Thermal Oil / Hot Water Pump

Etabloc SYT/ Etaline SYT

Close-coupled or In-line Design

Installation/Operating Manual

Etabloc SYT

Etaline SYT

CE

KSB

Legal information/Copyright

Installation/Operating Manual Etabloc SYT/ Etaline SYT

Original operating manual

Subject to technical modification without prior notice.

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Glossary

Back pull-out design

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

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

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

IE2

Efficiency class to IEC 60034-30: 2 = High Efficiency (IE = International Efficiency)

IE3

Efficiency class to IEC 60034-30: 3 = Premium Efficiency (IE = International Efficiency)

IE4

Efficiency class to IEC TS 60034-30-2:2016 = Super Premium Efficiency (IE = International Efficiency)

In-line design

A pump whose suction and discharge nozzle are arranged opposite each other and have the same nominal diameter.

Pool of pumps

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

Pump

Machine without drive, additional components or accessories

Pump set

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

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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

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

1.5 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇨	Result of an action
⇨	Cross-references

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1 If included in agreed scope of supply

Symbol	Description
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
	**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

DANGER

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

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

2.1 General

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

2.2 Intended use

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

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

2.7 Safety information for maintenance, inspection and installation

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

- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.1.7, Page 38) (⇨ Section 6.3, Page 41)
- Decontaminate pumps which handle fluids posing a health hazard.
- 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 33)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

DANGER

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

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

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

Especially adhere to the sections in this manual marked with the symbol opposite and the following sections, (⇨ Section 2.9.1, Page 10) to (⇨ Section 2.9.4, Page 11)
The explosion-proof status of the pump is only assured if the pump is used in accordance with its intended use.
Never operate the product outside the limits stated in the data sheet and on the name plate.
Prevent impermissible modes of operation at all times.

2.9.1 Marking

Pump

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

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

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants. (⇨ Section 2.9.2, Page 10)

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

Shaft coupling

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

Motor

The motor has its own marking. The marking is maintained on the condition that the temperatures the pump causes to develop at the motor flange and motor shaft are permitted by the motor manufacturer.

The motors fitted by KSB on pumps with *ATEX* certification meet this condition.

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

2.9.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected on the surface of the pump casing and at the shaft seal.
The surface temperature at the pump casing corresponds to the temperature of the fluid handled. If the pump is heated in addition, the operator of the system is responsible for observing the specified temperature class and fluid temperature (operating temperature).

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The table (⇨ Table 4) lists the temperature classes and the resulting maximum permissible fluid temperatures. The values shown correspond to the theoretical limits. They include only a general safety margin for the mechanical seal. For single mechanical seals, the safety margin required for specific operating conditions and mechanical seal designs may be substantially higher. If operating conditions differ from those stated on the data sheet, or if different mechanical seals are used, the actual safety margin required needs to be determined individually. If in doubt please contact the manufacturer.

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

Table 4: Temperature limits

Temperature class to ISO 80079-36	Maximum permissible fluid temperature[2)]
T1	Temperature limit of the pump
T2	280 °C
T3	185 °C
T4	120 °C
T5	85 °C
T6	Only after consultation with the manufacturer

If the pump is to be operated at a higher temperature, the data sheet is missing or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

Motor supplied by the operator

If a pump is supplied without motor (as part of a pool of pumps), the motor specified in the pump data sheet must meet the following conditions:

- The permissible temperature limits at the motor flange and motor shaft must be higher than the temperatures generated by the pump.
- Contact the manufacturer for the actual pump temperatures.

2.9.3 Monitoring equipment

The pump (set) must only be operated within the limits specified in the data sheet and on the name plate.
If the system operator cannot warrant compliance with these operating limits, appropriate monitoring devices must be used.
Check whether monitoring equipment is required to ensure that the pump set functions properly.

Contact KSB for further information about monitoring equipment.

2.9.4 Operating limits

The minimum flow rates indicated in (⇨ Section 6.2.3.1, Page 40) refer to water and water-like fluids handled. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures at the pump surface. However, if the physical properties of the fluids handled are different from water, it is essential to check whether an additional heat build-up may occur and if the minimum flow rate must therefore be increased. The calculation formula in (⇨ Section 6.2.3.1, Page 40) can be used to check whether an additional heat build-up may lead to a dangerous temperature increase at the pump surface.

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2 Subject to further limitations for mechanical seal temperature rise

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

DANGER

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

Danger to life from falling parts!

- Always transport the pump (set) in the specified position.
- Never attach the suspension arrangement to the free shaft end or the motor eyebolt.
- Observe the information about weights, centre of gravity and fastening points.
- Observe the applicable local accident prevention regulations.
- Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

CAUTION

Incorrect transport of the pump

Damage to the shaft seal!

- For transport, lock the pump shaft with a suitable transport lock to prevent any movement of the shaft.

When transporting the pump without motor, shaft 210 must be locked.

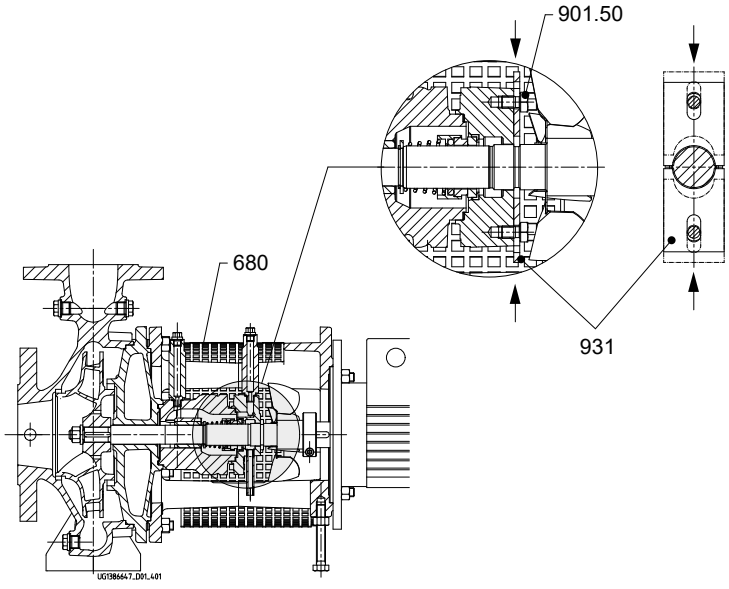


Fig. 1: Fitting the transport lock

1. Undo screws 914.98 at guard 680.
2. Remove guard 680.
3. Insert lock washers 931 into the shaft groove.
4. Tighten hexagon head bolts 901.50.

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

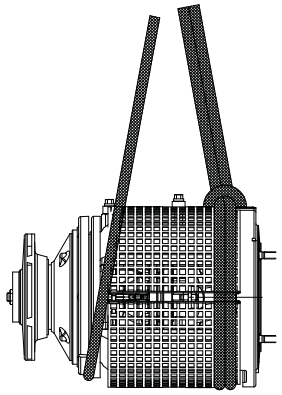
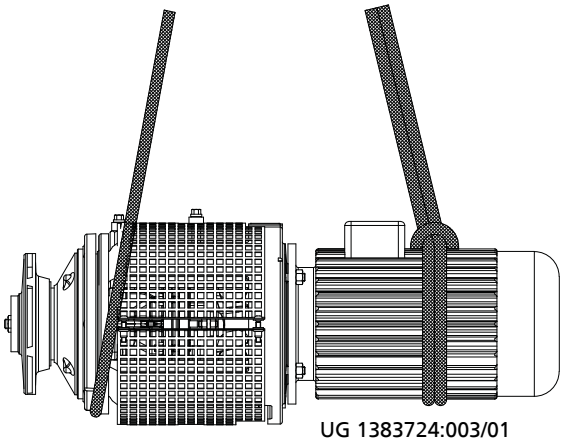
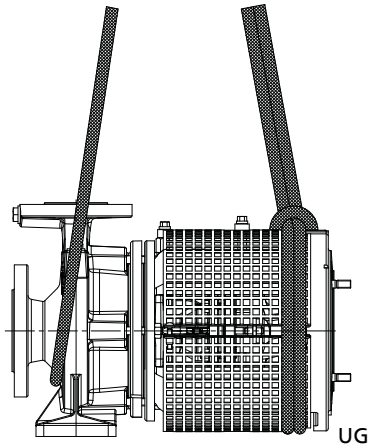


Fig. 2: Transporting the back pull-out unit



UG 1383724:003/01

Fig. 3: Transporting the back pull-out unit with motor



UG 1383724:001/01

Fig. 4: Transporting the pump

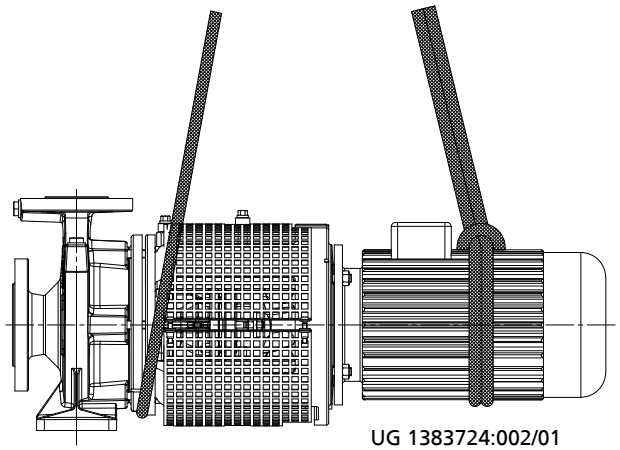


Fig. 5: Transporting the pump set

3.3 Storage/preservation

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

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

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

- Store the pump (set) in a dry, protected room where the atmospheric humidity is as constant as possible.
- Rotate the shaft by hand once a month, e.g. via the motor fan.

If properly stored indoors, the pump set is protected for a maximum of 12 months. New pumps/pump sets are supplied by our factory duly prepared for storage.

For storing a pump (set) which has already been operated, the shutdown measures must be adhered to. (⇨ Section 6.3.1, Page 41)

3.4 Return to supplier

1. Drain the pump as per operating instructions.
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, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
   Indicate any safety measures and decontamination measures taken.
   (⇨ Section 11, Page 64)

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NOTE

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

3.5 Disposal

⚠ WARNING

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

Hazard to persons and the environment!

