

In-line Pump

ILN / ILNC / ILNR

Operating Manual



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Operating Manual ILN / ILNC / ILNR

Original operating manual

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Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Close-coupled design

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

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

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

Pump

Machine without drive, additional components or accessories

Pump set

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

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇒ Section 2.3, Page 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 and installation dimensions for the pump (set), weights
Drawing of auxiliary connections	Description of auxiliary connections
Hydraulic characteristic curve	Characteristic curves showing head, NPSH required, efficiency and power input
General assembly drawing ¹⁾	Sectional drawing of the pump
Sub-supplier product literature ¹⁾	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists ¹⁾	Description of spare parts
Piping layout ¹⁾	Description of auxiliary piping
List of components ¹⁾	Description of all pump components
Assembly drawing ¹⁾	Sectional drawing of the installed shaft seal
Operating manual of the auxiliary pump / ejector ²⁾	Operating manual of the priming system


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

¹⁾ If agreed to be included in the scope of supply

²⁾ Only for versions with automatic priming system








1.5 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇔	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (ATEX).
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



2 Safety

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

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

2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- 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.
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump (set) to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the pump (set) without the fluid to be handled.
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Always operate the pump (set) in the direction of rotation it is intended for.
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

2.2.1 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
- 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 operator/user

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Contain leakages (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- Connect an earthing connection to the metal casing of the pump or to the baseplate if the fluid handled is electrostatically charged.
- Never earth the electric welding equipment on the pump or baseplate.
- 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.
- Observe the application limits of the fluid handled.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 41)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3, Page 46)
- 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 34)

2.8 Unauthorised modes of operation

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

The warranty relating to the operating reliability and safety of the supplied pump (set) is only valid if the equipment is used in accordance with its intended use. (⇒ Section 2.2, Page 9)

2.9 Explosion protection



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

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

Special conditions apply to the operation of explosion-proof pump sets in accordance with EU Directive 2014/34/EU (ATEX).

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 2.9.2, Page 11)

The explosion-proof status is only assured if the product 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

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.

2.9.2 Repair






Special regulations apply to repair work on explosion-proof pumps. Modifications or alterations of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.

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 data-bbox="507 526 683 571"> DANGER</div> <p>The pump (set) could slip out of the suspension arrangement Danger to life from falling parts!</p> <ul style="list-style-type: none"> ▷ Always transport the pump (set) in the specified position. ▷ Never attach the suspension arrangement to the free shaft end or the motor eyebolt. ▷ Observe the information on weights, centre of gravity and fastening points. ▷ Observe the applicable local accident prevention regulations. ▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs. ▷ Maintain adequate safety distance during lifting operations.
	<div data-bbox="507 963 702 1008"> WARNING</div> <p>Temporary storage on unsecured and uneven surfaces Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Always place the pump (set) on a secured and level surface. ▷ Secure the pump (set) against tipping over or rolling off.
	<div data-bbox="507 1209 638 1254">CAUTION</div> <p>Use of unsuitable lifting tackle Damage to the coating! Premature damage due to oxidation!</p> <ul style="list-style-type: none"> ▷ Never use hooks or lifting chains for transport. ▷ Only use webbing straps or slings as lifting tackle.

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

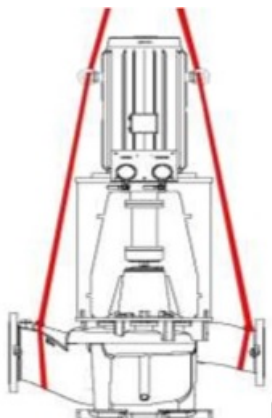


Fig. 1: Transporting the pump set

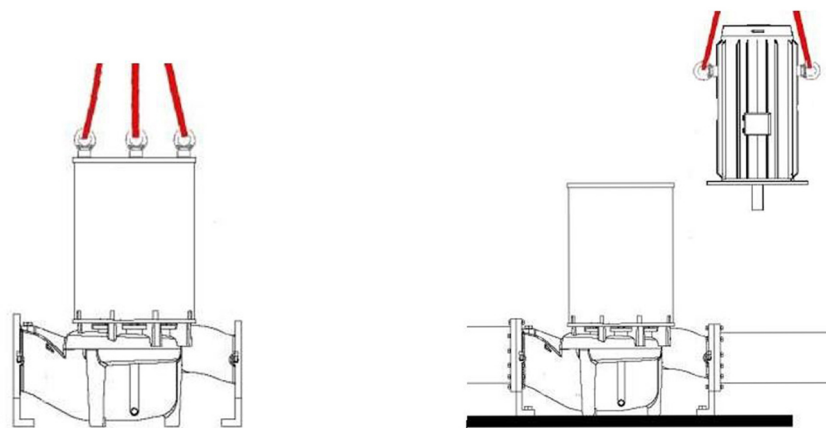




Fig. 2: Transporting the pump and motor separately

3.3 Storage/preservation

	<p>CAUTION</p> <p>Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the pump (set)!</p> <p>► For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.</p>
	<p>CAUTION</p> <p>Wet, contaminated or damaged openings and connections Leakage or damage of the pump set!</p> <p>► Only remove caps/covers from the openings of the pump set at the time of installation.</p>

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) under vibration-free conditions in a dry, protected room where the atmospheric humidity is as constant as possible.
- Rotate the shaft by hand at least once a month, e.g. via the motor fan.
- Disconnect the motor. Remove the motor power cable. Close the terminal box. Disconnect the control cabinets and place them in a vertical position.
- Check that the coating is in good condition. If the coating needs to be touched up, contact KSB for the coating specification.
- Preserve wetted components made of low-alloy materials. Commercially available preservatives can be used for this purpose. Observe the manufacturer's instructions for application/removal.
- Oil or grease all blank parts and surfaces of the pump (with silicone-free oil or grease) to protect them against corrosion.

If properly stored indoors, the equipment is protected for a maximum of 12 months.



For storing a pump (set) which has already been operated, observe the instructions in (⇒ Section 6.3.1, Page 41) .

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 46)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 10, Page 86)

	<div style="background-color: #0056b3; color: white; padding: 5px;">NOTE</div> <p>If required, a blank certificate of decontamination can be downloaded from the following web site: www.ksb.com/certificate_of_decontamination</p>
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3.5 Disposal

	<div style="background-color: #f4a460; padding: 5px;"> WARNING</div> <p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and properly dispose of flushing fluid and any fluid residues. ▷ Wear safety clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
--	--

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

4 Description of the Pump (Set)

4.1 General description

- Vertical centrifugal pump in in-line design.
- Pump for handling clean to slightly contaminated water

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/>.

4.2.2 Product Information as per Regulation No. 547/2012 (for water pumps with a maximum shaft power of 150 kW) implementing "Ecodesign" Directive 2009/125/EC

- Minimum efficiency index: see name plate, key to name plate
- The benchmark for the most efficient water pumps is $MEI \geq 0.70$.
- Year of construction: see name plate, key to name plate
- Manufacturer's name or trade mark, commercial registration number and place of manufacture: see data sheet or order documentation
- Product's type and size identifier: see name plate, key to name plate
- Hydraulic pump efficiency (%) with trimmed impeller: see data sheet
- Pump performance curves, including efficiency characteristics: see documented characteristic curve
- The efficiency of a pump with a trimmed impeller is usually lower than that of a pump with full impeller diameter. Trimming of the impeller will adapt the pump to a fixed duty point, leading to reduced energy consumption. The minimum efficiency index (MEI) is based on the full impeller diameter.
- Operation of this water pump with variable duty points may be more efficient and economic when controlled, for example, by the use of a variable speed drive that matches the pump duty to the system.
- Information on dismantling, recycling and disposal after decommissioning: (⇒ Section 3.5, Page 14)
- Information on benchmark efficiency or benchmark efficiency graph for $MEI = 0.70$ (0.40) for the pump based on the model shown in the Figure are available at: <http://www.europump.org/efficiencycharts>

4.3 Designation

Table 4: Designation example

Position																																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
I	L	N	C		0	5	0	-	0	3	2	-	2	0	0	A	G	B		I	1	1	D	M	B	V	0	0	3	0	2	5	A
See name plate and data sheet																											See data sheet						

Table 5: Designation key

Position	Code	Description
1-4	Pump type	
	ILN	Long-coupled in-line pump
	ILNC	Close-coupled in-line pump
	ILNR	Long-coupled in-line pump, additional sizes
5	Priming system	
	_ ³⁾	Without priming system
	S	With auxiliary pump
	E	With ejector
6-17	Size	
	050	Nominal suction nozzle diameter [mm]
	032	Nominal discharge nozzle diameter [mm]
	200	Nominal impeller diameter [mm]
	A	Hydraulic system
18	Pump casing material	
	G	EN-GJL-250 / A48CL35
	B	CC491K-GS
	A	CC333G-GS
	D	A995 Gr.1B
	D	A995 Gr. 5A
19	Impeller material	
	B	CC480K-GS
	A	CC333G-GS
	1	A890 Gr 1B
	2	A890 Gr 5A
20	Description	
	_ ³⁾	Standard
	X	Non-standard (BT3D, BT3)
21	Shaft seal type	
	I	Single mechanical seal, internal circulation
22-23	Seal code	
	01	Q1Q1VGG
	07	Q1Q1EGG
	11	BQ1EGG
	31	Q1Q1VMM
	20	AQ1PGG
24	Scope of supply	
	A	Pump only (Fig. 0)
	D	Pump set
25	Special design	

³ Blank

Position	Code	Description
25	_)3)	Standard
	M	Design for marine applications
26-27	Ship classification society	
	_)3)	No acceptance inspection
	AB	ABS: American Bureau of Shipping
	BV	BV: Bureau Veritas
	DN	DNV: Det Norske Navale
	RI	RINA: Registro Italiano Navale
	GL	GL: Germanischer Lloyd
	RM	RMRS: Russian Maritime Register of Shipping
	CC	CCS: China Classification Society
	NK	NKK: Nippon Kaije Kyokai
	KR	KR: Korean Register
	LR	LR: Lloyd's Register
	ZZ	Other inspection agency
28-31	Motor rating P_N [kW]	
	0030	3
	1320	132
	0075	7,5
	0007	0,75
32	Number of motor poles	
	2	2 poles
	4	4 poles
	6	6 poles
	8	8 poles
33	Motor efficiency	
	0	No classification
	4	IE1
	5	IE2
	6	IE3
	7	IE4
34	Product generation	
	A	ILN/ILNC/ILNR from 2017

4.4 Name plate

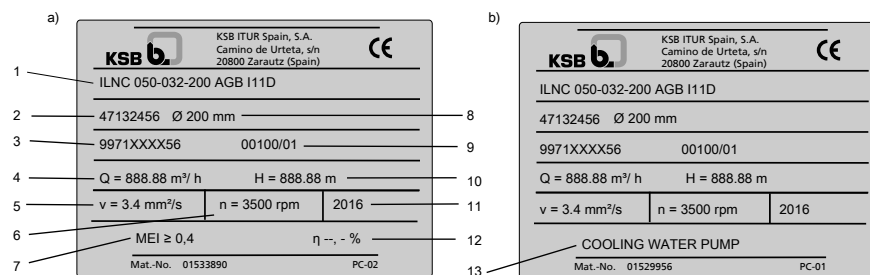


Fig. 3: Name plate (example) a) Standard b) Marine applications

1	Type series, size, version	2	Material number
3	KSB order number	4	Flow rate
5	Dynamic viscosity of the fluid handled	6	Speed
7	Minimum efficiency index	8	Nominal impeller diameter
9	KSB order item number	10	Head
11	Year of construction	12	Efficiency
13	Customer-specific information (optional)		

4.5 Design

4.5.1 Design details ILN

Design

- In-line design
- Vertical installation
- Single-stage
- Single-suction or double-suction⁴⁾
- Coupling between pump and motor
- Spacer bush (except 350-300-330 and 500-400-430)

Pump casing

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

Drive (fixed speed version)

- Surface-cooled IEC three-phase motor
- Type of construction IM V1
- Frequency 50 Hz/60 Hz
- Enclosure IP55
- 230/400 V and 400/690 V

Shaft seal

- Mechanical seal

Impeller type

- Closed radial impeller

⁴ Double-suction design for sizes 350-300-330 and 500-400-430

Bearings

- Upper bearing:
 - Closed deep groove ball bearing
 - Greased for life
- Lower bearing:
 - Closed deep groove ball bearing or closed double-row angular contact ball bearing
 - Greased for life

Automation

Automation options:

- PumpDrive
- PumpMeter

For operation on a frequency inverter consultation with KSB is required.

4.5.2 Design details ILNC

Design

- Close-coupled design / in-line design
- Vertical installation
- Single-stage
- Single-suction

Pump casing

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

Drive (fixed speed version)

- Surface-cooled IEC three-phase motor
- Type of construction IM V1
- Frequency 50 Hz/60 Hz
- Enclosure IP55
- 230/400 V and 400/690 V

Shaft seal

- Mechanical seal

Impeller type

- Closed radial impeller

Bearings

- Closed deep groove ball bearing or closed double-row angular contact ball bearing
- Greased for life

Automation

Automation options:

- PumpDrive
- PumpMeter

For operation on a frequency inverter consultation with KSB is required.

4.5.3 Design details ILNR

Design

- In-line design
- Vertical installation
- Single-stage
- Single-suction
- Coupling between pump and motor

Pump casing

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

Drive (fixed speed version)

- Surface-cooled IEC three-phase motor
- Type of construction IM V1
- Frequency 50 Hz/60 Hz
- Enclosure IP55
- 230/400 V and 400/690 V

Shaft seal

- Mechanical seal

Impeller type

- Closed radial impeller

Bearings

- Upper bearing:
 - Closed deep groove ball bearing or closed double-row angular contact ball bearing
 - Greased for life
- Lower bearing:
 - Closed deep groove ball bearing
 - Greased for life

Automation

Automation options:

- PumpDrive
- PumpMeter

For operation on a frequency inverter consultation with KSB is required.

4.6 Configuration and function

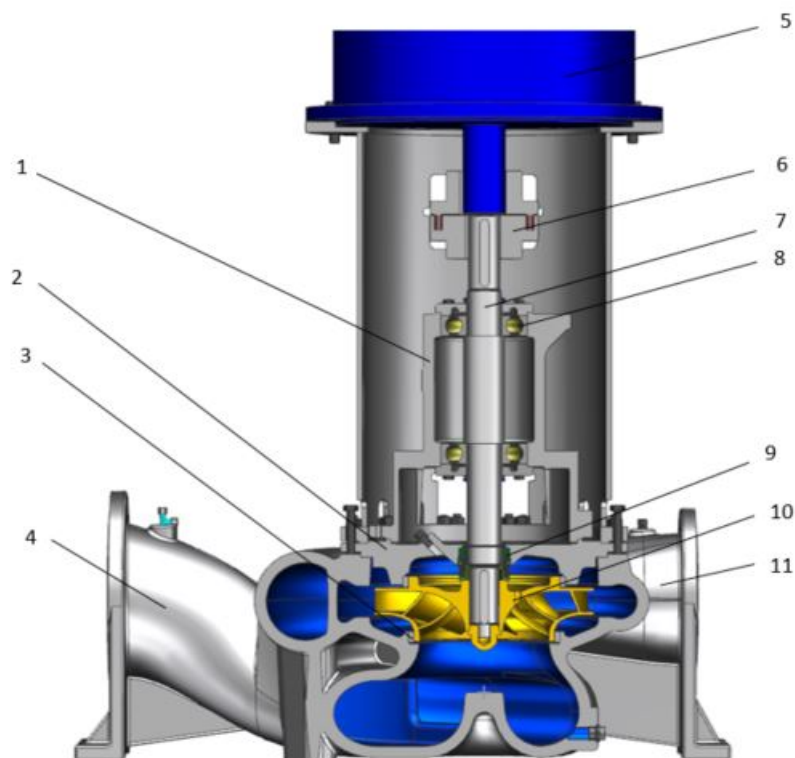


Fig. 4: Sectional drawing

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

Design ILN/ILNR: The hydraulic system is connected to the motor (5) via a coupling (6). The impeller (10) is fitted on the pump shaft; the rotor is fitted on a separate drive shaft.

ILNC: The hydraulic system and the motor (5) are connected via a stub shaft and form a close-coupled unit. The impeller (10) and rotor are arranged on a common shaft.

Function The fluid enters the pump via the suction nozzle (4) and is accelerated outward by the rotating impeller (10). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid handled is pumped to the discharge nozzle (11), where it leaves the pump. The clearance gap (3) prevents any fluid from flowing back from the casing to the suction nozzle. On the rear side of the impeller (10) the shaft (7) enters the hydraulic system through the casing cover (2). The shaft passage through the cover is sealed to atmosphere with a shaft seal (9). The shaft runs in grease-lubricated rolling element bearings (8). The motor (5) is connected to the pump casing via a bearing bracket (1).

Sealing The pump is sealed with a shaft seal (9).

