

Closed-coupled Pump

Etachrom B

Installation/Operating Manual



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Installation/Operating Manual Etachrom B

Original operating manual

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Glossary

ACS

French drinking water regulations (ACS = Attestation de Conformité Sanitaire)

WRAS

Approved by all water suppliers in the UK (WRAS = Water Regulations Advisory Scheme)

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.

Close-coupled design

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

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

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

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

UBA

German drinking water regulations to German Environment Agency

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. (⇒ Section 7.5.4, Page 48)

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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

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

1.5 Symbols

Table 2: Symbols used in this manual

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

¹ If agreed to be included in the scope of supply

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

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

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



2 Safety

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

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

2.1 General

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

2.2 Intended use

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

2.3 Personnel qualification and training

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

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

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

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

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 shutting down 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 6.1.5, Page 32) (⇒ Section 6.3, Page 35)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3, Page 41)
- 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 29)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection



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

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

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

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇒ Section 2.9.1, Page 10) to (⇒ Section 2.9.4, Page 11)

The explosion-proof status is only assured if the product is used in accordance with its intended use.

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

Prevent impermissible modes of operation at all times.

2.9.1 Marking

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 used 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).

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 flows indicated in (⇒ Section 6.2.3.1, Page 34) 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 34) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

1213.8/22-EN

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

	<div style="background-color: #e67e22; color: white; padding: 5px;">! DANGER</div> <p>The pump (set) could slip out of the suspension arrangement Danger to life from falling parts!</p> <ul style="list-style-type: none"> ▷ Always transport the pump (set) in the specified position. ▷ Never attach the suspension arrangement to the free shaft end or the motor eyebolt. ▷ Observe the information 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.
	<div style="background-color: #f1c40f; color: black; padding: 5px;">CAUTION</div> <p>Incorrect transport of the pump Damage to the shaft seal!</p> <ul style="list-style-type: none"> ▷ For transport, lock the pump shaft with a suitable transport lock to prevent any movement of the shaft.

Transport lock consisting of locking bolts

This type of transport lock is used for the following pump sizes:

050-025-125.1	050-032-125.1	065-040-125
050-025-125	050-032-125	065-040-160
050-025-160	050-032-160	065-040-200
050-025-200	050-032-200	065-050-125
		065-050-160

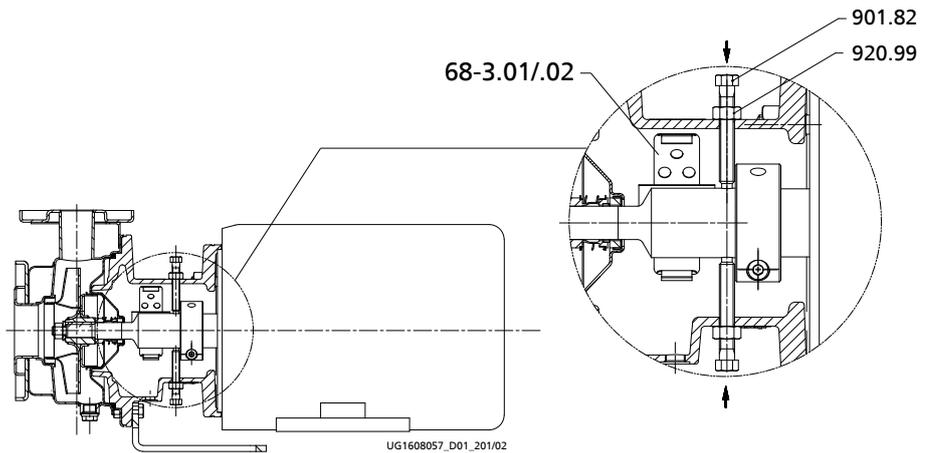


Fig. 1: Fitting the transport lock

901.82	Hexagon head bolt	920.99	Hexagon nut
68-3.01/.02	Cover plate		

1. Remove cover plates 68-3.01/.02 from drive lantern 341.
2. Undo hexagon nuts 920.99.
3. Screw both hexagon head bolts 901.82 evenly into the shaft bore and tighten them.
4. Tighten hexagon nuts 920.99 against the drive lantern.
5. Fit cover plates 68-3.01/.02.

