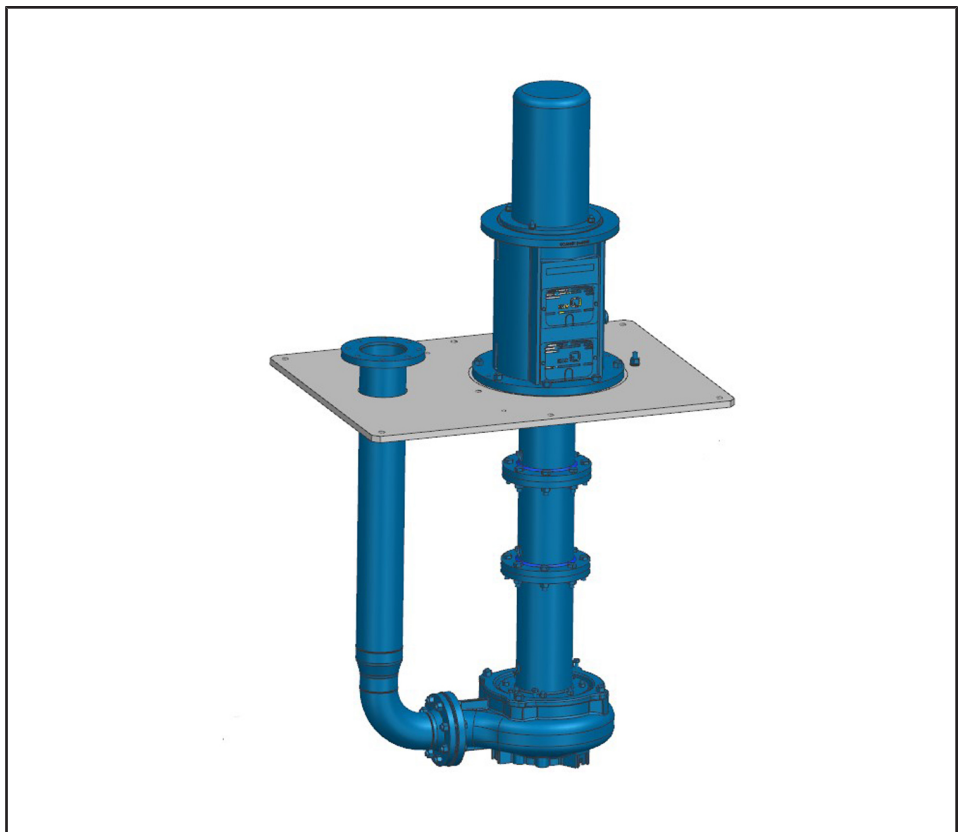


Vertical Immersion Pump

**Estigia K**

## Installation/Operating Manual



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Installation/Operating Manual Estigia K

Original operating manual

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## Glossary

### **Certificate of decontamination**

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

### **Discharge line**

The pipeline which is connected to the discharge nozzle

### **Pool of pumps**

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

### **Pump**

Machine without drive, additional components or accessories

### **Pump set**

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

## 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 10)

### 1.4 Other applicable documents

**Table 1:** Overview of other applicable documents

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

<sup>1</sup> If included in agreed 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
 <b>DANGER</b>	<b>DANGER</b> This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	<b>WARNING</b> This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	<b>CAUTION</b> This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	<b>Explosion protection</b> This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with the <i>Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016</i> .
	<b>General hazard</b> In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	<b>Electrical hazard</b> In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	<b>Machine damage</b> In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.





## 2 Safety

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

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

### 2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
  - Arrow indicating the direction of rotation
  - Markings for connections
  - Name plate
- The operator is responsible for ensuring compliance with all local regulations 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 7)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- The pump (set) must only be operated on a frequency inverter upon prior consultation.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Never operate the pump without the fluid to be handled.
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

#### 2.2.1 Prevention of foreseeable misuse

- Never exceed the permissible application and operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Never open the discharge-side shut-off elements further than permitted.
  - The maximum flow rates specified in the product literature or data sheet would be exceeded.
  - Risk of cavitation damage
- Never close the suction-side shut-off elements further than permitted.
  - The minimum flow rate specified in the product literature or data sheet would not be met.
  - Possible damage by vibrations
- Observe all safety information and instructions in this manual.

### 2.3 Personnel qualification and training

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

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

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

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

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

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

### 2.5 Safety awareness

In addition to the safety information contained in this 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 user/operator

- 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.
- Make sure the structure into which the pump (set) is to be installed has been designed correctly.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 35)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3, Page 43)
- 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 31)

## 2.8 Unauthorised modes of operation

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

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

## 2.9 Explosion protection

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

Pumps/Pump sets must not be used in potentially explosive atmospheres unless marked as explosion-proof **and** identified as such in the data sheet.

Special conditions apply to the operation of explosion-proof pump sets in accordance with the UK's *Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016*.

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇒ Section 2.9.1, Page 11) to (⇒ Section 2.9.4, Page 12)  
The explosion-proof status of the pump is only assured if the pump is used in accordance with its intended use.

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

Prevent impermissible modes of operation at all times.

### 2.9.1 Marking

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

Example of such marking:  
II 2G Ex h IIC T5-T1 Gb

Refer to the data sheet for the applicable temperature class.

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



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

**Motor** The motor must be considered separately.

### 2.9.2 Temperature limits

In normal pump operation, the highest temperatures on accessible components are to be expected on the surface of the soleplate and the discharge piping, at the shaft seal and in the bearing areas.

The surface temperature at the discharge piping corresponds to the temperature of the fluid handled. If the pump is heated in addition, the operator of the system is responsible for observing the specified temperature class and fluid temperature (operating temperature).

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

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

**Table 4:** Temperature limits

Temperature class to ISO 80079-36	Maximum permissible fluid temperature
T1	$\leq 450\text{ °C}^{2)}$
T2	$\leq 300\text{ °C}$
T3	$\leq 200\text{ °C}$
T4	$\leq 135\text{ °C}$

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

If the pump is to be operated at a higher temperature, if there is no data sheet or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

### 2.9.3 Monitoring equipment

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

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

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

Contact KSB for further information about monitoring equipment.

### 2.9.4 Operating limits

The minimum flows indicated in refer to water and water-like fluids handled. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures at the pump surface. However, if the physical properties of the fluids handled are different from water, it is essential to check whether an additional heat build-up may occur and if the minimum flow rate must therefore be increased.



<sup>2</sup> Depending on the material variant

### 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

	<div style="background-color: #e67e22; color: white; padding: 5px;"><b>! DANGER</b></div> <p><b>The pump (set) could slip out of the suspension arrangement</b> Danger to life from falling parts!</p> <ul style="list-style-type: none"> <li>▷ Always transport the pump (set) in the specified position.</li> <li>▷ Never attach the suspension arrangement to the free shaft end or the motor eyebolt.</li> <li>▷ Observe the information about weights, centre of gravity and fastening points.</li> <li>▷ Observe the applicable local accident prevention regulations.</li> <li>▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.</li> </ul>
	<div style="background-color: #f1c40f; color: black; padding: 5px;"><b>CAUTION</b></div> <p><b>Improper pump transport</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Never suspend the pump/pump set from the power cable.</li> <li>▷ Prevent the pump (set) from getting knocked or dropped.</li> </ul>

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

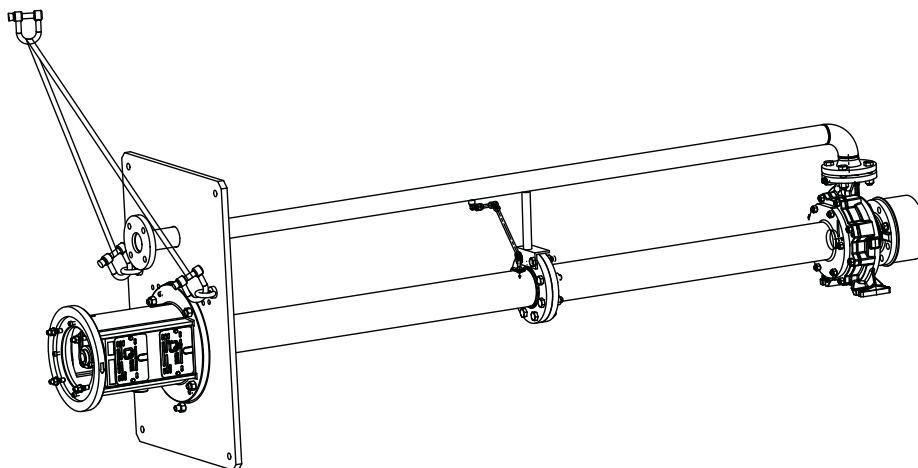




Fig. 1: Transporting the pump set

#### 3.3 Storage/preservation

	<div style="background-color: #f1c40f; color: black; padding: 5px;"><b>CAUTION</b></div> <p><b>Damage during storage due to humidity, dirt or vermin</b> Corrosion/contamination of the pump (set)!</p> <ul style="list-style-type: none"> <li>▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.</li> </ul>
---	---

	CAUTION
	<p><b>Wet, contaminated or damaged openings and connections</b></p> <p>Leakage or damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.</li> </ul>

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 equipment is protected for a maximum of 12 months.


For storing a pump which has already been operated, observe the measures to be taken for shutdown. (⇒ Section 6.3.1, Page 35)

### 3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 43)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids. (⇒ Section 6.5, Page 36)
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.  
Indicate any safety measures and decontamination measures taken.  
(⇒ Section 11, Page 68)

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

### 3.5 Disposal

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

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

## 4 Description of the Pump (Set)

### 4.1 General description

- Vertical immersion pump

Pump for wells, ditches and tanks. For neutral or aggressive liquids with a low solids content.

### 4.2 Product information

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

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

### 4.3 Designation

Table 5: Designation example

Position																																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
S	T	G	K	0	6	5	-	3	1	5	-	G	G	X	W	D	L	0	-	1	D	4	3	1	0	S	5	L	0	0	7	5	E	2	B	P	D	2	-
See name plate and data sheet																										See data sheet													

Table 6: Designation key

Position	Code	Description
1-3	Pump type	
	STG	Estigia
4	Impeller type	
	K	Channel impeller
5-12	Size, e.g.	
	065	Nominal discharge nozzle diameter [mm]
	315	Nominal impeller diameter [mm]
13	Casing material	
	G	Cast iron JL 1040 / A48 CL35
	C	Stainless steel 1.4408 / A743 CF8M
	D	Noridur 1.4593/1.4517 / A995 CD4MCuN
14	Impeller material	
	G	Cast iron EN-GJL 250 / A48 CL35B
	C	Stainless steel 1.4408 / A743 CF8M
	D	Noridur 1.4593/1.4517 / A995 CD4MCuN
	H	White cast iron EN-GJN-HB555 (XCR14)
15	Design	
	<sup>3)</sup>	Standard
	X	Non-standard (BT3D, BT3)
16	Installation type	
	D	Dry (cantilever design)
	W	Wet (with plain bearing)
17	Scope of supply	
	C	Pump and coupling
	D	Pump set
18	Seal	
	L	Lip seal
	C	Cartridge seal
19	Bearing lubrication	
	1	External liquid
	2	By electric grease pump
20	Explosion protection status	
	<sup>3)</sup>	Non-explosion-proof
	A	Explosion-proof
21-22	Riser design	
	0D	DN discharge nozzle, with DIN upper flange
	1D	DN discharge nozzle + 1 nominal size, with DIN upper flange
	2D	DN discharge nozzle + 2 nominal sizes, with DIN upper flange
	0A	DN discharge nozzle, with ANSI upper flange
	1A	DN discharge nozzle + 1 nominal size, with ANSI upper flange

<sup>3)</sup> Blank



Position	Code	Description
21-22	2A	DN discharge nozzle + 2 nominal sizes, with ANSI upper flange
23-26	Immersion depth [mm]	
27	Baseplate design	
	0	Rectangular, steel
	1	Round, steel (DIN)
	2	Round, steel (ASME)
	3	Rectangular, stainless steel
	4	Round, stainless steel (DIN)
	5	Round, stainless steel (ASME)
28	Bearing size	
	4	VCS 40
	5	VCS 50
	6	VCS 60
	8	VCS 80
29	Bearing lubrication	
	L	Grease-packed for life
	G	Re-greasable
30-33	Motor rating $P_N$ [kW]	
	_3)	Without motor
	0007	0,75
	...	...
	1320	132,00
34	Frequency [Hz]	
	E	50
	A	60
35	Number of motor poles	
36	Product generation	
	B	Estigia from 2017
37-40	Automation	
	PD2-	PumpDrive 2
	PD2E	PumpDrive 2 Eco
	-NPD	Without PumpDrive

#### 4.4 Name plate

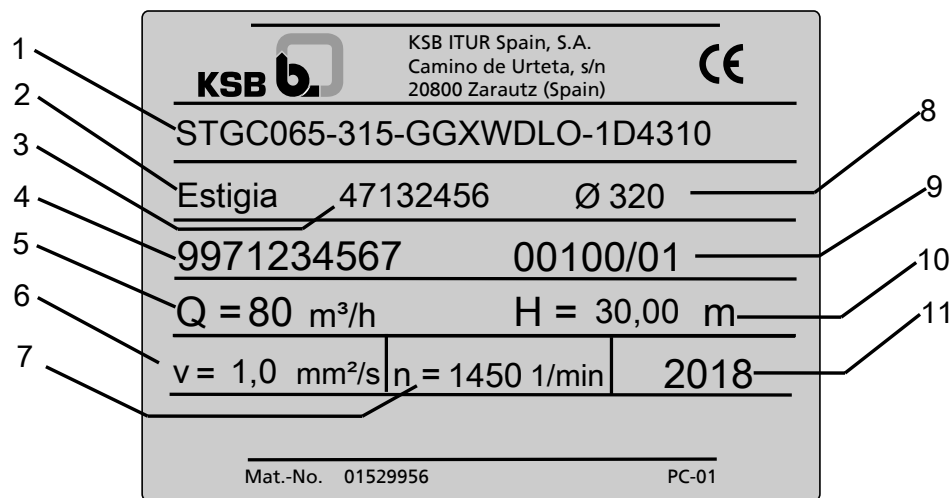


Fig. 2: Name plate

1	Type series code, size and version	7	Speed
2	Type series	8	Nominal impeller diameter
3	Material number	9	KSB order item number
4	KSB order number	10	Head
5	Flow rate	11	Year of construction
6	Kinematic viscosity of the fluid handled		

#### 4.5 Design details

##### Design

- Volute casing pump
- For vertical installation in closed tanks under atmospheric pressure
- Single-stage
- In accordance with DIN EN ISO 5199 (with comments)
- Coupling between pump and motor

##### Pump casing

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

##### Drive

- KSB surface-cooled IEC three-phase current squirrel-cage motor
- Type of construction IM V1
- Frequency 50 Hz/60 Hz
- Enclosure IP55
- Thermal class F with temperature sensor
- Duty type: continuous duty S1

#### Shaft seal

- Cartridge seal
- Lip seal

#### Impeller type

- Closed radial impeller with multiply curved vanes

#### Bearings

- Various application-oriented bearings

#### Automation

Automation options:

- PumpDrive<sup>4)</sup>
- PumpMeter
- KSB SuPremE

### 4.6 Configuration and function

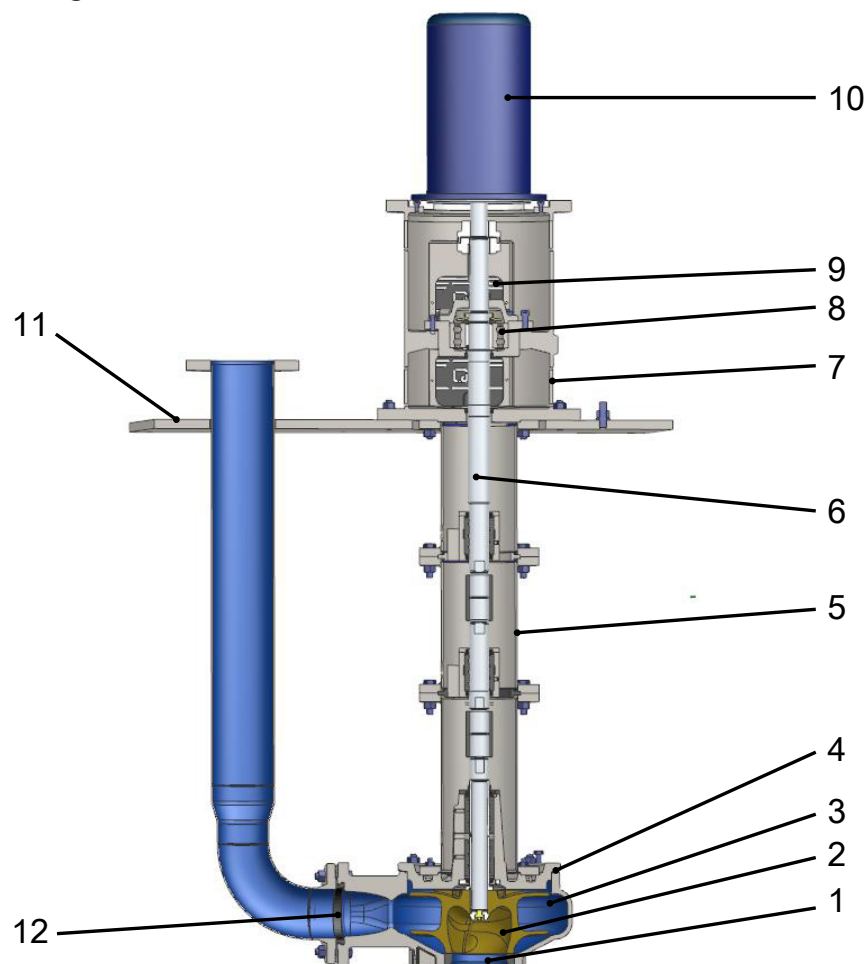


Fig. 3: Sectional drawing

1	Suction nozzle	7	Drive lantern
2	Impeller	8	Rolling element bearing
3	Pump casing	9	Coupling
4	Casing cover	10	Motor

<sup>4</sup> Consultation with KSB is required for operation on a frequency inverter.

5	Support column	11	Cover plate
6	Shaft	12	Discharge nozzle

**Design** The pump is designed with an axial fluid inlet and an axial fluid outlet. The hydraulic system is connected to the motor (10) via a coupling (9). On the rear side of the impeller (2) the shaft (6) enters the hydraulic system through the casing cover (4). The shaft (6) runs in rolling element bearings (8), which are supported by a drive lantern (7). The drive lantern (7) is connected to the pump casing (3) or casing cover (4), as applicable, via the support column (5). The pump set is mounted on a cover plate (11).

Thanks to the variable lengths of support column (5) and shaft (6) the pump set can be matched to different immersion depths.

**Function** The fluid enters the pump via the suction nozzle (1) and is accelerated outward by the rotating impeller (2). In the flow passage of the pump casing (3) the kinetic energy of the fluid handled is converted into pressure energy. The fluid handled is pumped to the discharge nozzle (12), where it leaves the pump.

**Sealing** Depending on the fluid handled, the pump is fitted with a lip seal or cartridge seal.

## 4.7 Bearings

**Table 7:** Overview of bearings used

Bearing size	Plain bearing		Double angular contact ball bearing <sup>5)6)</sup>
	Pump end	Intermediate <sup>7)</sup>	Drive end
VCS 40	PTFE-GF25	PTFE-GF25	3307 2RS C3
VCS 50	PTFE-GF25	PTFE-GF25	3310 2RS C3
VCS 60	PTFE-GF25	PTFE-GF25	3312 2RS C3
VCS 80	PTFE-GF25	PTFE-GF25	3314 2Z C3

The plain bearings are located in the casing cover of the pumps and, for pumps with several support column sections, in the intermediate couplings.

These bearings must always be lubricated and cooled. The bearings can be lubricated in any of the following two ways:

- Lubrication by external liquid  
(An external auxiliary connection is located in the cover plate of the pump. Clean water or another liquid compatible with the fluid handled is injected at a pressure of approximately 0.5 kg/cm<sup>2</sup> (pressure gauge) above the pump discharge pressure.)
- Lubrication by electrically driven pump  
(The auxiliary pump is designed with a grease reservoir for lubricating the bearings. The auxiliary pump is maintenance-free; the reservoir must be filled with grease at all times.)

## 4.8 Scope of supply

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

- Pump
- Drive
- Cover plate
- Discharge line

For pump sets with cartridge seal:

- Assembly fixture

<sup>5</sup> Grease-packed for life or re-greasable

<sup>6</sup> Mainly for severely abrasive liquids and liquids with a high solids content

<sup>7</sup> Can be lubricated by the fluid handled, by an external liquid or grease-lubricated by means of an electric grease pump

## 4.9 Dimensions and weights

### 4.9.1 Pump dimensions and immersion depths

#### Estigia K with rectangular baseplate

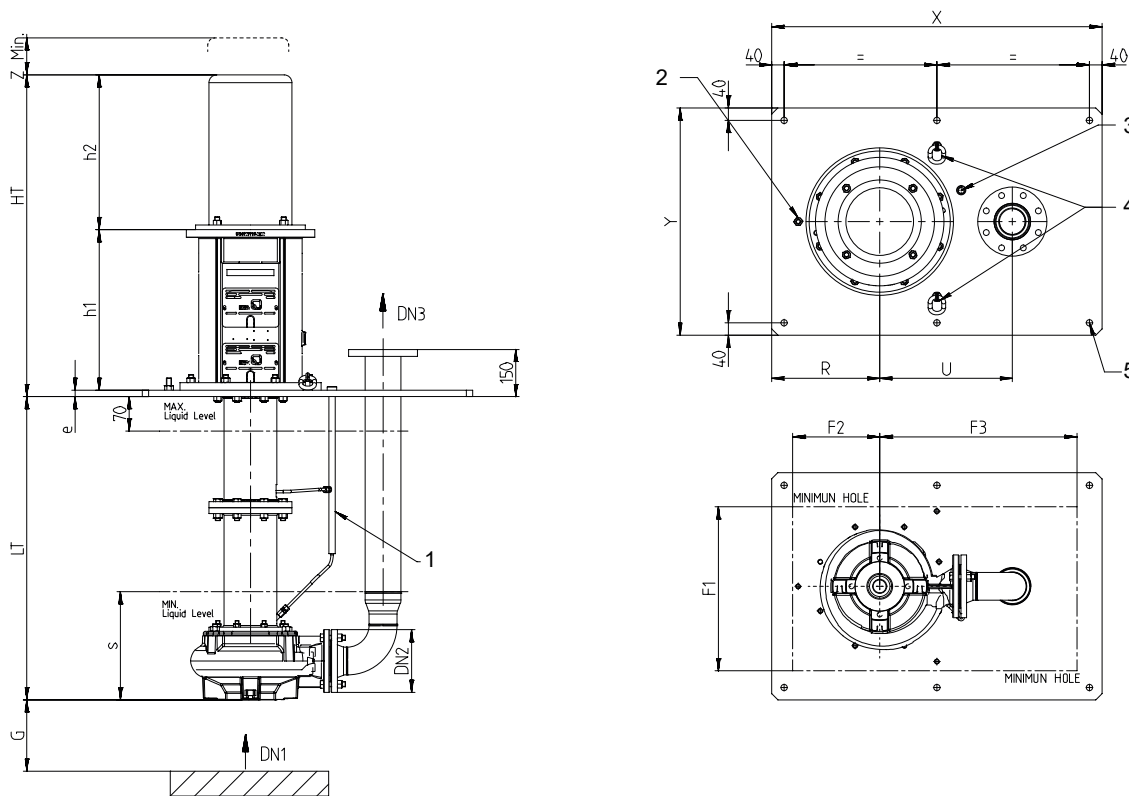


Fig. 4: Pump dimensions and immersion depths, rectangular baseplate

1	Lubrication by external liquid	2	1 earthing connection M16
3	1 external liquid inlet, 1/2" gas threaded	4	2 eyebolts
5	6 mounting holes		

>: Minimum

<: Maximum

Table 8: Pump dimensions and immersion depths [mm] - rectangular baseplate

Size	Motor size	Bearing size	Possible immersion depth (ET) <sup>8)</sup>	DN3	e	F1 min	F2 min	F3 min <sup>9)</sup>	G	LT	R	s min	U	X	Y	k
					[mm]											
40-252	≤ 280	VCS60	A	DN040	20	410	205	407	65	(ET+100)-k	375	270	331	980	740	20
40-252	≤ 280	VCS60	A	DN050	20	410	205	413	65	(ET+100)-k	375	270	331	980	740	20
40-252	≤ 280	VCS60	A	DN065	20	410	205	421	65	(ET+100)-k	375	270	331	980	740	20
80-253	≤ 280	VCS60	A	DN080	20	505	240	519	90	(ET+124)-k	345	300	423	1054	725	20
80-253	≤ 280	VCS60	A	DN100	20	505	240	531	90	(ET+124)-k	345	300	423	1054	725	20
80-253	≤ 280	VCS60	A	DN125	20	505	240	545	90	(ET+124)-k	345	300	423	1054	725	20
100-253	≤ 280	VCS60	A	DN100	20	505	239	581	110	(ET+125)-k	345	300	473	1054	725	20
100-253	≤ 280	VCS60	A	DN125	20	505	239	595	110	(ET+125)-k	345	300	473	1054	725	20

<sup>8)</sup> See Table: Possible immersion depths (ET) depending on number of support columns

<sup>9)</sup> Minimum dimension if maximum dimension is selected for DN3

Size	Motor size	Bearing size	Possible immersion depth (ET) <sup>8)</sup>	DN3	e	F1 min	F2 min	F3 min <sup>9)</sup>	G	LT	R	s min	U	X	Y	k
					[mm]											
100-253	≤ 280	VCS60	A	DN150	20	505	239	609	110	(ET+125)-k	345	300	473	1054	725	20
100-254	≤ 280	VCS60	A	DN100	20	524	244	571	110	(ET+127)-k	345	300	463	1054	725	20
100-254	≤ 280	VCS60	A	DN125	20	524	244	585	110	(ET+127)-k	345	300	463	1054	725	20
100-254	≤ 280	VCS60	A	DN150	20	524	244	599	110	(ET+127)-k	345	300	463	1054	725	20
100-316	≤ 280	VCS60	A	DN100	20	540	330	632	120	(ET+118)-k	430	300	524	1260	870	20
100-316	≤ 280	VCS60	A	DN125	20	540	330	646	120	(ET+118)-k	430	300	524	1260	870	20
100-316	≤ 280	VCS60	A	DN150	20	540	330	660	120	(ET+118)-k	430	300	524	1260	870	20
100-401	≤ 280	VCS80	B	DN100	30	744	328	716	125	(ET+160)-k	475	350	608	1544	990	30
100-401	≤ 280	VCS80	B	DN125	30	744	328	730	125	(ET+160)-k	475	350	608	1544	990	30
100-401	≤ 280	VCS80	B	DN150	30	744	328	744	125	(ET+160)-k	475	350	608	1544	990	30
150-317	≤ 280	VCS60	A	DN150	20	664	307	794	150	(ET+100)-k	430	270	658	1380	865	20
150-317	≤ 280	VCS60	A	DN200	20	664	307	820	150	(ET+100)-k	430	270	658	1380	865	20
150-317	≤ 280	VCS60	A	DN250	20	664	307	847	150	(ET+100)-k	430	270	658	1380	865	20
150-403	≤ 280	VCS80	B	DN150	30	796	374	919	150	(ET+170)-k	475	360	783	1544	990	30
150-403	≤ 280	VCS80	B	DN200	30	796	374	945	150	(ET+170)-k	475	360	783	1544	990	30
150-403	≤ 280	VCS80	B	DN250	30	796	374	972	150	(ET+170)-k	475	360	783	1544	990	30
200-317	≤ 280	VCS60	A	DN200	20	820	352	980	200	(ET+150)-k	455	320	818	1580	1020	20
200-317	≤ 280	VCS60	A	DN250	20	820	352	1007	200	(ET+150)-k	455	320	818	1580	1020	20
200-317	≤ 280	VCS60	A	DN300	20	820	352	1032	200	(ET+150)-k	455	320	818	1580	1020	20
200-318	≤ 280	VCS60	A	DN200	20	820	352	980	200	(ET+150)-k	455	320	818	1580	1020	20
200-318	≤ 280	VCS60	A	DN250	20	820	352	1007	200	(ET+150)-k	455	320	818	1580	1020	20
200-318	≤ 280	VCS60	A	DN300	20	820	352	1032	200	(ET+150)-k	455	320	818	1580	1020	20

Table 9: Possible immersion depths (ET) depending on number of support columns

Number of support columns	Possible immersion depth (ET)	
	A	B
[Qty]	[mm]	
1	715	729
1	865	879
1	1115	1129
1	1315	1329
1	1452	1466
1	1616	1630
1	1866	1880
1	2116	2130
2	2335	2349
2	2535	2549
2	2636	2650
2	2809	2823
2	2836	2850
2	2973	2987
2	3137	3151
2	3336	3350
2	3473	3487

Number of support columns	Possible immersion depth (ET)	
	A	B
[Qty]	[mm]	
2	3637	3651
2	3887	3901
2	4137	4151
3	4166	4180
3	4193	4207
3	4330	4344
3	4494	4508
3	4580	4594
3	4658	4672
3	4744	4758
3	4908	4922
3	5158	5172
3	5408	5422
3	5658	5672
3	5908	5922
3	6158	6172

#### 4.9.2 Motor dimensions

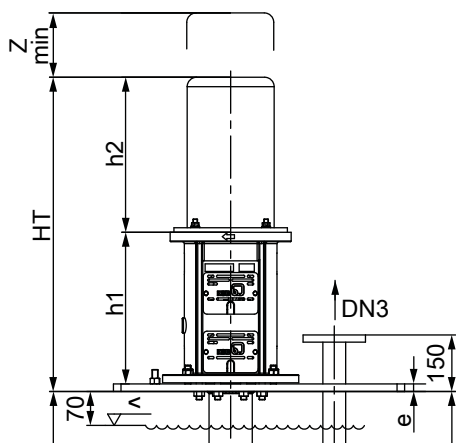


Fig. 5: Motor dimensions

<: Maximum

Table 10: Motor dimensions [mm]

Motor size	Number of poles		Z min	h2 <sup>10)</sup>	VCS 50 / 60			VCS 80		
	2	4			h1	e	HT <sup>10)</sup>	h1	e	HT <sup>10)</sup>
	[mm]									
90L	✗	✗	100	297	-	-	-	-	-	-
90S	✗	✗	100	297	-	-	-	-	-	-
100L	✗	✗	110	335	463	20	818	-	-	-
112M	✗	✗	110	333	463	20	816	-	-	-
132S	✗	✗	130	385	483	20	888	-	-	-
132M	✗	✗	130	410	483	20	913	-	-	-
160M	✗	✗	160	494	513	20	1027	515	30	1039

<sup>10)</sup> Depending on motor manufacturer

Motor size	Number of poles		Z min	h2 <sup>(10)</sup>	VCS 50 / 60			VCS 80		
	2	4			h1	e	HT <sup>(10)</sup>	h1	e	HT <sup>(10)</sup>
					[mm]					
160L	✗	✗	160	532	513	20	1065	515	30	1077
180M	✗	✗	160	602	513	20	1135	515	30	1147
180L	✗	✗	160	602	513	20	1135	515	30	1147
200L	✗	✗	160	660	513	20	1193	515	30	1205
225S	✗	-	160	746	513	20	1279	515	30	1291
225M	✗	-	160	746	513	20	1279	515	30	1291
225S	-	✗	190	746	543	20	1309	545	30	1321
225M	-	✗	190	746	543	20	1309	545	30	1321
250M	✗	✗	190	825	543	20	1388	545	30	1400
280S	✗	✗	190	820	543	20	1383	545	30	1395
280M	✗	✗	190	931	543	20	1494	545	30	1506
315S	✗	-	190	932	-	-	-	545	30	1507
315M	✗	-	190	1104	-	-	-	545	30	1679
315L	✗	-	190	1092	-	-	-	545	30	1667
315S	-	✗	220	932	-	-	-	575	30	1537
315M	-	✗	220	1104	-	-	-	575	30	1709
315L	-	✗	220	1092	-	-	-	575	30	1697
355S	-	✗	260	1177	-	-	-	615	30	1822
355M	-	✗	260	1237	-	-	-	615	30	1882
355L	-	✗	260	1237	-	-	-	615	30	1882




#### 4.9.3 Weights

For weights refer to the general arrangement drawing / outline drawing of the pump (set).