4.6.1 Configuration and function of ILNS/ILNCS pump sets with auxiliary pump

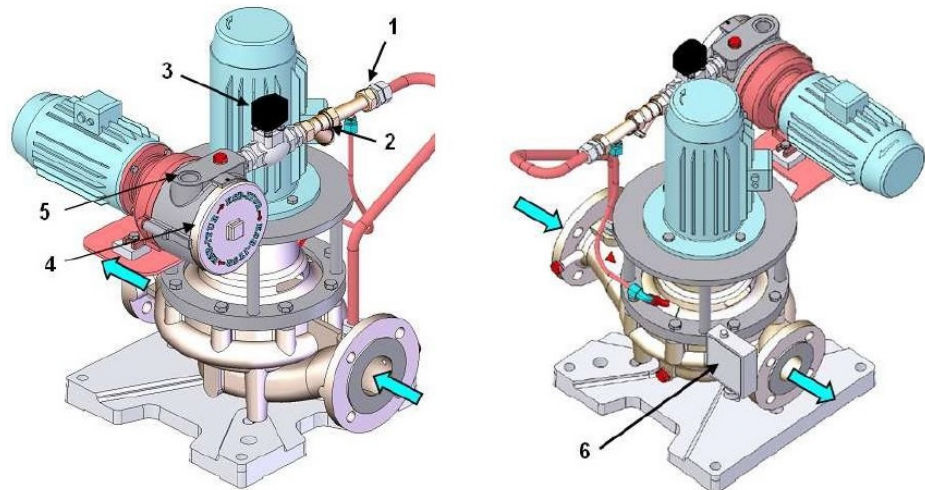



Fig. 5: Priming system using auxiliary pump

1	Check valve	2	Filter
3	Solenoid valve	4	Auxiliary pump
5	Discharge nozzle for air/water	6	Pressure controller

Function During commissioning/start-up the auxiliary pump (4) starts up and the solenoid valve (3) opens, so air can escape from the piping. After duration T1⁵⁾ has passed, the main pump starts up; both pump are running. When the fluid handled reaches the main pump, the pressure controller (6) recognises a pressure rise. A timer stops the auxiliary pump and closes the solenoid valve after the duration T2⁶⁾ has passed. When the pressure controller detects a pressure of 0.4 bar, it automatically starts up the auxiliary pump to vent the main pump and the piping. The main pump keeps running. When 70 % of the operating pressure of the main pump or the minimum pressure set at the pressure controller are detected, the pressure controller stops the auxiliary pump.

The duration T1 depends on the quantity of air escaping. The minimum value for T1 is determined in manual venting tests. The timer is then set to this value.

The duration T2 is influenced by any instability during the commissioning/start-up process.

	CAUTION
	<p>Auxiliary pump running too long Motor overheated!</p> <ul style="list-style-type: none"> ▷ Set duration T2 to a maximum of 5 seconds or to the star-delta start-up time. ▷ The total runtime of the auxiliary pump must not exceed 15 seconds.

⁵ T1: duration until the main pump starts up

⁶ T2: duration until the solenoid valve is closed

4.6.2 Configuration and function of ILNE/ILNCE pump sets with ejector

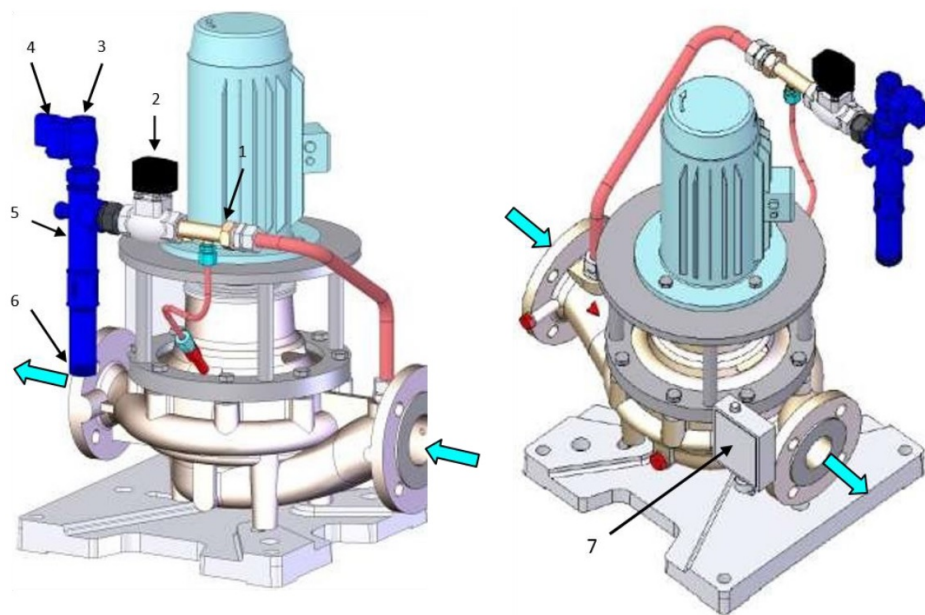


Fig. 6: Priming system using ejector

1	Check valve	2	Solenoid valve (suction valve)
3	Compressed air inlet	4	Solenoid valve (compressed air valve)
5	Ejector	6	Discharge nozzle
7	Pressure controller		

Function During commissioning/start-up the solenoid valve (2) opens, so air can escape from the piping. After duration T1⁷⁾ has passed, the main pump starts up; both pump are running. When the fluid handled reaches the main pump, the pressure controller (7) recognises a pressure rise. A timer closes the solenoid valve after the duration T2⁸⁾ has passed.

When the pressure controller detects a pressure of 0.4 bar, it automatically starts up the solenoid valve to vent the main pump and the piping. The main pump keeps running. When 70 % of the operating pressure of the main pump or the minimum pressure set at the pressure controller are detected, the pressure controller closes the solenoid valve.

The duration T1 depends on the quantity of air escaping. The following values can be used as a reference:

Table 6: Reference values T1

Suction line diameter	Duration T1
[mm]	[s]
< 50	60
≤ 125	120
> 125	180

The duration T2 is influenced by any instability during the commissioning/start-up process. The value must be between 10 and 30 seconds.

4.7 Scope of supply

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

- Pump

⁷ T1: duration until the main pump starts up

⁸ T2: duration until the solenoid valve is closed

Drive

- Surface-cooled IEC frame three-phase squirrel-cage motor

Special accessories




- As required

4.8 Dimensions and weights

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


5 Installation at Site

5.1 Safety regulations

 	<p>⚠ DANGER</p> <p>Improper installation in potentially explosive atmospheres Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Comply with the applicable local explosion protection regulations. ▸ Observe the information in the data sheet and on the name plates of pump and motor.
	<p>NOTE</p> <p>KSB can provide support for the selection of a piping system and foundation by means of the required data and recommendations. However, the responsibility regarding selection, installation and operation of these components lies with the plant engineer or the corresponding companies commissioned.</p>



5.2 Checks to be carried out prior to installation




Place of installation

	<p>⚠ WARNING</p> <p>Installation on a mounting surface which is unsecured and cannot support the load Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1. ▸ The mounting surface must be set, flat, and level. ▸ Check the indicated weights.
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1. Check the structural requirements.
All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

5.3 Installing the pump set

	<p>⚠ WARNING</p> <p>Improper handling of mortar cartridge Skin sensitisation and/or irritation!</p> <ul style="list-style-type: none"> ▸ Wear suitable protective clothing.
	<p>⚠ WARNING</p> <p>Impermissibly large inclination angle of the pump set Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Never exceed a maximum inclination angle of 15° off the vertical for single-suction pumps mounted on a baseplate.



	<p>⚠ WARNING</p> <p>Connecting the pump set prior to installing it on the foundation Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Only connect the suction nozzle and discharge nozzle to the piping after the pump set has been installed on the foundation.
	<p>⚠ WARNING</p> <p>Mounting the motor prior to installing the pump on the foundation Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Only mount the motor after the pump has been installed on the foundation and the pump nozzles have been connected to the piping.
	<p>CAUTION</p> <p>Dry running / Ingress of leakage into the motor Damage to the motor!</p> <ul style="list-style-type: none"> ▷ Always install the pump set in a vertical position.

Installing the pump set in a vertical position

If the foundation bolts are to be inserted into the holes provided: Insert the foundation bolts into the corresponding openings.

5.4 Piping

5.4.1 Connecting the piping

	<p>⚠ DANGER</p> <p>Impermissible loads acting on the pump nozzles Danger to life from escaping hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> ▷ Do not use the pump as an anchorage point for the piping. ▷ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains. ▷ Observe the permissible forces and moments at the pump nozzles. ▷ Take appropriate measures to compensate for thermal expansion of the piping.
	<p>CAUTION</p> <p>Incorrect earthing during welding work at the piping Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> ▷ Never earth the electric welding equipment on the pump or baseplate. ▷ Prevent current flowing through the rolling element bearings.



NOTE

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

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
- ✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.
- ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.
- ✓ The diameter of pipes, valves and accessories is calculated with consideration of the head loss in order for the following flow velocities to be met: 2 - 3 m/s in the discharge line, 1 - 2 m/s in the suction line.



CAUTION

Welding beads, scale and other impurities in the piping

Damage to the pump!

- ▷ Remove any impurities from the piping.
- ▷ If necessary, install a filter.
- ▷ Observe the information in (⇒ Section 7.2.2.1, Page 44) .

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Before installing the pump in the piping, remove the flange covers on the suction nozzle and discharge nozzle of the pump.
3. If required, install a filter in the piping (see drawing: Filter in the piping).

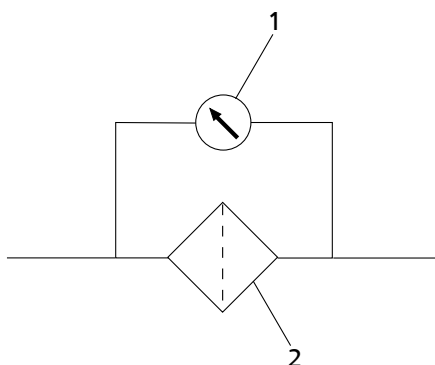


Fig. 7: Filter in the piping


1	Differential pressure gauge	2	Filter
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NOTE

Use a filter with laid-in wire mesh (mesh width 0.5 mm, wire diameter 0.25 mm) of corrosion-resistant material.
Use a filter with a filter area three times the cross-section of the piping.
Conical filters have proved suitable.

4. Connect the pump nozzles to the piping.

	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Aggressive flushing liquid and pickling agent</p> <p>Damage to the pump!</p> <p>► Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.</p>
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5.4.2 Permissible 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.

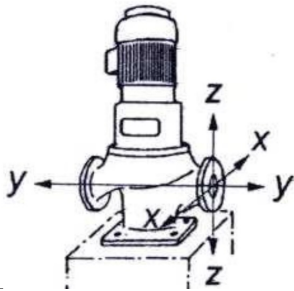



Fig. 8: Forces and moments at the pump nozzles

Table 7: Forces and moments at the pump nozzles

Size	Suction nozzle						Discharge nozzle					
	F_x	F_y	F_z	M_x	M_y	M_z	F_x	F_y	F_z	M_x	M_y	M_z
	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
050-032-160	600	600	500	450	250	300	350	400	300	300	100	150
050-032-200	600	600	500	450	250	300	350	400	300	300	100	150
050-032-250	600	600	500	450	250	300	350	400	300	300	100	150
065-040-160	700	800	600	500	300	350	400	500	400	400	200	250
065-040-250	700	800	600	500	300	350	400	500	400	400	200	250
065-050-200	700	800	600	500	300	350	600	600	500	450	250	300
080-065-160	850	900	800	550	300	400	700	800	600	500	300	350
080-065-250	850	900	800	550	300	400	700	800	600	500	300	350
080-065-315	850	900	800	550	300	400	700	800	600	500	300	350
100-080-160	850	900	800	550	300	400	850	900	800	550	300	400
100-080-200	850	900	800	550	300	400	850	900	800	550	300	400
100-080-250	850	900	800	550	300	400	850	900	800	550	300	400
100-080-315	850	900	800	550	300	400	850	900	800	550	300	400
100-080-400	850	900	800	550	300	400	850	900	800	550	300	400
150-100-250	1700	1900	1500	1000	600	750	1100	1250	1000	600	350	450
150-100-315	1700	1900	1500	1000	600	750	1100	1250	1000	600	350	450
150-100-400	1700	1900	1500	1000	600	750	1100	1250	1000	600	350	450
150-125-250	1700	1900	1500	1000	600	750	1350	1500	1200	800	500	700
150-125-315	1700	1900	1500	1000	600	750	1350	1500	1200	800	500	700
150-125-400	1700	1900	1500	1000	600	750	1350	1500	1200	800	500	700
200-150-250	2250	2500	2000	1350	900	1050	1700	1900	1500	1000	600	750
200-150-315	2250	2500	2000	1350	900	1050	1700	1900	1500	1000	600	750
200-150-400	2250	2500	2000	1350	900	1050	1700	1900	1500	1000	600	750
200-150-500	2250	2510	2025	1375	900	1075	1685	1875	1515	1000	625	775
250-200-330	2800	3100	2500	1950	1300	1550	2250	2500	2000	1350	900	1050
250-200-400	2790	3130	2530	1975	1325	1575	2250	2510	2025	1375	900	1075
250-200-500	2790	3130	2530	1975	1325	1575	2250	2510	2025	1375	900	1075

Size	Suction nozzle						Discharge nozzle					
	F _x	F _y	F _z	M _x	M _y	M _z	F _x	F _y	F _z	M _x	M _y	M _z
	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
300-250-330	3350	3750	3000	2750	1900	2200	2800	3100	2500	1950	1300	1550
300-250-400	3355	3750	3015	2775	1900	2225	2790	3130	2530	1975	1325	1575
300-250-500	3355	3750	3015	2775	1900	2225	2790	3130	2530	1975	1325	1575
350-300-330	4000	3900	400	3100	2300	2600	3400	3100	3800	2200	2800	1950
350-300-400	3915	4365	3525	3625	2500	2925	3355	3750	3015	2775	1900	2225
350-300-500	3915	4365	3525	3625	2500	2925	3355	3750	3015	2775	1900	2225
500-400-430	4500	4100	4900	3600	4650	3150	4500	4100	4900	3600	4650	3150

5.4.3 Auxiliary connections




⚠ DANGER

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

Risk of burns!

Explosion hazard!

- ▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.



⚠ WARNING

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


Risk of injuries by escaping fluid!

Risk of burns!

Malfunction of the pump!

- ▷ Refer to the general arrangement drawing, the piping layout and pump markings (if any) for the number, dimensions and locations of auxiliary connections.
- ▷ Use the auxiliary connections provided.
- ▷ The connections must only be used to absorb stresses caused by the circulation of the fluid handled. Do not expose the connections to any external stresses.


In the case of clean fluids handled no cooling liquid is required for the mechanical seal. The mechanical seal is cooled by the circulation of the fluid handled.



NOTE

On pumps with a priming system a check valve must be fitted in the discharge line immediately downstream of the pump.

5.5 Checking the coupling alignment

	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Risk of coupling misalignment resulting in a potentially explosive atmosphere Explosion hazard! Risk of burns!</p> <ul style="list-style-type: none"> ▷ Install non-electric devices only. The zone classification and temperature class of the coupling must correspond to the zone classification and temperature class of the pump as a minimum. ▷ Observe the manufacturer's coupling alignment instructions.
---	---

1. Align the coupling with a spirit level.
If necessary, compensate any differences in height with shims. The radial and axial deviation between the two coupling halves must not exceed 0.2 mm.
Observe the distance between the coupling halves given in the table.

Table 8: Distance between coupling halves



Outside diameter of the coupling [mm]	Distance between coupling halves [mm]	Tolerance [mm]
110	3	+/- 1
125	3	+/- 1
140	3	+/- 1
160	4	+/- 2
180	4	+/- 2
200	4	+/- 2
225	4	+/- 2
250	5,5	+/- 2,5
280	5,5	+/- 2,5

Make sure that the coupling is correctly aligned at all times.



If the motor was previously removed, observe the following for re-mounting it:



1. The surfaces of the motor and the support flange at the motor bracket have to be spotlessly clean and smooth.
2. Check the distance between the coupling halves.
3. Rotate the coupling by hand and check the alignment.

5.6 Enclosure/insulation


	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Volute casing and bearing bracket lantern take on the same temperature as the fluid handled. Risk of burns!</p> <ul style="list-style-type: none"> ▷ Insulate the volute casing. ▷ Fit protective guard.
	<div style="background-color: #f4d03f; padding: 5px;">CAUTION</div> <p>Heat build-up in the bearing bracket Damage to the bearing!</p> <ul style="list-style-type: none"> ▷ Never insulate the bearing bracket, bearing bracket lantern and casing cover.

5.7 Electrical connection

	 DANGER
	<p>Electrical connection work by unqualified personnel Risk of fatal injury due to electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained and qualified electrician. ▷ Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.

	 WARNING
	<p>Incorrect connection to the mains Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> ▷ Observe the technical specifications of the local energy supply companies.

1. Check the available mains voltage against the data on the motor name plate.
2. Connect the earthing of pump, baseplate or motor to the earthing of the system.
3. Select an appropriate starting method.

	NOTE
	<p>Fitting a circuit breaker for the motor and a thermistor motor protection relay is recommended.</p>

5.7.1 Setting the time relay



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

Table 9: Time relay settings for star-delta starting:

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

5.7.2 Connecting the motor

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

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

DOL starting

The motor can be wired in star configuration or delta configuration. The voltage and wiring are stamped on the name plate of the motor.

Example:

400 VY: 400 Volt star configuration

240 VD: 240 Volt delta configuration

1. Check the voltage of the available power supply network against the data on the motor name plate.
2. Connect the terminals as shown in the diagram.

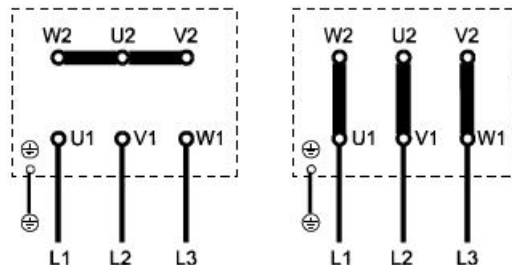


Fig. 9: Wiring of star configuration / delta configuration

Star-delta starting

1. Check the voltage of the available power supply network against the data on the motor name plate for star-delta starting (D).
2. Connect 6 terminals as per the diagram.

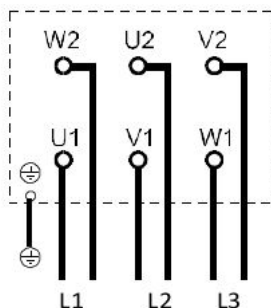


Fig. 10: Wiring of star-delta contactor



5.7.3 Connecting the priming system

For the electrical connection of the automatic priming system observe the wiring diagrams (⇒ Section 9.2, Page 84) as well as the operating manual of the auxiliary pump or ejector.