Transport lock consisting of lock washers

This type of transport lock is used for the following pump sizes:

- | | | | |
|-------------|-------------|-------------|-------------|
| 050-025-250 | 065-040-250 | 080-065-200 | 100-080-200 |
| 050-032-250 | 065-050-200 | 080-065-250 | 100-080-250 |
| | 065-050-250 | | |

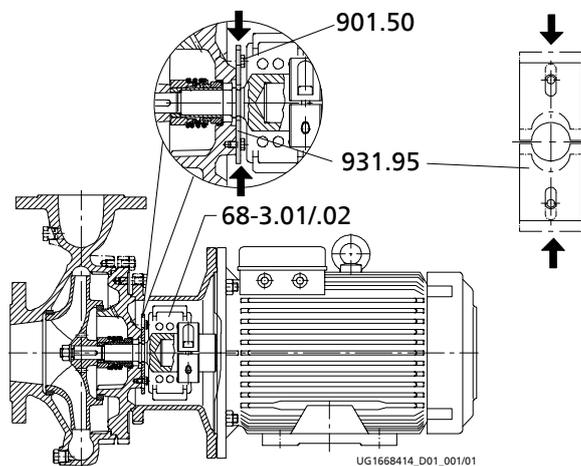


Fig. 2: Fitting the lock washers

901.50	Hexagon head bolt	931.95	Lock washer
68-3.01/.02	Cover plate		

1. Remove cover plates 68-3.01/.02 from drive lantern 341.
2. Undo hexagon head bolts 901.50.
3. Insert lock washers 931.95 into the shaft groove.
4. Tighten hexagon head bolts 901.50.
5. Fit cover plates 68-3.01/.02.

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

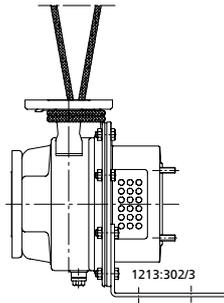


Fig. 3: Transporting the pump

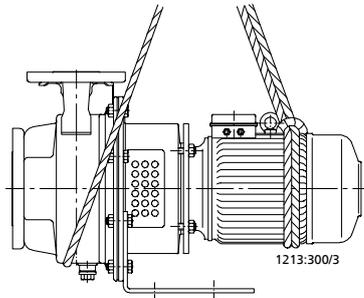


Fig. 4: Transporting the pump set with pump foot

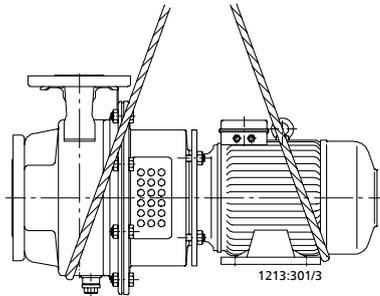


Fig. 5: Transporting the pump set with motor foot

3.3 Storage/preservation

	<p style="background-color: yellow; margin: 0;">CAUTION</p> <p>Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the pump (set)!</p> <ul style="list-style-type: none"> ▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.
	<p style="background-color: yellow; margin: 0;">CAUTION</p> <p>Wet, contaminated or damaged openings and connections Leakage or damage to the pump!</p> <ul style="list-style-type: none"> ▷ 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 35)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 41)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 11, Page 74)

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

3.5 Disposal

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

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

4 Description of the Pump (Set)

4.1 General description

- Close-coupled pump with shaft seal
- Handling clean or aggressive fluids not chemically and mechanically aggressive to the pump materials.