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

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

4 Description of the Pump (Set)

4.1 General description

- Thermal oil / hot water pump

Pump for handling thermal oil or hot water

4.2 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

- This product is designed for use above 120 °C only.
- Further technical data see data sheet.

4.3 Designation

Etabloc SYT

Table 5: Designation example

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

Table 6: Designation key

Position	Code	Description	
1-4	Pump type		
	ETBY	Etabloc SYT	
5-16	Size, e.g.		
	050	Nominal suction nozzle diameter [mm]	
	032	Nominal discharge nozzle diameter [mm]	
	160	Nominal impeller diameter [mm]	
17	Pump casing material		
	S	Nodular cast iron	EN-GJS-400-15
18	Impeller material		
	C	Stainless steel	1.4408 / A743CF8M
	G	Cast iron	EN-GJL-250 / A48CL35
19	Design		
	D	DNV GL (BT3)	
	S	Standard	
	X	Non-standard (BT3D, BT3)	
20	Casing cover		
	D	Casing cover for Etabloc SYT (dead-end arrangement)	
21	Shaft seal type		
	B	Dead-end arrangement, only for Etabloc SYT	
22-23	Seal code, single mechanical seal		
	08	AQ1V7GG	NU028M0-4EYS
24	Scope of supply		
	A	Pump only (Fig. 0)	
	D	Pump, motor	
	E	Back pull-out unit	
25	Shaft unit		
	2	Shaft unit 25	
26-29	Motor rating P_N [kW]		

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Position	Code	Description
26-29	0075	7,50
	...	...
	1320	132,00
30	Number of motor poles	
31-32	Explosion protection	
	ex	With explosion-proof motor
	--	Without explosion-proof motor
33	Product generation	
	B	Etabloc SYT 2014
34-37	Design	
	-	Fixed speed version, without PumpDrive
	PD2	Variable speed version, with PumpDrive 2
	PD2E	Variable speed version, with PumpDrive 2 Eco

Etaline SYT

Table 7: Designation example

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

Table 8: Designation key

Position	Code	Description	
1-4	Pump type		
	ETLY	Etaline SYT	
5-16	Size, e.g.		
	032	Nominal suction nozzle diameter [mm]	
	032	Nominal discharge nozzle diameter [mm]	
	160	Nominal impeller diameter [mm]	
17	Pump casing material		
	S	Nodular cast iron	EN-GJS-400-15
18	Impeller material		
	G	Cast iron	EN-GJL-250 / A48CL35
	C	Stainless steel	1.4408 / A743CF8M
19	Design		
	D	DNV GL (BT3)	
	S	Standard	
	X	Non-standard (BT3D, BT3)	
20	Casing cover		
	D	Casing cover Etaline SYT	
21	Shaft seal type		
	B	Dead-end arrangement	
22-23	Seal code, single mechanical seal		
	08	AQ1V7GG	NU028M0-4EYS
24	Scope of supply		
	A	Pump only (Fig. 0)	
	D	Pump, motor	
	E	Back pull-out unit	
25	Shaft unit		
	2	Shaft unit 25	

Position	Code	Description
26-29	Motor rating P_N [kW]	
	0075	7,50
	...	...
	1320	132,00
30	Number of motor poles	
31-32	Explosion protection	
	ex	With explosion-proof motor
	--	Without explosion-proof motor
33	Product generation	
	B	Etaline SYT 2014
34-37	Design	
	-	Fixed speed version, without PumpDrive
	PD2	Variable speed version, with PumpDrive 2
	PD2E	Variable speed version, with PumpDrive 2 Eco

4.4 Name plate

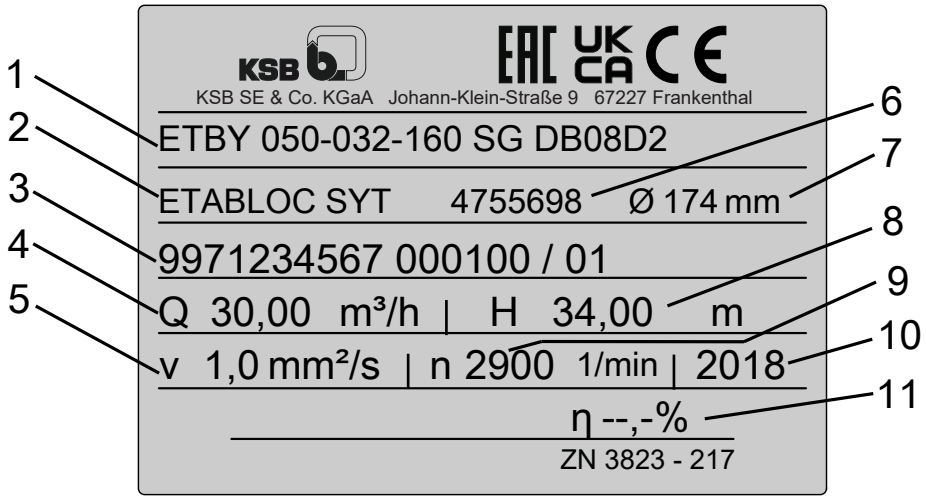

Fig. 6: Name plate (example)

1	Type series code, size and version	2	Type series
3	KSB order No., order item No. and consecutive No.	4	Flow rate
5	Kinematic viscosity of the fluid handled	6	Material number (if applicable)
7	Impeller diameter	8	Head
9	Speed	10	Year of construction
11	Efficiency (see data sheet)		

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4.5 Design details

Design

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

Etabloc SYT:

- Ratings to EN 733

Pump casing

- Radially split volute casing
- Replaceable casing wear rings

Etabloc SYT:

- Volute casing with integrally cast pump feet

Etaline SYT:

- In-line design

Drive

Standard design:

- KSB surface-cooled IEC three-phase current squirrel-cage motor
- Rated voltage (50 Hz) 230 V, delta configuration ≤ 2.20 kW
- Rated voltage (50 Hz) 400 V, star configuration ≤ 2.20 kW
- Rated voltage (50 Hz) 400 V, delta configuration ≥ 3.00 kW
- Rated voltage (50 Hz) 690 V, star configuration ≥ 3.00 kW
- Rated voltage (60 Hz) 460 V, star configuration ≤ 2.60 kW
- Rated voltage (60 Hz) 460 V, delta configuration ≥ 3.60 kW
- Type of construction IM V1
- Enclosure IP55
- Duty type: continuous duty S1
- Thermal class F with temperature sensor, 3 PTC thermistors
- Efficiency class IE2 / IE3 to IEC 60034-30

or

- Surface-cooled KSB SuPremE motor, IEC-compatible, magnetless synchronous reluctance motor[3)] (PumpDrive required)
- Mounting points to EN 50347:2001
- Envelope dimensions to DIN VDE 42673-4:2011-07
- Frequency 50 Hz / 60 Hz (PumpDrive input)
- Voltage 380 V to 480 V (PumpDrive input)
- Type of construction IM V1
- Enclosure IP55
- Duty type: continuous duty S1
- Thermal class F with temperature sensor, 3 PTC thermistors
- Efficiency class IE4 to IEC 60034-30

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3 Motor sizes 0.55 kW / 0.75 kW with 1500 rpm are designed with permanent magnets.

Explosion-proof design:

- KSB surface-cooled IEC three-phase current squirrel-cage motor
- Rated voltage (50 Hz) 230 V, delta configuration ≤ 1.85 kW
- Rated voltage (50 Hz) 400 V, star configuration ≤ 1.85 kW
- Rated voltage (50 Hz) 400 V, delta configuration ≥ 2.50 kW
- Rated voltage (50 Hz) 690 V, star configuration ≥ 2.50 kW
- Type of construction IM V1
- Enclosure IP55
- Duty type: continuous duty S1
- II 3G Ex ec IIC T3 Gc
- II 2G Ex eb IIC T3 Gb
- II 2G Ex db (eb) IIB T4 Gb
- II 2G Ex db (eb) IIC T4 Gb

Shaft seal

- KSB single mechanical seal
- To EN 12756

Impeller type

- Closed radial impeller with multiply curved vanes

Bearings

- Product-lubricated carbon plain bearings
- Grease-lubricated radial ball bearings in the motor housing

Static sealing elements

- Between volute casing and discharge cover
- Between discharge cover and bearing housing
- Between bearing housing and seal cover

Automation

Automation options:

- PumpDrive (mounting variants: wall-mounted, cabinet-mounted)

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4.6 Configuration and function

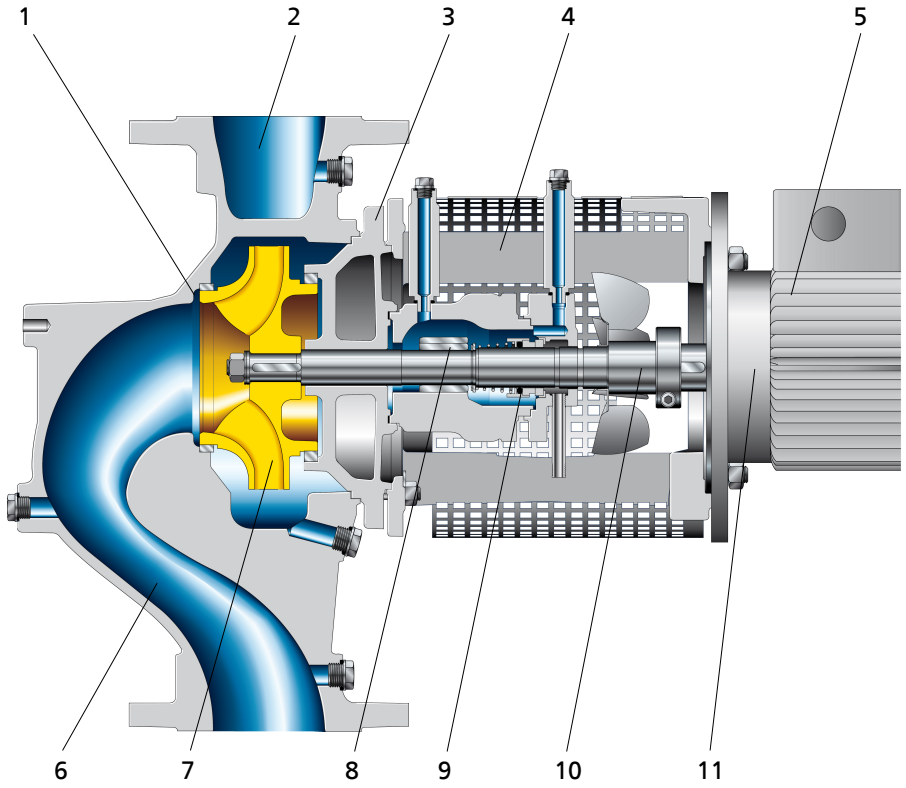

Fig. 7: Etaline SYT sectional drawing

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

Design The pump is designed with a radial fluid inlet (suction nozzle) and a radial outlet (discharge nozzle) arranged on the same axis. The hydraulic system is rigidly connected to the motor by a shaft coupling.

