35
  Intervals 35

I
Impeller type 15
Installation
  Installation on a foundation 18
Installation at site 18
Intended use 8

K
Key to safety symbols/markings 7

L
List of components 55, 56

M
Maintenance 33
Mechanical seal 29

N
Name plate 14
Noise characteristics 16

O
Order number 6
Other applicable documents 6

P
Partly completed machinery 6
Piping 20
Preservation 12, 32
Pump casing 15

R
Reassembly 38, 41
Return to supplier 12
Returning to service 32

S
Safety 8
Safety awareness 9
Scope of supply 17
Shaft seal 15
Shutdown 32
Spare part
  Ordering spare parts 49
Spare parts 49
Storage 12, 32

T
Tightening torques 47, 48
Transport 11

W
Warnings 7
Warranty claims 6

1311.83/06-EN

1311.83/06-EN (01512582)

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