5.8 Checking the direction of rotation

	<p>⚠ DANGER</p> <p>Temperature increase resulting from contact between rotating and stationary components</p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Never check the direction of rotation by starting up the unfilled pump set. ▶ Separate the pump from the motor to check the direction of rotation.
	<p>⚠ WARNING</p> <p>Hands inside the pump casing</p> <p>Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▶ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

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

The correct direction of rotation of motor and pump corresponds with the arrow indicating the direction of rotation on the pump (seen from the drive end).

1. Start the motor and stop it again immediately to determine the motor's direction of rotation.
2. Check the direction of rotation.
The motor's direction of rotation must match the arrow indicating the direction of rotation on the pump.
3. If the motor 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 mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇒ Section 5.7, Page 31)
- The pump has been primed with the fluid to be handled. The pump has been vented. (⇒ Section 6.1.4, Page 34)
- The direction of rotation has been checked. (⇒ Section 5.8, Page 32)
- All auxiliary connections required are connected and operational.
- The lubricants have been checked.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇒ Section 6.4, Page 41)

6.1.2 Filling in the lubricant

Versions ILN, ILNC and reinforced sizes of version ILNR

The bearings are closed and grease-packed for life. They do not need to be re-greased.



Version ILNR

The bearings are closed with NILOS rings on both sides and filled with high-quality polyurea high-temperature grease. (⇒ Section 7.2.2.2, Page 44) The bearings may overheat during commissioning. To prevent this from happening, a speed of 800 rpm is recommended for the running-in process (24 hours).


6.1.3 Checking the shaft seal

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

Double mechanical seal

	<div style="background-color: #e67e22; color: white; padding: 5px;"> DANGER</div> <p>Excessive temperature of barrier fluid (pumps with double mechanical seal) Explosion hazard! Excessive surface temperature</p> <ul style="list-style-type: none"> ▷ For pumps with double mechanical seal, make sure that the barrier fluid's temperature does not exceed 60 °C.
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6.1.4 Priming and venting the pump

	<div style="background-color: #f1c40f; color: black; padding: 5px;">CAUTION</div> <p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.
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Prior to commissioning and after it has been shut down for a prolonged period of time:

Design with auxiliary pump (⇒ Section 6.1.4.1, Page 35)

Version with ejector (⇒ Section 6.1.4.2, Page 36)

Version without priming system:




Normal operation

- Disconnect the power supply of the motor.
- Close the shut-off elements in the suction line and discharge line.
- Remove the plug from the vent connection at the pump casing or the vent connection of the discharge line upstream of the check valve.
- Slightly open the shut-off element in the suction line until the fluid handled escapes through the vent connection.
- Close the vent connection.
- Fully open the shut-off element in the suction line.
- Check the direction of rotation of the pump.
- Fully open the shut-off element in the discharge line.

Suction lift operation

- Disconnect the power supply of the motor.
- Remove the plug from the vent connection at the pump casing or the vent connection of the discharge line upstream of the check valve.
- Close the shut-off element in the discharge line.
- Fill in the fluid handled through the vent connection until it overflows.
- Close the vent connection.
- Check the direction of rotation of the pump.
- Fully open the shut-off element in the discharge line.



6.1.4.1 Priming the pump and venting it with an auxiliary pump

	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Pump not vented Pump malfunction! Damage to the mechanical seal!</p> <ul style="list-style-type: none"> ▷ Do not close or cover the discharge nozzle of the auxiliary pump. ▷ Observe the maximum installation height.
	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Auxiliary pump running too long Motor overheated!</p> <ul style="list-style-type: none"> ▷ Set duration T2 (⇒ Section 4.6.1, Page 22) to a maximum of 5 seconds or to the star-delta start-up time. ▷ The total runtime of the auxiliary pump must not exceed 15 seconds.
	<div style="background-color: #0070C0; color: white; padding: 5px;">NOTE</div> <p>Electric control devices for the auxiliary pump are not included in the scope of supply unless explicitly agreed.</p>

The maximum installation height must not exceed 6 metres seen from the lowest fill level of the fluid handled. Flow losses in the priming system must be considered.

- ✓ All connections and pipes have been checked for leakage.
- ✓ For commissioning: The auxiliary pump has been vented.
- ✓ All electrical connections have been checked.
- ✓ The discharge nozzle of the auxiliary pump is open or connected to a drain line.
 1. Prime the auxiliary pump with the fluid handled.
 2. Check that the auxiliary pump is not blocked.
 3. Start up the auxiliary pump.


6.1.4.2 Priming the pump and venting it with an ejector


	CAUTION Pump not vented Pump malfunction! Damage to the mechanical seal! <ul style="list-style-type: none"> ▷ Do not close or cover the discharge nozzle of the ejector. ▷ Observe the maximum installation height.
	NOTE Electric control devices for the ejector are not included in the scope of supply unless explicitly agreed.


The maximum installation height must not exceed 6 metres seen from the lowest fill level of the fluid handled. Flow losses in the priming system must be considered.

- ✓ All connections and pipes have been checked for leakage.
- ✓ All electrical connections have been checked.
- ✓ The discharge nozzle of the ejector is open or connected to a drain line.
 1. Check that the compressed air supply and the ejector are not blocked.
 2. Start the ejector.


6.1.5 Start-up

	DANGER Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed. Explosion hazard! Hot or toxic fluids escaping! <ul style="list-style-type: none"> ▷ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed. ▷ Only start up the pump set with the discharge-side shut-off element slightly or fully open.
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	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures due to dry running or excessive gas content in the fluid handled</p> <p>Explosion hazard!</p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Prime the pump as per operating instructions. (⇒ Section 6.1.4, Page 34) ▷ Always operate the pump within the permissible operating range.
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	<div style="background-color: #f4d03f; padding: 5px;">CAUTION</div> <p>Abnormal noises, vibrations, temperatures or leakage</p> <p>Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Switch off the pump (set) immediately. ▷ Eliminate the causes before returning the pump set to service.
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- ✓ The system piping has been cleaned.
- ✓ The pump, suction line and inlet tank (if any) have been vented and primed with the fluid to be handled.
- ✓ The lines for priming and venting have been closed.
- ✓ The coupling has been aligned, and the alignment has been checked.
(⇒ Section 5.5, Page 30)

	<div style="background-color: #f4d03f; padding: 5px;">CAUTION</div> <p>Start-up against open discharge line</p> <p>Motor overload!</p> <ul style="list-style-type: none"> ▷ Make sure the motor has sufficient power reserves. ▷ Use a soft starter. ▷ Use speed control.
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1. Fully open the shut-off element in the suction head line / suction lift line.
2. Close or slightly open the shut-off element in the discharge line.
3. Start up the motor.
4. Immediately after the pump has reached full rotational speed, slowly open the shut-off element in the discharge line and adjust it to comply with the duty point.


	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Seal leakages at operating temperature</p> <p>Leakage of hot or toxic fluid handled!</p> <ul style="list-style-type: none"> ▷ Once the operating temperature has been reached, re-tighten the hexagon socket head cap screws between casing and casing cover.
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6.1.6 Shutdown

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


✓ The shut-off element in the suction line is and remains open.

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



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

For prolonged shutdown periods:


1. Close the shut-off element in the suction line.
2. Close the auxiliary connections.

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

6.2 Operating limits

	 DANGER
	<p>Non-compliance with operating limits for pressure, temperature, fluid handled and speed Hot fluids escaping!</p> <ul style="list-style-type: none"> ▷ Comply with the operating data indicated in the data sheet. ▷ Avoid prolonged operation against a closed shut-off element. ▷ Never operate the pump at product temperatures exceeding those specified in the data sheet or on the name plate.

6.2.1 Ambient temperature

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

Observe the following parameters and values during operation:

Table 10: Permissible ambient temperatures


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

6.2.2 Frequency of starts

The frequency of starts is usually determined by the maximum temperature increase of the motor. It largely 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). The following number of starts per hour must not be exceeded:

Table 11: Frequency of starts

Motor rating [kW]	Maximum frequency of starts [Starts/hour]
≤ 3	20
4 - 11	15
12 - 45	10
> 45	5




CAUTION


Re-starting while motor is still running down
 Damage to the pump (set)!

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

6.2.3 Fluid handled

6.2.3.1 Flow rate



 **DANGER**

Actual flow rate below minimum flow rate
 Explosion hazard!

- ▷ Never let the flow rate drop below the minimum flow rate as per the operating curve.
- ▷ Never operate the pump at zero flow.

Minimum flow rate required for the pump

The minimum flow rate for the pump indicated in the data sheets must be observed. If necessary, provide protective equipment preventing pump operation without the fluid to be handled or automatically ensuring the minimum flow rate.

The below calculation formula determines the minimum flow rate for fluids whose physical properties differ from water:

$$Q_{\min} = \frac{3,600,000 \times Pa}{Pe \times Ce}$$

Maximum permissible flow rate for the pump

Unless specified otherwise in the characteristic curves or in the data sheets, the following applies:


$$Q_{\max} = 1.1 \times Q_{\text{opt}}$$

Table 12: Key

Symbol	Description	Unit
Ce	Specific heat capacity of the fluid handled	J/kg °C
Pa	Power input when the shut-off element is closed	kW
Pe	Specific weight of the fluid handled	kg/m ³
Q _{max}	Maximum permissible flow rate	m ³ /h
Q _{min}	Minimum permissible flow rate	m ³ /h
Q _{opt}	Flow rate at best efficiency point	m ³ /h

6.2.3.2 Density of the fluid handled

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

	CAUTION
	<p>Impermissibly high density of the fluid handled</p> <p>Motor overload!</p> <ul style="list-style-type: none"> ▷ Observe the density specifications in the data sheet and, if applicable, in the ATEX declaration of conformity. ▷ Make sure the motor has sufficient power reserves.

6.2.3.3 Abrasive fluids


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

6.2.3.4 Fluid temperature

The maximum permissible fluid temperature is indicated in the data sheet or ATEX declaration of conformity. For a higher fluid temperature consultation with KSB is required.

6.2.3.5 Viscosity of the fluid handled

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

	CAUTION
	<p>The fluid handled has a higher viscosity than permitted.</p> <p>Risk of motor overload!</p> <ul style="list-style-type: none"> ▷ Observe the viscosity limits for the fluid handled given in the data sheet. ▷ Make sure the motor has sufficient power reserves.

6.2.4 Maximum permissible speed

Comply with the rotational speed indicated on the name plate.

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. During prolonged shutdown periods, start up the pump set regularly for approximately five minutes. Check the tightness of the sealing elements and the functionality of the auxiliary connections. Observe the intervals given in the "Intervals for operation during shutdown" table.
 - ⇒ This will prevent the formation of deposits within the pump and the pump intake area.

Table 13: Intervals for operation during shutdown

Application	Intervals
Fire-fighting pump	Monthly
Drinking water pump	Every 48 hours
Stand-by pump	Weekly

The intervals indicated apply as a minimum; daily operation is recommended.



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

- ✓ The pump has been properly drained. (⇒ Section 7.3, Page 46)
- ✓ The safety instructions for dismantling the pump have been observed. (⇒ Section 7.1, Page 42)
 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)

6.4 Returning to service

For returning the equipment to service observe the sections on commissioning/start-up, the operating limits and the coupling alignment . (⇒ Section 5.5, Page 30) (⇒ Section 6.1, Page 34) (⇒ Section 6.2, Page 38)




In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7, Page 42)

	WARNING
	Failure to re-install or re-activate protective devices Risk of injury from moving parts or escaping fluid! ▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.
	NOTE
	If the equipment has been out of service for more than one year, replace all elastomer seals.

7 Servicing/Maintenance

7.1 Safety regulations

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

	<p>⚠ WARNING</p> <p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.
	<p>⚠ WARNING</p> <p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury!</p> <ul style="list-style-type: none"> ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
	<p>⚠ WARNING</p> <p>Insufficient stability Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.


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



	<p>NOTE</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 "www.ksb.com/contact" on the Internet.</p>
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Never use force when dismantling and reassembling the pump set.

7.2 Servicing/Inspection


7.2.1 Supervision of operation

	<p>CAUTION</p> <p>Excessive temperatures as a result of bearings running hot or defective bearing seals Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Regularly check the lubricant level. ▷ Regularly check the rolling element bearings for running noises.
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	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.
	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Impermissibly high temperature of fluid handled Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid). ▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇒ Section 6.2, Page 38)

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


- The pump must run quietly and free from vibrations at all times.
- 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 final bearing temperature may exceed the ambient temperature by up to 40 °C, however, it must not exceed 90 °C (measured on the outside of the bearing bracket).
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).

	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Operation outside the permissible bearing temperature Damage to the pump!</p> <ul style="list-style-type: none"> ▷ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the motor housing).
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7.2.2 Inspection work

	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures caused by friction, impact or frictional sparks</p> <p>Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Regularly check the cover plates, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.
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7.2.2.1 Cleaning filters

	<div style="background-color: #f4d03f; padding: 5px;">CAUTION</div> <p>Insufficient inlet pressure due to clogged filter in the suction line</p> <p>Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge). ▷ Clean filter at appropriate intervals.
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7.2.2.2 Lubrication and lubricant change of rolling element bearings

Versions ILN, ILNC and reinforced sizes of version ILNR

The bearings are sealed on both sides, they are grease-packed and maintenance-free. For this reason, the pump is not equipped with a lubricating nipple.

	<div style="background-color: #2980b9; color: white; padding: 5px;">NOTE</div> <p>Only bearings of the type 2RS may be installed.</p>
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Version ILNR

The bearings are closed with NILOS rings on both sides and filled with high-quality polyurea high-temperature grease.

7.2.2.2.1 Intervals

- Under suitable operating conditions the grease-lubricated bearings will run for 15,000 operating hours.
- Under unfavourable operating conditions (e.g. high room temperature, high atmospheric humidity, dust-laden air, aggressive industrial atmosphere) check the bearings earlier and clean and re-lubricate them, if required.
- Replace the rolling element bearings after 15,000 operating hours or 2 years of continuous operation.

7.2.2.2.2 Grease quality

Optimum grease properties for rolling element bearings

- Polyurea high melting point grease
- Free of resin and acid
- Not liable to crumble
- Rust-preventive characteristics

Table 14: Grease quality to DIN 51825

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

A different soap basis is possible. In this case observe the following:


1. Remove all grease residues.
2. Thoroughly flush the bearings. Use a suitable solvent.

7.2.2.2.3 Grease quantity

Table 15: Grease quantity to DIN 625

Code	Grease per bearing approx. [g]
6413 C3	30

7.2.2.2.4 Changing the grease

	CAUTION
	Mixing greases of differing soap bases Changed lubricating qualities! ▷ Thoroughly clean the bearings. ▷ Adjust the re-lubrication intervals to the grease used.

- ✓ The pump has been dismantled for changing the grease.
(⇒ Section 7.4, Page 46)

1. Fill the bearing cavities with grease.

7.2.2.3 Maintenance schedule / Inspection schedule


Table 16: Maintenance schedule / Inspection schedule

What/where	Action	Work	Interval
Filter of priming system ⁹⁾	Cleaning the filter	Removing the filter	Monthly
Mechanical seal	Checking for tightness	Visual inspection	Every 3 months
	Replacing the mechanical seal		If leakage occurs
Volute casing / casing cover	Checking for tightness	Visual inspection	Every 3 months
Flanges / priming system	Checking for tightness	Visual inspection	Every 3 months
Bearing	Checking the bearing temperature	Measuring with a thermocouple	Every 3 months
Tie bolts	Checking the seat of screws, bolts and nuts	Checking manually (⇒ Section 7.6, Page 62)	Every 3 months and following dismantling
Coupling	Aligning and checking	(⇒ Section 5.5, Page 30)	Every 6 months and following dismantling
Pump	Pump maintenance	Perform the work described in (⇒ Section 7, Page 42) .	Annually
	Functional test	Reading off the instruments	Depending on the use
Impeller, rings	Checking for wear	Dismantling the casing, visual inspection	Annually
Shaft, bearing	Checking for wear	Dismantling the support, visual inspection	Annually
Flexible coupling ⁹⁾	Replacing the coupling	(⇒ Section 7.5.2.5, Page 58)	Every 6 months

⁹⁾ If applicable

What/where	Action	Work	Interval
Sealing elements	Replacing the sealing elements	Replacing the sealing elements	Every time they are removed
Pump shaft, motor shaft	Performing a run-out check	(⇒ Section 5.5, Page 30)	Following dismantling




7.3 Drainage/cleaning

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

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

7.4 Dismantling the pump set


7.4.1 General information/Safety regulations




	⚠ WARNING
	Unqualified personnel performing work on the pump (set) Risk of injury! <ul style="list-style-type: none"> ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.
	⚠ WARNING
	Hot surface Risk of injury! <ul style="list-style-type: none"> ▷ Allow the pump set to cool down to ambient temperature.
	⚠ WARNING
	Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

Always observe the safety instructions and information. (⇒ Section 7, Page 42)

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

For dismantling and reassembly, refer to the general assembly drawing.

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


	<p>NOTE</p> <p>All sealing elements affected by the dismantling process must be replaced.</p>
	<p>⚠ DANGER</p> <p>Insufficient preparation of work on the pump (set) Risk of injury!</p> <ul style="list-style-type: none"> ▷ Properly shut down the pump set. (⇒ Section 6.1.6, Page 38) ▷ Close the shut-off elements in the suction line and discharge line. ▷ Drain the pump and release the pump pressure. (⇒ Section 7.3, Page 46) ▷ Shut off any auxiliary connections. ▷ Allow the pump set to cool down to ambient temperature.
	<p>NOTE</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 Dismantling the pump set: ILN

7.4.3.1 Dismantling the complete pump set

	<p>NOTE</p> <p>The pump casing can remain installed in the piping for further dismantling.</p>
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- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) have been observed/carried out.
1. Disconnect the discharge nozzle and suction nozzle from the piping.
 2. Depending on the pump/motor size, remove the supports from the pump set.
 3. Remove the complete pump set from the piping.