Function The fluid enters the pump via the suction nozzle (6) and is accelerated outward by the rotating impeller (7). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the casing to the suction nozzle. The hydraulic system is closed with a casing cover (3) at the rear side of the impeller; the stub shaft (10) enters the casing via the casing cover (3). The shaft passage through the cover is sealed to the atmosphere with a dynamic shaft seal (9). The stub shaft runs in a plain bearing (8) and the motor's rolling element bearings. The motor housing (5) is linked with the pump casing and the casing cover via the drive lantern (4).

Sealing The pump is sealed by a reinforced mechanical seal with standardised installation dimensions.

4.7 Noise characteristics

Table 9: Surface sound pressure level L_{pA} [4)]

Rated power input P_N [kW]	Pump set			
	1450 rpm [dB]	1750 rpm [dB]	2900 rpm [dB]	3500 rpm [dB]
0,55	55	56	-	-
0,75	57	58	64	-
1,1	60	61	64	67
1,5	60	61	69	72
2,2	64	65	69	72
3	64	65	71	74
4	62	63	73	76
5,5	68	69	72	75
7,5	68	69	72	75
11	69	70	75	78
15	69	70	75	78
18,5	70	71	75	78
22	72	73	78	81

4.8 Scope of supply

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

- Pump

Drive

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

Contact guard

- Cover plates on drive lantern to EN 294

4.9 Dimensions and weights

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

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4 Surface sound pressure level as per ISO 3744 and DIN EN ISO 20361; valid for a pump operating range of Q/QBEP = 0.8 - 1.1 and non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance.

5 Installation at Site

5.1 Checks to be carried out prior to installation

Place of installation

⚠ WARNING

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

Personal injury and damage to property!

- ▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206.
- ▷ The mounting surface must be set, even, and level.
- ▷ Observe the weights indicated.

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

5.2 Installing the pump set

⚠ DANGER

Electrostatic charging due to insufficient potential equalisation

Explosion hazard!

- ▷ Make sure that the connection between pump and baseplate is electrically conductive.

CAUTION

Ingress of leakage into the motor

Damage to the pump!

- ▷ Never install the pump set with the "motor below".

Table 10: Fastening

Motor size	Type of fastening	
	Etabloc SYT	Etaline SYT
80 M to 180M	▪ Horizontal installation – Fix in place using the volute casing foot – By fastening to the piping	▪ Horizontal installation – By fastening to the piping ▪ Vertical installation – By fastening to the piping or using three additional supports (one additional support from size 100-100-160)
	▪ Vertical installation – By fastening to the piping	

1. Position the pump set on the foundation and fasten it.
2. Place a spirit level on the discharge nozzle or suction nozzle/motor to level the pump set.

5.3 Piping

5.3.1 Connecting the piping

DANGER

Impermissible loads acting on the pump nozzles

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

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

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

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

NOTE

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

For Etabloc SYT also observe the following safety information.

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⚠ WARNING

Incorrect sealing element between suction flange and piping

Risk of injury from improper sealing!

- ▷ Never use spiral wound gaskets, type ASME B16.20, at suction-side DN 80 flange, drilled to ASME / NPS 4.

- ✓ 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.

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.

CAUTION

Welding beads, scale and other impurities in the piping

Damage to the pump!

- ▷ Remove any impurities from the piping.
- ▷ If necessary, install a filter.
- ▷ Observe the information in (⇨ Section 7.2.2.2, Page 46) .

3. Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
4. If required, install a filter in the piping (see drawing: Filter in the piping).

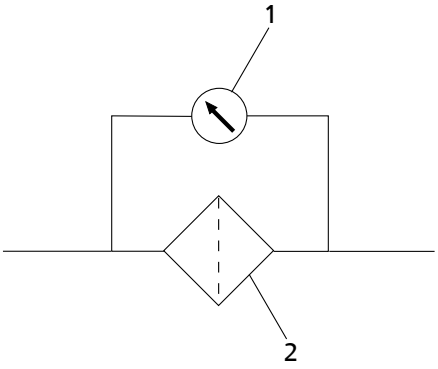

Fig. 8: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

Installing a fine filter of corrosion-resistant material for the run-in phase of the system is recommended.
Use a filter with a filter area three times the cross-section of the piping.
Conical filters have proved suitable.

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.

1. Connect the pump nozzles to the piping.

CAUTION

Aggressive flushing liquid and pickling agent

Damage to the pump!

- ▷ Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.

5.3.2 Permissible forces and moments at the pump nozzles

The data on forces and moments apply to static piping loads only.

Etabloc SYT

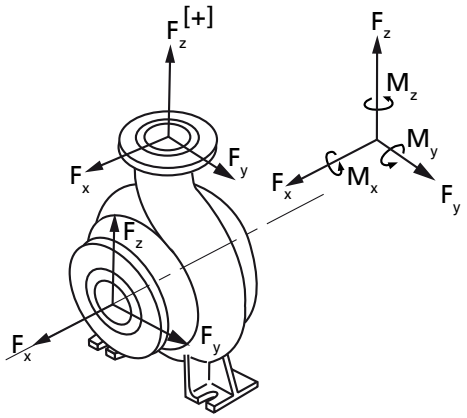

Fig. 9: Forces and moments at the pump nozzles

Table 11: Forces and moments at the pump nozzles for casing material JS 1030 / A536 Gr. 60-40-18

Size Etabloc SYT	Suction nozzle								Discharge nozzle							
	DN	Fx	Fy	Fz	∑F	Mx	My	Mz	DN	Fx	Fy	Fz	∑F	Mx	My	Mz
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
040-025-160	40	553	492	430	856	553	393	455	25	325	307	369	580	387	258	301
040-025-200	40	553	492	430	856	553	393	455	25	325	307	369	580	387	258	301
050-032-125.1	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-160	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-160.1	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-200	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-200.1	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
065-040-160	65	910	799	738	1418	651	479	516	40	492	430	553	856	553	393	455
065-040-200	65	910	799	738	1418	651	479	516	40	492	430	553	856	553	393	455
065-050-160	65	910	799	738	1418	651	479	516	50	651	578	713	1126	615	437	492
065-050-200	65	910	799	738	1418	651	479	516	50	651	578	713	1126	615	437	492
080-065-160	80	1082	971	885	1703	688	492	565	65	799	738	910	1418	651	479	516
080-065-200	80	1082	971	885	1703	688	492	565	65	799	738	910	1418	651	479	516
100-080-160	100	1451	1291	1168	2266	762	541	627	80	971	885	1082	1703	688	492	565

Correction coefficients by temperature (see the following diagram)

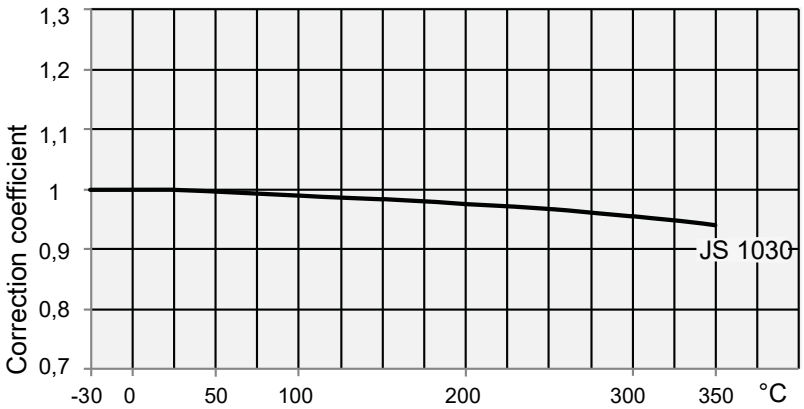

Fig. 10: Temperature correction diagram for casing material JS 1030

Etaline SYT

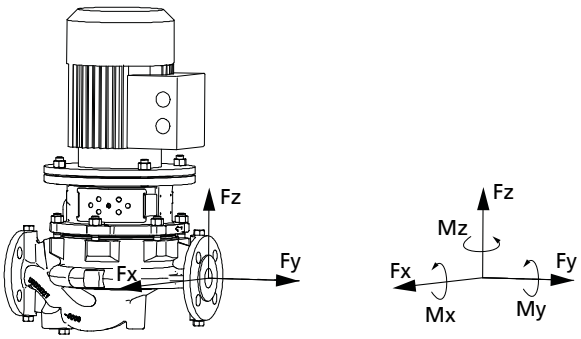

Fig. 11: Forces and moments at the pump nozzles

Table 12: Forces and moments at the pump nozzles for casing material JS 1030 / A536 Gr. 60-40-18

Size Etaline SYT	Suction nozzle							
	DN	Fx	Fy	Fz	∑F	Mx	My	Mz
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
032-032-160	32	394	455	369	706	480	326	369
032-032-200	32	394	455	369	706	480	326	369
040-040-160	40	492	554	431	856	554	394	455
040-040-200	40	492	554	431	856	554	394	455
050-050-160	50	652	713	578	1127	615	431	492
050-050-200	50	652	713	578	1127	615	431	492
065-065-160	65	800	910	738	1418	652	480	517
065-065-200	65	800	910	738	1418	652	480	517
080-080-160	80	972	1082	886	1704	689	492	566
100-100-160	100	1292	1451	1169	2267	763	541	627

Correction coefficients by temperature (see the following diagram)

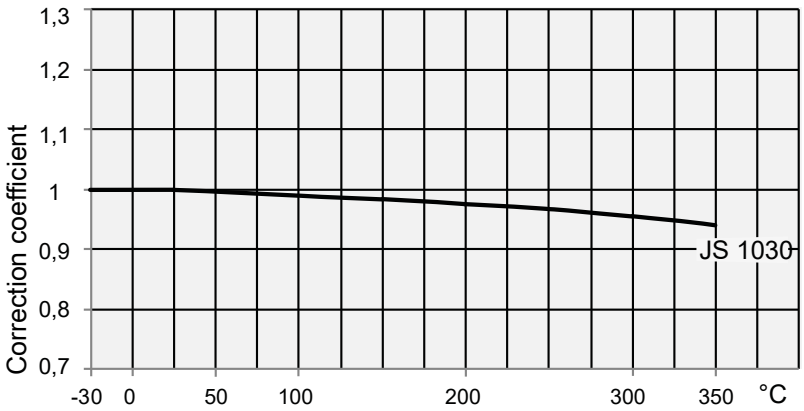

Fig. 12: Temperature correction diagram for casing material JS 1030

5.3.3 Vacuum balance line

NOTE

Where fluid has to be pumped out of a vessel under vacuum, installing a vacuum balance line is recommended.