## 5 Installation at Site

### 5.1 Safety regulations

 	<div style="background-color: #e67e22; color: white; padding: 5px;"> <b>DANGER</b></div> <p><b>Installing electric equipment (motors) in potentially explosive atmospheres</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Comply with the applicable local explosion protection regulations.</li> <li>▷ Verify the test certificate of the motor.</li> <li>▷ Keep the test certificate close to the location of operation (e.g. in the foreman's office).</li> </ul>
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### 5.2 Checks to be carried out prior to installation

Check the structural requirements.

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

Check the operating data.

Before installing the pump set, verify that the name plate data matches the data given in the purchase order and the site system data.

	<div style="background-color: #2980b9; color: white; padding: 5px;"><b>NOTE</b></div> <p>Observe the recommendations by the Hydraulic Institute regarding the construction of wells to prevent undesirable operating behaviour (vortex formation etc).</p>
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### 5.3 Installing the pump set

**Foundation** Cover plate 68-3.01 serves as a foundation on which the pump set is fastened. This cover plate covers the tank opening completely.

#### Installing the pump

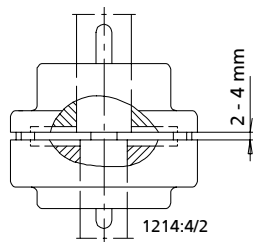
1. Carefully align the support for the cover plate.
2. Align the upper flange of the support column with a spirit level.
3. Make adjustments between cover plate and tank edge if required.

If the pump is installed without suction strainer, observe a minimum distance G to the tank floor. (⇒ Section 4.9.1, Page 21)

#### Mounting the motor

- ✓ The motor's direction of rotation has been checked and corrected if necessary. (⇒ Section 5.7, Page 29)
1. Mount the motor.
  2. Bolt the motor to the drive lantern.

### Installing the coupling






**Fig. 6:** Coupling clearance

- ✓ The coupling is torsionally flexible and dampens shock and vibrations.
  - ✓ The motor has been mounted on the drive lantern.
1. Secure both coupling halves on the respective shaft ends using a grub screw each.  
The clearance between the two coupling halves must range between 2 and max. 4 mm.

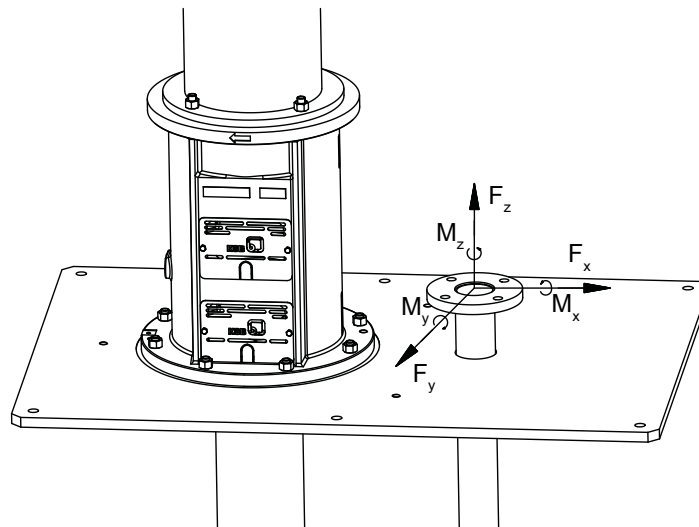
## 5.4 Piping

### 5.4.1 Connecting the piping

	<div style="background-color: #f4a460; padding: 5px;"><b>! DANGER</b></div> <p><b>Impermissible loads acting on the pump nozzles</b> Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> <li>▷ Do not use the pump as an anchorage point for the piping.</li> <li>▷ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains.</li> <li>▷ Take appropriate measures to compensate for thermal expansion of the piping.</li> </ul>
	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Incorrect earthing during welding work at the piping</b> Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> <li>▷ Never earth the electric welding equipment on the pump or baseplate.</li> <li>▷ Prevent current flowing through the rolling element bearings.</li> </ul>
	<div style="background-color: #2980b9; color: white; padding: 5px;"><b>NOTE</b></div> <p>Installing check and shut-off elements in the system is recommended, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.</p>

- ✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.
  - ✓ To prevent excessive pressure losses, adapters to larger diameters have a diffuser angle of approx. 8°.
  - ✓ The pipeline is anchored in close proximity to the discharge flange and connected without transmitting any stresses or strains. Its weight must not be carried by the pump discharge flange.
1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
  2. Check that the coupling and shaft can easily be rotated by hand.

### 5.4.2 Permissible forces and moments at the pump nozzles



**Fig. 7:** Forces and moments at the pump nozzles

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

**Table 11:** Forces and moments at the pump nozzles

DN <sub>3</sub>	F <sub>x</sub>	F <sub>y</sub>	F <sub>z</sub>	M <sub>x</sub>	M <sub>y</sub>	M <sub>z</sub>
	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
25	394	368	446	280	70	140
30	473	446	551	420	175	245
40	578	525	656	504	252	347
50	788	709	866	630	350	455
65	971	893	1103	700	420	490
80	1181	1076	1313	770	455	560
100	1575	1418	1759	875	525	665
125	1864	1680	2074	1120	700	980
150	2363	2126	2625	1400	875	1085
200	3150	2838	3518	1925	1260	1505
250	3911	3544	4384	2765	1855	2205
300	4699	4226	5250	3885	2660	3115
350	5486	4935	6116	5075	3500	4095

### 5.5 Auxiliary connections

	<b>⚠ WARNING</b>
	<p><b>Screw plugs subjected to pressure</b> Risk of injuries by parts flying off and escaping fluid!</p> <ul style="list-style-type: none"> <li>▷ Never use screw plugs for releasing pressure from the pump casing.</li> <li>▷ Always use suitable venting devices (e.g. vent valve).</li> </ul>

The following auxiliary connections are available:

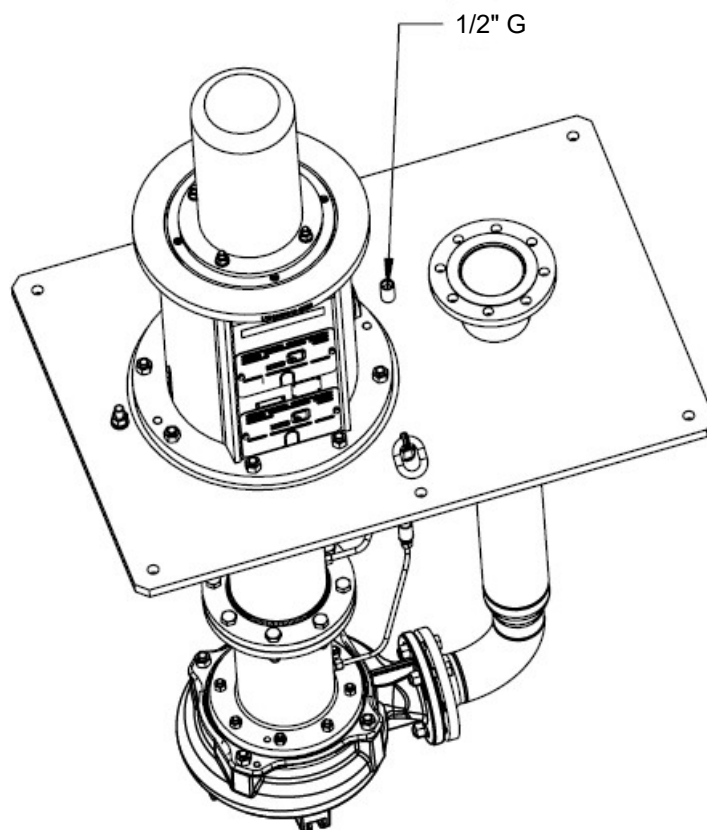




Fig. 8: Auxiliary connections



Table 12: Auxiliary connections

Size	Connection
	External liquid
040-252	G 1/2
080-253	G 1/2
100-253	G 1/2
100-254	G 1/2
100-316	G 1/2
150-317	G 1/2
200-317	G 1/2
200-318	G 1/2


## 5.6 Electrical connection

	 <b>DANGER</b>
	<p><b>Electrical connection work by unqualified personnel</b>            Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▸ Always have the electrical connections installed by a trained electrician.</li> <li>▸ Observe regulations IEC 60364 and, for explosion-proof versions, BS 60079 .</li> </ul>


4721.87/01-EN

	 <b>WARNING</b>
	<p><b>Incorrect connection to the mains</b>            Damage to the power supply network, short circuit!</p> <p>▷ Observe the technical specifications of the local energy supply companies.</p>

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

	<b>NOTE</b>
	<p>Installing a motor protection device is recommended.</p>


#### 5.6.1 Setting the time relay

	<b>CAUTION</b>
	<p><b>Switchover between star and delta on three-phase motors with star-delta starting takes too long.</b>            Damage to the pump (set)!</p> <p>▷ Keep switch-over intervals between star and delta as short as possible.</p>

**Table 13:** Time relay settings for star-delta starting:




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



#### 5.6.2 Connecting the motor

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

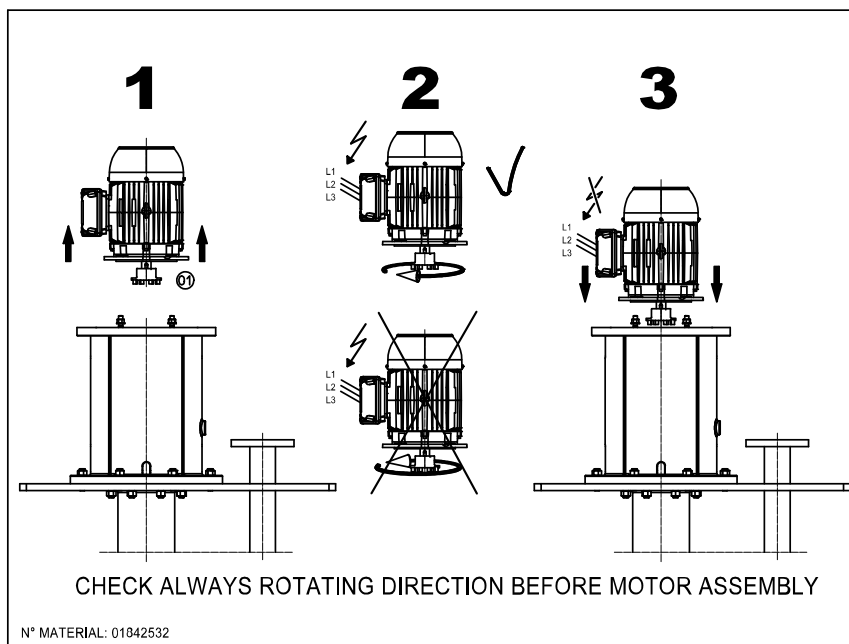
1. Match the motor's direction of rotation to that of the pump.
2. Observe the manufacturer's product literature supplied with the motor.

#### 5.7 Checking the direction of rotation

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

	<p><b>WARNING</b></p> <p><b>Hands inside the pump casing</b> Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ 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.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Drive and pump running in the wrong direction of rotation</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Refer to the arrow indicating the direction of rotation on the pump.</li> <li>▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.</li> </ul>

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



**Fig. 9:** Checking the direction of rotation of the motor

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

## 6 Commissioning/Start-up/Shutdown




### 6.1 Commissioning/Start-up

#### 6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇒ Section 5.6, Page 28)
- The minimum fluid level has been reached.





#### 6.1.2 Priming and venting the pump

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping</b>  Risk of burns!  Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.</li> <li>▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems must be filled with the fluid to be handled at all times.</li> <li>▷ Never operate the pump set at less than the minimum immersion depth.</li> <li>▷ Provide an appropriate monitoring system.</li> </ul>
	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Excessive temperatures due to insufficient lubrication</b>  Explosion hazard!  Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set without liquid fill.</li> <li>▷ Set the required pressure for the barrier fluid and the external lubricating liquid.</li> <li>▷ Always operate the pump within the permissible operating range.</li> </ul>
	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Increased wear due to dry running</b>  Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set at less than the minimum immersion depth.</li> </ul>

The liquid level must be higher than the minimum immersion depth and max. 70 mm below the cover plate. (⇒ Section 4.9.1, Page 21)

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.

### 6.1.3 Start-up

	<div style="background-color: #f4a460; padding: 5px;"><b>! DANGER</b></div> <p><b>Non-compliance with the permissible pressure and temperature limits due to a clogged intake or if the pump is operated with the discharge line closed.</b> Explosion hazard! Leakage of hot fluids!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump with the shut-off elements in the discharge line closed.</li> <li>▷ Only start up the pump set against a slightly or completely open discharge-side shut-off element.</li> <li>▷ Make sure that the intake area is clean and free from foreign objects.</li> </ul>
	<div style="background-color: #f4a460; padding: 5px;"><b>! DANGER</b></div> <p><b>Excessive temperatures due to dry running or excessive gas content in the fluid handled</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set without liquid fill.</li> <li>▷ Prime the pump as per operating instructions.</li> <li>▷ Always operate the pump within the permissible operating range.</li> </ul>
	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Abnormal noises, vibrations, temperatures or leakage</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Switch off the pump (set) immediately.</li> <li>▷ Eliminate the causes before returning the pump set to service.</li> </ul>
	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Start-up against open discharge line</b> Motor overload!</p> <ul style="list-style-type: none"> <li>▷ Make sure the motor has sufficient power reserves.</li> <li>▷ Use a soft starter.</li> <li>▷ Use speed control.</li> </ul>

- ✓ The system piping has been cleaned.
- ✓ The inlet area has been cleaned.
- ✓ The pump has been vented and primed with the fluid to be handled.
- ✓ The vent lines have been closed.
- ✓ If an external lubricant is used, it has been pressurised correctly.