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

- Minimum efficiency index: see name plate, key to name plate (⇒ Section 4.4, Page 18)
- The benchmark for the most efficient water pumps is $MEI \geq 0.70$.
- Year of construction: see name plate, key to name plate (⇒ Section 4.4, Page 18)
- Manufacturer's name or trade mark, commercial registration number and place of manufacture: see data sheet or order documentation
- Product's type and size identifier: see name plate, key to name plate (⇒ Section 4.4, Page 18)
- Hydraulic pump efficiency (%) with trimmed impeller: see data sheet
- Pump performance curves, including efficiency characteristics: see documented characteristic curve
- The efficiency of a pump with a trimmed impeller is usually lower than that of a pump with full impeller diameter. Trimming of the impeller will adapt the pump to a fixed duty point, leading to reduced energy consumption. The minimum efficiency index (MEI) is based on the full impeller diameter.
- Operation of this water pump with variable duty points may be more efficient and economic when controlled, for example, by the use of a variable speed drive that matches the pump duty to the system.
- Information on dismantling, recycling and disposal after decommissioning: (⇒ Section 3.5, Page 15)
- Information on benchmark efficiency or benchmark efficiency graph for $MEI = 0.70$ (0.40) for the pump based on the model shown in the Figure are available at: <http://www.europump.org/efficiencycharts>

4.3 Designation

Table 5: Designation example

Position																																											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
E	T	C	B	0	5	0	-	0	2	5	-	1	2	5		C	C	S	A	A	0	7	D	1	0	1	0	0	2	e	x	B	P	D	2		M	K	S	B	I	E	4
See name plate and data sheet																																		See data sheet									

Table 6: Designation key

Position	Code	Description
1-4	Pump type	
	ETCB	Etachrom B
	ETCF	Etachrom B bottle rinser variant
5-16	Size, e.g.	
	050	Nominal suction nozzle diameter [mm]
	025	Nominal discharge nozzle diameter [mm]
	125	Nominal impeller diameter [mm]
16	F	Etachrom B with free-flow impeller (size 065-050-125 only)
17	Pump casing material	

Position	Code	Description	
17	C	Stainless steel	1.4571
18	Impeller material		
	C	Stainless steel	1.4571/1.4408
19	Design		
	E	Materials in contact with food to Regulation (EC) 1935/2005	
	F	Bottle rinser variant	
	H	Approved for drinking water to ACS	
	K	Approved for drinking water to KSB standard	
	U	Approved for drinking water to UBA	
	S	Standard	
	W	Approved for drinking water to WRAS	
X	Non-standard (BT3D, BT3)		
20-21	Casing cover		
	AA	Internal circulation (seal chamber only)	
	AS	Internal circulation (seal chamber only), casing cover with anti-swirl baffles	
	AV	Vented seal chamber	
	EA	External circulation	
	ES	External circulation, casing cover with anti-swirl baffles	
	FA	External flushing	
	FS	External flushing, casing cover with anti-swirl baffles	
22-23	Seal code, single mechanical seal		
	01	Q1Q1VGG	1A (ZN1181)
	07	Q1Q1EGG	1A (ZN1181)
	09	U3U3VGG	MG13G60
	10	Q1Q1X4GG	1 (ZN1181)
	11	BQ1EGG-WA (WA = drinking water)	1 (ZN1181)
	12	Q12Q1M1GG1	M37GN83
	17	Q1BVGG	M7N
	26	XYHY2VY	Roten Uniten 3
	45	BQ7E1GG/Y10	KU 022 S0 - eMG12G6
	46	Q7Q7E1GG/Y10	KU 022 S0 - eMG12G6
	66	Q7Q7EGG/Y10-WA	eMG13G6
	67	Q6Q6X4GG	MG13G60
	68	BQ7V16GG/Y10	KU 022 S0 - eMG12G6
	69	Q7Q7V16GG/Y10	KU 022 S0 - eMG12G6
24	Scope of supply		
	A	Pump, without motor (figure 0 bare-shaft pump)	
	D	Pump, motor	
25	Shaft unit		
	1	Shaft unit 25.1	
	2	Shaft unit 25.2	
	3	Shaft unit 35	
26-29	Motor rating P_N [kW]		
	0750	7,50	
	