The following rules apply to vacuum balance lines:

- Minimum nominal line diameter 25 mm.
- The line extends above the highest permissible fluid level in the vessel.

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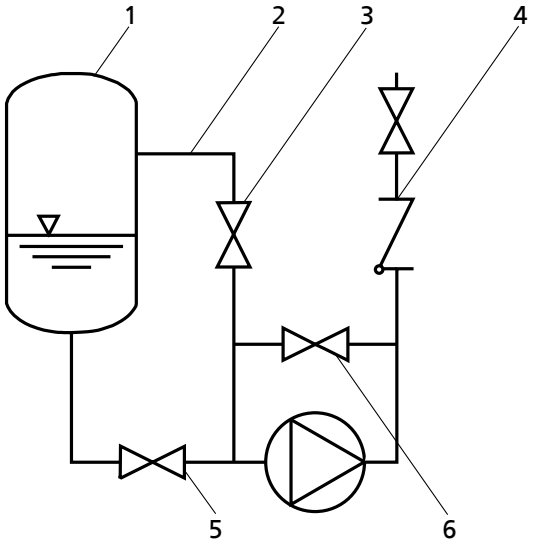

Fig. 13: Vacuum balance system

1	Vessel under vacuum	2	Vacuum balance line
3	Shut-off element	4	Swing check valve
5	Main shut-off element	6	Vacuum-tight shut-off element

NOTE

An additional line fitted with a shut-off valve (from the pump discharge nozzle to the balance line) facilitates venting of the pump before start-up.

5.3.4 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 injury from escaping fluid!

Risk of burns!

Malfunction of the pump!

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

NOTE

Connecting a pipe to connection 8B (leakage drain) is recommended to guide the mechanical seal leakage into a collecting container.

5.4 Enclosure/insulation

DANGER

Explosive atmosphere forming due to insufficient venting

Explosion hazard!

- ▷ Make sure the space between the casing cover/discharge cover and the motor flange is sufficiently vented.
- ▷ Do not cover the perforations of the contact guards at the drive lantern (e.g. by insulation).

WARNING

The volute casing and casing/discharge cover take on the same temperature as the fluid handled

Risk of burns!

- ▷ Insulate the volute casing.
- ▷ Fit protective equipment.

CAUTION

Heat build-up inside the drive lantern

Damage to the bearing!

- ▷ Never insulate the casing cover and the drive lantern.

NOTE

Pump casings handling fluids at temperatures below freezing point may be insulated at the site, subject to the manufacturer's prior approval.

5.5 Electrical connection

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock and explosion!

- ▷ Always have the electrical connections installed by an electrically qualified person.
- ▷ Observe regulations IEC 60364 and, for explosion-proof versions, EN 60079 .

WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

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

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

NOTE

Installing a motor protection device is recommended.

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5.5.1 Setting the time relay

CAUTION

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

Damage to the pump (set)!

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

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

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

5.5.2 Earthing

DANGER

Electrostatic charging

Explosion hazard!

Fire hazard!

Damage to the pump set!

- ▷ Connect the PE conductor to the earthing terminal provided.

5.5.3 Connecting the motor

NOTE

In compliance with IEC 60034-8, three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub).

The pump's direction of rotation is indicated by an arrow on the pump.

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

5.6 Checking the direction of rotation

DANGER

Temperature increase resulting from contact between rotating and stationary components

Explosion hazard!

Damage to the pump set!

- ▷ Never check the direction of rotation by starting up the unfilled pump.

WARNING

Hands inside the pump casing

Risk of injuries, damage to the pump!

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

CAUTION

Drive and pump running in the wrong direction of rotation

Damage to the pump!

- ▷ Refer to the arrow indicating the direction of rotation on the pump.
- ▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.

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

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

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6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇨ Section 5.5, Page 30)
- The pump has been filled with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked. (⇨ Section 5.6, Page 31)
- 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)
- The lock washers, if any, have been removed from the shaft groove.

6.1.2 Removing the transport lock

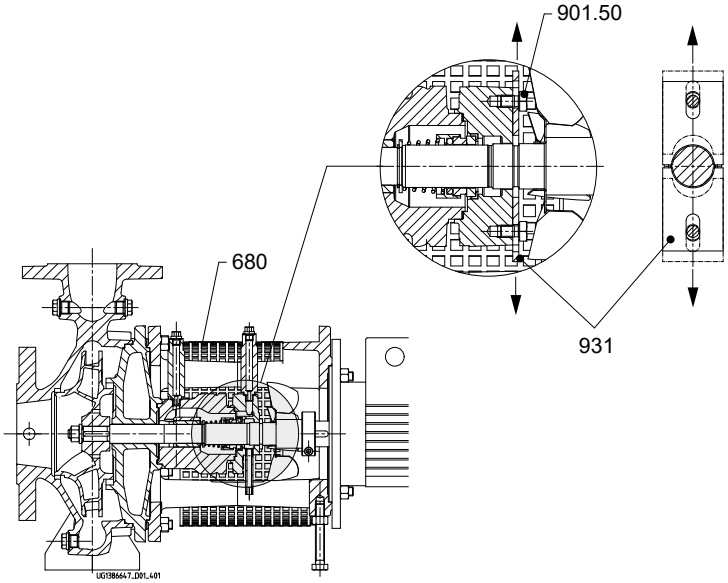

Fig. 14: Removing the transport lock

1. Undo screws 914.98 at guard 680.
2. Remove guard 680.
3. Pull lock washers 931 out of the groove in the stub shaft.
4. Tighten hexagon head bolts 901.50.

6.1.3 Priming and venting the pump

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.

DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

- The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.
- Provide sufficient inlet pressure.
- Provide an appropriate monitoring system.

DANGER

Shaft seal failure caused by insufficient lubrication

Hot or toxic fluid could escape!

Damage to the pump!

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

CAUTION

Increased wear due to dry running

Damage to the pump set!

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

NOTE

In the run-in phase of the system, venting the pump repeatedly via the screw plug on the bearing bracket is recommended.

1. To fill the bearing housing remove screw plug 903.92 /.94 (connection 6D.1). Fill the bearing housing with the fluid. Fit and tighten screw plug 903.92 /.94.
2. To vent the bearing housing, slowly open screw plug 903.92 /.94 (connection 6D.1) by no more than half a turn to a full turn. Leave the screw plug open until the gas has left the bearing housing and liquid starts to escape. Then, tighten screw plug 903.92 /.94 again.
3. Vent the pump and suction line and prime both with the fluid to be handled. The pump can be primed with the fluid to be handled from the system via the inlet line.
4. Fully open the shut-off element in the suction line.
5. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.) if any.
6. Open the shut-off element, if any, in the vacuum balance line and close the vacuum-tight shut-off element if any.

DANGER

Hot fluid spurting out of the vent chamber

Burns, scalding!

- Always use utmost caution during the venting process and wear appropriate protective gear.

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⚠ WARNING

Hot water escaping under pressure when the vent plug is opened

Risk of electric shock!

Risk of scalding!

- ▹ Protect the electric components against escaping fluid.
- ▹ Wear protective clothing (e.g. gloves).

7. Close the vent hole (connection 6D or connection 6D.1 for Etabloc SYT) with screw plug 903.02/.03/.92/.94. See (⇨ Table 14)
8. Close the vent hole (connection 6D or connection 6D.1/ 6D.2/ 6D.3 for Etaline SYT) with screw plug 903.01/.02/.39/.92/.94. See (⇨ Table 14)

NOTE

Replacing the screw plug with a globe valve and vent line is recommended, so that gases and hot fluids handled can be drained safely during the venting process.

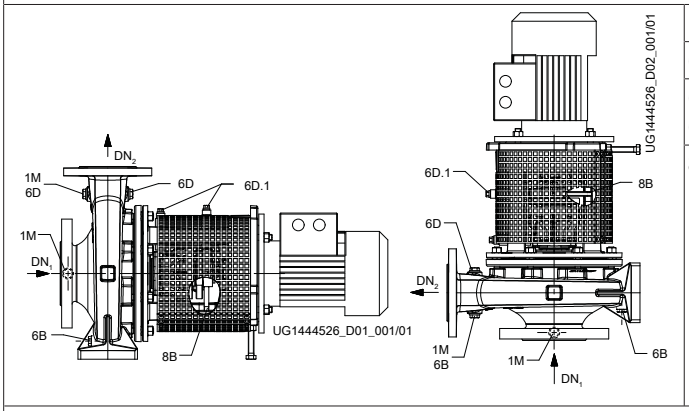
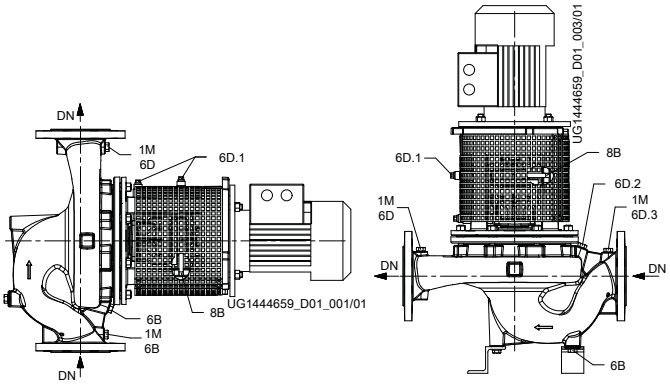
Venting during operation

1. Switch off the pump and let it run down to a standstill.
2. This allows the gases to escape reliably.
3. Close the shut-off elements as required by the system configuration.
4. To vent the bearing bracket open screw plug 903.92/.94 1/2 by 1/2 turn to maximum 1 turn until no more gas escapes.
5. When no more gas escapes, close the screw plug again.