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

### 6.1.4 Checking the shaft seal

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





## Double mechanical seal

	<b>⚠ DANGER</b>
	<p><b>Excessive temperature of barrier fluid (pumps with double mechanical seal)</b> Explosion hazard! Excessive surface temperature</p> <ul style="list-style-type: none"> <li>▷ For pumps with double mechanical seal, make sure that the barrier fluid's temperature does not exceed 60 °C.</li> </ul>




### 6.1.5 Shutdown


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

	<b>NOTE</b>  If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open provided that the system conditions and system regulations are considered and observed.
---	---


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

### 6.2 Operating limits

 	<div> <b>DANGER</b></div> <p><b>Non-compliance with operating limits for pressure, temperature, fluid handled and speed</b></p> <p>Explosion hazard!</p> <p>Hot or toxic fluid could escape!</p> <ul style="list-style-type: none"><li>▷ Comply with the operating data specified in the data sheet.</li><li>▷ Never use the pump for handling fluids it is not designed for.</li><li>▷ Avoid prolonged operation against a closed shut-off element.</li><li>▷ Never operate the pump at temperatures, pressures or rotational speeds exceeding those specified in the data sheet or on the name plate unless the written consent of the manufacturer has been obtained.</li></ul>
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	<b>⚠ DANGER</b>  <b>Formation of a potentially explosive atmosphere inside the pump</b> Explosion hazard! <ul style="list-style-type: none"> <li>▷ When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring).</li> </ul>
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### 6.2.1 Ambient temperature


	<div style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></div> <p><b>Operation outside the permissible ambient temperature</b> Damage to the pump (set)!</p> <p>▷ Observe the specified limits for permissible ambient temperatures.</p>
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Observe the following parameters and values during operation:

**Table 14:** Permissible ambient temperatures


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

### 6.2.2 Frequency of starts

	<div style="background-color: #FF4500; padding: 5px;"><b>! DANGER</b></div> <p><b>Excessive surface temperature of the motor</b> Explosion hazard! Damage to the motor!</p> <p>▷ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.</p>
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The frequency of starts is determined by the maximum temperature increase of the motor. The frequency of starts depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL starting, star-delta starting, 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 shut-off valve slightly open:

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

	<div style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></div> <p><b>Re-starting while motor is still running down</b> Damage to the pump (set)!</p> <p>▷ Do not re-start the pump set before the pump rotor has come to a standstill.</p>
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### 6.2.3 Fluid handled

#### 6.2.3.1 Flow rate


**Table 15:** Flow rate Q

Operating period	Flow rate Q	
	Min.	Max.
For a short period (approximately 2 minutes)	≈ 25 % of $Q_{BEP}^{11)}$	See hydraulic characteristic curves
Continuous duty	$Q_{Part\ load} \geq 50\ \% \text{ of } Q_{BEP}^{11)}$	


#### 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.

<sup>11</sup> Best efficiency point

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

### 6.2.3.3 Fluid temperature

	CAUTION
	<p><b>Lubricant washed out of the bearing by vaporisation of the fluid handled</b> Damage to the bearings!</p> <ul style="list-style-type: none"> <li>▷ Never exceed the fluid temperature of 100 °C.</li> <li>▷ The fluid temperature must remain at least 5 °C below the boiling point.</li> </ul>

### 6.2.3.4 Abrasive fluids

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

### 6.2.4 Vibrations

Recommended settings for vibration monitoring:

- Alarm to be triggered at  $v_{\text{eff}} = 11 \text{ mm/s}$ 
  - This vibration limit requires remedial action.
  - In general, pump operation may continue until the causes of the change in vibration level have been detected and remedies have been determined.
- Cut-out at  $v_{\text{eff}} = 14 \text{ mm/s}$ 
  - If this vibration velocity is exceeded, continued pump set operation may result in damage.
  - Suitable action to reduce vibrations should be taken immediately, or the pump set should be switched off.

## 6.3 Shutdown/storage/preservation

### 6.3.1 Measures to be taken for shutdown

**The pump (set) remains installed**

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

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



- ✓ The pump has been properly drained. (⇒ Section 7.3, Page 43)
  - ✓ The safety instructions for dismantling the pump have been observed.
  - ✓ The permissible ambient temperature for storing the pump is observed.
    1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
    2. Spray the preservative through the suction nozzle and discharge nozzle. It is advisable to then close the pump nozzles (e.g. with plastic caps)
    3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil or grease, food-approved, if required) to protect them against corrosion.
- Observe the additional instructions on preservation. (⇒ Section 3.3, Page 13)

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 31) (⇒ Section 6.2, Page 33)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7, Page 37)












	<div style="background-color: #f4a460; padding: 5px;"><b>! WARNING</b></div> <div style="padding: 5px;"> <b>Failure to re-install or re-activate protective devices</b>            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.         </div>
	<div style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></div> <div style="padding: 5px;">           If the equipment has been out of service for more than one year, replace all elastomer seals.         </div>


### 6.5 Cleaning the pump set

	<div style="background-color: #ffd966; padding: 5px;"><b>CAUTION</b></div> <div style="padding: 5px;"> <b>Cleaning the pump set</b>            Damage to the coupling and bearing!            ▷ Never allow spray water to enter the coupling and bearing area through the bearing lantern's cover plate.         </div>
	<div style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></div> <div style="padding: 5px;">           For the electric motor observe the manufacturer's product literature.         </div>

## 7 Servicing/Maintenance

### 7.1 Safety regulations

	<div data-bbox="507 315 683 360"> <b>DANGER</b></div> <p><b>Sparks produced during servicing work</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Observe the safety regulations in force at the place of installation!</li> <li>▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres.</li> </ul>
 	<div data-bbox="507 591 683 636"> <b>DANGER</b></div> <p><b>Improperly serviced pump set</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Service the pump set regularly.</li> <li>▷ Prepare a maintenance schedule with special emphasis on lubricants and shaft seal.</li> </ul>
<p>The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.</p>	
	<div data-bbox="507 1008 702 1052"> <b>WARNING</b></div> <p><b>Unintentional starting of the pump set</b> Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>
	<div data-bbox="507 1285 683 1330"> <b>DANGER</b></div> <p><b>Improper cleaning of coated pump surfaces</b> Explosion hazard by electrostatic discharge!</p> <ul style="list-style-type: none"> <li>▷ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.</li> </ul>
	<div data-bbox="507 1523 702 1568"> <b>WARNING</b></div> <p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Observe all relevant laws.</li> <li>▷ When draining the fluid take appropriate measures to protect persons and the environment.</li> <li>▷ Decontaminate pumps which handle fluids posing a health hazard.</li> </ul>

	<b>⚠ WARNING</b>
	<b>Insufficient stability</b> Risk of crushing hands and feet! <ul style="list-style-type: none"> <li>▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.</li> </ul>



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.



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


Never use force when dismantling and reassembling the pump set.



## 7.2 Servicing/Inspection

### 7.2.1 Supervision of operation

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



 	<b>⚠ DANGER</b>
	<b>Excessive temperatures as a result of bearings running hot or defective bearing seals</b> Explosion hazard! Fire hazard! Damage to the pump set! Risk of burns! <ul style="list-style-type: none"> <li>▷ Regularly check the lubricant level.</li> <li>▷ Regularly check the rolling element bearings for running noises.</li> </ul>

	<b>⚠ DANGER</b>
	<b>Risk of potentially explosive atmosphere inside the pump</b> Explosion hazard! <ul style="list-style-type: none"> <li>▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.</li> <li>▷ Provide sufficient inlet pressure.</li> <li>▷ Provide an appropriate monitoring system.</li> </ul>


	<p><b>CAUTION</b></p> <p><b>Increased wear due to dry running</b> Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set without liquid fill.</li> <li>▷ Never close the shut-off element in the suction line and/or supply line during pump operation.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Impermissibly high temperature of fluid handled</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).</li> <li>▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇒ Section 6.2, Page 33)</li> </ul>

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.
- Cooling system  
Take the pump out of service at least once a year to thoroughly clean the cooling system.
- Monitor the stand-by pump.  
To make sure that stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.  
The bearing temperature must not exceed 90 °C (measured on the outside of the bearing bracket).

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

### 7.2.2 Inspection work

	<div style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Excessive temperatures caused by friction, impact or frictional sparks</b></p> <p>Explosion hazard!</p> <p>Fire hazard!</p> <p>Damage to the pump set!</p> <p>► Regularly check the cover plates, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.</p>
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#### 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.

If the distance between the half couplings needs adjusting, unscrew the grub screws. Make sure to fit and tighten the grub screws again after the adjustment.

#### 7.2.2.2 Checking the clearances

If the clearances need to be checked, remove the impeller. If the clearance is larger or smaller than permitted (⇒ Table 16) , (⇒ Table 17) , fit a new casing wear ring 502.01 and/or 502.02.

The clearance specified (⇒ Table 16) refers to the distance between the back vanes and the casing cover.

**Table 16:** Clearances between impeller and casing cover

Size	Clearance
	[mm]
040-252	2
080-253	3
100-253	1,5
100-254	1,5
100-316	2
100-401	1,5
150-317	1,5
150-403	1,5
200-317	9
200-318	9




The clearance specified (⇒ Table 17) refers to the diameter.

**Table 17:** Radial clearances between impeller and casing / between impeller and casing cover depending on the material variant

	Clearances
	[mm]
New	0,4
Maximum permissible enlargement	1,2



## 7.2.3 Lubrication and lubricant change of rolling element bearings

 	 <b>DANGER</b>
	<p><b>Excessive temperatures as a result of bearings running hot or defective bearing seals</b></p> <p>Explosion hazard!</p> <p>Fire hazard!</p> <p>Damage to the pump set!</p> <p>▷ Regularly check the rolling element bearings for running noises.</p>

## 7.2.3.1 Grease lubrication

The bearings are packed with high-quality grease at the factory.

## 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 18: 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

Shaft unit <sup>12)</sup>	Motor end	
	Code	Grease per bearing approx. [g]
VCS_40	3307 2RS C3	14
VCS_50	3310 2RS C3	14
VCS_60	3312 2RS C3	35
VCS_80	3314 2Z C3	48

<sup>12)</sup> Shaft unit see data sheet.


#### 7.2.3.1.4 Changing the grease

	<div style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></div> <p><b>Mixing greases of differing soap bases</b> Changed lubricating qualities!</p> <ul style="list-style-type: none"> <li>▸ Thoroughly clean the bearings.</li> <li>▸ Adjust the re-lubrication intervals to the grease used.</li> </ul>
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✓ The pump has been dismantled for changing the grease.

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

#### 7.2.4 Plain bearing lubrication

	<div style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></div> <p><b>Pump set filled insufficiently</b> Lack of lubrication of product-lubricated plain bearings! Dry running of the plain bearings!</p> <ul style="list-style-type: none"> <li>▸ Monitor the pump set fill with a fill level monitoring device.</li> </ul>
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During operation the hydrodynamic plain bearings are lubricated by the fluid handled or the barrier fluid. Bearings must be checked for wear in the following cases:

- When the pump has been operated under dry-running or cavitation conditions, the bearings should be checked immediately if possible.
- Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear at the bearings (insufficient lubrication). Also check the bearings in this case.

#### 7.2.4.1 Grease lubrication

The bearings are packed with high-quality grease at the factory.

##### 7.2.4.1.1 Grease quality



**Optimum grease properties for plain bearings**

**Table 19:** Grease quality to DIN 51502

Soap basis	NLGI grade	Class
Lithium	2 to 3	K2K

- Antioxidant additives









### 7.3 Drainage/cleaning

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

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.  
Always flush and clean the pump before transporting it to the workshop.  
Provide a cleaning record for the pump.

### 7.4 Dismantling the pump set

#### 7.4.1 General information/Safety regulations



	 <b>DANGER</b>
	<p><b>Insufficient preparation of work on the pump (set)</b></p> <p>Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Properly shut down the pump set.</li> <li>▷ Close the shut-off elements in the discharge line.</li> <li>▷ Drain the pump and release the pump pressure.</li> <li>▷ Shut off any auxiliary feed lines.</li> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>
	 <b>WARNING</b>
	<p><b>Unqualified personnel performing work on the pump (set)</b></p> <p>Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.</li> </ul>
	 <b>WARNING</b>
	<p><b>Hot surface</b></p> <p>Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>
	 <b>WARNING</b>
	<p><b>Improper lifting/moving of heavy assemblies or components</b></p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>

Always observe the safety instructions and information. (⇒ Section 7.1, Page 37)

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 59)


In case of damage you can always contact KSB Service.

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

#### 7.4.2 Preparing the pump set

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

#### 7.4.3 Removing the motor

	<p><b>WARNING</b></p> <p><b>Motor tipping over</b> Risk of crushing hands and feet!</p> <p>▷ Suspend or support the motor to prevent it from tipping over.</p>
--	--

- ✓ The general information / safety regulations for dismantling have been observed. (⇒ Section 7.4.1, Page 43)
- ✓ The pump set has been prepared accordingly. (⇒ Section 7.4.2, Page 44)
  1. Undo and remove hexagon nuts 920.6, discs 550.6 and studs 902.6.
  2. Take motor 800 off drive lantern 341.
  3. If applicable, take intermediate lantern 146 off drive lantern 341.

#### 7.4.4 Removing the complete pump set from the piping

- ✓ The general information / safety regulations for dismantling have been observed. (⇒ Section 7.4.1, Page 43)
- ✓ The pump set has been prepared accordingly. (⇒ Section 7.4.2, Page 44)
  1. Remove studs 902.8 and nuts 920.8 from cover plate 68-3.
  2. Remove the complete pump set with the cover plate from the tank opening.
  3. Place the removed pump with cover plate 68-3.01 horizontally on a suitable surface in a clean and level assembly area.
  4. Place a drip tray underneath the pump for collecting any escaping fluid.

#### 7.4.5 Removing the riser

- ✓ The general information / safety regulations for dismantling have been observed. (⇒ Section 7.4.1, Page 43)
- ✓ The pump set has been prepared accordingly. (⇒ Section 7.4.2, Page 44)
  1. Undo and remove hexagon head bolts 901.11 and nuts 920.11.
  2. Remove gasket 400 or profile seal 410.

#### 7.4.6 Removing the volute casing

- ✓ The riser has been removed. (⇒ Section 7.4.5, Page 44)
  1. Undo and remove nuts 920.1 and studs 902.1.
  2. Remove volute casing 101.

#### 7.4.7 Removing the impeller

- ✓ The volute casing has been removed. (⇒ Section 7.4.6, Page 45)
  1. Undo hexagon socket head cap screw 914.30. Remove impeller nut 922.
  2. Remove impeller 230 and key 940.1.
  3. Carefully pull out shaft sleeve 523.1.