	0300	30,00	
30	Number of motor poles		
31-32	Explosion protection		

Position	Code	Description
31-32	ex	With explosion-proof motor
	--	Without explosion-proof motor
33	Product generation	
	B	Etachrom B 2015
34-37	PumpDrive	
	PD2	PumpDrive 2
	PD2E	PumpDrive 2 Eco
38	PumpMeter	
	M	PumpMeter
39-41	Motor manufacturer	
	KSB	KSB
	SIE	Siemens
	LOH	Loher
	HAL	Halter
42-44	Efficiency class	

4.4 Name plate



Fig. 6: Etachrom B name plate (example)

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

4.5 Design details

Design

- Design with materials to Regulation (EC) No. 1935/2004 can be provided.
- Design to ATEX

Design

- Circular casing pumps
- Close-coupled design
- Back pull-out design
- Flanges to EN 1092-1
- Horizontal installation
- Single-stage
- Dimensions and ratings to EN 733
- Rigid connection between pump and motor
- Pump and motor connected by a stub shaft

Pump casing

- Circular casing
- Replaceable casing wear rings

Installation

- Pump foot
- Motor foot
- Foot base with vertically adjustable ball feet
- Foot base with vertically adjustable machine mounts

Drive

Standard design:

- KSB/Siemens surface-cooled IEC frame three-phase squirrel-cage motor
- Rated voltage (50 Hz) 220-240 V / 380-420 V \leq 2.20 kW
- Rated voltage (50 Hz) 380-420 V / 660 - 725 V \geq 3.00 kW
- Rated voltage (60 Hz) 440-480 V \leq 2.60 kW
- Rated voltage (60 Hz) 440-480 V \geq 3.60 kW
- Type of construction IM V1 \leq 4.00 kW
- Type of construction IM V15 \geq 5.50 kW
- Enclosure IP55
- Duty type: continuous duty S1
- Thermal class F
- 3 PTC thermistors

or

- KSB surface-cooled IEC frame three-phase current squirrel-cage motor as described above, but West European make to our choice

or

Explosion-proof design:

- Surface-cooled IEC three-phase current squirrel-cage motor
- Rated voltage (50 Hz) 220 - 240 V / 380 - 420 V \leq 1.85 kW
- Rated voltage (50 Hz) 380 - 420 V / 660 - 725 V \geq 2.50 kW
- Type of construction IM V1 \leq 3.30 kW
- Type of construction IM V15 \geq 4.60 kW
- Enclosure IP55 or IP54
- 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

- Single mechanical seal to EN 12756
- The shaft is fitted with a replaceable shaft sleeve in the shaft seal area (sizes 080-065-250, 100-080-200, 100-080-250)

Impeller type

- Closed radial impeller with multiply curved vanes
- Free-flow impeller

Automation

Automation options:

- PumpDrive
- PumpMeter

4.6 Design and function

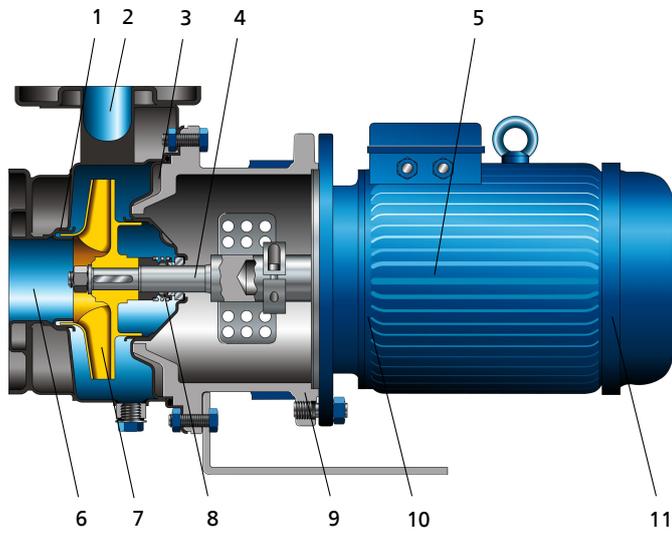


Fig. 7: Sectional drawing

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

Design The pump is designed with an axial fluid inlet and a radial outlet. The hydraulic system is rigidly connected with the motor via a stub shaft coupling or has a common shaft with the motor.