7.4.3.2 Removing the motor

	<p>⚠ WARNING</p> <p>Motor tipping over Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ Suspend or support the motor to prevent it from tipping over.
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- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.1, Page 47) have been observed/carried out.
1. Remove hexagon head bolt 901.3.
 2. Remove the motor.

7.4.3.3 Dismantling the coupling



Single-suction version

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.2, Page 47) have been observed/carried out.
- 1. Remove the coupling guard.
- 2. Remove tie bolts at the coupling and remove spacer.
- 3. Remove grub screws on both coupling hubs.
- 4. Remove the coupling with a puller. Never loosen the coupling by tapping it with a mallet as this can severely damage the bearings or mechanical seal.

Double-suction version

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.2, Page 47) have been observed/carried out.
- 1. Remove grub screws on both coupling hubs.
- 2. Remove the coupling with a puller. Never loosen the coupling by tapping it with a mallet as this can severely damage the bearings or mechanical seal.

7.4.3.4 Removing the back pull-out unit

	 WARNING
	Back pull-out unit tilting Risk of crushing hands and feet! ▷ Suspend or support the bearing bracket at the pump end.

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.3, Page 48) have been observed/carried out.
- 1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
- 2. Remove hexagon socket head cap screw 914 between volute casing 102 and casing cover 161.
- 3. Pull the back pull-out unit out of volute casing 102.
- 4. Place the back pull-out unit on a clean and level surface.
- ⇒ After the back pull-out unit has been removed, casing wear ring 502.1 is accessible.

7.4.3.5 Removing the impeller

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.4, Page 48) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
- 1. **For double-entry design only:** Remove hexagon head bolt 901.4.
- 2. **For double-entry design only:** Remove spring 950, washer 550.1 and shaft sleeve 523.
- 3. Undo impeller nut 922.
- 4. Remove impeller 230.
- 5. Place impeller 230 on a clean and level surface.
- ⇒ After the impeller has been removed, casing wear ring 502.2 is accessible.

7.4.3.6 Removing the mechanical seal

Single-suction version

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.5, Page 48) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
- ✓ The impeller has been removed.
 1. If applicable, remove spring plate 484.
 2. Undo the rotating assembly of the mechanical seal (primary ring with spring) and pull it off shaft 210.
 3. **Sizes in accordance with general assembly drawing 1:** Remove bearing cover 360.
Sizes in accordance with general assembly drawing 2: Remove hexagon head bolt 901.4 and bearing housing 350.
 General assembly drawings per pump size (⇒ Table 27) .
 4. Remove shaft 210 with bearings.
 5. Pull out the stationary assembly of the mechanical seal. Do not touch the seal face during this process.

Double-suction version


- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.5, Page 48) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
- ✓ The impeller has been removed.
 1. Undo bearing cover 360.1. Pull the bearing cover off the shaft.
 2. Undo circlip 932.1. Carefully pull out casing cover 161.2.
 3. Pull out the stationary assembly and the rotating assembly of the mechanical seal. Do not touch the seal face during this process.

7.4.3.7 Dismantling the bearing assembly

Single-suction version

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.6, Page 49) have been observed/carried out.
- ✓ The bearing bracket has been placed in a clean and level assembly area.
 1. Remove thrower 507.
 2. Remove circlip 932.1.
 3. Remove the pump shaft with bearings by tapping it gently with a plastic mallet.


Double-suction version

	<p>NOTE</p> <p>Radial ball bearing 321 has already been removed together with the mechanical seal. (⇒ Section 7.4.3.6, Page 49)</p>
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- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.3.6, Page 49) have been observed/carried out.
- ✓ The bearing bracket has been placed in a clean and level assembly area.
 1. Undo hexagon socket head cap screws 914.2. Remove bearing cover 360.2.
 2. Remove bearing bushes 545.1/2.


7.4.4 Dismantling the pump set: ILNC

7.4.4.1 Dismantling the complete pump set

	<p>NOTE</p> <p>The pump casing can remain installed in the piping for further dismantling.</p>
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- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) have been observed/carried out.
 1. Disconnect the discharge nozzle and suction nozzle from the piping.
 2. Depending on the pump/motor size, remove the supports from the pump set.
 3. Remove the complete pump set from the piping.

7.4.4.2 Removing the motor

	<p>WARNING</p> <p>Motor tipping over Risk of crushing hands and feet!</p> <p>▷ Suspend or support the motor to prevent it from tipping over.</p>
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- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.4.1, Page 50) have been observed/carried out.
 1. Undo hexagon head bolts 901.3.
 2. Undo grub screws 904.
 3. Remove the motor.

7.4.4.3 Removing the back pull-out unit

	<p>WARNING</p> <p>Back pull-out unit tilting Risk of crushing hands and feet!</p> <p>▷ Suspend or support the bearing bracket at the pump end.</p>
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- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.4.1, Page 50) to (⇒ Section 7.4.4.2, Page 50) have been observed/carried out.
 1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
 2. Undo hexagon head bolt 901.1 between volute casing 102 and drive lantern 341.
 3. Remove drive lantern 341.
 4. Pull the back pull-out unit out of volute casing 102.
 5. Place the back pull-out unit on a clean and level surface.

⇒ After the back pull-out unit has been removed, casing wear ring 502.1 is accessible.

7.4.4.4 Removing the impeller

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.4.1, Page 50) to (⇒ Section 7.4.4.3, Page 50) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
 1. Undo impeller nut 922.
 2. Remove impeller 230.
 3. Place impeller 230 on a clean and level surface.
- ⇒ After the impeller has been removed, wear ring 502.2 is accessible.

7.4.4.5 Removing the mechanical seal


- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.4.1, Page 50) to (⇒ Section 7.4.4.4, Page 51) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
- ✓ The impeller has been removed.
 1. Undo the rotating assembly of the mechanical seal (primary ring with spring) and pull it off shaft 210.
 2. Remove bearing cover 360.
 3. Remove circlip 932.2.
 4. Remove shaft 210 with bearings.
 5. Pull out the stationary assembly of the mechanical seal. Do not touch the seal face during this process.

7.4.4.6 Dismantling the bearing assembly

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.4.1, Page 50) to (⇒ Section 7.4.4.5, Page 51) have been observed/carried out.
- ✓ The bearing bracket has been placed in a clean and level assembly area.
 1. Remove thrower 507.
 2. Remove circlip 932.1.
 3. Remove the pump shaft with bearings by tapping it gently with a plastic mallet.



7.4.5 Dismantling the pump set: ILNR

7.4.5.1 Dismantling the complete pump set

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

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) have been observed/carried out.
 1. Disconnect the discharge nozzle and suction nozzle from the piping.
 2. Depending on the pump/motor size, remove the supports from the pump set.
 3. Remove the complete pump set from the piping.

7.4.5.2 Removing the motor



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

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.5.1, Page 51) have been observed/carried out.
- 1. Undo hexagon head bolts 901.1.
- 2. Remove washer 550.1.
- 3. Remove the motor.

7.4.5.3 Dismantling the coupling

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.5.1, Page 51) to (⇒ Section 7.4.5.2, Page 52) have been observed/carried out.
- 1. Remove the coupling guard.
- 2. Remove grub screws on both coupling hubs.
- 3. Remove the coupling with a puller. Never loosen the coupling by tapping it with a mallet as this can severely damage the bearings or mechanical seal.

7.4.5.4 Removing the back pull-out unit

	 WARNING
	Back pull-out unit tilting Risk of crushing hands and feet! <p>▷ Suspend or support the bearing bracket at the pump end.</p>

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.5.1, Page 51) to (⇒ Section 7.4.5.3, Page 52) have been observed/carried out.
- 1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
- 2. Undo and remove nuts 920.3.
- 3. Remove drive lantern 341. If it is difficult to remove, use hexagon head bolts 901.3.
- 4. Pull the back pull-out unit out of volute casing 102.
- 5. Place the back pull-out unit on a clean and level surface.
- ⇒ After the back pull-out unit has been removed, the casing wear ring is accessible.

7.4.5.5 Removing the impeller

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.5.1, Page 51) to (⇒ Section 7.4.5.4, Page 52) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
- 1. Undo impeller nut 922.
- 2. Remove impeller 230.
- 3. Place impeller 230 on a clean and level surface.
- ⇒ After the impeller has been removed, casing wear ring 502.2 is accessible.

7.4.5.6 Removing the mechanical seal

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.5.1, Page 51) to (⇒ Section 7.4.5.5, Page 52) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
- ✓ The impeller has been removed.
 1. Pull mechanical seal 433 off shaft 210.

7.4.5.7 Dismantling the bearing assembly

Version ILNR



- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.5.1, Page 51) to (⇒ Section 7.4.5.6, Page 53) have been observed/carried out.
- ✓ The bearing bracket has been placed in a clean and level assembly area.
 1. Undo nut 920.3.
 2. Pull casing cover 161 off shaft 210. If it is difficult to remove, use hexagon head bolt 901.4.
 3. Remove joint ring 411.2.
 4. Undo hexagon head bolt 901.2.
 5. Remove bearing cover 360.
 6. Remove the pump shaft with bearings by tapping it gently with a plastic mallet.


Version ILNR, reinforced sizes

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 46) to (⇒ Section 7.4.2, Page 47) and (⇒ Section 7.4.5.1, Page 51) to (⇒ Section 7.4.5.6, Page 53) have been observed/carried out.
- ✓ The bearing bracket has been placed in a clean and level assembly area.
 1. Undo nut 920.3.
 2. Pull casing cover 161 off shaft 210. If it is difficult to remove, use hexagon head bolt 901.4.
 3. Remove thrower 507.
 4. Undo hexagon socket head cap screw 914.
 5. Remove bearing cover 360.
 6. Remove circlip 932.1.
 7. Remove the pump shaft with bearings by tapping it gently with a plastic mallet.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

	 WARNING
	Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Improper reassembly Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▷ Use original spare parts only.
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- Sequence** Always reassemble the pump in accordance with the corresponding general assembly drawing or exploded view. (⇒ Section 9.1, Page 68)
- 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. (⇒ Section 7.6, Page 62)

7.5.2 Assembling the pump set: ILN

7.5.2.1 Installing the bearing assembly

Single-suction version

General assembly drawings per pump size (⇒ Table 27) .

Sizes in accordance with general assembly drawing 1:

- ✓ The individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Press deep groove ball bearing 321 and/or rolling element bearing 320 onto shaft 210 as far as it will go.
 2. Fit circlip 932.1.
 3. Insert thrower 507 into casing cover 161.
 4. Insert pre-assembled shaft 210 into casing cover 161.
 5. Fit circlip 932.2.
 6. Press bearing cover 360 into casing cover 161.

Sizes in accordance with general assembly drawing 2:

- ✓ The individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Press deep groove ball bearing 321 and/or rolling element bearing 320 onto shaft 210 as far as it will go.
 2. Fit circlip 932.1.
 3. Insert pre-assembled shaft 210 into bearing housing 350.
 4. Insert thrower 507 into casing cover 161.
 5. Fasten bearing housing 350 with hexagon head bolt 901.4 to casing cover 161.

Double-suction version

Upper deep groove ball bearing

- ✓ The individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Press deep groove ball bearing 321 onto shaft 210 as far as it will go.
 2. Fit washers 550.1 and 550.3.
 3. Fit circlip 932.1.
 4. Insert pre-assembled shaft 210 into casing cover 161.2.
 5. Fit washer 550.2.
 6. Fit circlip 932.2.
 7. Slide thrower 507 onto the shaft.
 8. Press bearing cover 360.1 into casing cover 161.2.

Lower plain bearing

- ✓ The individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Insert bearing bushes 545.1 and 545.2.
 2. Fit bearing cover 360.2 and fasten with hexagon socket head cap screw 914.2.
 3. Fit the impeller. (⇒ Section 7.5.2.3, Page 57)
 4. Slide shaft sleeve 523 onto shaft 210.
 5. Slide washer 550.1 and spring 950 onto shaft 210.
 6. Tighten hexagon head bolt 901.4.



7.5.2.2 Installing the mechanical seal

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

- Work cleanly and accurately.
- Prevent any damage to the seal faces or O-rings.



Single-suction version

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.2.1, Page 54) have been observed/carried out.
 - ✓ The bearing assembly as well as the individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Apply a suitable lubricant to the O-rings of the mechanical seal to reduce friction when fitting them into casing cover 161.
 2. Insert the stationary assembly of the mechanical seal into casing cover 161.
 3. Slide the rotating assembly of the mechanical seal onto shaft 210.

	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <div style="padding: 5px;"> Elastomers in contact with oil/grease Shaft seal failure! <ul style="list-style-type: none"> ▷ Use water as assembly lubricant. ▷ Never use oil or grease as assembly lubricant. </div>
	<div style="background-color: #0070C0; color: white; padding: 5px;">NOTE</div> <div style="padding: 5px;"> When fitting the mechanical seal, wet the shaft protecting sleeve and stationary ring with water to prevent friction. </div>

Double-suction version

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.2.1, Page 54) have been observed/carried out.
 - ✓ The bearing assembly as well as the individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Apply a suitable lubricant to the O-rings of the mechanical seal to reduce friction when fitting them into casing cover 161.2.
 2. Insert the stationary assembly of the mechanical seal into casing cover 161.2.
 3. Slide the rotating assembly of the mechanical seal onto shaft 210.

	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <div style="padding: 5px;"> Elastomers in contact with oil/grease Shaft seal failure! <ul style="list-style-type: none"> ▷ Use water as assembly lubricant. ▷ Never use oil or grease as assembly lubricant. </div>
	<div style="background-color: #0070C0; color: white; padding: 5px;">NOTE</div> <div style="padding: 5px;"> When fitting the mechanical seal, wet the shaft protecting sleeve and stationary ring with water to prevent friction. </div>

7.5.2.3 Fitting the impeller



Single-suction version

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) have been observed/ (⇒ Section 7.5.2.2, Page 55) carried out.
- ✓ The pre-assembled components (motor, shaft, drive lantern, discharge cover) as well as the individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
 1. Fit casing wear ring 502.2 onto casing cover 161.
 2. If applicable, slide on spring plate 484.
 3. Insert key 940.1 and slide impeller 230 onto shaft 210.
 4. Screw on and tighten impeller nut 922. Observe the tightening torques. (⇒ Section 7.6, Page 62)

Double-suction version

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.2.2, Page 55) have been observed/carried out.
- ✓ The pre-assembled components (motor, shaft, drive lantern, discharge cover) as well as the individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
 1. Slide casing cover 161.1 onto shaft 210.
 2. Fit casing wear ring 502.2 onto casing cover 161.1.
 3. Insert key 940.1 and slide impeller 230 onto shaft 210.
 4. Screw on and tighten impeller nut 922. Observe the tightening torques. (⇒ Section 7.6, Page 62)

7.5.2.4 Installing the back pull-out unit

	 WARNING
	Back pull-out unit tilting Risk of crushing hands and feet! ▷ Suspend or support the bearing bracket at the pump end.

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.2.3, Page 57) have been observed/carried out.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
 1. If required, suspend or support the back pull-out unit to prevent it from tilting.
 2. Insert casing wear ring 502.1 into volute casing 102.
 3. Insert the back pull-out unit into volute casing 102.
 4. Tighten hexagon socket head cap screws 914. Observe the tightening torques. (⇒ Section 7.6, Page 62)

7.5.2.5 Installing the coupling

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.2.4, Page 57) have been observed/carried out.
- 1. Fit the pump-end coupling half on pump shaft 210.
- 2. Fit the drive-end coupling half on the motor shaft.
- 3. Insert the teeth of the pump-end coupling half into the flexible coupling elements of the drive-end coupling half .
- 4. **For single-suction version ILN only:** Fit and tighten spacer.

After the motor has been mounted, (⇒ Section 7.5.2.6, Page 58) the coupling must be aligned. (⇒ Section 5.5, Page 30)

7.5.2.6 Mounting the motor

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.2.5, Page 58) have been observed/carried out.
- 1. Place the motor on drive lantern 341.
- 2. Tighten hexagon head bolts 901.3.
- 3. Align the pump and motor. (⇒ Section 5.5, Page 30)

7.5.3 Installing the pump set: ILNC

7.5.3.1 Installing the bearing assembly

General assembly drawings per pump size (⇒ Table 27) .

Sizes in accordance with general assembly drawing 4:

- ✓ The individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- 1. Press deep groove ball bearing 321 and/or rolling element bearing 320 onto shaft 210 as far as it will go.
- 2. Fit circlip 932.1.
- 3. Insert thrower 507 into casing cover 161.
- 4. Insert pre-assembled shaft 210 into casing cover 161.
- 5. Fit circlip 932.2.
- 6. Press bearing cover 360 into casing cover 161.



Sizes in accordance with general assembly drawing 5:

- ✓ The individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- 1. Press deep groove ball bearing 321 onto shaft 210 as far as it will go.
- 2. Fit circlip 932.1.
- 3. Insert thrower 507 into casing cover 161.
- 4. Insert pre-assembled shaft 210 into casing cover 161.
- 5. Fasten bearing housing 350 with hexagon head bolt 901.4 to casing cover 161.

7.5.3.2 Installing the mechanical seal

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

- Work cleanly and accurately.
- Prevent any damage to the seal faces or O-rings.
- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.3.1, Page 58) have been observed/carried out.
- ✓ The bearing assembly as well as the individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- 1. Apply a suitable lubricant to the O-rings of the mechanical seal to reduce friction when fitting them into casing cover 161.
- 2. Insert the stationary assembly of the mechanical seal into casing cover 161.
- 3. Slide the rotating assembly of the mechanical seal onto the shaft.