#### 7.4.8 Removing the casing cover

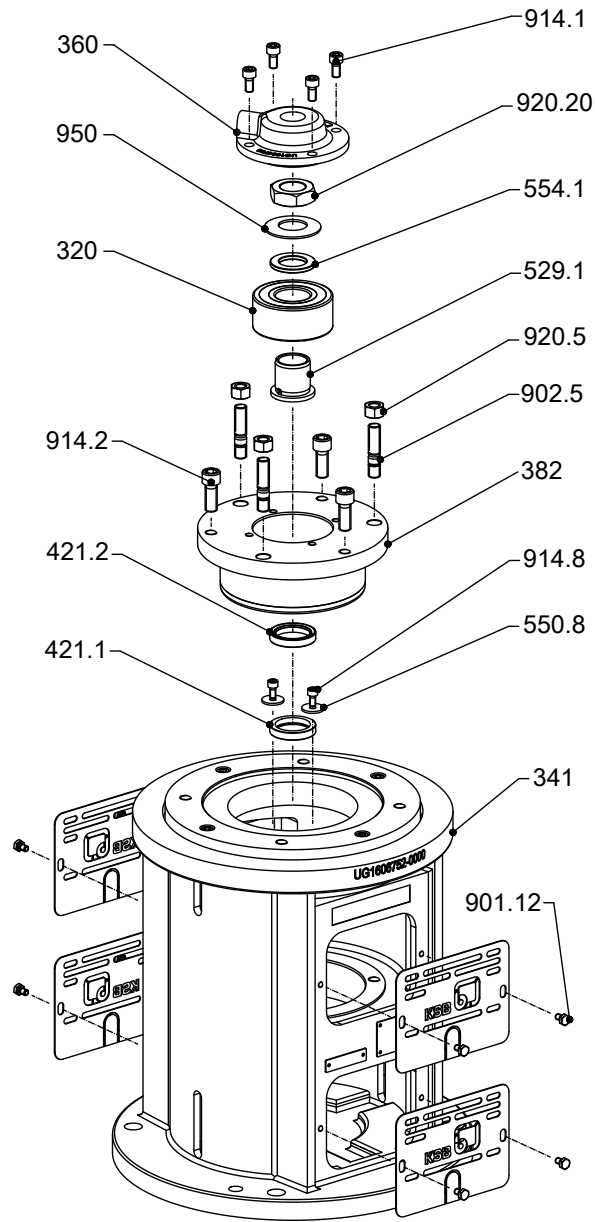
- ✓ The impeller has been removed.
  1. Undo and remove nuts 920.2 and studs 902.2.
  2. Remove casing cover 161 from shaft 210 or pump shaft 211.

#### 7.4.9 Removing the support column

- ✓ The casing cover has been removed. (⇒ Section 7.4.8, Page 45)
  1. Remove the connections of the plain bearings.
  2. Undo and remove hexagon head bolts 901.10 and nuts 920.10. Remove support columns 712.1 and 712.2.
  3. Undo and remove nuts 920.3 and studs 902.3.
  4. Remove support column 712.3 or 712.4 from drive lantern 341.
  5. Remove shaft 210 or pump shaft 211 from coupling part 860.
  6. Remove bearing carrier 382 with bearing bush 545.

### 7.4.10 Removing the drive shaft

#### Version with lip seal



**Fig. 10:** Removing the drive shaft for version with lip seal

- ✓ The support column has been removed. (⇒ Section 7.4.9, Page 45)
- 1. Undo hexagon socket head cap screws 914.2.
- 2. Remove nuts 920.5 and studs 902.5.
- 3. Carefully remove the top shaft from drive lantern 341.
- 4. Undo hexagon socket head cap screws 914.1. Remove bearing cover 360.
- 5. Remove washer 554.1, spring 950 and nut 920.20.
- 6. Carefully pull rolling element bearing 320 with bearing sleeve 529.1 out of bearing carrier 382.
- 7. Undo hexagon socket head cap screws 914.8 and discs 550.8.
- 8. If applicable, remove lip seal 421.2 from drive shaft 213.
- 9. If applicable, pull circlip 932.1 off drive shaft 213.

Version with mechanical seal

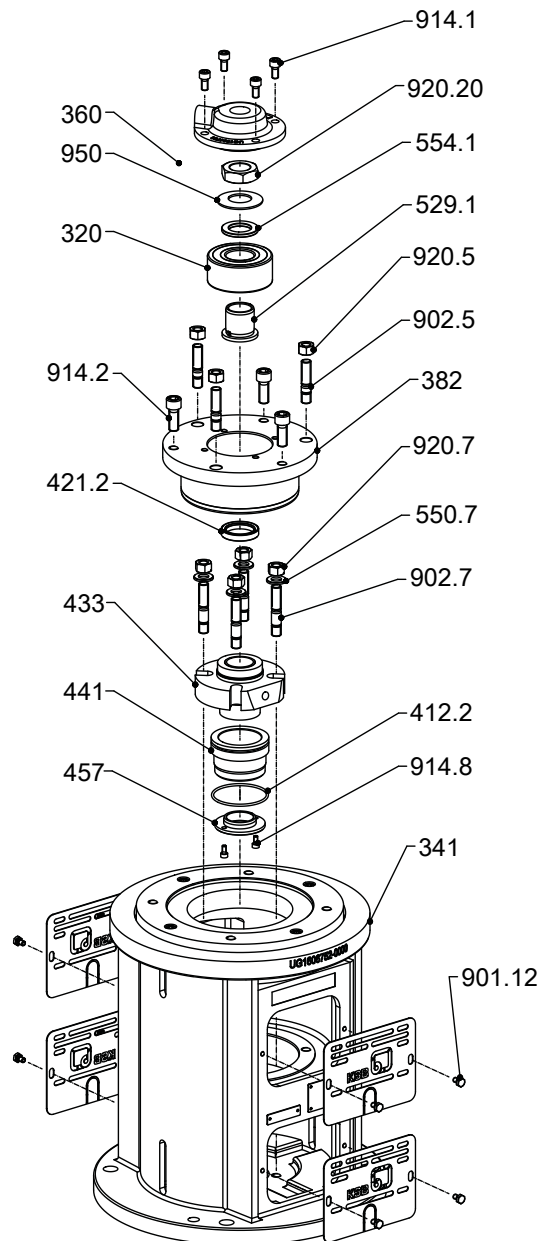


Fig. 11: Removing the drive shaft for version with mechanical seal

✓ The support column has been removed. (⇒ Section 7.4.9, Page 45)



1. Undo hexagon socket head cap screws 914.2.
2. Remove nuts 920.5.
3. Carefully remove drive shaft 213 from drive lantern 341.
4. Fasten the mechanical seal to shaft seal housing 441 with the assembly fixtures supplied with the pump to maintain the internal pressure of the mechanical seal.
5. Undo nuts 920.7 and discs 550.7 at the mechanical seal.
6. Remove hexagon socket head cap screws 914.1. Remove bearing cover 360.
7. Remove washer 554.1, spring 950 and nut 920.20.
8. Carefully pull out rolling element bearing 320 with bearing sleeve 529.1 at bearing carrier 382.
9. Undo and remove mechanical seal nuts 920.7 and discs 550.7 from studs 902.7.
10. Pull mechanical seal 433 off drive shaft 213.

#### 7.4.11 Removing the drive lantern from the cover plate

- ✓ The drive shaft has been removed. (⇒ Section 7.4.10, Page 46)
- 1. Undo nuts 920.4 and remove them from studs 902.4.
- 2. Carefully take drive lantern 341 off cover plate 68-3.
- 3. If applicable, remove the sealing element.

### 7.5 Reassembling the pump set

#### 7.5.1 General information/Safety regulations

	<b>WARNING</b>
	<b>Improper lifting/moving of heavy assemblies or components</b> Personal injury and damage to property! <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>
	<b>CAUTION</b>
	<b>Improper reassembly</b> Damage to the pump! <ul style="list-style-type: none"> <li>▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.</li> <li>▷ Use original spare parts only.</li> </ul>

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

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

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

**Assembly aids** Avoid the use of assembly adhesives if possible.

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

Only apply adhesive at selected points and in thin layers.

Never use quick-setting adhesives (cyanoacrylate adhesives).

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

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

**Tightening torques** For reassembly, tighten all screws and bolts as specified in this manual.

#### 7.5.2 Mounting the drive lantern on the cover plate

- ✓ 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.
- 1. Insert studs 902.4 in cover plate 68-3.
- 2. If applicable, fit the sealing element.
- 3. Place drive lantern 341 on the cover plate. Fasten it with nuts 920.4.



### 7.5.3 Installing the drive shaft

#### Version with lip seal

- ✓ The drive lantern has been mounted on the cover plate.
- 1. Slide lip seal 421.2 onto drive shaft 213.
- 2. Insert key 940.3 into drive shaft 213.
- 3. If applicable, slide circlip 932.1 onto drive shaft 213.
- 4. Carefully insert rolling element bearing 320 with bearing sleeve 529.1 into bearing carrier 382, and slide the bearing carrier onto drive shaft 213.
- 5. Fasten the bearing with washer 554.1, spring 950 and nut 920.20.
- 6. Fit bearing cover 360. Fit and tighten hexagon socket head cap screw 914.1.
- 7. Carefully insert the top shaft into drive lantern 341.
- 8. Position lip seal 421.2.
- 9. Fit and tighten nuts 920.5 and studs 902.5.
- 10. Tighten hexagon socket head cap screws 914.2.

#### Version with mechanical seal

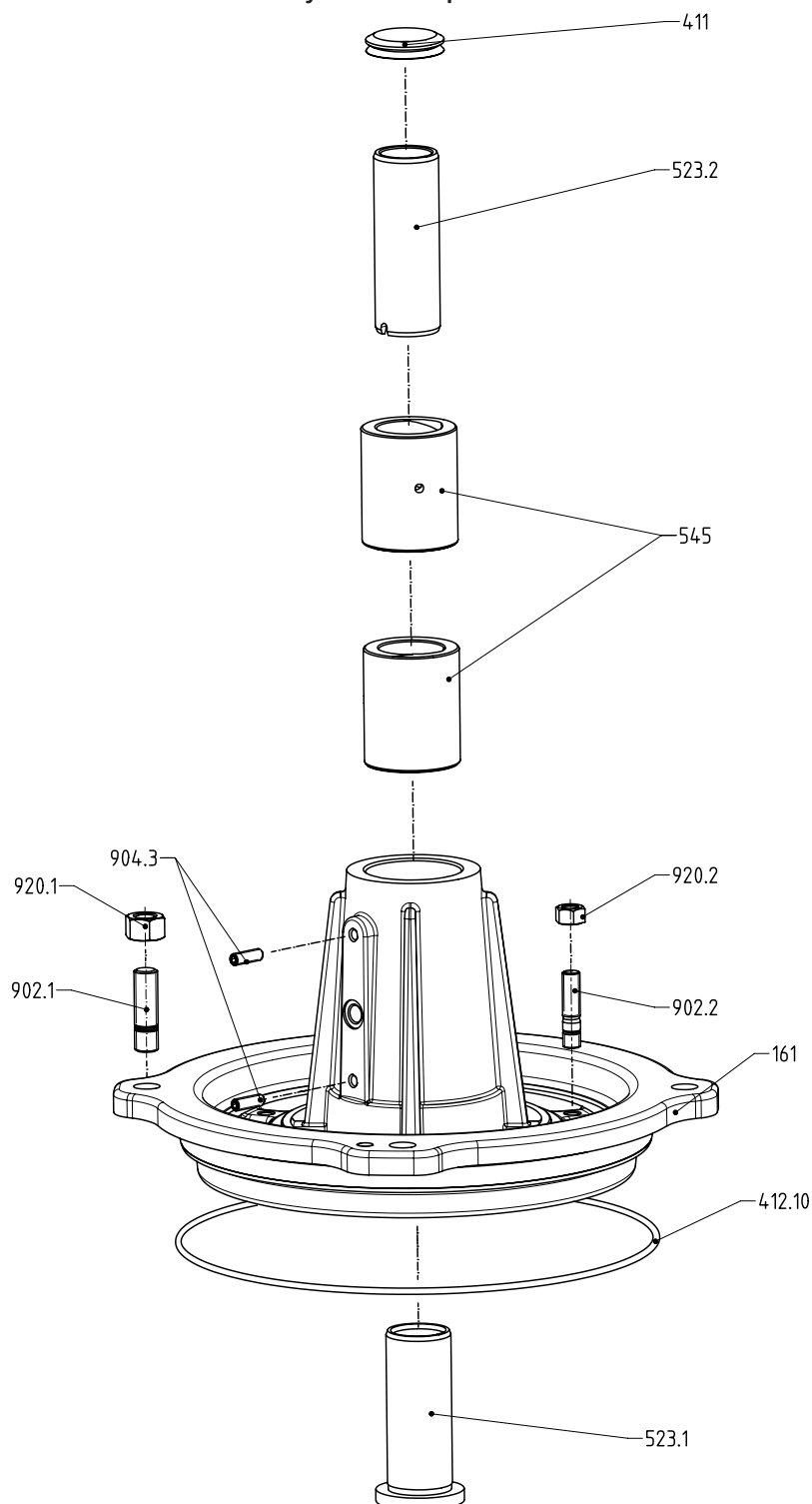
- ✓ The drive lantern has been mounted on the cover plate.
- 1. Slide mechanical seal 433 and shaft seal housing 441 onto drive shaft 213.
- 2. If applicable, slide circlip 932.1 onto drive shaft 213.
- 3. Carefully insert rolling element bearing 320 with bearing sleeve 529.1 into bearing carrier 382, and slide the bearing carrier onto drive shaft 213.
- 4. Fasten the bearing with washer 554.1, spring 950 and nut 920.20.
- 5. Fit bearing cover 360. Fit and tighten hexagon socket head cap screw 914.1.
- 6. Remove nuts 920.5 and studs 902.5.
- 7. Insert key 940. Lubricate the O-ring of the mechanical seal.
- 8. Position lip seal 421.2.
- 9. Fit and tighten nuts 920.5 and studs 902.5.
- 10. Tighten hexagon socket head cap screws 914.2.
- 11. Tighten mechanical seal nuts 920.7 and discs 550.7 on studs 902.7.
- 12. Leave the rotor in its lowest position.

### 7.5.4 Installing the support column

- ✓ The drive shaft has been installed.
- 1. Place support column 712.3 or 712.4 on drive lantern 341.
- 2. Fit and tighten nuts 920.3 and studs 902.3.
- 3. Insert bearing carrier 382 with bearing bush 545.
- 4. Connect the connections of the plain bearings.
- 5. Thoroughly clean the shaft ends.
- 6. Apply Loctite to coupling 852 and half the thread of top shaft 213. Screw the top shaft into the coupling.
- 7. Apply Loctite to half the thread of shaft 210 or pump shaft 211, as applicable. Screw the shaft into the coupling.
- 8. If applicable, fit support columns 712.1 and 712.2. Check the correct positioning of the pipe connections. Fasten with hexagon head bolts 901.10 and nuts 920.10.