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. At the rear side of the impeller, the shaft (4) enters the casing via the casing cover (3). The shaft passage through the cover is sealed to atmosphere with a dynamic shaft seal (8). The shaft runs in rolling element bearings (10 and 11), which are supported by a motor housing (5) linked with the pump casing and/or casing cover (3) via the drive lantern (9).

Sealing The pump is sealed by a standardised mechanical seal.

4.7 Noise characteristics

Table 7: Surface sound pressure level L_{pA} ^{3) 4)}

Rated power input P_N	Pump set	
	1450 rpm	2900 rpm
[kW]	[dB]	[dB]
0,55	55	64
0,75	57	64
1,1	60	64
1,5	60	69
2,2	64	69
3	64	71
4	62	73
5,5	68	72
7,5	68	72
11	69	75
15	69	75
18,5	70	75
22	-	78
30	-	79
37	-	79
45	-	79

4.8 Scope of supply

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

- Pump
- Surface-cooled IEC three-phase current squirrel-cage motor
- Cover plates at drive lantern to EN 294

4.9 Dimensions and weights

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

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

⁴⁾ Increase for 60 Hz operation: 3500 rpm +3 dB, 1750 rpm +1 dB

5 Installation at Site

5.1 Checks to be carried out prior to installation

Place of installation

	⚠ WARNING
	<p>Installation on mounting surface which is unsecured and cannot support the load Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1. ▷ The mounting surface must be set, flat, and level. ▷ 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 Setting up the pump set

	⚠ DANGER
	<p>Static charging due to insufficient potential equalisation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure that the connection between pump and baseplate is electrically conductive.

	CAUTION
	<p>Ingress of leakage into the motor Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Never install the pump set with the "motor below".

Fastening

See examples of installation types (⇒ Section 9.1, Page 59)

Table 8: Fastening

Motor rating	Type of fastening
Up to 7.5 kW (with explosion protection up to 4.6 kW)	<p>Horizontal installation:</p> <ul style="list-style-type: none"> ▪ Up to 4 kW, fix in place using the support foot or by suspending in the piping (remove the support foot). ▪ From 4 kW to 7.5 kW, fix in place using the motor foot or by suspending in the piping. <p>Vertical installation:</p> <ul style="list-style-type: none"> ▪ Up to 4 kW, fix in place using the support foot. ▪ From 4 kW to 7.5 kW, fix in place using the motor foot.
From 11 kW to 45 kW	Fix in place using the motor foot.

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	NOTE
	For installation on a foundation, shim the motor feet from motor size 132.

1. Position the pump set on the foundation and fasten it (see the Fastening table).
2. Place a spirit level on the discharge nozzle to align the pump set.

5.3 Piping

5.3.1 Connecting the piping

	! DANGER
	<p>Impermissible loads acting on the pump nozzles Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> ▷ Do not use the pump as an anchorage point for the piping. ▷ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains. ▷ Take appropriate measures to compensate for thermal expansion of the piping.

	CAUTION
	<p>Incorrect earthing during welding work at the piping Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> ▷ Never earth the electric welding equipment on the pump or baseplate. ▷ Prevent current flowing through the rolling element bearings.

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

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least twice the inside diameter of the suction flange has been provided upstream of the suction flange.
- ✓ The nominal diameters of the pipelines are equal to or greater than the nominal diameters of the pump nozzles.
- ✓ 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 and discharge nozzles of the pump.

	CAUTION
	<p>Welding beads, scale and other impurities in the piping Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Remove any impurities from the piping. ▷ If necessary, install a filter. ▷ Observe the information in (⇒ Section 7.2.2.2, Page 40) .