	<p>CAUTION</p> <p>Elastomers in contact with oil/grease Shaft seal failure!</p> <ul style="list-style-type: none"> ▷ Use water as assembly lubricant. ▷ Never use oil or grease as assembly lubricant.
	<p>NOTE</p> <p>When fitting the mechanical seal, wet the shaft protecting sleeve and stationary ring with water to prevent friction.</p>

7.5.3.3 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.3.1, Page 58) to (⇒ Section 7.5.3.2, Page 59) have been observed/carried out.
- ✓ The pre-assembled components (motor, shaft, drive lantern, discharge cover) as well as the individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- 1. Fit casing wear ring 502.2 onto casing cover 161.
- 2. Insert key 940.1 and slide impeller 230 onto shaft 210.
- 3. Screw on and tighten impeller nut 922. Observe the tightening torques. (⇒ Section 7.6, Page 62)

7.5.3.4 Installing the back pull-out unit

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.3.1, Page 58) to (⇒ Section 7.5.3.3, Page 59) have been observed/carried out.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- 1. If required, suspend or support the back pull-out unit to prevent it from tilting.
- 2. Insert casing wear ring 502.1 into volute casing 102.
- 3. Insert the back pull-out unit into volute casing 102.

4. Mount drive lantern 341.
5. Tighten hexagon head bolts 901.1. Observe the tightening torques.
(⇒ Section 7.6, Page 62)

7.5.3.5 Mounting the motor

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.3.1, Page 58) to (⇒ Section 7.5.3.4, Page 59) have been observed/ carried out.
1. Insert the stub shaft of the motor into pump shaft 210.
 2. Tighten grub screw 904.
 3. Tighten hexagon head bolt 901.3.

7.5.4 Installing the pump set: ILNR

7.5.4.1 Installing the bearing assembly

Version ILNR

- ✓ The individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Fit rings 500.2 on the shaft.
 2. Press deep groove ball bearing 321 onto shaft 210 as far as it will go.
 3. Press bearing cover 360 into the lower end of the bearing bracket.
 4. Tighten hexagon head bolts 901.2.
 5. Insert lower ring 500.1 into bearing bracket 330.
 6. Insert pre-assembled shaft 210 into bearing bracket 330.
 7. Slide upper ring 500.1 onto the shaft.
 8. Press bearing cover 360 into the upper end of the bearing bracket.
 9. Tighten hexagon head bolts 901.2.
 10. Slide joint rings 411.1 and 411.2 onto shaft 210.
 11. Press bearing cover 360 into casing cover 161.
 12. Fasten bearing bracket 330 with nuts 920.3 to casing cover 161.

Version ILNR, reinforced sizes



- ✓ The individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Press rolling element bearing 320 onto shaft 210 as far as it will go.
 2. Fit lock washer 931 on shaft 210.
 3. Tighten nut 920.20.
 4. Insert circlip 932.2.
 5. Insert pre-assembled shaft 210 into bearing bracket 330.
 6. Press bearing cover 360 into bearing bracket 330 and tighten upper hexagon socket head cap screw 914.
 7. Press deep groove ball bearing 321 onto shaft 210 as far as it will go.
 8. Insert circlip 932.1.
 9. Press bearing cover 360 into bearing bracket 330 and tighten lower hexagon socket head cap screw 914.

10. Slide thrower 507 onto shaft 210.
11. Fasten bearing bracket 330 with nuts 920.2 to casing cover 161.

7.5.4.2 Installing the mechanical seal

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

- Work cleanly and accurately.
 - Prevent any damage to the seal faces or O-rings.
 - ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.4.1, Page 60) have been observed/carried out.
 - ✓ The bearing assembly as well as the individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Apply a suitable lubricant to the O-rings of the mechanical seal to reduce friction when fitting them on the cartridge seal.
 2. Slide mechanical seal 433 onto shaft 210 and press into casing cover 161.

	CAUTION
	<p>Elastomers in contact with oil/grease</p> <p>Shaft seal failure!</p> <ul style="list-style-type: none"> ▷ Use water as assembly lubricant. ▷ Never use oil or grease as assembly lubricant.
	NOTE
	<p>When fitting the mechanical seal, wet the shaft protecting sleeve and stationary ring with water to prevent friction.</p>

7.5.4.3 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.4.1, Page 60) to (⇒ Section 7.5.4.2, Page 61) have been observed/carried out.
 - ✓ The pre-assembled components (motor, shaft, drive lantern, discharge cover) as well as the individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Fit casing wear ring 502.2 onto casing cover 161.
 2. Insert key 940.1 and slide impeller 230 onto shaft 210.
 3. Screw on and tighten impeller nut 922. Observe the tightening torques. (⇒ Section 7.6, Page 62)

7.5.4.4 Installing the back pull-out unit

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.4.1, Page 60) to (⇒ Section 7.5.4.3, Page 61) have been observed/carried out.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
 1. If required, suspend or support the back pull-out unit to prevent it from tilting.
 2. Insert casing wear ring 502.1 into volute casing 102.
 3. Insert the back pull-out unit into volute casing 102.
 4. Mount drive lantern 341.
 5. Tighten nuts 920.3. Observe the tightening torques. (⇒ Section 7.6, Page 62)

7.5.4.5 Installing the coupling

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.4.1, Page 60) to (⇒ Section 7.5.4.4, Page 62) have been observed/carried out.
 1. Fit the pump-end coupling half on pump shaft 210.
 2. Fit the drive-end coupling half on the motor shaft.
 3. Insert the teeth of the pump-end coupling half into the flexible coupling elements of the drive-end coupling half.

After the motor has been mounted, (⇒ Section 7.5.4.6, Page 62) the coupling must be aligned. (⇒ Section 5.5, Page 30)

7.5.4.6 Mounting the motor

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) and (⇒ Section 7.5.4.5, Page 62) to (⇒ Section 7.5.4.5, Page 62) have been observed/carried out.
 1. Place the motor on drive lantern 341.
 2. Tighten hexagon head bolts 901.1.
 3. Align the pump and motor. (⇒ Section 5.5, Page 30)

7.6 Tightening torques

7.6.1 Tightening torques for ILN/ILNC

Table 17: Tightening torques for bolts, screws and/or nuts

Thread	Steel	Stainless steel
	Tightening torques [Nm]	
M4	3,1	2,15
M5	6,1	4,25
M6	10,4	7,3
M8	25,2	17,7
M10	49,5	34,8
M12	85,2	59,9
M16	211	148
M20	412	290
M24	710	500
M27	1050	750
M30	1420	1000

5211.8/08-EN

7.6.2 Tightening torques for the impeller nut of ILN/ILNC

Table 18: Tightening torques for the impeller nut of ILN/ILNC

Thread	Tightening torques [Nm]
M14x1,5	38
M20x1,5	100
M27x1,5	250
M33x1,5	460
M52x1,5	2000

7.6.3 Tightening torques for ILNR

Table 19: Tightening torques for ILNR

Description	Material	Thread size	Tightening torques [Nm]		
			New	-15%	-20%
Bolt, screw / nut volute casing - pump stool	1.7709	M16	190	162	152
	Monix		320	272	256
	1.7219	M20	330	281	264
	Monix		620	572	496
Impeller nut	1.4571	M20x1,5	200	-	-
		M24x1,5	500	-	-
Hexagon head bolt	8.8	M12	55	-	-
		M16	130	-	-
		M20	240	-	-
Plug	Steel	G 3/4	220	-	-
		G 1/2	130	-	-
		G 1/4	55	-	-

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
- Year of construction

Also specify the following data:

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

7.7.2 Recommended spare parts stock

Recommended spare parts stock for continuous operation of the pump

Table 20: Spare parts for commissioning/start-up

Part No.	Description	Quantity
400 ¹⁰⁾	Gasket	1
411 ¹¹⁾	Joint ring	1
412	O-ring	1
433	Mechanical seal	1

Table 21: Spare parts for 2 years' operation

Part No.	Description	Quantity
320 ¹¹⁾	Rolling element bearing	1
321	Radial ball bearing	1
400 ¹⁰⁾	Gasket	2
411 ¹¹⁾	Joint ring	2
412	O-ring	2
433	Mechanical seal	2
502	Casing wear ring	1
507	Thrower	1
523 ¹¹⁾¹²⁾	Shaft sleeve	1
531 ¹¹⁾¹²⁾	Locking sleeve	1
545 ¹¹⁾¹²⁾	Bearing bush	1
860	Coupling part	1
932 ¹¹⁾	Circlip	1
940	Key	1

Table 22: Large set of spare parts for 5 years' operation (in addition to those for commissioning/start-up and 2 years' operation)

Part No.	Description	Quantity
210	Shaft	1
230	Impeller	1
320 ¹¹⁾	Rolling element bearing	2
321	Radial ball bearing	2
400 ¹⁰⁾	Gasket	5
411 ¹¹⁾	Joint ring	5
412	O-ring	5
433	Mechanical seal	3
502	Casing wear ring	2
507	Thrower	2
523 ¹¹⁾	Shaft sleeve	2
531 ¹¹⁾	Locking sleeve	2
545 ¹¹⁾¹²⁾	Bearing bush	2
840 ¹³⁾	Coupling	1
860	Coupling part	2
922	Impeller nut	2
932 ¹¹⁾	Circlip	2
940	Key	2

¹⁰⁾ For design variant ILNR only

¹¹⁾ For design variant ILN/ILNC only

¹²⁾ For double-suction design only

¹³⁾ For design variant ILN only

Additionally recommended spare parts for auxiliary vacuum pump (design variants ILNS and ILNCS)

Table 23: Spare parts for commissioning/start-up

Part No.	Description	Quantity
400	Gasket	1
411	Joint ring	1
412	O-ring	1
433	Mechanical seal	1


Table 24: Spare parts for 2 years' operation

Part No.	Description	Quantity
400	Gasket	2
411	Joint ring	2
412	O-ring	2
433	Mechanical seal	2
740	Valve	1
759	Valve disc	1
901	Hexagon head bolt	1
940	Key	1

Table 25: Spare parts for 5 years' operation

Part No.	Description	Quantity
740	Valve	2
759	Valve disc	2
230	Impeller	1
400	Gasket	5
411	Joint ring	5
412	O-ring	5
433	Mechanical seal	3
901	Hexagon head bolt	2
940	Key	2

8 Trouble-shooting

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

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

- A Pump is running, but does not deliver
- B Insufficient flow rate or pressure
- C Excessive current/power input
- D Vibrations and noise during pump operation
- E Increased bearing temperature
- F Excessive leakage at the shaft seal
- G Premature wear of wear rings
- H Automatic priming system is not priming.¹⁴⁾
- I Main pump is not priming.¹⁴⁾
- J Automatic priming system is priming but does not stop.¹⁴⁾

Table 26: Trouble-shooting

A	B	C	D	E	F	G	H	I	J	Possible cause	Remedy
X	X	-	-	-	-	-	-	-	-	Suction-side / discharge-side shut-off element closed or set incorrectly	Open the suction-side shut-off element Partially close the discharge-side shut-off element to comply with the duty point.
X	-	-	-	-	-	-	X	-	-	Wrong direction of rotation	Check the electrical connection of the motor.
X	-	-	-	-	-	-	X	X	-	Air ingress through suction line, check valve in discharge line or at another point between check valve and discharge line	Check tightness of piping. Check tightness of check valve.
X	-	-	-	-	-	-	-	-	-	Pump or suction line are not completely vented or primed. ¹⁵⁾	Adjust the piping, so the vent connections are positioned at the highest point of the piping.
X	-	-	-	-	-	-	-	-	-	Discharge head too low	Increase speed. Have the selection of pump or impeller checked.
-	X	-	-	-	-	-	-	-	-	Incorrect speed	Measure the speed. Check the supply voltage of the motor.
-	X	-	-	-	-	-	-	-	-	Pump or pipelines are not completely vented or primed.	Prime and vent the pump as per the instructions. (⇒ Section 6.1.4, Page 34)
-	X	-	-	-	-	-	X	X	-	Air enters through the sealing system.	Check the sealing system. Check the sealing elements.
-	X	-	X	-	-	X	-	-	-	Impeller	Re-balance the impeller. Replace the impeller.
-	X	-	X	-	-	-	-	-	-	Wear rings worn or fitted incorrectly.	Replace the wear rings.

¹⁴⁾ Only for versions with automatic priming system

¹⁵⁾ Only for versions without automatic priming system

A	B	C	D	E	F	G	H	I	J	Possible cause	Remedy
-	X	-	-	-	-	-	-	-	-	Excessively high back pressure	Increase speed. If this is not possible, have the selection of pump or impeller checked.
-	-	X	-	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Re-adjust to duty point. Replace the motor.
-	-	X	X	X	-	X	-	-	-	Misalignment of pump and motor	Align the coupling.
-	-	X	-	-	-	-	-	-	-	Pump, impeller or pump nozzle blocked.	Dismantle and clean the pump.
-	-	X	-	-	-	-	-	-	-	Discharge head of pump lower than specified in the purchase order	Partially close the discharge-side shut-off element.
-	-	X	X	X	-	-	-	-	-	Ball bearing	Replace ball bearing. Check ball bearing installation. Top up lubricant.
-	-	X	-	-	-	-	-	-	-	Excessive friction of rotating components	Dismantle pump and check component installation.
-	-	-	X	-	-	X	-	-	-	Shaft offset or deformed	Replace the shaft.
-	-	-	X	-	-	-	-	-	-	Impeller nut loosened	Tighten the impeller nut.
-	-	-	X	X	-	X	-	-	-	Pump is warped.	Reinforce piping. Align pump set.
-	-	-	X	-	-	-	-	-	-	Foundation fastening	Adjust strength or properties of foundation Tighten foundation bolts.
-	-	-	X	X	-	-	-	-	-	Cavitation in the pump	Contact the manufacturer.
-	-	-	X	-	-	-	-	-	-	Flexible coupling elements	Replace flexible coupling elements.
-	-	-	X	-	-	-	-	-	-	Pipeline diameter too small	Adjust piping.
-	-	-	-	X	-	-	-	-	-	Non-compliance with specified coupling distance	Adjust the distance.
-	-	-	-	-	X	-	-	-	-	Mechanical seal	Replace mechanical seal.
-	-	-	-	X	-	-	-	-	-	Excessive inlet pressure	Contact the manufacturer.
-	-	-	-	-	-	-	X	-	-	No check valve fitted or defective check valve	Check the check valve. Install a check valve.
-	-	-	-	-	-	-	X	-	-	Filter of auxiliary pump dirty or suction line of auxiliary pump clogged ¹⁴⁾	Clean the filter. Check suction line of auxiliary pump.
-	-	-	-	-	-	-	X	X	-	Suction lift higher than specified in the purchase order	Adjust the head. Replace pump. Contact the manufacturer.
-	X	-	-	-	-	-	-	-	-	Piping clogged	Clean the piping.
-	-	-	-	-	-	-	X	-	-	Insufficient compressed air supply at ejector ¹⁴⁾	Check and adjust compressed air supply.
-	-	-	-	-	-	-	X	-	-	Incorrect operation of ejector ¹⁴⁾	Contact KSB
-	-	-	-	-	-	-	X	-	-	Discharge nozzle of ejector clogged ¹⁴⁾	Check discharge nozzle.
-	-	-	-	-	-	-	-	-	X	Pressure set too high at pressure controller	Contact KSB

9 Related Documents

9.1 General assembly drawings with list of components

Table 27: Drawings per pump size

Pump type	Size	General assembly drawing						
		1	2	3	4	5	6	7
ILN	080-065-160	✓	–	–	–	–	–	–
	080-065-250	✓	–	–	–	–	–	–
	080-065-315	–	✓	–	–	–	–	–
	100-080-160	✓	–	–	–	–	–	–
	100-080-200	✓	–	–	–	–	–	–
	100-080-250	✓	–	–	–	–	–	–
	100-080-315	–	✓	–	–	–	–	–
	100-080-400	–	✓	–	–	–	–	–
	150-100-250	✓	–	–	–	–	–	–
	150-100-315	–	✓	–	–	–	–	–
	150-100-400	–	✓	–	–	–	–	–
	150-125-250	✓	–	–	–	–	–	–
	150-125-315	✓	–	–	–	–	–	–
	150-125-400	–	✓	–	–	–	–	–
	200-150-250	✓	–	–	–	–	–	–
	200-150-315	–	✓	–	–	–	–	–
	200-150-400	–	✓	–	–	–	–	–
	250-200-330	–	✓	–	–	–	–	–
	300-250-330	–	✓	–	–	–	–	–
	350-300-330	–	–	✓	–	–	–	–
	500-400-430	–	–	✓	–	–	–	–
ILNC	050-032-160	–	–	–	✓	–	–	–
	050-032-200	–	–	–	✓	–	–	–
	050-032-250	–	–	–	✓	–	–	–
	065-040-160	–	–	–	✓	–	–	–
	065-040-250	–	–	–	✓	–	–	–
	065-050-200	–	–	–	✓	–	–	–
	080-065-160	–	–	–	✓	–	–	–
	080-065-250	–	–	–	✓	–	–	–
	080-065-315	–	–	–	–	✓	–	–
	100-080-160	–	–	–	✓	–	–	–
	100-080-200	–	–	–	✓	–	–	–
	100-080-250	–	–	–	✓	–	–	–
	100-080-315	–	–	–	–	✓	–	–
	150-100-250	–	–	–	✓	–	–	–
	150-100-315	–	–	–	–	✓	–	–
	150-125-250	–	–	–	✓	–	–	–
ILNR	200-150-500	–	–	–	–	–	✓	✓
	250-200-400	–	–	–	–	–	✓	✓
	250-200-500	–	–	–	–	–	✓	✓
	300-250-400	–	–	–	–	–	✓	✓
	300-250-500	–	–	–	–	–	✓	✓
	350-300-400	–	–	–	–	–	✓	✓
	350-300-500	–	–	–	–	–	✓	✓