### 7.5.5 Fitting the casing cover

### Version with lubrication by external liquid



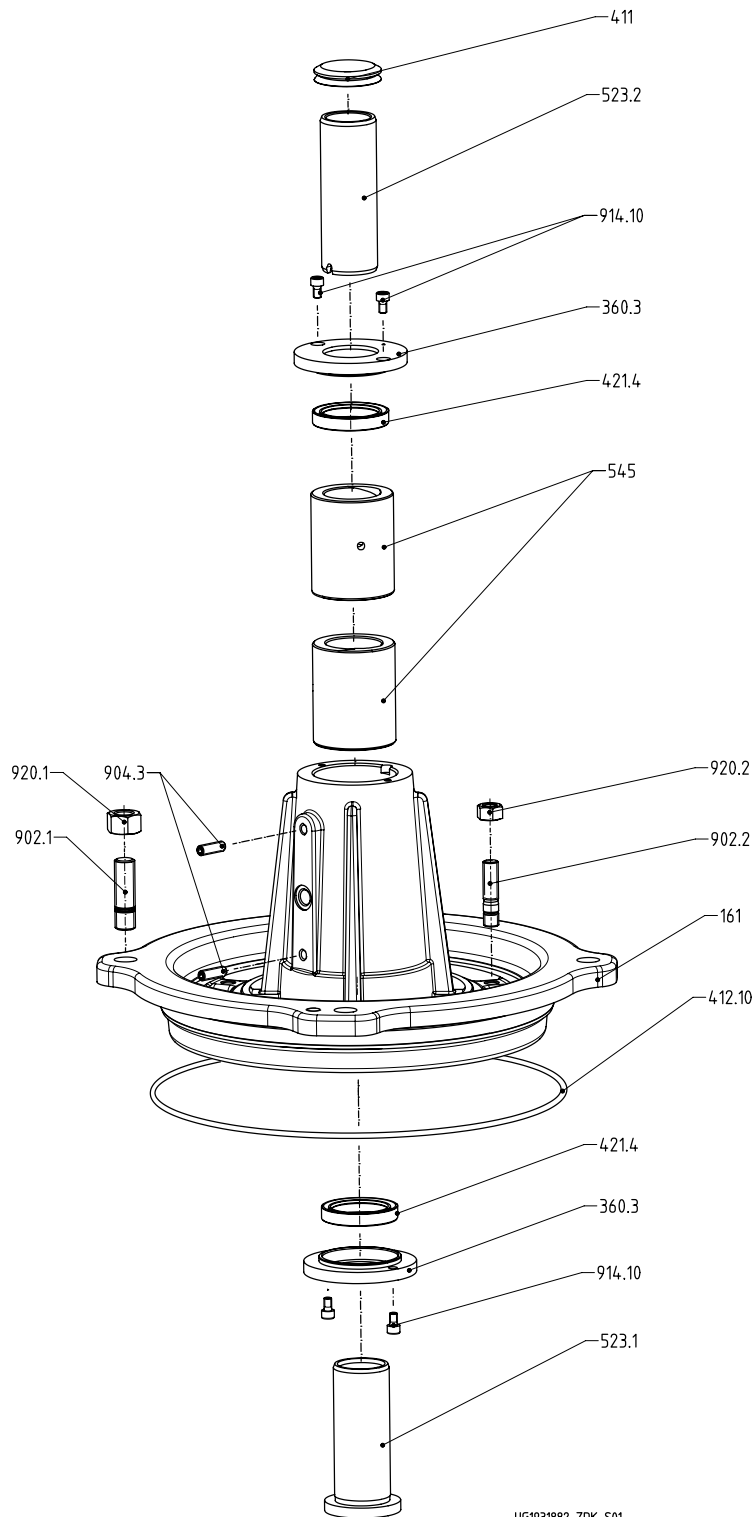
**Fig. 12:** Fitting the casing cover, version with lubrication by external liquid

- ✓ The support column has been fitted. (⇒ Section 7.5.4, Page 49)
- 1. If applicable, fit casing wear ring 502.2 in casing cover 161.
- 2. Insert O-rings 412.1 in bearing cartridge 381. Lubricate them.
- 3. Fit bearing cartridge 381 in non-drive-end bearing cover 361.
- 4. Insert bush 540. Fasten it with circlip 932.2.
- 5. Tighten grub screw 904.1 at locking ring 515.

6. Place bearing sleeve 529.2 on locking ring 515.

7. Fit casing cover 161 on pump shaft 211. Fasten studs 902.2 with nuts 920.2.

#### Version with external grease lubrication



UG1931882\_ZDK\_S01

**Fig. 13:** Fitting the casing cover, version with external grease lubrication

✓ The support column has been fitted. (⇒ Section 7.5.4, Page 49)

1. If applicable, fit casing wear ring 502.2 in casing cover 161.
2. Insert O-rings 412.1 in bearing cartridge 381. Lubricate them.
3. Insert bearing cartridge 381 into bearing housing 350.1.
4. Fit upper bearing housing 350.2. Fasten it with circlip 932.2.

5. Fit grub screw 904.1 on pump shaft 211.
6. Fit bearing sleeve 529.2 on pump shaft 211.
7. Fit casing cover 161 on pump shaft 211. Fasten studs 902.2 with nuts 920.2.

#### 7.5.6 Fitting the impeller

- ✓ The casing cover has been mounted. (⇒ Section 7.5.5, Page 50)

  1. Insert key 940.1 in pump shaft 211.
  2. Slide impeller 230 onto pump shaft 211
  3. Fit impeller nut 922. Fasten hexagon socket head cap screw 914.30.
  4. Insert casing wear ring 502.1 into volute casing 101.
  5. Fit volute casing 101.
  6. Fit and tighten studs 902.1 and nuts 920.1.

#### Adjusting the impeller, version with lip seal

1. Undo nuts 920.5.
2. Move the rotor into its highest position. Tighten hexagon socket head cap screws 914.2.
3. Undo hexagon socket head cap screws 914.2 by two turns. Check the clearances (⇒ Section 7.2.2.2, Page 40) .
4. Tighten nuts 920.5.
5. Tighten hexagon socket head cap screws 914.2.

#### Adjusting the impeller, version with mechanical seal

1. Fasten the mechanical seal to shaft seal housing 441 with the assembly fixtures to maintain the internal pressure of the mechanical seal.
2. Move the rotor into its highest position. Tighten hexagon socket head cap screws 914.2.
3. Undo hexagon socket head cap screws 914.2 by two turns.
4. Tighten nuts 920.5.
5. Tighten hexagon socket head cap screws 914.2.
6. Separate mechanical seal 433 from mechanical seal housing 441.
7. Fasten the cartridge seal to the shaft with fastening pins. Secure the fastening pins with a thread-locking agent (e.g. Loctite 243).
8. Remove the assembly fixtures and store them in a separate bag.



#### 7.5.7 Installing the riser

- ✓ The general information / safety regulations for re-assembly have been observed. (⇒ Section 7.5.1, Page 48)
- ✓ The fastening bolts of the support column have not been tightened completely.

  1. Turn the pump casing until the two flanges are perfectly parallel to each other.
  2. Position gasket 400 or profile seal 410 between the discharge nozzle and the riser.
  3. Fasten riser 711 to the discharge nozzle with hexagon head bolts 901.11 and nuts 920.11.
  4. Completely tighten the support columns and the fastening bolts at the pump casing.

#### 7.5.8 Mounting the motor

- ✓ The riser has been installed.
- ✓ The direction of rotation has been checked.

	<b>⚠ WARNING</b>
	<b>Motor tipping over</b> Risk of crushing hands and feet! ▷ Suspend or support the motor to prevent it from tipping over.
	<b>CAUTION</b>
	<b>Drive and pump running in the wrong direction of rotation</b> 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.

1. Pull coupling half 861 onto the motor shaft end. Fasten it with a grub screw.
2. Place the motor on drive lantern 341.  
Make sure that coupling half 861 engages in the other coupling half 861.
3. Tighten hexagon nuts 920.11 on studs 902.11.  
The motor and the drive lantern or intermediate lantern are centred via the motor flange.

#### 7.5.9 Installing the complete pump set

- ✓ The general information / safety regulations for re-assembly have been observed.  
(⇒ Section 7.5.1, Page 48)
- 1. Place the complete pump set with cover plate on the tank opening.
- 2. Fasten studs 902.8 and nuts 920.8.
- 3. Tighten hexagon head bolts 901.11 and nuts 920.11.

## 7.6 Tightening torques

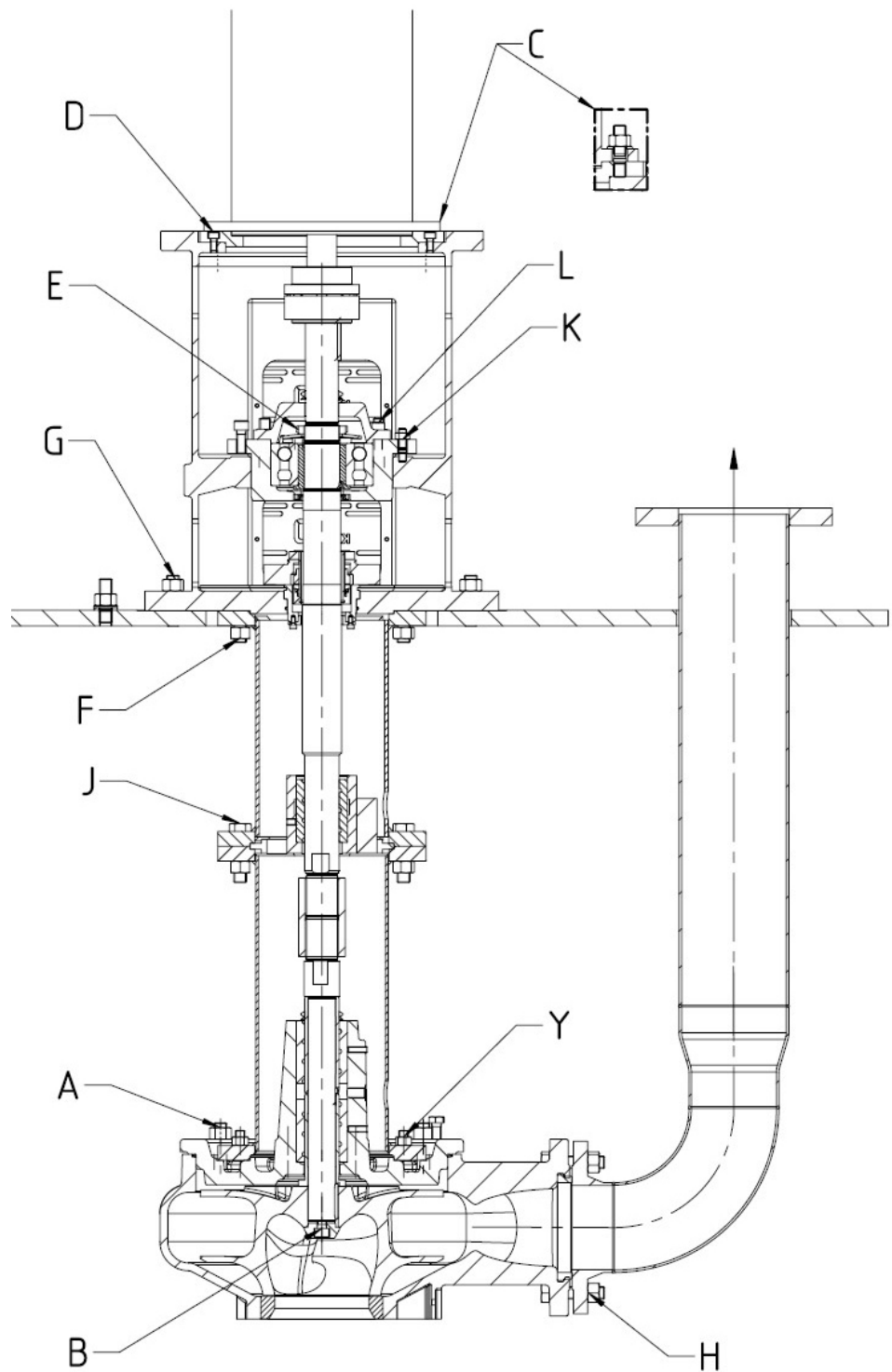


Fig. 14: Tightening torques

**Table 20:** Tightening torques for bolted/screwed connections at the pump

Position	Part No.	Thread	Tightening torques
			[Nm]
A	901.1	M12	50
	920.1	M16	125
B	914.30	M10 × 1,0 <sup>13)</sup>	46
		M12 × 1,5 <sup>14)</sup>	80
C	902.6 920.6 550.6	M10	40
		M12	70
		M16	175
		M20	540
D	914.3	M8	23
		M10	45
E	920.20	M27 × 1,5 <sup>15)</sup>	Until the conical disc flattens
		M35 × 1,5 <sup>16)</sup>	Until the conical disc flattens
		M45 × 1,5 <sup>17)</sup>	Until the conical disc flattens
		M50 × 1,5 <sup>18)</sup>	Until the conical disc flattens
F	902.3	M16	125
	920.3		
G	902.4	M16	175
	920.4		
H	901.11 920.11	M12	50
		M16	125
		M20	240
		M24	420
J	901.10	M16	125
	920.10		
K	902.5	M12	70
	920.5	M14	70
L	914.1	M8	23
		M10	45
Y	902.2	M12	50
	920.2		

<sup>13)</sup> Sizes 040-253 and 100-254

<sup>14)</sup> All sizes (except sizes 040-252 and 100-253)

<sup>15)</sup> Bearing size VCS 40

<sup>16)</sup> Bearing size VCS 50

<sup>17)</sup> Bearing size VCS 60

<sup>18)</sup> Bearing size VCS 80

## 7.7 Spare parts stock

### 7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also specify the following data:

- Part number and description (⇒ Section 9.1, Page 59)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

**Table 21:** Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 - 7	8 - 9	10 and more
		Number of spare parts						
210	Shaft	1	1	2	2	2	3	30 %
211 <sup>19)</sup>	Pump shaft	1	1	2	2	2	3	30 %
230	Impeller	1	1	2	2	2	3	30 %
320	Rolling element bearing	1	1	2	2	2	3	30 %
400	Gasket	2	3	4	5	6	7	80 %
411 <sup>19)</sup>	Joint ring	2	3	4	5	6	7	80 %
412 <sup>19)</sup>	O-ring	2	3	4	5	6	7	80 %
421.1 <sup>20)</sup> /2/.3	Lip seal	1	1	2	2	2	3	30 %
433 <sup>21)</sup>	Mechanical seal	2	3	4	5	6	7	80 %
502.1	Casing wear ring	1	1	2	2	2	3	30 %
529.1	Bearing sleeve	1	1	2	2	2	3	30 %
545 <sup>22)</sup>	Bearing bush	1	1	2	2	3	4	40 %
554.1	Washer	1	1	2	2	3	4	50 %
852	Screwed coupling	1	1	2	2	2	3	30 %
860 <sup>19)</sup>	Coupling part	1	1	2	2	2	3	30 %
904.2 <sup>22)</sup>	Grub screw	1	1	2	2	2	3	40 %
950	Spring	1	1	2	2	2	3	30 %

<sup>19)</sup> Available as spare parts kit, see general assembly drawing with list of components



<sup>20)</sup> For versions with lip seal only

<sup>21)</sup> For versions with mechanical seal only

<sup>22)</sup> Quantity of parts per support column



## 8 Trouble-shooting

	<div style="background-color: #f4a460; padding: 5px; border: 1px solid black; margin-bottom: 5px;">  <b>WARNING</b> </div> <p><b>Improper work to remedy faults</b></p> <p>Risk of injury!</p> <p>► For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.</p>
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If problems occur that are not described in the following table, consultation with the KSB service is required.

- A** Pump delivers insufficient flow rate
- B** Motor is overloaded
- C** Increased bearing temperature
- D** Vibrations during pump operation
- E** Insufficient discharge pressure

**Table 22: Trouble-shooting**

A	B	C	D	E	Possible cause	Remedy <sup>23)</sup>
X	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust duty point. Fit a larger impeller.
X	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
X	-	-	X	-	Suction lift is too high/NPSH <sub>Available</sub> (positive suction head) is too low.	Check/alter liquid level. Check any strainers installed/suction opening.
X	-	-	-	-	Wrong direction of rotation	Interchange two of the phases of the power cable.
X	-	-	-	-	Speed is too low. <sup>24)</sup>	Increase the speed.
X	-	-	X	-	Wear of internal parts	Replace worn parts by new ones.
-	X	-	X	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point. In the case of persistent overloading, turn down impeller. <sup>24)</sup>
-	X	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
-	-	X	-	-	Increased axial thrust <sup>24)</sup>	Clean balancing holes in the impeller. Fit new casing wear rings.
-	-	X	X	-	Deep groove ball bearing defective	Replace.
X	X	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	X	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	X	-	Defective plain bearing	Replace.
-	-	-	X	-	Insufficient flow rate	Increase the minimum flow rate.
X	-	-	X	-	Unsuitable installation / disturbances caused by other pumps	Observe the installation information.
-	-	-	X	-	Stresses and strains in the piping at the pump	Observe the installation information.
-	-	-	X	-	Foundation or chemical anchors not rigid enough	Replace foundation or chemical anchors.
X	-	-	-	X	Excessive air content in fluid handled	Increase suction-side liquid level in the tank/well.
X	-	-	X	X	Intake area is clogged.	Clean the intake area.