Excessive venting

1. Prevent excessive venting.
   ⇨ Hot fluid handled will flow from the piping system through the volute casing into the mechanical seal chamber and result in an inadmissible heat build-up in the mechanical seal.
2. When no more gas escapes, close the screw plug again.

Table 14: Connections

Type series / illustration	Connection	Type
Etabloc SYT		
	1M	Connection for pressure gauge
	6B	Fluid drain
	6D, 6D.1	Fluid priming and venting
	8B	Leakage drain
Etaline SYT		
	1M	Connection for pressure gauge
	6B	Fluid drain
	6D, 6D.1, 6D.2, 6D.3	Fluid priming and venting
	8B	Leakage drain

6.1.4 Keeping warm / heating up the pump (set)

CAUTION

Pump blockage

Damage to the pump!

▷ Prior to pump start-up, heat up the pump as described in the manual.

Observe the following when heating up the pump (set) and keeping it warm:

- Make sure that the temperature is increased continuously.
- Heating speed: max. 5 °C/min (5 K/min)

Fluid temperatures above 150 °C

When the pump is used for handling fluids at temperatures above 150 °C make sure that the pump has been heated throughout before starting it up.

Temperature difference

The temperature difference between the pump's surface and the fluid handled must not exceed 100 °C (100 K) when the pump is started up.

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!

- ▹ 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.

DANGER

Excessive temperatures due to dry running or excessive gas content in the fluid handled

Explosion hazard!

Damage to the pump set!

- ▹ Never operate the pump set without liquid fill.
- ▹ Prime the pump as per operating instructions.
- ▹ Always operate the pump within the permissible operating range.

CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

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

- ✓ The system piping has been cleaned.
- ✓ The pump, suction line and inlet tank, if any, have been vented and primed with the fluid to be handled.
- ✓ The filling and venting lines have been closed.

CAUTION

Start-up against open discharge line

Motor overload!

- ▹ Make sure the motor has sufficient power reserves.
- ▹ Use a soft starter.
- ▹ Use speed control.

1. Fully open the shut-off element in the suction head/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 the duty point.

6.1.6 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

DANGER

Excessive temperature of barrier fluid (pumps with double mechanical seal)

Explosion hazard!

Excessive surface temperature

- ▷ For pumps with double mechanical seal, make sure that the barrier fluid's temperature does not exceed 60 °C.

6.1.7 Shutdown

CAUTION

Heat build-up inside the pump

Damage to the shaft seal!

- ▷ 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.

CAUTION

Backflow of fluid handled is not permitted

Motor and/or winding damage!

Mechanical seal damage!

- ▷ Close the shut-off elements.

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

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

NOTE

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

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Close any auxiliary lines.
   If the fluid to be handled is fed in under vacuum, also supply the shaft seal with barrier fluid during standstill.

CAUTION

Risk of freezing during prolonged pump shutdown periods

Damage to the pump!

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

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6.2 Operating limits

DANGER

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

Explosion hazard!

Hot or toxic fluid could escape!

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

DANGER

Formation of a potentially explosive atmosphere inside the pump

Explosion hazard!

- When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring).

6.2.1 Ambient temperature

CAUTION

Operation outside the permissible ambient temperature

Damage to the pump (set)!

- Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 15: Permissible ambient temperatures

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

Table 16: Permissible ambient temperature DNV-GL (marine)

Permissible ambient temperature DNV-GL (marine)	Value
Maximum	45 °C at a fluid temperature of 300 °C max.
Minimum	See data sheet

6.2.2 Frequency of starts

DANGER

Excessive surface temperature of the motor

Explosion hazard!

Damage to the motor!

- In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.

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

Table 17: Frequency of starts

Impeller material	Maximum number of starts [Starts/hour]
G (JL1040/ A48CL35B)	15
C (1.4408/ A743 GR CF8M)	6

CAUTION

Re-starting while motor is still running down

Damage to the pump (set)!

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

6.2.3 Fluid handled

6.2.3.1 Flow rate

Table 18: Flow rate

Minimum flow rate	Maximum flow rate
≈ 15 % of Q_{Opt} [5]	See hydraulic characteristic curves

The calculation formula below can be used to check if an additional heat build-up could lead to a dangerous temperature increase at the pump surface.

$$T_O = T_f + \Delta\vartheta$$

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

Table 19: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Acceleration due to gravity	m/s^2
H	Pump discharge head	m
T_f	Fluid temperature	°C
T_O	Temperature at the casing surface	°C
η	Pump efficiency at duty point	-
$\Delta\vartheta$	Temperature difference	K

6.2.3.2 Density of the fluid handled

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

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5 Best efficiency point

CAUTION

Impermissibly high density of the fluid handled

Motor overload!

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

6.2.3.3 Abrasive fluids

When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system and the shaft seal are to be expected. In this case, reduce the commonly recommended inspection intervals.

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

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

✓ Sufficient fluid is supplied for the functional check run of the pump.

1. For prolonged shutdown periods, start up the pump (set) regularly between once a month and once every three months for approximately five minutes.
   ⇨ This will prevent the formation of deposits within the pump and the pump intake area.

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

✓ The pump has been properly drained. (⇨ Section 7.3, Page 47)

✓ The safety instructions for dismantling the pump have been observed.

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

1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
2. Spray the preservative through the suction nozzle and discharge nozzle.
   It is advisable to then close the pump nozzles (e.g. with plastic caps).
3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved, if required) to protect them against corrosion.
   Observe the additional instructions on preservation. (⇨ Section 3.3, Page 14)

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

6.4 Returning to service

For returning the equipment to service observe the sections on commissioning/start-up and the operating limits. (⇨ Section 6.1, Page 33) (⇨ Section 6.2, Page 39)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 43)

⚠ 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.

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7 Servicing/Maintenance

7.1 Safety regulations

DANGER

Sparks produced during servicing work

Explosion hazard!

- Observe the safety regulations in force at the place of installation!
- Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres.

DANGER

Improperly serviced pump set

Explosion hazard!

Damage to the pump set!

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

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

WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

DANGER

Improper cleaning of coated pump surfaces

Explosion hazard by electrostatic discharge!

- When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.

WARNING

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

Risk of injury!

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

⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

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

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

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact.

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/inspection

7.2.1 Supervision of operation

⚠ DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

- ▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.
- ▷ Provide sufficient inlet pressure.
- ▷ Provide an appropriate monitoring system.

⚠ DANGER

Incorrectly serviced shaft seal

Explosion hazard!

Hot, toxic fluid escaping!

Damage to the pump set!

Risk of burns!

Fire hazard!

- ▷ Regularly service the shaft seal.

⚠ DANGER

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

Explosion hazard!

Fire hazard!

Damage to the pump set!

- ▷ Regularly check the rolling element bearings for running noises.

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CAUTION

Increased wear due to dry running

Damage to the pump set!

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

CAUTION

Impermissibly high temperature of fluid handled

Damage to the pump!

- ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- ▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇨ Section 6.2, Page 39)

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

- The pump must run quietly and free from vibrations at all times.
- Check the shaft seal. (⇨ Section 6.1.6, Page 37)
- Check the static sealing elements for leakage.
- Check the rolling element bearings for running noises.
  Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
  To make sure that stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.
  The bearing temperature must not exceed 90 °C (measured on the motor housing).

CAUTION

Operation outside the permissible bearing temperature

Damage to the pump!

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

NOTE

After commissioning, increased temperatures may occur at grease-lubricated rolling element bearings due to the running-in process. The final bearing temperature is only reached after a certain period of operation (up to 48 hours depending on the conditions).

7.2.2 Inspection work

DANGER

Excessive temperatures caused by friction, impact or frictional sparks

Explosion hazard!

Fire hazard!

Damage to the pump set!

- ▹ Regularly check the cover plates, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.

DANGER

Electrostatic charging due to insufficient potential equalisation

Explosion hazard!

- ▹ Make sure that the connection between pump and baseplate is electrically conductive.

7.2.2.1 Checking the clearances

For checking the clearances remove the impeller, if required.
If the clearance is larger than permitted (see the following table), fit new casing wear ring 502.01 and/or 502.02.
The clearances given refer to the diameter.

Table 20: Clearances between impeller and casing and/or between impeller and casing cover

Impeller material	Permissible clearances [mm]	
	New	Maximum
G (JL1040/ A48CL35B)	0,3	0,9
C (1.4408/ A743 GR CF8M)	0,5	1,5

NOTE

If the clearances given are exceeded by more than 1 mm (referring to the diameter) replace the affected components or restore the original clearance by means of a casing wear ring.
Contact KSB.

7.2.2.2 Cleaning filters

CAUTION

Insufficient inlet pressure due to clogged filter in the suction line

Damage to the pump!

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

7.2.2.3 Checking the clearances

The bearing clearance must not exceed the permissible maximum clearance (see the table below).

If the permissible maximum clearance is exceeded, fit a new plain bearing 310.

Maximum clearance, plain bearing		Nominal clearance, plain bearing
SU 25	0.35 mm	0.08 - 0.13 mm

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7.3 Drainage/cleaning

⚠ WARNING

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

Hazard to persons and the environment!

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

1. Use connection 6B to drain the fluid handled.
2. 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 certificate of decontamination for the pump. (⇨ Section 11, Page 64)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- ▹ Properly shut down the pump set. (⇨ Section 6.1.7, Page 38)
- ▹ Close the shut-off elements in the suction line and discharge line.
- ▹ Drain the pump and release the pump pressure.
- ▹ Shut off any auxiliary feed lines.
- ▹ Allow the pump set to cool down to ambient temperature.

⚠ WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

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

⚠ WARNING

Hot surface

Risk of injury!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

⚠ WARNING

Thin metal foil used as carrier material in joint rings

Risk of injury (cuts)!

- ▹ Wear protective clothing.
- ▹ Always use an appropriate tool to remove joint rings.

Observe the general safety instructions and (⇨ Section 7.1, Page 43) information.

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

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

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

NOTE

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

NOTE

After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use a brand name penetrating agent and/or - if possible - an appropriate puller.

NOTE

We recommend placing a drip pan under the pump along its entire length to collect any fluid escaping during dismantling.

7.4.2 Preparing the pump set

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

7.4.3 Dismantling the complete pump set

NOTE

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

✓ The notes and steps stated in to (⇨ Section 7.4.2, Page 48) have been observed/ carried out.