9.1.1 General assembly drawing 1 ILN

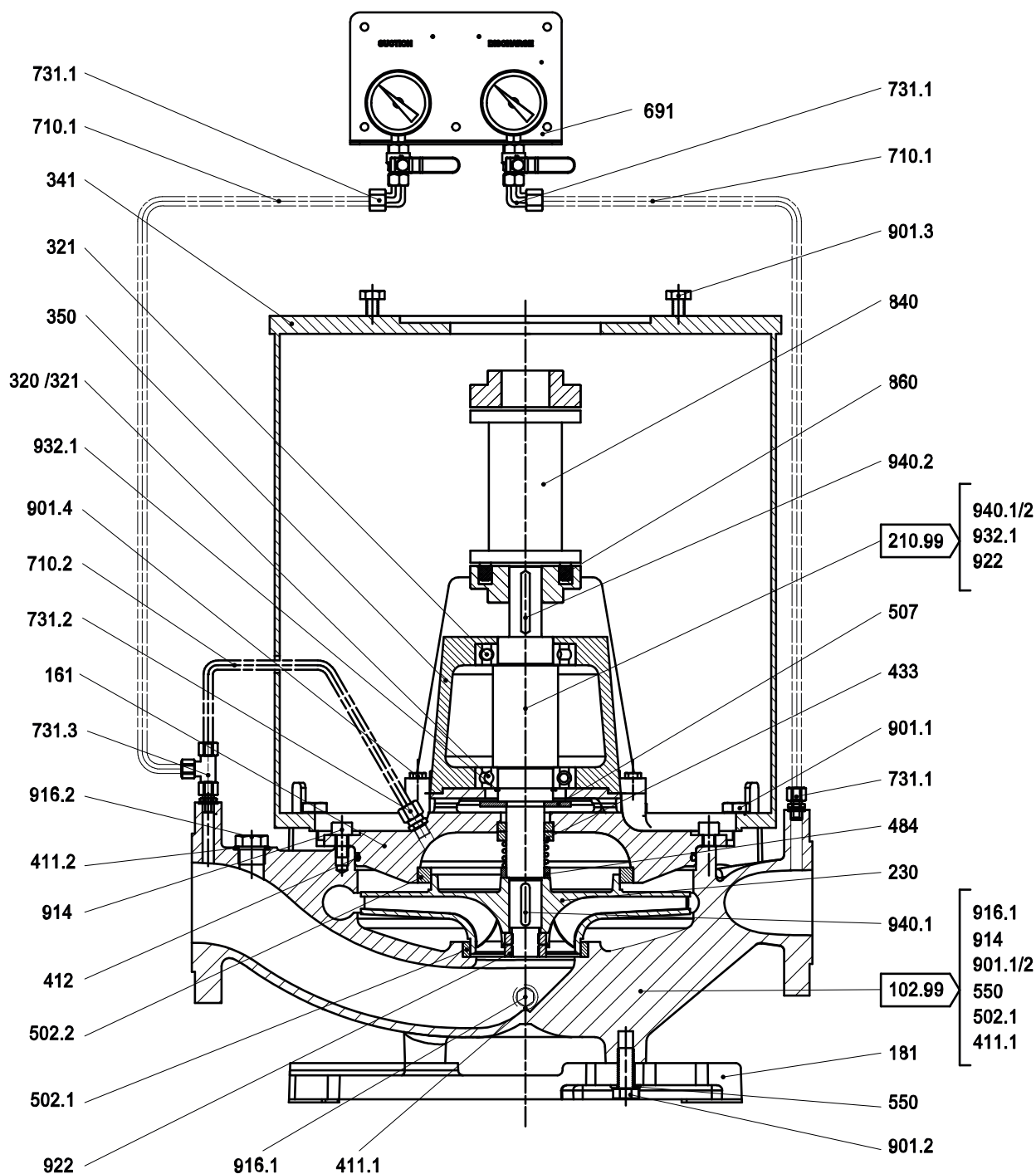


Fig. 11: General assembly drawing 1 ILN

Table 28: List of components

Part No.	Description	Part No.	Description
102	Volute casing	507	Thrower
161	Casing cover	550	Washer
181	Pump stool	691	Pressure gauge
210	Shaft	710.1/2	Pipe

Part No.	Description	Part No.	Description
230	Impeller	731.1/.2/.3 ¹⁶⁾	Pipe union
320 ¹⁷⁾	Rolling element bearing	840	Coupling
321 ¹⁷⁾	Radial ball bearing	860	Coupling part
341	Drive lantern	901.1/.2/.3	Hexagon head bolt
360	Bearing cover	914	Hexagon socket head cap screw
411.1/.2 ¹⁶⁾	Joint ring	916.1/.2 ¹⁶⁾	Plug
412	O-ring	922	Impeller nut
433	Mechanical seal	932.1/.2	Circlip
484 ¹⁸⁾	Spring plate	940.1/.2	Key
502.1/.2	Casing wear ring		

The relevant version is indicated in the product literature supplied.

¹⁶⁾ Not for ILNE and ILNS

¹⁷⁾ Bearing design depending on pump size

¹⁸⁾ Not on all versions

9.1.2 General assembly drawing 2 ILN

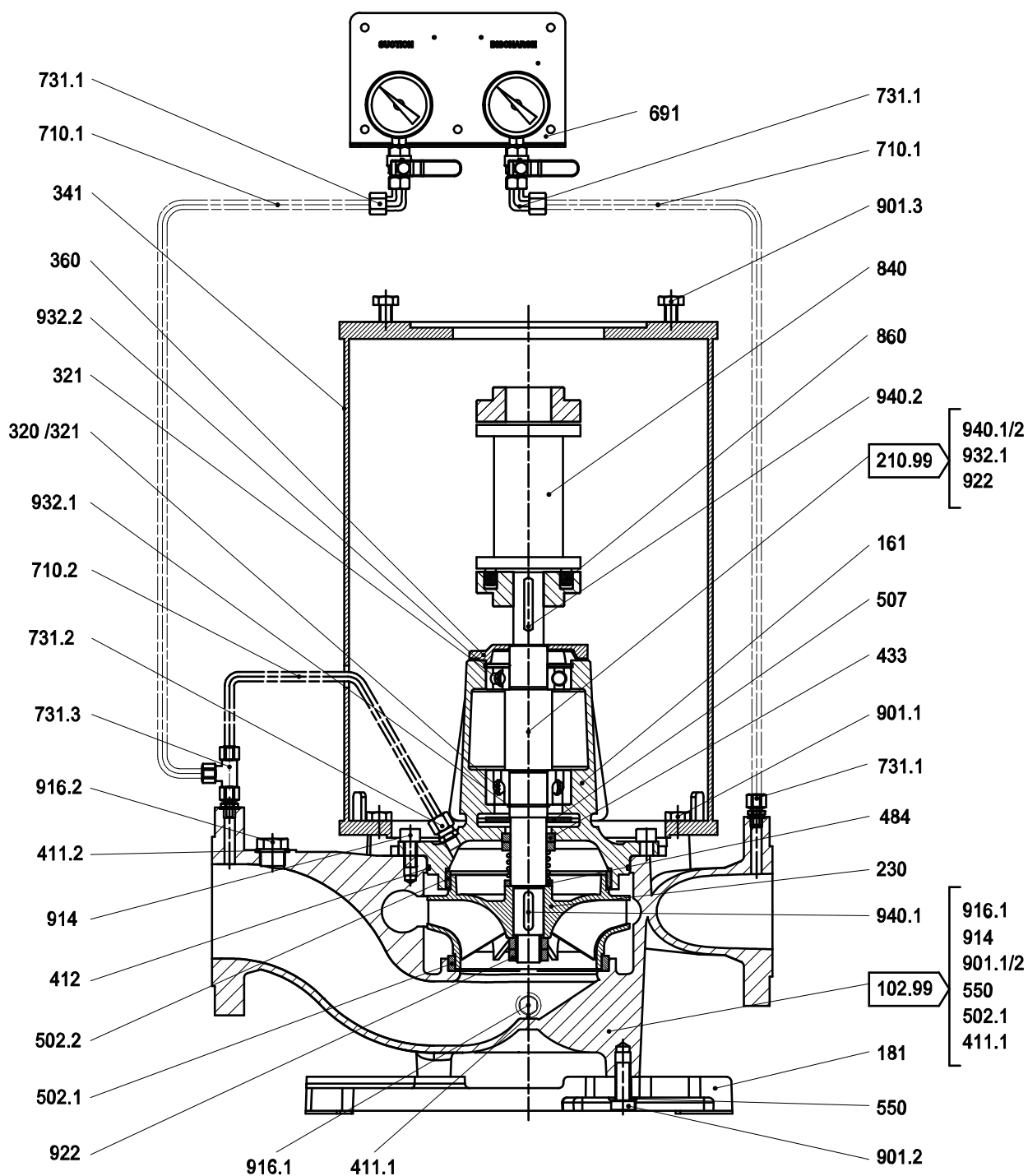


Fig. 12: General assembly drawing 2 ILN

Table 29: List of components

Part No.	Description	Part No.	Description
102	Volute casing	507	Thrower
161	Casing cover	550	Washer
181	Pump stool	691	Pressure gauge
210	Shaft	710.1/2	Pipe

Part No.	Description	Part No.	Description
230	Impeller	731.1/.2/.3 ¹⁹⁾	Pipe union
320 ²⁰⁾	Rolling element bearing	840	Coupling
321 ²⁰⁾	Radial ball bearing	860	Coupling part
341	Drive lantern	901.1/.2/.3/.4	Hexagon head bolt
350	Bearing housing	914	Hexagon socket head cap screw
411.1/.2 ¹⁹⁾	Joint ring	916.1/.2 ¹⁹⁾	Plug
412	O-ring	922	Impeller nut
433	Mechanical seal	932.1/.2	Circlip
484 ²¹⁾	Spring plate	940.1/.2	Key
502.1/.2	Casing wear ring		

The relevant version is indicated in the product literature supplied.

¹⁹⁾ Not for ILNE and ILNS

²⁰⁾ Bearing design depending on pump size

²¹⁾ Not on all versions

9.1.3 General assembly drawing 3 ILN

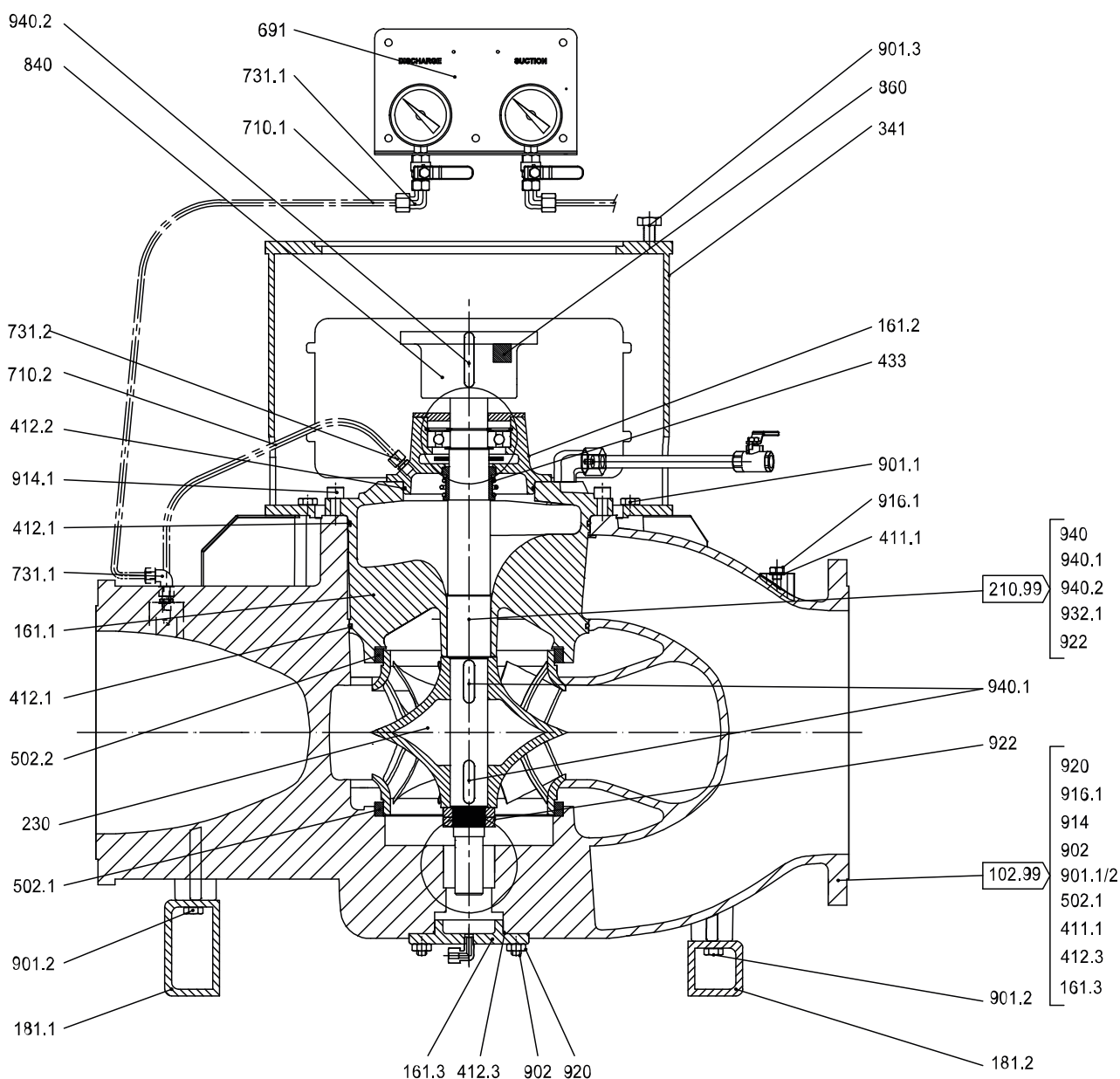
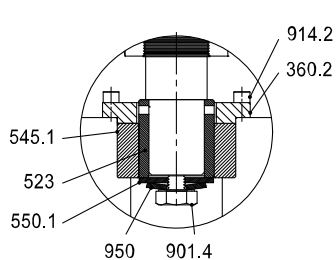
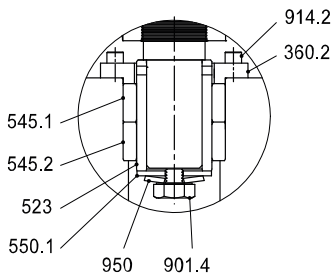


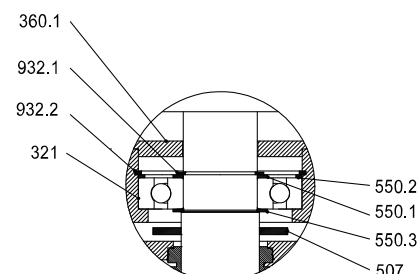
Fig. 13: General assembly drawing 3 ILN



Bearing bush ILN 300-330



Bearing bush ILN 400-430



Detailed view of bearing assembly

Table 30: List of components

Part No.	Description	Part No.	Description
102	Volute casing	550.1/.2/.3	Washer
161.1/.2/.3	Casing cover	691	Pressure gauge
181.1/.2	Pump stool	710.1/.2	Pipe
210	Shaft	731.1/.2/.3	Pipe union
230	Impeller	840	Coupling
321	Radial ball bearing	860	Coupling part
341	Drive lantern	901.1/.2/.3/.4	Hexagon head bolt
360.1/.2	Bearing cover	902	Stud
411.1	Joint ring	914.1/.2	Hexagon socket head cap screw
412.1/.2/.3	O-ring	916.1	Plug
433	Mechanical seal	920	Nut
502.1/.2	Casing wear ring	922	Impeller nut
507	Thrower	932.1/.2	Circlip
523	Shaft sleeve	940.1/.2	Key
545.1/.2	Bearing bush	950	Spring

9.1.4 General assembly drawing 4 ILNC

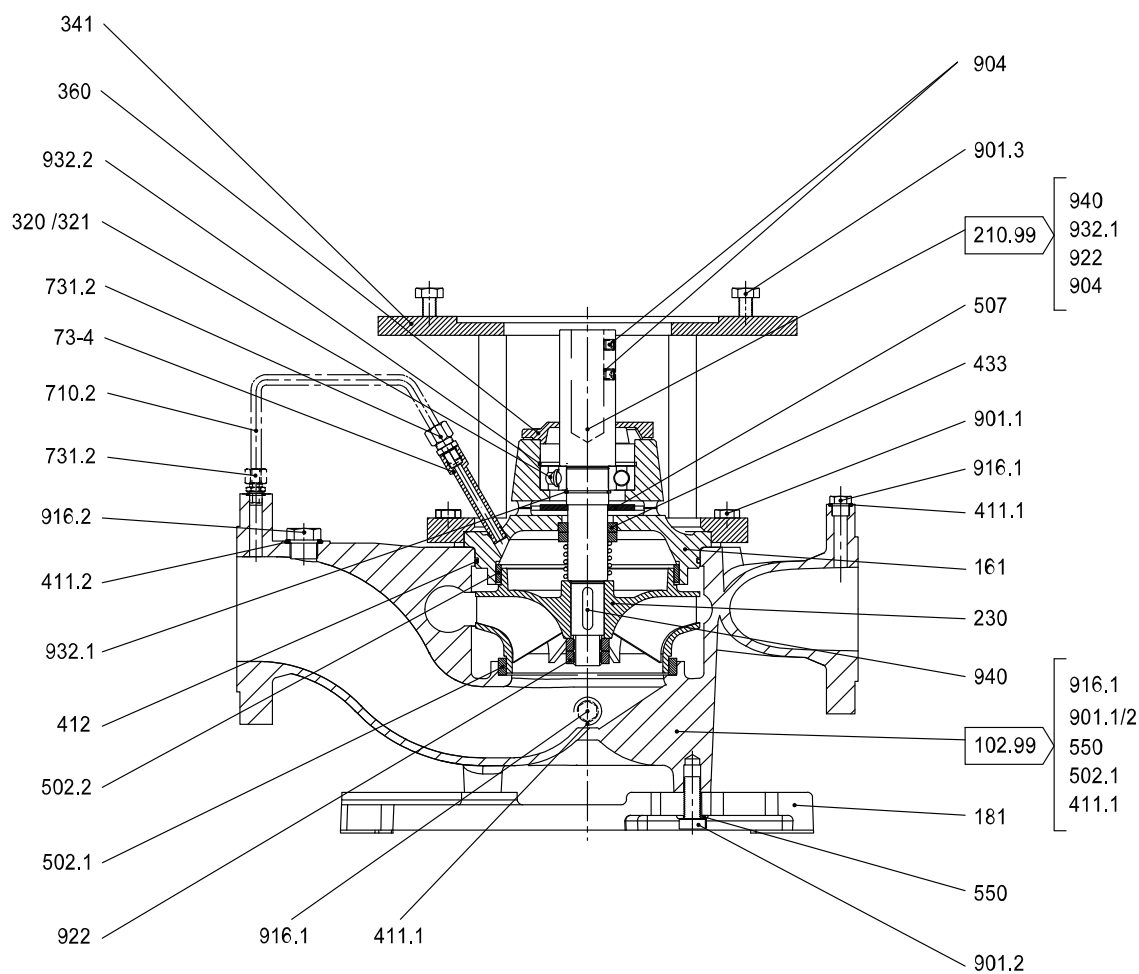


Fig. 14: General assembly drawing 4 ILNC

Table 31: List of components

Part No.	Description	Part No.	Description
102	Volute casing	502.1/2	Casing wear ring
161	Casing cover	507	Thrower
181	Pump stool	550	Washer
210	Shaft	710.2	Pipe
230	Impeller	73-4 ²²⁾	Barrel nipple
320 ²³⁾	Rolling element bearing	731.2	Pipe union
321 ²³⁾	Radial ball bearing	901.1/2/3	Hexagon head bolt
341	Drive lantern	904	Grub screw
360	Bearing cover	916.1/2 ²⁴⁾	Plug
411.1/2 ²⁴⁾	Joint ring	922	Impeller nut
412	O-ring	932.1/2	Circlip
433	Mechanical seal	940	Key

The relevant version is indicated in the product literature supplied.