<sup>23</sup> Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

<sup>24</sup> Contact KSB.

A	B	C	D	E	Possible cause	Remedy <sup>23)</sup>
X	-	-	-	X	Insufficient submergence of suction nozzle	Increase suction-side liquid level in the tank/well.
X	-	-	-	X	Unsuitable tank/well design	Correct the tank/well design.
X	-	-	X	X	Formation of vortices	Correct the tank/well design. Increase suction-side liquid level in the tank/well.

## 9 Related Documents

### 9.1 General drawings with list of components

#### 9.1.1 Estigia K, 1 support column

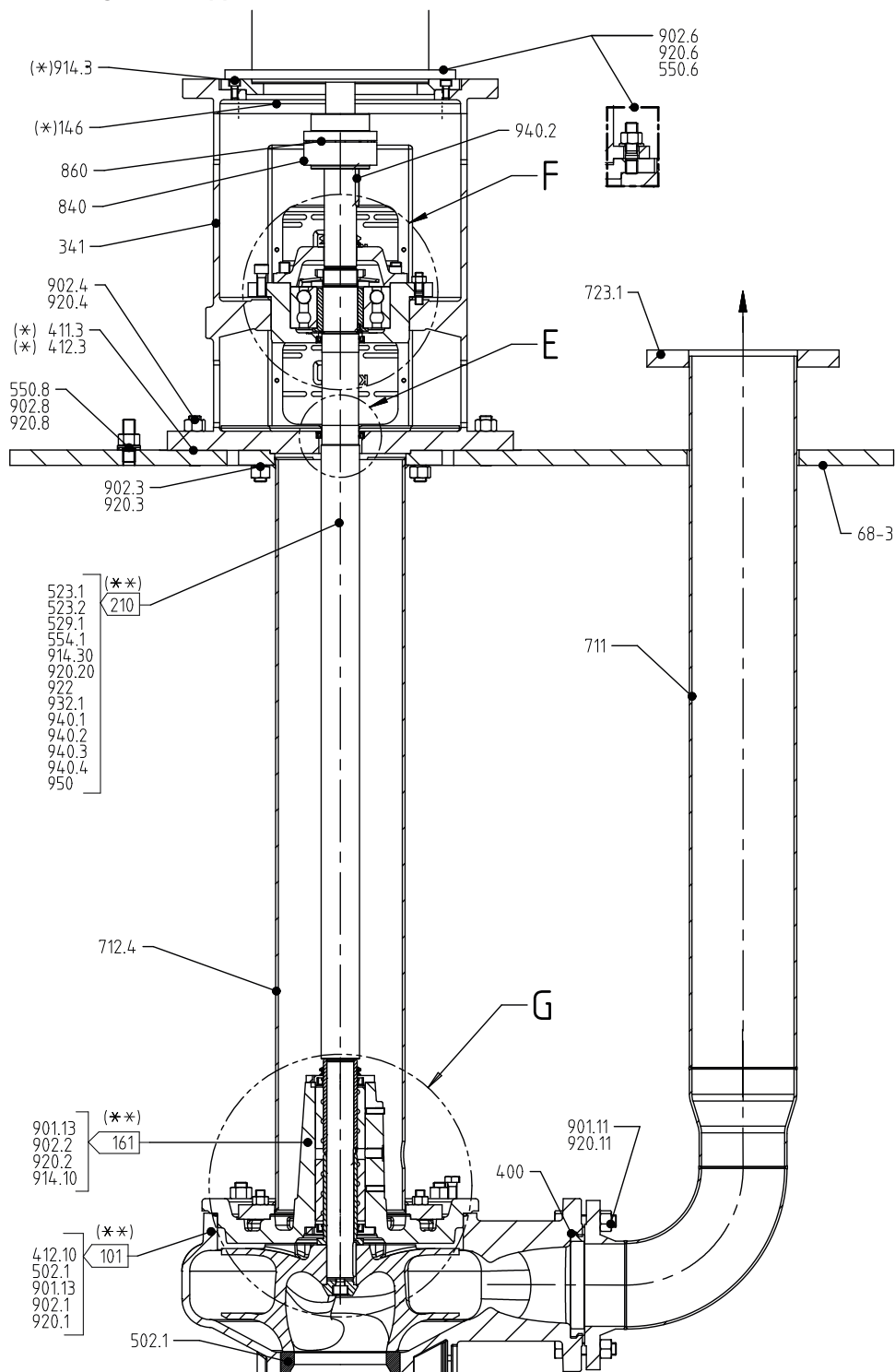


Fig. 15: General assembly drawing

G	Hydraulic system (⇒ Section 9.2.2, Page 63)	E	Seal (⇒ Section 9.2.3, Page 63)
F	Bearings (⇒ Section 9.2.4, Page 64)		

\*: On specific designs only

\*\* : Available as spare parts kit including the parts listed

**Table 23:** List of components

Part No.	Description	Part No.	Description
68-3	Cover plate	711	Discharge pipe
101	Pump casing	712.4	Support column
146	Intermediate lantern	723.1	Flange
161	Casing cover	840	Coupling
210	Shaft	860	Coupling part
341	Drive lantern	901.11/.13	Hexagon head bolt
400	Gasket	902.1/.2/.3/.4/.6/.8	Stud
411.3	Joint ring	914.3/.10/.30	Hexagon socket head cap screw
412.3/.10	O-ring	920.1/.2/.3/.4/.6/.8/.11/.20	Nut
502.1	Casing wear ring	922	Impeller nut
523.1/.2	Shaft sleeve	932.1	Circlip
529.1	Bearing sleeve	940.1/.2/.3/.4	Key
550.6/.8	Disc	950	Spring
554.1	Washer		

## 9.1.2 Estigia K, 3 support columns

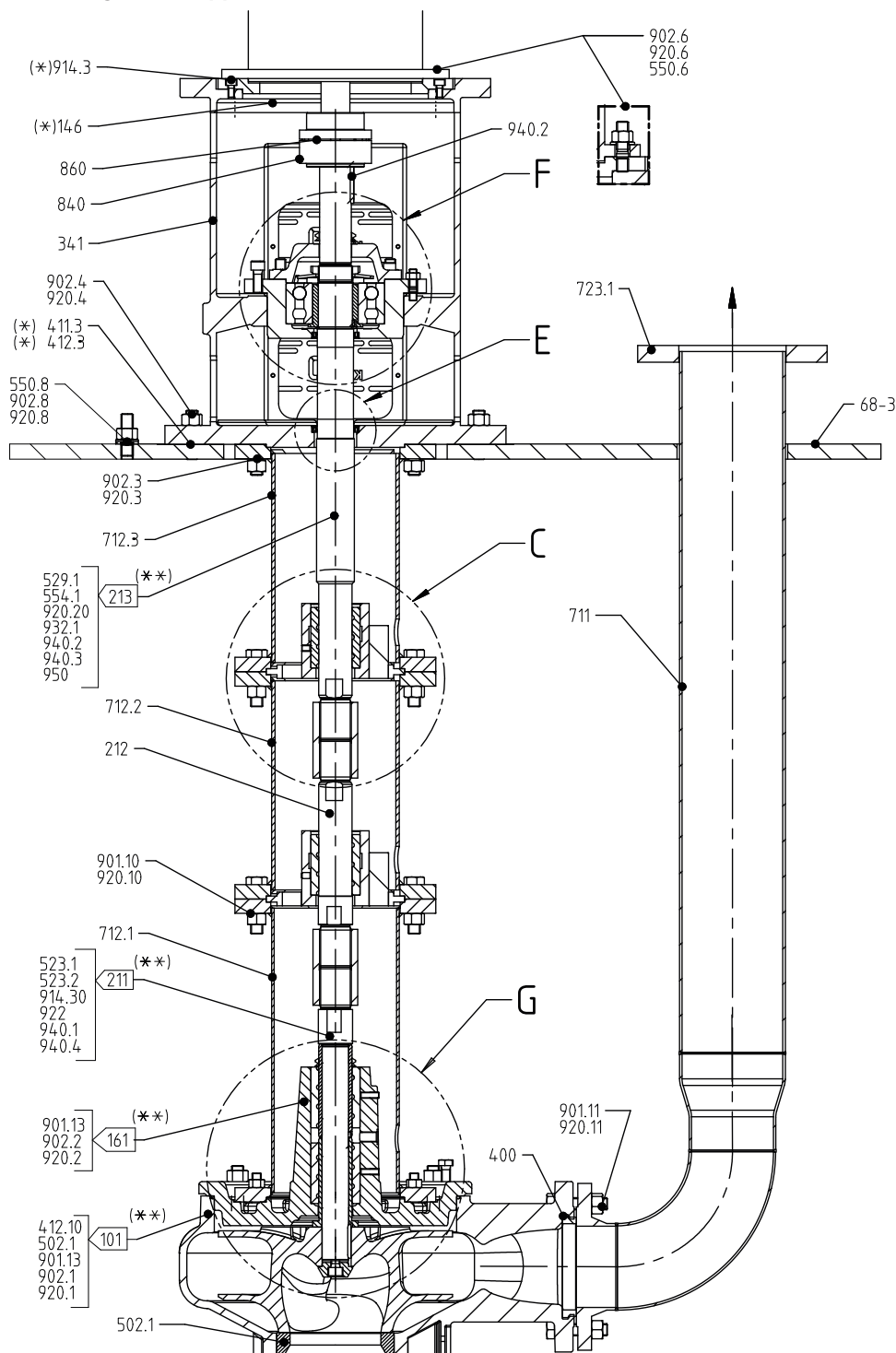


Fig. 16: General assembly drawing

C	Screwed coupling (⇒ Section 9.2.1, Page 62)	G	Hydraulic system (⇒ Section 9.2.2, Page 63)
E	Seal (⇒ Section 9.2.3, Page 63)	F	Bearings (⇒ Section 9.2.4, Page 64)

\*: On specific designs only

\*\*: Available as spare parts kit including the parts listed

Table 24: List of components

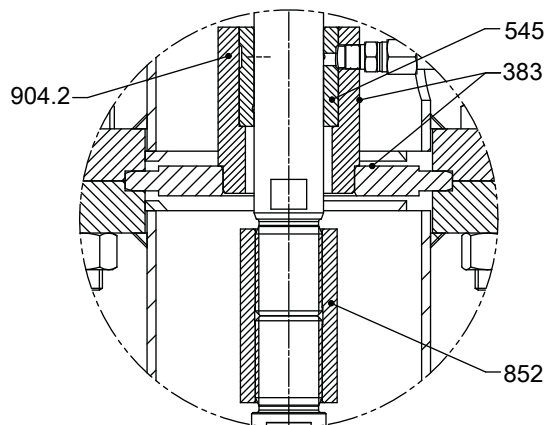
Part No.	Description	Part No.	Description
68-3	Cover plate	554.1	Washer
101	Pump casing	711	Discharge pipe

Part No.	Description	Part No.	Description
146	Intermediate lantern	712.1/.2/.3	Support column
161	Casing cover	723.1	Flange
211	Pump shaft	840	Coupling
212	Intermediate shaft	860	Coupling part
213	Top shaft	901.10/.11/.13	Hexagon head bolt
341	Drive lantern	902.1/.2/.3/.4/.6/.8	Stud
400	Gasket	914.3/.30	Hexagon socket head cap screw
411.3	Joint ring	920.1/.2/.3/.4/.6/.8/.10/.11/.20	Nut
412.3/.10	O-ring	922	Impeller nut
502.1	Casing wear ring	932.1	Circlip
523.1/.2	Shaft sleeve	940.1/.2/.3/.4	Key
529.1	Bearing sleeve	950	Spring
550.6/.8	Disc		

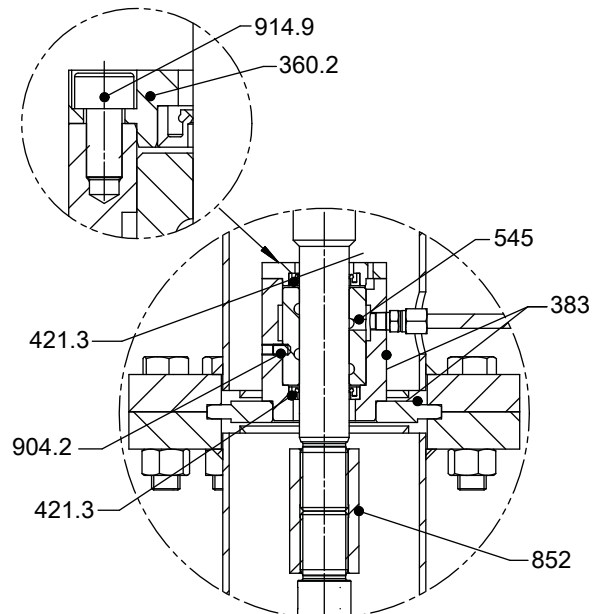
## 9.2 Detail drawings

### 9.2.1 Screwed coupling

C1



C2



**Fig. 17:** Detail drawings of screwed coupling (only for versions with 2 or 3 support columns)

C1	Lubricated by fluid handled or external liquid	C2	Lubricated by electrically driven pump
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**Table 25:** List of components

Part No.	Description	Part No.	Description
383	Bearing spider	852	Screwed coupling
421.3	Lip seal	904.2	Grub screw
545	Bearing bush		

## 9.2.2 Hydraulic system

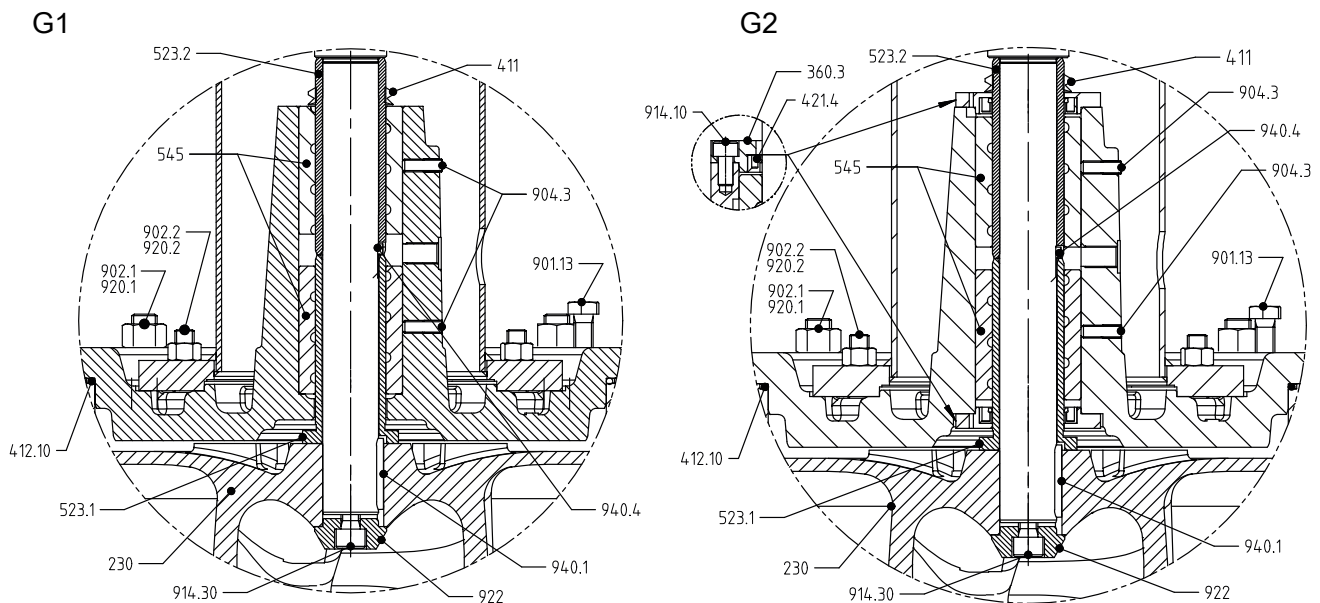


Fig. 18: Detail drawings of hydraulic system (depending on the type of lubrication)