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

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7.4.4 Removing the motor

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

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

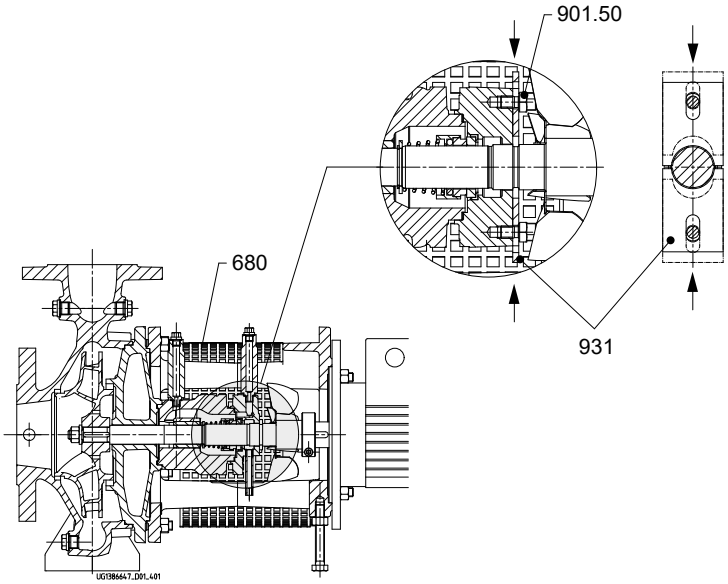

Fig. 15: Fitting the transport lock

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 47) to (⇨ Section 7.4.3, Page 48) have been observed and carried out.

1. Undo screws 914.98 at guard 680.
2. Remove guard 680.
3. Undo hexagon head bolts 901.50.
4. Insert both lock washers 931 into the groove in shaft 210.
5. Tighten hexagon head bolts 901.50.
6. Undo hexagon socket head cap screw 914.24.
7. Undo hexagon nut 920.11.
8. Remove the motor.

7.4.5 Removing the back pull-out unit

⚠ WARNING

Back pull-out unit tilting

Risk of squashing hands and feet!

▹ Suspend or support the back pull-out unit at the pump end.

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 47) to (⇨ Section 7.4.4, Page 49) 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 nut 920.1 at the discharge cover.
3. Pull the back pull-out unit out of the volute casing.
4. Remove and dispose of gasket 411.10.
5. Place the back pull-out unit on a clean and level surface.

7.4.6 Removing the impeller

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 47) to (⇨ Section 7.4.5, Page 49) have been observed/carried out.

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

1. Undo impeller nut 920.95 (right-hand thread).
2. Remove impeller 230 with an impeller removal tool.
3. Place impeller 230 on a clean and level surface.
4. Remove key 940.01 from shaft 210.

7.4.7 Removing the mechanical seal

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 47) to (⇨ Section 7.4.6, Page 50) have been observed and carried out.

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

1. Undo nuts 920.02.
2. Undo seal cover 471 and pull out of bearing housing 350 together with shaft 210.
3. Remove circlip 932.04 and disc 550.02.
4. Undo the grub screws of mechanical seal 433 (primary ring).
5. Remove the rotating assembly of the mechanical seal (primary ring) from shaft 210.
6. Pull seal cover 471 off shaft 210.
7. Remove the stationary assembly of the mechanical seal (mating ring) from seal cover 471.
8. Remove and dispose of gasket 411.37.

7.4.8 Removing the plain bearing

1. Press plain bearing 310 out of bearing housing 350.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

DANGER

Wrong selection of motor

Explosion hazard!

- ▹ Use an original motor or a motor of identical design from the same manufacturer.
- ▹ The permissible temperature limits at the motor flange and motor shaft must be higher than the temperatures generated by the pump. (Contact KSB for temperatures).

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.

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	**CAUTION** **Improper reassembly** Damage to the pump! ▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▷ Use original spare parts only.

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

Sealing elements
Check O-rings for any damage and replace by new O-rings, if required.

Always use new gaskets, making sure that they have the same thickness as the old ones.

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

Assembly adhesives
Avoid the use of assembly adhesives, if possible.
Should an assembly adhesive be required after all, use a commercially available contact adhesive (e.g. Pattex) or sealant (e.g. HYLOMAR or Epple 33).
Only apply adhesive at selected points and in thin layers.

Never use quick-setting adhesives (cyanoacrylate adhesives).

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

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

7.5.2 Fitting the plain bearing

1. Press plain bearing 310 carefully into bearing housing 350 until it will not go any further.

7.5.3 Installing the mechanical seal

	**CAUTION** **Use of non-original spare parts** Damage to the pump set! Loss of warranty! ▷ Only use original KSB spare parts. This applies especially to the replacement of the bearing, mechanical seals, static sealing elements and lip seal.

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

- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.

✓ The notes and steps stated in have been observed/carried out.
✓ The individual parts have been placed in a clean and level assembly area.
✓ All dismantled parts have been cleaned and checked for wear.
✓ Any damaged or worn parts have been replaced by original spare parts.
✓ The sealing surfaces have been cleaned.

1. Clean the shaft and the seal cover and gently remove any deposits.

CAUTION

Elastomers in contact with oil/grease

Shaft seal failure!

- ▹ Use a water/soap mixture as assembly lubricant.
- ▹ Never use oil or grease as assembly lubricant.

2. Wet the mating ring location of the mechanical seal in seal cover 471 with a water/soap mixture.
3. Carefully press the mating ring into seal cover 471. Make sure to apply pressure evenly.
4. Slide seal cover 471 onto shaft 210. Secure shaft 210 axially using a suitable device.
5. Slide the rotating assembly of the mechanical seal (primary ring) onto shaft 210. Fit disc 550.02. Secure with circlip 932.04.
6. Tighten the grub screws of mechanical seal 433 (primary ring). Observe the tightening torques. (⇨ Section 7.6, Page 54)
7. Slide shaft 210 into bearing housing 350. Tighten nuts 920.02.

7.5.4 Fitting the impeller

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.3, Page 51) have been observed and carried out.

✓ The pre-assembled unit (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. Insert key 940.01 and slide impeller 230 onto shaft 210.
2. Fasten impeller nut 920.95 and safety device 930.95.

7.5.5 Installing the back pull-out unit

⚠ WARNING

Back pull-out unit tilting

Risk of squashing hands and feet!

- ▹ Suspend or support the back pull-out unit at the pump end.

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.4, Page 52) 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 tipping over.
2. Fit new gasket 411.10 into the recess of volute casing 102.
3. Push the back pull-out unit into volute casing 102.
4. Depending on the type of pump, fit hexagon head bolt 901.72 and hexagon nut 920.12.
5. Fasten hexagon nut 920.01 at volute casing 102.

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7.5.6 Mounting the motor

DANGER

Incorrect shaft connection

Explosion hazard!

▹ Connect the shafts between pump and motor as described in this manual.

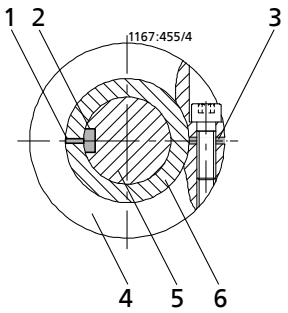

Fig. 16: Fitting the motor shaft stub on the shaft

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

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.5, Page 52) have been observed and carried out.

1. Fit the motor shaft stub on shaft 210 and make sure that the keyway of the motor shaft end aligns with the slot in shaft 210 and that both are located opposite the slot of locking ring 515 (see illustration: Fitting the motor shaft stub on the shaft).
2. Tighten hexagon socket head cap screw 914.24.
3. Tighten hexagon nut 920.11.
4. Undo hexagon head bolt 901.50.

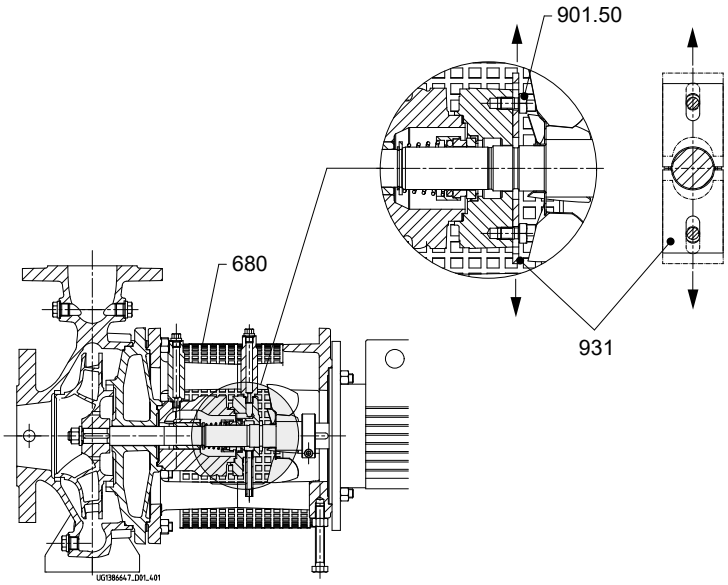

Fig. 17: Removing the transport lock

5. Pull both lock washers 931 out of the groove in shaft 210.
6. Tighten hexagon head bolt 901.50.
7. Fit guard 680.

7.6 Tightening torques

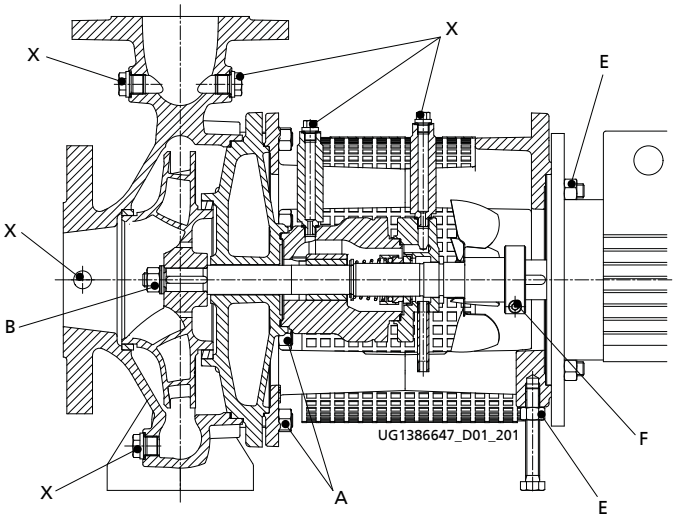

Fig. 18: Tightening points at the pump

Table 21: Tightening torques for bolted/screwed connections at the pump

Position	Thread	[Nm]
A	M8	20
	M12	55
B	M12 × 1,5	55
E	M10	38
	M12	55
	M16	130
F	M6	15
	M8	38
X	1/8	25
	3/8	80
	1/4	55

Table 22: Tightening torques for the grub screws at the mechanical seal

Type series	Mechanical seal	Thread	[Nm]
ETBY/ETLY	4EYS028	M6	5
ETNY	4EYS033	M6	5
ETNY	4EYS048	M6	7
ETNY	4EYT033	M6	5
ETNY	4EYT048	M6	7

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

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Refer to the name plate for all data.