²² Not on all versions

²³ Bearing design depending on motor size

²⁴ Not for ILNCE and ILNCS

9.1.5 General assembly drawing 5 ILNC

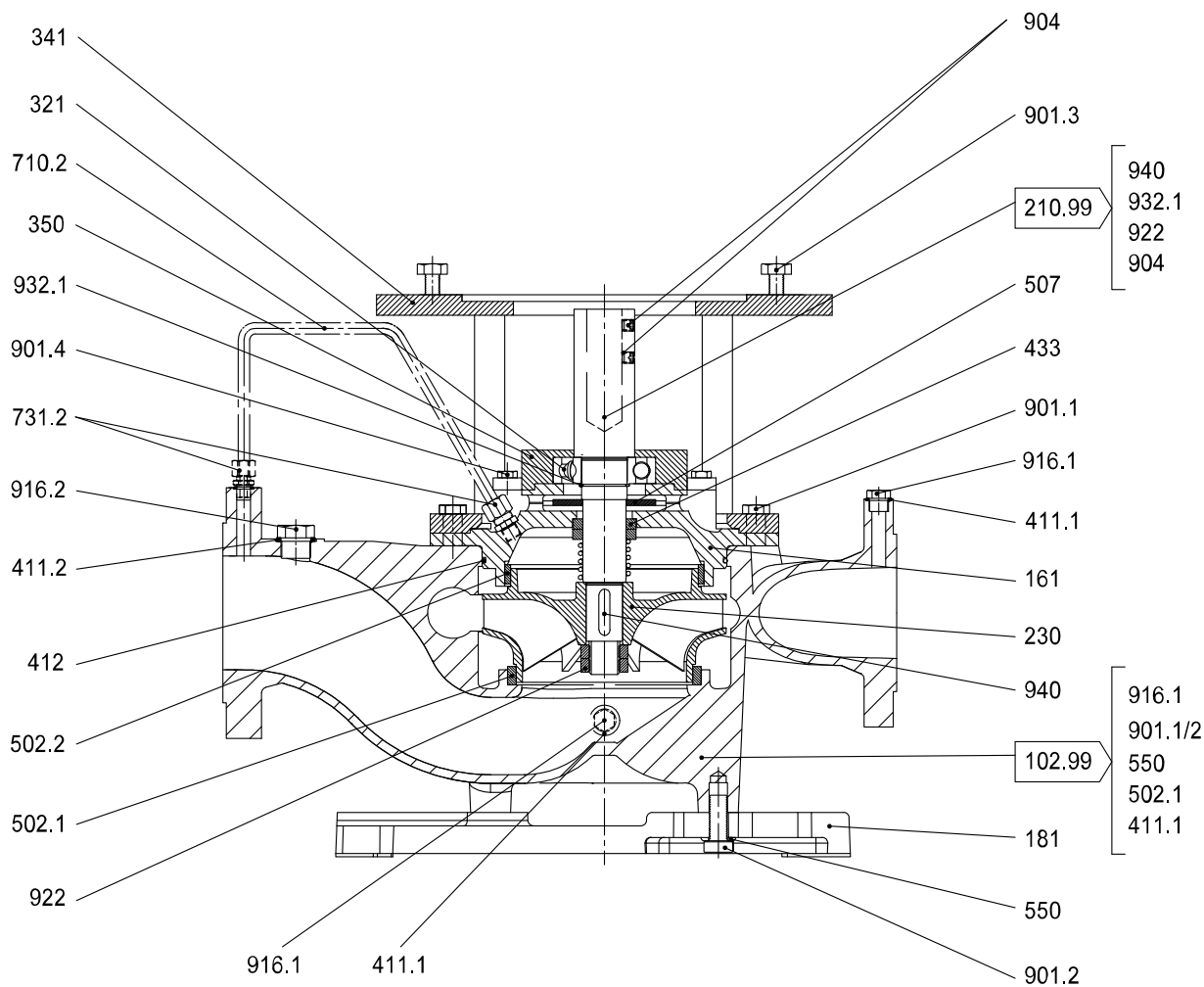


Fig. 15: General assembly drawing 5 ILNC

Table 32: List of components

Part No.	Description	Part No.	Description
102	Volute casing	502.1/2	Casing wear ring
161	Casing cover	507	Thrower
181	Pump stool	550	Washer
210	Shaft	710.2	Pipe
230	Impeller	731.2	Pipe union
321	Radial ball bearing	901.1/2/3/4	Hexagon head bolt
341	Drive lantern	904	Grub screw
350	Bearing housing	916.1/2 ²⁵⁾	Plug
411.1/2 ²⁵⁾	Joint ring	922	Impeller nut
412	O-ring	932.1/2	Circlip
433	Mechanical seal	940	Key

²⁵⁾ Not for ILNCE and ILNCS

9.1.6 General assembly drawing 6 ILNR

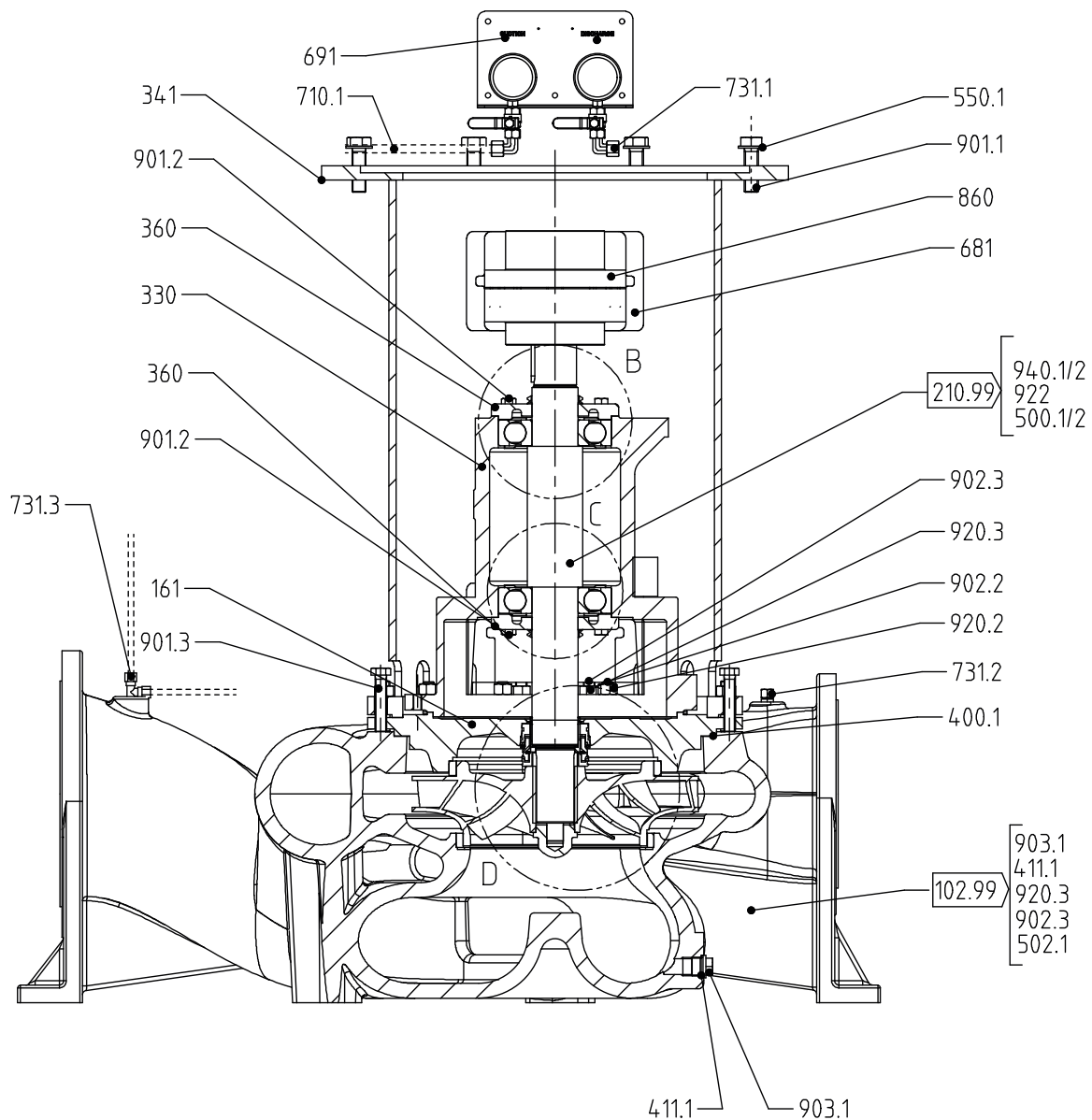
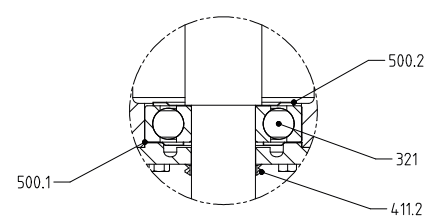
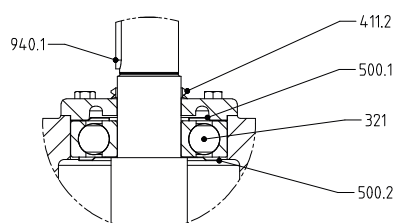
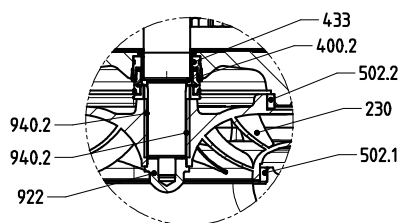


Fig. 16: General assembly drawing 6 ILNR



Detailed view of hydraulic system

Detailed view of radial ball bearing B

Detailed view of radial ball bearing C

Table 33: List of components

Part No.	Description	Part No.	Description
102	Volute casing	550	Washer
161	Casing cover	681	Coupling guard
210	Shaft	691	Pressure gauge
230	Impeller	710.1	Pipe

Part No.	Description	Part No.	Description
321	Radial ball bearing	731.1/.2/.3	Pipe union
330	Bearing bracket	860	Coupling part
341	Drive lantern	901.1/.2/.3	Hexagon head bolt
360	Bearing cover	902.2/.3	Stud
400.1/.2	Gasket	903.1	Screw plug
411.1/.2	Joint ring	920.2/.3	Nut
433	Mechanical seal	922	Impeller nut
500.1/.2	Ring	940.1/.2	Key
502.1/.2	Casing wear ring		

9.1.7 General assembly drawing 7 ILNR, reinforced version

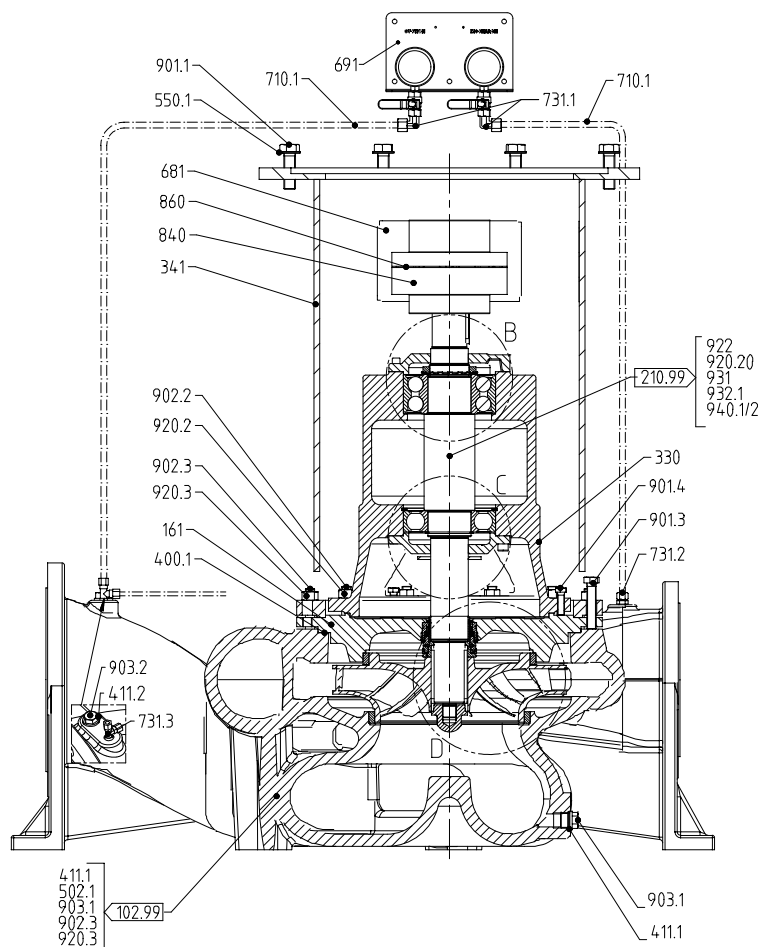
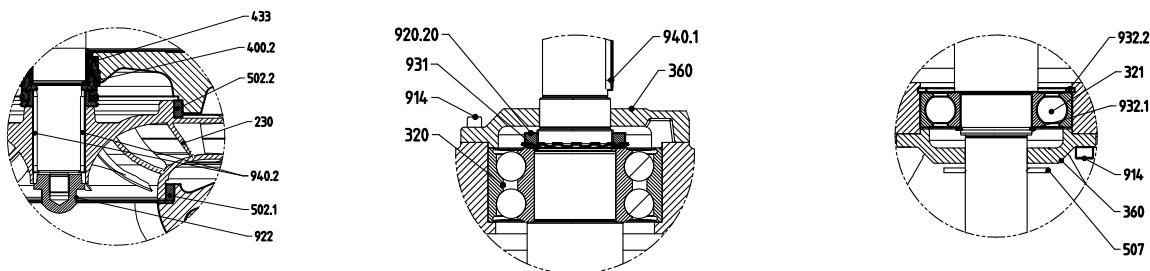


Fig. 17: General assembly drawing 7 ILNR, reinforced version



Detailed view of hydraulic system

Detailed view of radial ball bearing B

Detailed view of radial ball bearing C

Table 34: List of components

Part No.	Description	Part No.	Description
102	Volute casing	681	Coupling guard
161	Casing cover	691	Pressure gauge
210	Shaft	710.1	Pipe
230	Impeller	731.1/.2/.3 ²⁶⁾	Pipe union
320	Rolling element bearing	840	Coupling
321	Radial ball bearing	860	Coupling part
330	Bearing bracket	901.1/.3/.4	Hexagon head bolt
341	Drive lantern	902.2/.3	Stud

²⁶ Not for ILNRE and ILNRS

Part No.	Description	Part No.	Description
360	Bearing cover	903.1/.2 ²⁶⁾	Screw plug
400.1/.2	Gasket	914	Hexagon socket head cap screw
411.1/.2 ²⁶⁾	Joint ring	920.2/.3/.20	Nut
433	Mechanical seal	922	Impeller nut
502.1/.2	Casing wear ring	931	Lock washer
507	Thrower	932.1/.2	Circlip
550.1	Washer	940.1/.2	Key