G1	Hydraulic system of version with lubrication by external liquid	G2	Hydraulic system of version with lubrication by electrically driven pump
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Table 26: List of components

Part No.	Description	Part No.	Description
230	Impeller	901.13	Hexagon head bolt
360.3	Bearing cover	902.1/2	Stud
411	Joint ring	904.3	Grub screw
412.10	O-ring	914.10/30	Hexagon socket head cap screw
421.4	Lip seal	920.1/2	Nut
523.1/2	Shaft sleeve	922	Impeller nut
545	Bearing bush	940.1/4	Key

## 9.2.3 Seal

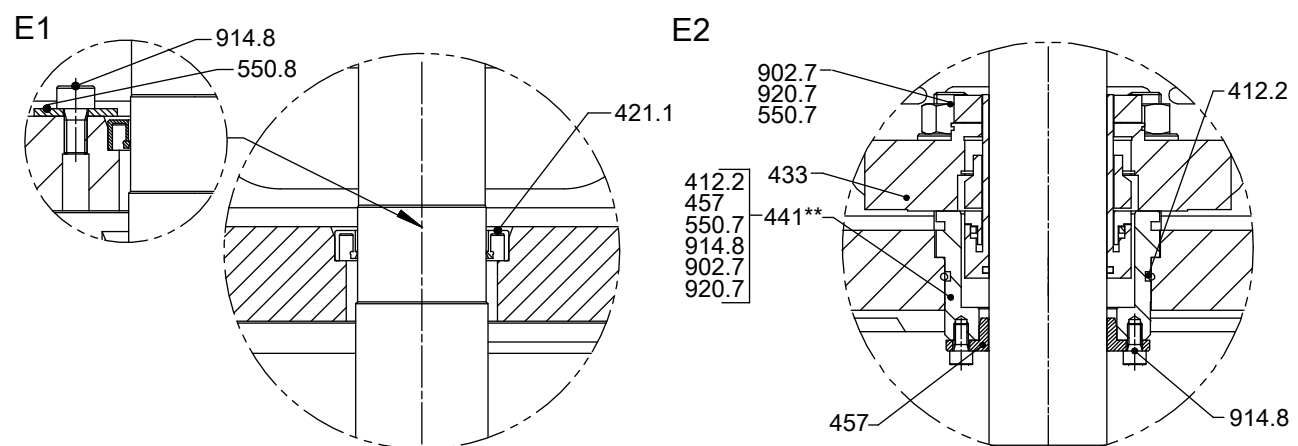


Fig. 19: Detail drawings of seal

E1	Lip seal	E2	Mechanical seal
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\*\* : Available as spare parts kit including the parts listed

Table 27: List of components

Part No.	Description	Part No.	Description
412.2	O-ring	550.7/8	Disc
421.1	Lip seal	902.7	Stud
433	Mechanical seal	914.8	Hexagon socket head cap screw
441/.99	Shaft seal housing	920.7	Nut
457	Neck ring		

#### 9.2.4 Bearings

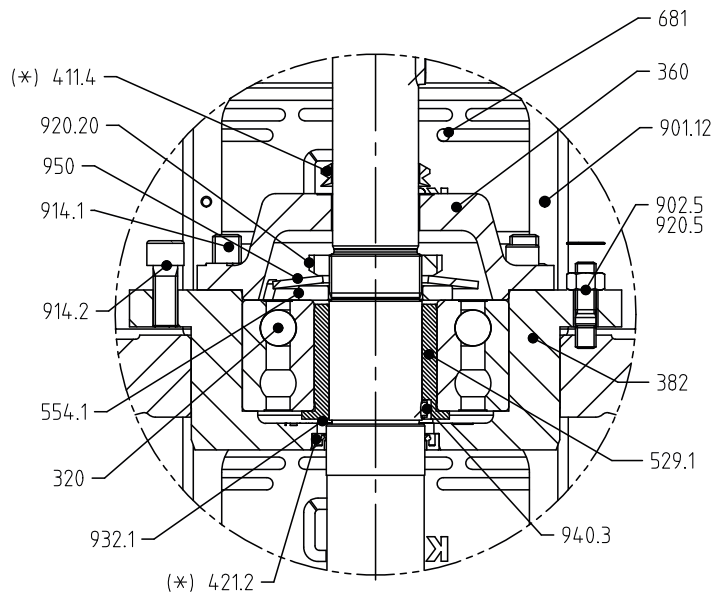


Fig. 20: Detail drawing of bearing

\*: On specific designs only

Table 28: List of components

Part No.	Description	Part No.	Description
320	Rolling element bearing	901.12	Bolt/screw
360	Bearing cover	902.5	Stud
382	Bearing carrier	914.2	Hexagon socket head cap screw
411.4	Joint ring	920.5/20	Nut
421.2	Lip seal	932.1	Circlip
529.1	Bearing sleeve	940.3	Key
554.1	Washer	950	Spring
681	Coupling guard		



## 9.2.5 Bearing lubrication

## Lubrication by external liquid

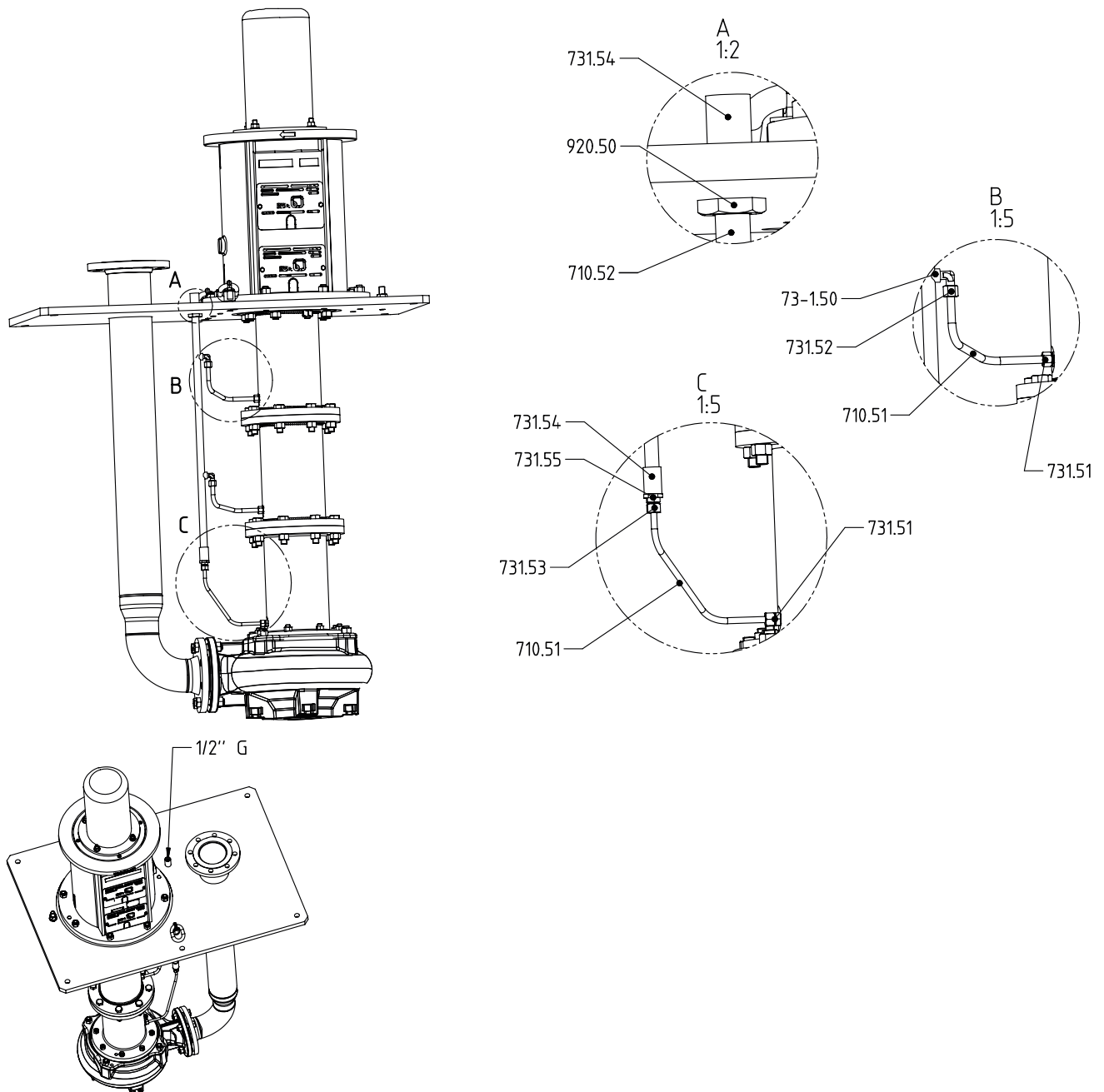


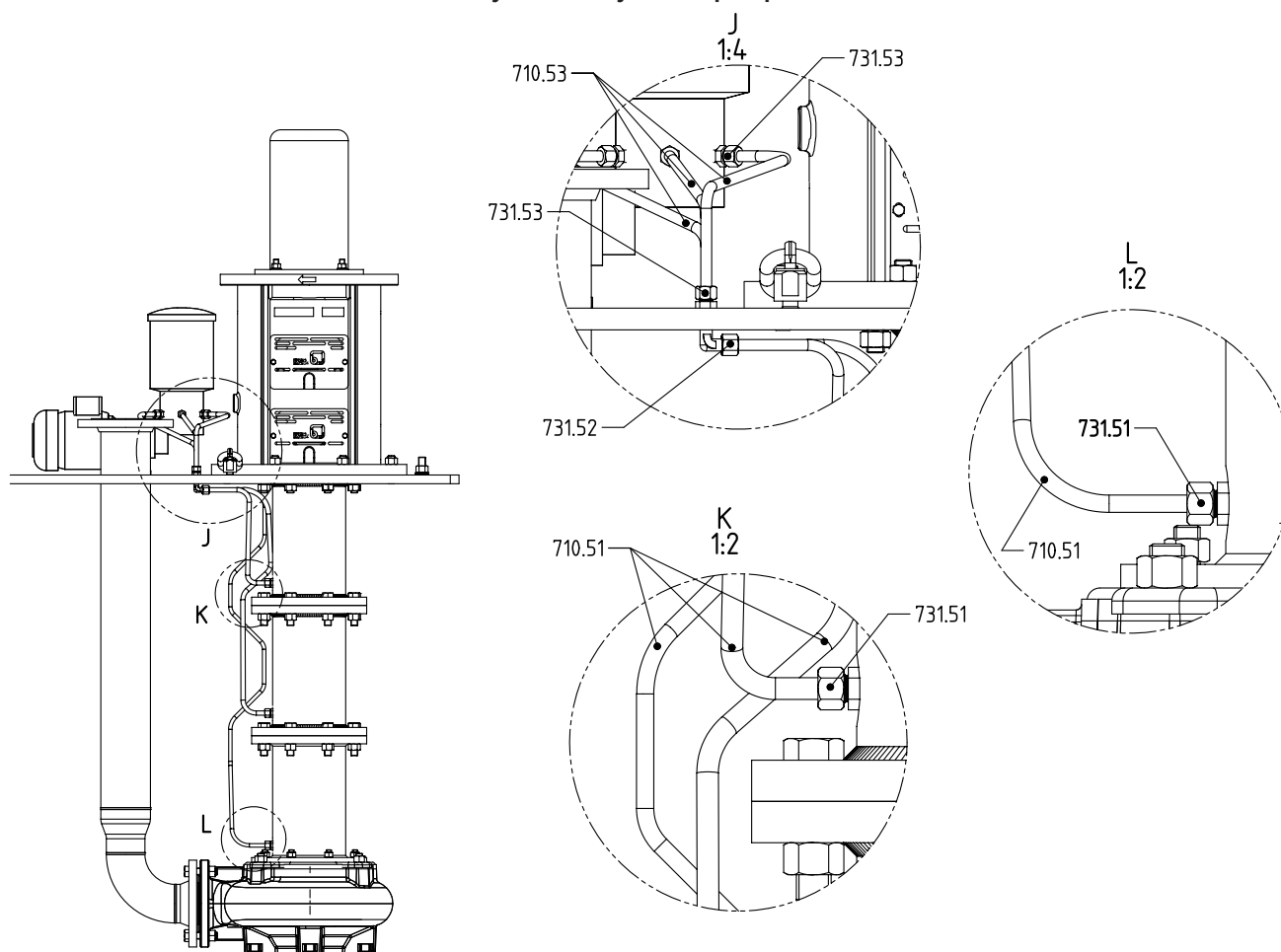
Fig. 21: Detail drawing of lubrication by external liquid

\*: On specific designs only

Table 29: List of components

Part No.	Description	Part No.	Description
710.51/.52	Pipe	731.51/.52/.53/.54/.55	Pipe union
73-1.50	Socket	920.50	Nut

### Lubrication by electrically driven pump



**Fig. 22:** Lubrication by electrically driven pump

\*: On specific designs only

**Table 30:** List of components

Part No.	Description	Part No.	Description
634.50	Grease pump	731.51/.52/.53	Pipe union
710.51	Pipe	914.5	Hexagon socket head cap screw

## 10 UK Declaration of Conformity

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

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

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

### Estigia, Estigia K

KSB order number: .....

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): Supply of Machinery (Safety) Regulations 2008
  - Electrical components<sup>25)</sup>: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- the following harmonised international standards<sup>26)</sup> 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 UK Declaration of Conformity was issued in/on:

Place, date

.....<sup>27)</sup>.....

Name  
 Function  
 Company  
 Address

<sup>25</sup> Where applicable

<sup>26</sup> Apart from the standards listed here referring to the *Supply of Machinery (Safety) Regulations 2008*, further standards are observed for explosion-proof versions (*Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016*) as applicable and are listed in the legally binding UK Declaration of Conformity.

<sup>27</sup> A signed, legally binding UK Declaration of Conformity is supplied with the product.

## 11 Certificate of Decontamination

Type: .....  
Order number /  
Order item number<sup>28)</sup>: .....  
Delivery date: .....  
Application: .....  
Fluid handled<sup>28)</sup>: .....

Please tick where applicable<sup>28)</sup>:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:<sup>28)</sup> .....  
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

<sup>28)</sup> Required field

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