Also specify the following data:

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

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

CAUTION

Use of non-original spare parts

Damage to the pump set!

Loss of warranty!

▷ Only use original KSB spare parts. This applies especially to the replacement of the bearing, mechanical seals, static sealing elements and lip seal.

Table 23: Quantity of spare parts for recommended spare parts stock

Part number	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
		Quantity of spare parts						
210	Shaft [6)]	1	1	1	2	2	2	20 %
230	Impeller	1	1	1	2	2	2	20 %
310	Plain bearing	2	3	4	5	7	9	100 %
350	Bearing housing[7)]	-	-	-	-	-	1	2 pcs.
433	Mechanical seal	1	1	2	2	2	3	25 %
502.01/.02	Casing wear ring	2	2	2	3	3	4	50 %
411.10/.15/.37	Joint rings (set)[8)]	4	6	8	8	9	12	150 %

6 Shaft 210 complete, consisting of shaft 210, taper lock ring 515, socket head cap screw 914.24, hexagon nut 920.95, key 940.01, spring washer 930.95, disc 550.95

7 Bearing housing 350 complete, consisting of plain bearing 310, bearing housing 350

8 Joint rings (set) consisting of joint ring 411.10/.15/.37

7.7.3 Interchangeability of Etabloc SYT / Etaline SYT pump components

Components featuring the same number in a column are interchangeable.

Etabloc SYT	Etaline SYT	Shaft unit	Description																	
			Volute casing	Discharge cover	Shaft						Impeller	Drive lantern				Plain bearing	Bearing housing	Mechanical seal	Seal cover	Casing wear ring (suction side)	Casing wear ring (discharge side)
			Part No.																		
			102	163	210 Motor size						230	341 Motor size				310	350	433	471	502.01	502.02
					80	90	100/112	132	160	180		80/90	100/112	132	160/180						
040-025-160/...		25	○	1	2	3	4	□	□	□	○	2	3	□	□	1	1	1	1	1	✗
040-025-200/...		25	○	2	2	3	4	5	□	□	○	2	3	4	□	1	1	1	1	1	5
050-032-125.1/...		25	○	1	2	3	4	5	□	□	○	2	3	4	□	1	1	1	1	2	✗
050-032-160/...	040-040-160/...	25	○	1	2	3	4	5	□	□	*	2	3	4	□	1	1	1	1	3	✗
050-032-160.1/...	032-032-160/...	25	○	1	2	3	4	5	6	□	*	2	3	4	5	1	1	1	1	2	✗
050-032-200/...	040-040-200/...	25	○	2	2	3	4	5	6	□	*	2	3	4	5	1	1	1	1	3	5
050-032-200.1/...	032-032-200/...	25	○	2	2	3	4	5	6	□	*	2	3	4	5	1	1	1	1	2	5
065-040-160/...	050-050-160/...	25	○	1	2	3	4	5	6	□	*	2	3	4	5	1	1	1	1	4	5
065-040-200/...	050-050-200/...	25	○	2	2	3	4	5	6	7	*	2	3	4	5	1	1	1	1	4	5
065-050-160/...	065-065-160/...	25	○	1	2	3	4	5	6	7	*	2	3	4	5	1	1	1	1	6	5
065-050-200/...	065-065-200/...	25	○	2	□	3	4	5	6	7	*	2	3	4	5	1	1	1	1	6	5
080-065-160/...	080-080-160/...	25	○	3	□	3	4	5	6	7	*	2	3	4	5	1	1	1	1	7	8
080-065-200/...		25	○	○	□	□	4	5	6	7	○	□	3	4	5	1	1	1	1	7	8
100-080-160/...	100-100-160/...	25	○	3	□	3	4	5	6	7	*	2	3	4	5	1	1	1	1	9	8

Table 24: Symbols key

Symbol	Description
*	Component interchangeable between Etabloc SYT and Etaline SYT
○	Components differ
✗	Component not fitted
□	Pump/motor combination available on request

Table 25: Motor / Rating

Motor	Rating
80	.../054, .../074, .../072, .../112
90	.../114, .../154, .../152, .../222
100	.../224, .../304, .../302
112	.../404, .../402
132	.../554, .../754, .../552, .../752
160	.../1102, .../1502, .../1852
180	.../2202

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

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

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

A Pump delivers insufficient flow rate

B Motor is overloaded

C Excessive discharge pressure

D Leakage at the pump

E Excessive leakage at the shaft seal

F Vibrations during pump operation

G Impermissible temperature increase in the pump

Table 26: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy[9]
✗	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller.[10]
✗	-	-	-	-	-	✗	✗	Pump and/or piping are not completely vented and/or primed.	Vent and/or prime. Clean vent hole.
✗	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
✗	-	-	-	-	-	-	-	Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
✗	-	-	-	-	-	✗	✗	Suction lift is too high/$NPSH_{available}$ (positive suction head) is too low.	Check/alter fluid level. Install pump at a lower level. Fully open the shut-off element in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed. Observe permissible speed of pressure fall.
✗	-	-	-	-	-	-	-	Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
✗	-	-	-	-	-	✗	-	Wear of internal components	Replace worn components by new ones.
-	✗	✗	-	-	-	✗	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point. In the case of persistent overloading, turn down impeller.[10]
-	✗	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	[10]
-	-	-	-	✗	-	-	-	Defective gasket	Fit new gasket between volute casing and discharge cover.
-	-	-	-	-	✗	-	-	Worn shaft seal	Fit new shaft seal.
-	-	-	✗	-	✗	✗	-	Pump is warped or sympathetic vibrations in the piping.	Check the piping connections and secure fixing of pump; if required, reduce distances between the pipe clamps. Fix the pipelines using anti-vibration material.

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

10 Contact KSB.

A	B	C	D	E	F	G	H	Possible cause	Remedy[9)]
✗	✗	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	-	-	-	✗	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	✗	-	Defective bearing(s)	Replace.
-	-	-	-	-	-	✗	✗	Flow rate is too low.	Increase the minimum flow rate.
-	-	-	✗	-	-	-	-	Defective gasket	Fit new gasket between volute casing and discharge cover or between discharge cover and bearing bracket.
-	-	-	✗	-	-	-	-	Gasket not pre-loaded sufficiently	Increase pre-loading of gasket at operating temperature: 1. Close the valves on the discharge and suction side. 2. Allow the pump set to cool down to a temperature below the boiling point of the fluid handled. 3. Re-tighten hexagon nuts 920.01 and 920.15 at the discharge cover. 4. Start up the pump set.
✗	-	-	-	-	-	-	-	Speed is too low - Operation with frequency inverter - Operation without frequency inverter	 - Increase voltage/frequency at the frequency inverter in the permissible range. - Check voltage.
-	✗	✗	-	-	-	-	-	Speed is too high.	Reduce speed.
-	-	-	-	✗	-	-	-	Tie bolts/sealing element defective	Fit new gasket between volute casing and casing cover. Re-tighten the bolts.
-	✗	✗	-	-	-	-	-	Transport lock has not been removed from the shaft groove.	Remove transport lock from the shaft groove.