9.1.8 General assembly drawing of priming system with auxiliary pump ILNS/ILNCS

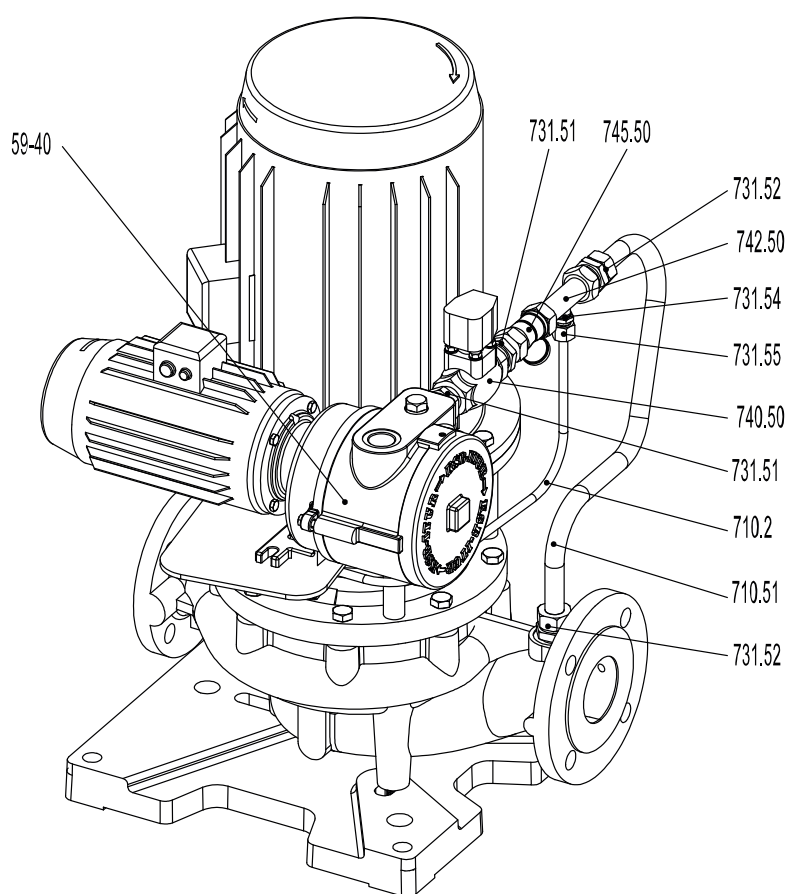
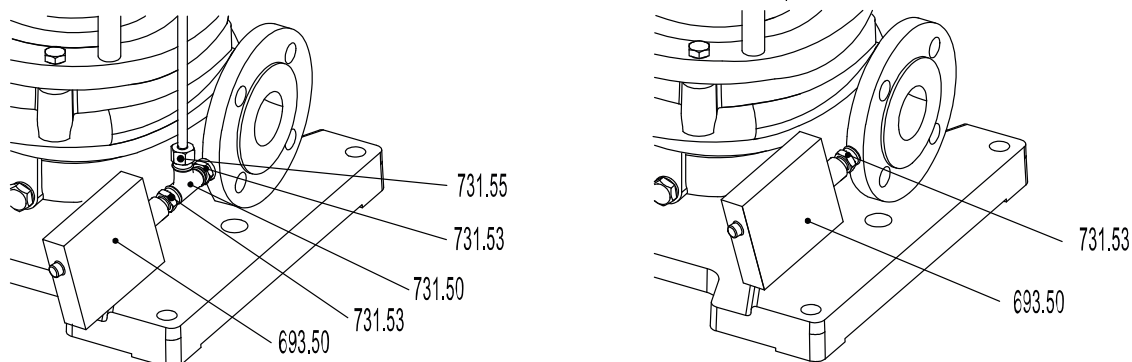


Fig. 18: General assembly drawing of venting system with auxiliary pump ILNS/ILNCS



Connection of pressure controller at discharge nozzle of ILNS

Connection of pressure controller at discharge nozzle of ILNCS

Table 35: List of components

Part No.	Description	Part No.	Description
59-40	Auxiliary pump	740.50	Valve
693.50	Pressure controller	742.50	Check valves
710.2/.51	Pipe	745.50	Filter
731.2/.50/.51/.52/.53/.54/.55	Pipe union		

9.1.9 General assembly drawing, priming system with ejector, ILNE/ILNCE

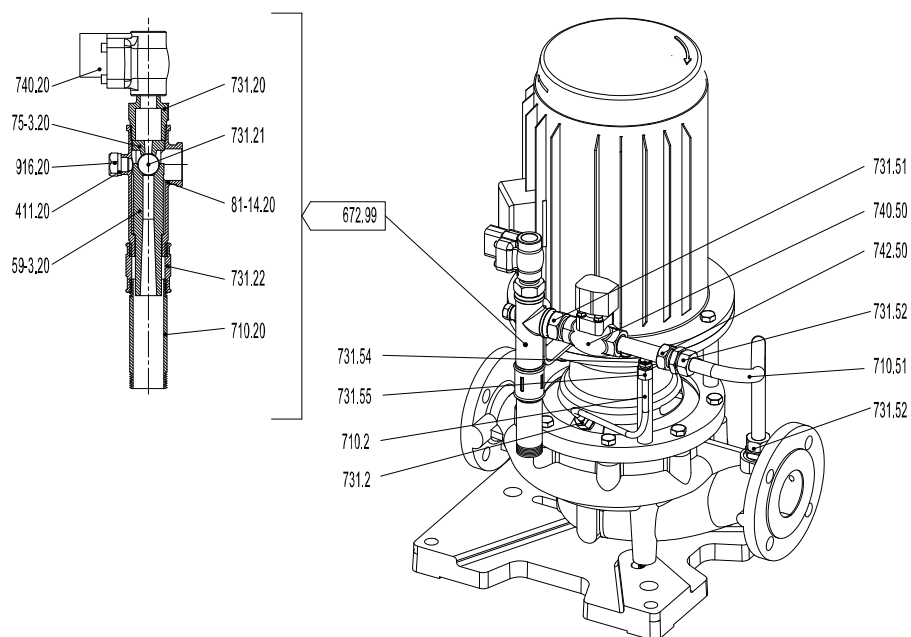
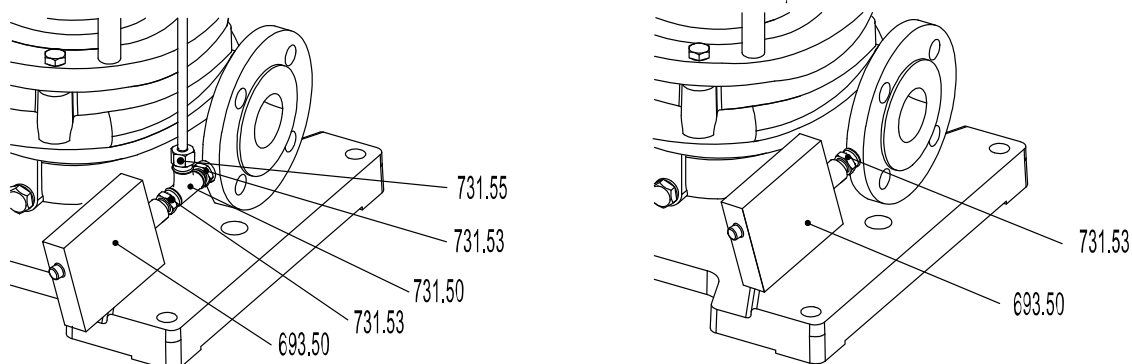


Fig. 19: General assembly drawing, venting system with ejector, ILNE/ILNCE



Connection of pressure controller at discharge nozzle of ILNE

Connection of pressure controller at discharge nozzle of ILNCE

Table 36: List of components

Part No.	Description	Part No.	Description
411.20	Joint ring	740.20/.50	Valve
59-3.20	Cylinder	742.50	Check valves
672	Venting device	75-3.20	Nozzle
693.50	Pressure controller	81-14.20	Collector
710.2/.20/.51	Pipe	916.20	Plug
731.2/.20/.21/.22/.50/.51/.52/.53/.54/.55	Pipe union		

9.1.10 Exploded view, auxiliary pump

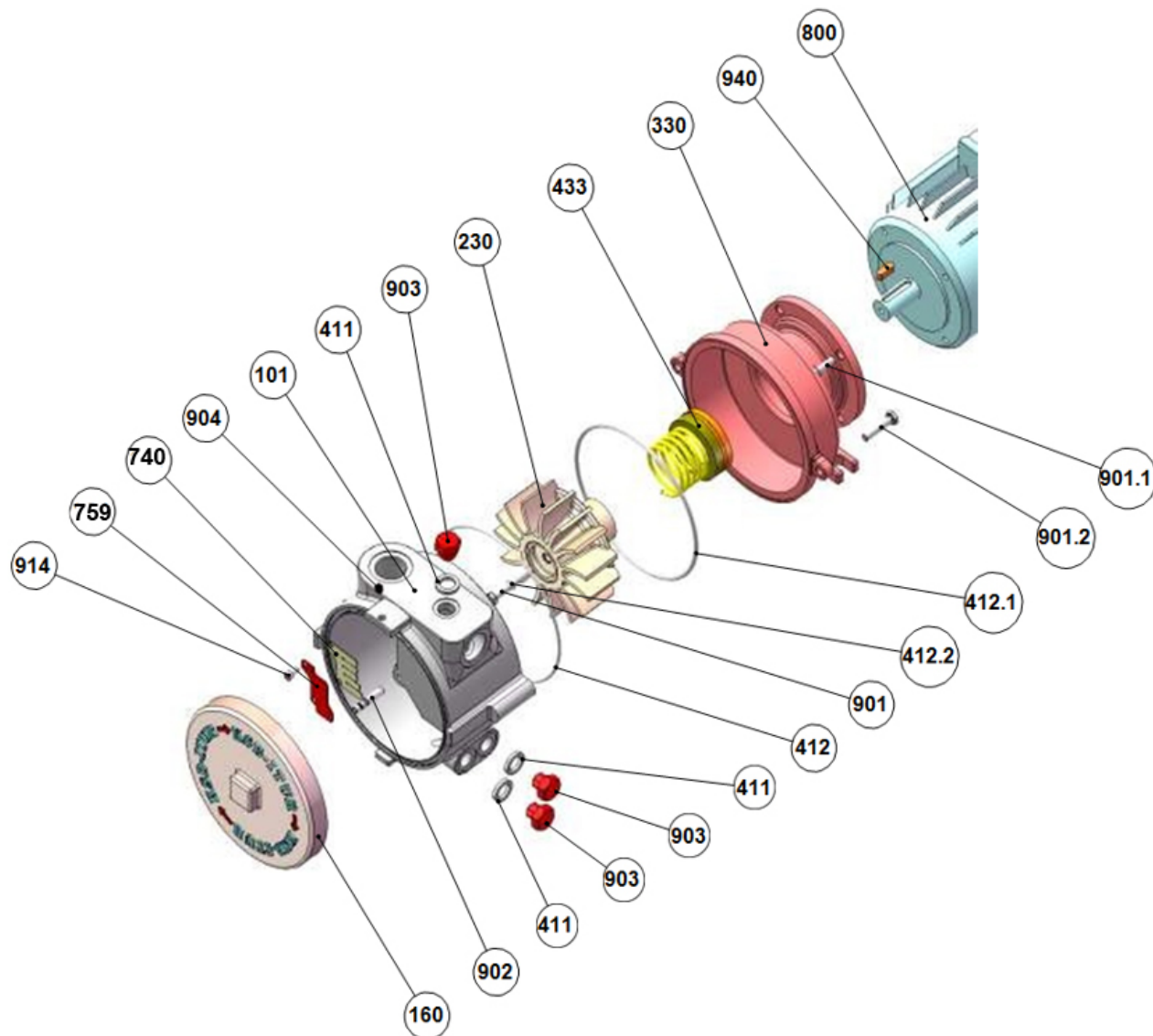


Fig. 20: Exploded view, auxiliary pump

Table 37: List of components

Part No.	Description	Part No.	Description
101	Pump casing	759	Valve disc
160	Cover	800	Motor
230	Impeller	901.1/2	Hexagon head bolt
330	Bearing bracket	902	Stud
411	Joint ring	903	Screw plug
412.1/2	O-ring	904	Grub screw
433	Mechanical seal	914	Hexagon socket head cap screw
740	Valve	940	Key

9.2 Wiring diagrams

9.2.1 Wiring diagram of priming system using auxiliary pump

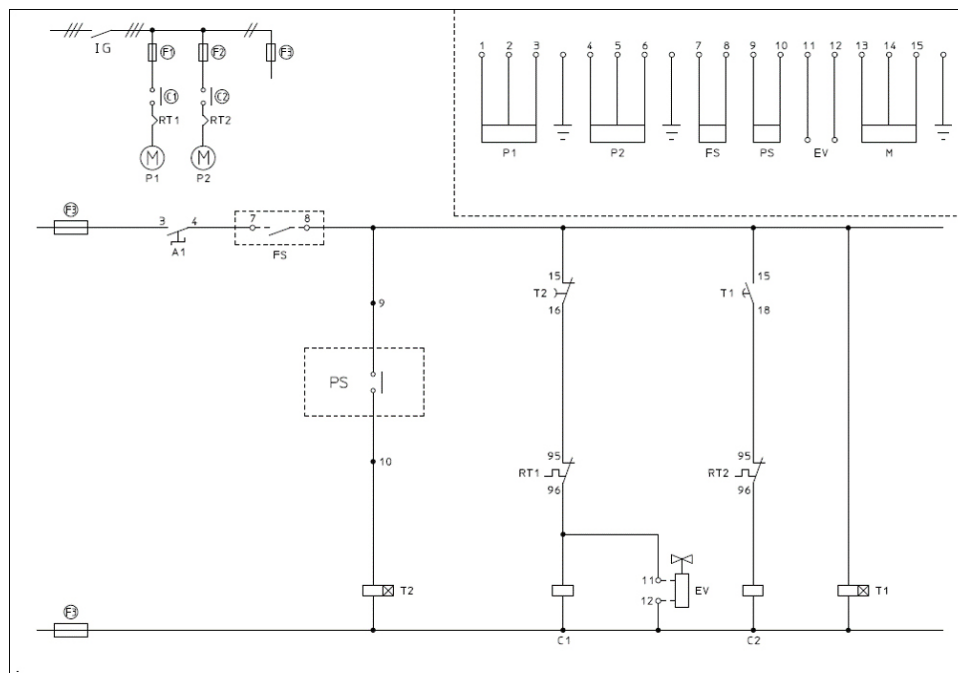


Fig. 21: Wiring diagram of priming system using auxiliary pump

P1	Auxiliary pump
P2	Main pump
FS	Float
PS	Pressure controller
EV	Solenoid valve
M	Mains supply
T1	Time relay T1
T2	Time relay T2

9.2.2 Wiring diagram of priming system using ejector

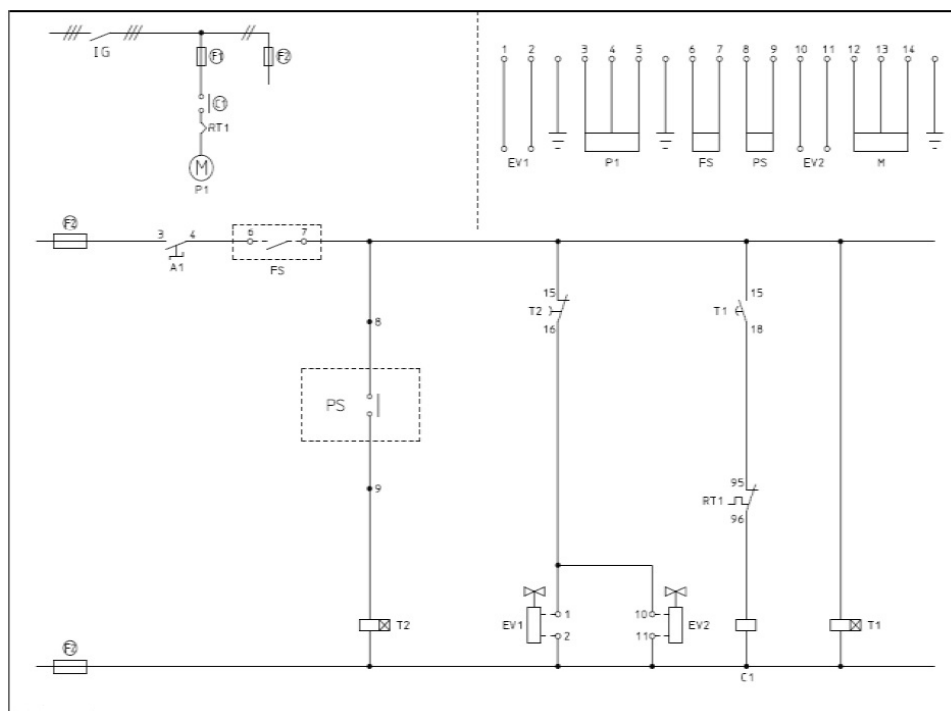


Fig. 22: Wiring diagram of priming system using ejector

P1	Main pump
FS	Float
PS	Pressure controller
EV 1/2	Solenoid valves
M	Mains supply
T1	Time relay T1
T2	Time relay T2

10 Certificate of Decontamination

Type:
Order number /
Order item number²⁷⁾:
Delivery date:
Application:
Fluid handled²⁷⁾:

Please tick where applicable²⁷⁾:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return²⁷⁾:
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

²⁷⁾ Required field

11 EU Declaration of Conformity

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

The manufacturer herewith declares that the product:

ILN, ILNC, ILNR

KSB order number:

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

The manufacturer also declares that

- the following harmonised international standards²⁸⁾ have been applied:
 - ISO 12100
 - EN 809
- Applied national technical standards and specifications, in particular:
 - DIN EN ISO 5199

Person authorised to compile the technical file:

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

The EU Declaration of Conformity was issued in/on:

Place, date

.....²⁹⁾.....

Name
 Function
 Company
 Address

²⁸⁾ Apart from the standards listed here referring to the Machinery Directive, further standards are observed for explosion-proof versions (ATEX Directive) as applicable and are listed in the legally binding EU Declaration of Conformity.

²⁹⁾ A signed, legally binding EU Declaration of Conformity is supplied with the product.

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