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9 Related Documents

9.1 Exploded views and list of components

9.1.1 Etabloc SYT exploded view

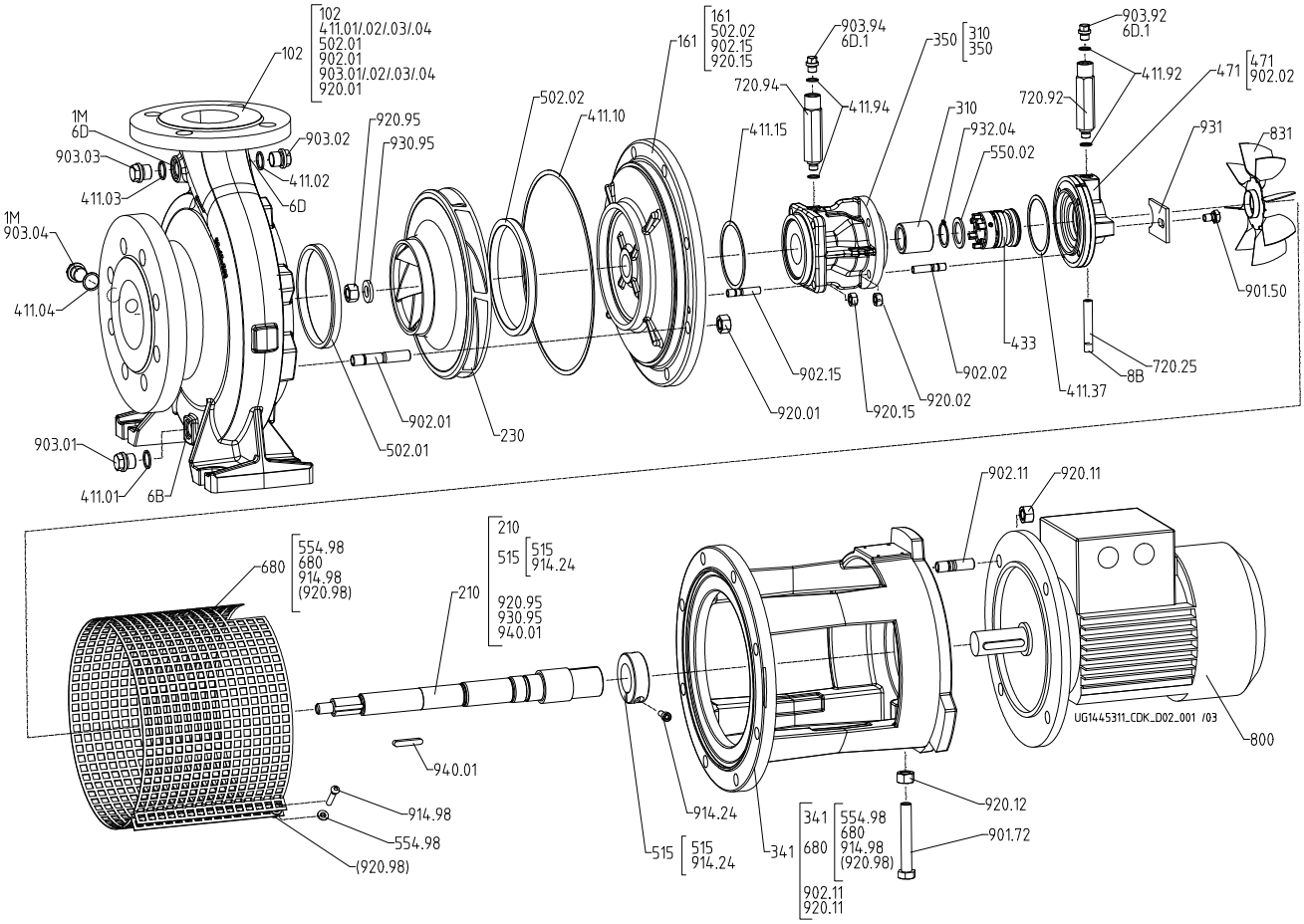

Fig. 19: Etabloc SYT exploded view

[Supplied in packaging units only
( ) Not available as individual spare part

Table 27: List of components

Part No.	Description	Part No.	Description
102	Volute casing	720.25/.92/.94	Fitting
161	Casing cover	800	Motor
210	Shaft	831	Fan impeller
230	Impeller	901.50/.72	Hexagon head bolt
310	Plain bearing	902.01/.02/.11/.15	Stud
341	Drive lantern	903.01/.02/.03/.04/.92/.94	Screw plug
350	Bearing housing	914.24	Hexagon socket head cap screw
411.01/.02/.03/.04/.10/.15/.37/.92/.94	Joint ring	914.98	Pan head screw
433	Mechanical seal	920.01/.02/.11/.12/.15/.95	Hexagon nut
471	Seal cover	920.98	Blind rivet nut
502.01/.02	Casing wear ring	930.95	Nord-Lock bolt securing element
515	Taper lock ring	931	Lock washer
550.02	Disc	932.04	Circlip

Part No.	Description	Part No.	Description
554.98	Lock washer	940.01	Key
680	Guard		

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9.1.2 Etaline SYT exploded view

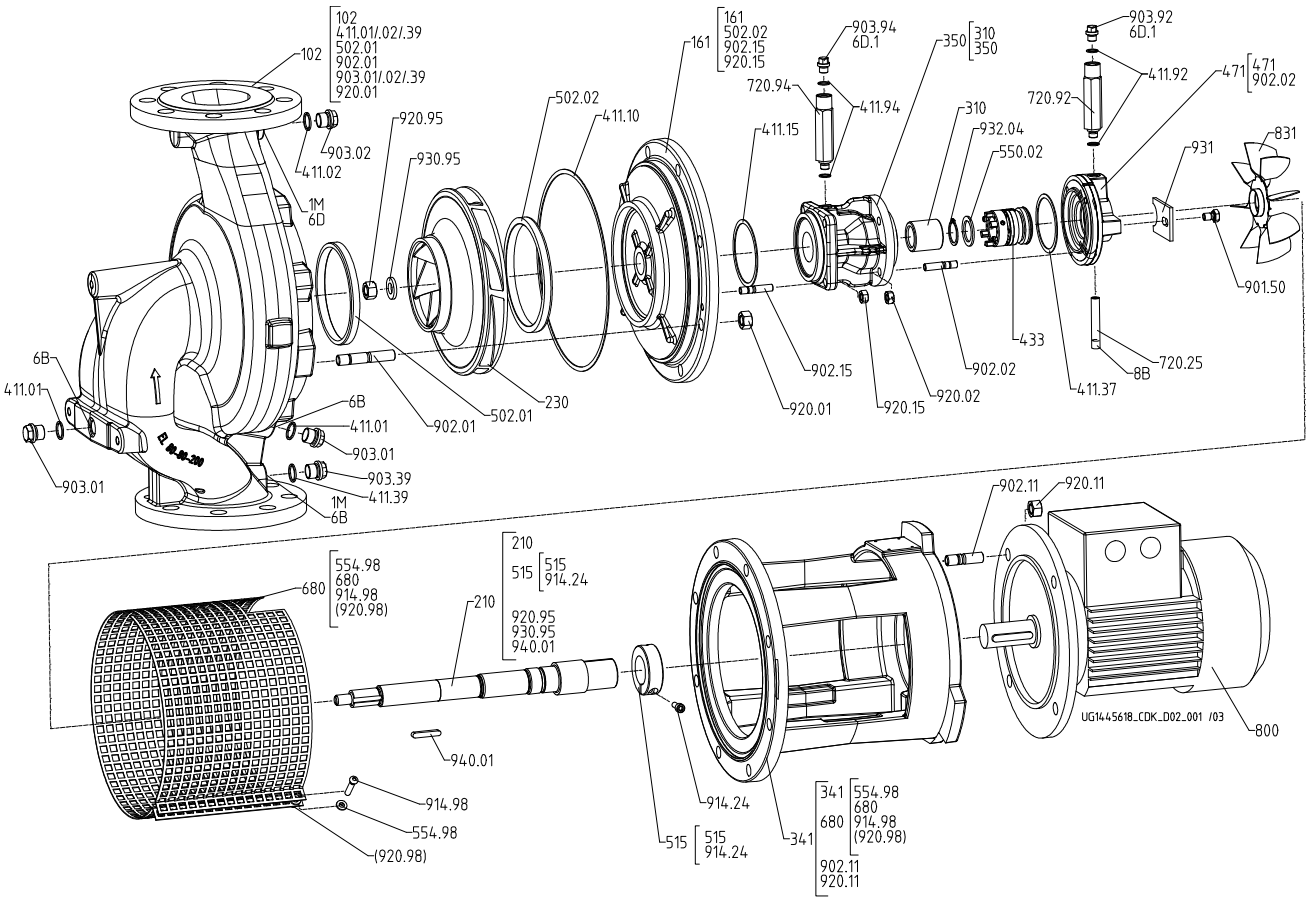

Fig. 20: Etaline SYT exploded view

[Supplied in packaging units only
( ) Not available as individual spare part

Table 28: List of components

Part No.	Description	Part No.	Description
102	Volute casing	720.25/.92/.94	Fitting
161	Casing cover	800	Motor
210	Shaft	831	Fan impeller
230	Impeller	901.50	Hexagon head bolt
310	Plain bearing	902.01/.02/.11/.15	Stud
341	Drive lantern	903.01/.02/.39/.92/.94	Screw plug
350	Bearing housing	914.24	Hexagon socket head cap screw
411.01/.02/.10/.15/.37/.39/.92/.94	Joint ring	914.98	Pan head screw
433	Mechanical seal	920.01/.02/.11/.15/.95	Hexagon nut
471	Seal cover	920.98	Blind rivet nut
502.01/.02	Casing wear ring	930.95	Nord-Lock bolt securing ring
515	Taper lock ring	931	Lock washer
550.02	Disc	932.04	Circlip
554.98	Lock washer	940.01	Key
680	Guard		

9.2 Spare parts list

CAUTION

Use of non-original spare parts

Damage to the pump set!

Loss of warranty!

- ▷ Only use original KSB spare parts. This applies especially to the replacement of the bearing, mechanical seals, static sealing elements and lip seal.

Table 29: Mechanical seal order information

Mechanical seal	Bearing bracket	KSB Mat. No.
Single mechanical seal	WS_25	01909210

Table 30: Plain bearing order information

Bearing	Bearing bracket	KSB Mat. No.
Plain bearing Lubrication by the fluid pumped	WS_25	47056891

Table 31: Joint ring order information, Etabloc SYT

Size	Shaft unit	KSB Mat. No. for joint ring		
		Volute casing / discharge cover	Discharge cover / bearing housing	Bearing housing / seal cover
040-025-160	WS_25	01140539	01185070	01140516
040-025-200	WS_25	01140541	01185070	01140516
050-032-125.1	WS_25	01140539	01185070	01140516
050-032-160.1	WS_25	01140539	01185070	01140516
050-032-200.1	WS_25	01140541	01185070	01140516
050-032-160	WS_25	01140539	01185070	01140516
050-032-200	WS_25	01140541	01185070	01140516
065-040-160	WS_25	01140539	01185070	01140516
065-040-200	WS_25	01140541	01185070	01140516
065-050-160	WS_25	01140539	01185070	01140516
065-050-200	WS_25	01140541	01185070	01140516
080-065-160	WS_25	01140539	01185070	01140516
080-065-200	WS_25	01140541	01185070	01140516
100-080-160	WS_25	01140539	01185070	01140516

Table 32: Joint ring order information, Etaline SYT

Size	Shaft unit	KSB Mat. No. for joint ring		
		Volute casing / discharge cover	Discharge cover / bearing housing	Bearing housing / seal cover
032-032-160	WS_25	01140539	01185070	01140516
032-032-200	WS_25	01140541	01185070	01140516
040-040-160	WS_25	01140539	01185070	01140516
040-040-200	WS_25	01140541	01185070	01140516
050-050-160	WS_25	01140539	01185070	01140516
050-050-200	WS_25	01140541	01185070	01140516
065-065-160	WS_25	01140539	01185070	01140516
065-065-200	WS_25	01140541	01185070	01140516
080-080-160	WS_25	01140539	01185070	01140516
100-100-160	WS_25	01140539	01185070	01140516

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10 EU Declaration of Conformity

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

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

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

KSB order number: .....

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

The manufacturer also declares that

- the following harmonised international standards[11)] have been applied:
  - ISO 12100
  - EN 809

Person authorised to compile the technical file:

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

The EU Declaration of Conformity was issued in/on:

Place, date

.....[12)].....

Name

Function

Company
Address

11 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.

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

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[13]: .....

Delivery date: .....

Application: .....

Fluid handled[13]: .....

Please tick where applicable[13]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[13]: .....

Comments: .....

.....

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

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

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

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

☐ No special safety precautions are required for further handling.

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

.....

.....

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

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

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13 Required field

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