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).

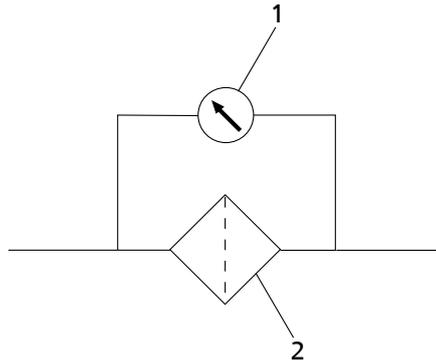


Fig. 8: Filter in the piping

1	Differential pressure gauge	2	Filter
---	-----------------------------	---	--------

	NOTE
	<p>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.</p>

5. Connect the pump nozzles to the piping.

	CAUTION
	<p>Aggressive flushing liquid and pickling agent Damage to the pump!</p> <ul style="list-style-type: none"> ▷ 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

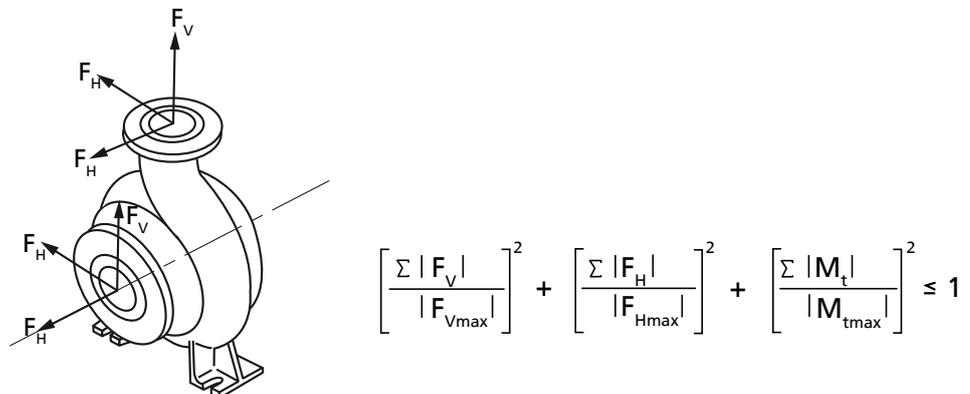


Fig. 9: Forces and moments at the pump nozzles

The following condition must be met:

$\sum|F_V|$, $\sum|F_H|$, and $\sum|M_i|$ are the sums of the absolute values of the respective loads acting on the nozzles. Neither the load direction nor the load distribution among the nozzles are taken into account in these sums.

Table 9: Forces and moments at the pump nozzles⁵⁾

Size	F_{Vmax}	F_{Hmax}	M_{tmax}
	[kN]	[kN]	[kNm]
050-025-125.1	2,6	1,8	0,55
050-025-125	2,6	1,8	0,55
050-025-160	2,5	1,7	0,5
050-025-200	2,5	1,7	0,5
050-025-250	2,5	1,7	0,5
050-032-125.1	2,6	1,8	0,55
050-032-125	2,6	1,8	0,55
050-032-160	2,5	1,7	0,5
050-032-200	2,5	1,7	0,5
050-032-250	2,5	1,7	0,5
065-040-125	2,6	1,8	0,6
065-040-160	2,6	1,8	0,6
065-040-200	2,6	1,8	0,6
065-040-250	2,6	1,8	0,6
065-050-125	2,7	2,0	0,75
065-050-160	2,7	1,9	0,7
065-050-200	2,7	1,9	0,7
065-050-250	2,7	1,9	0,7
080-065-200	3,0	2,2	0,85
080-065-250	3,2	2,4	1,05
100-080-200	4,0	2,9	1,45
100-080-250	4,0	2,9	1,45

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.

⁵⁾ The indicated values apply to pumps made of chrome nickel molybdenum steel 1.4571 on non-grouted baseplates.

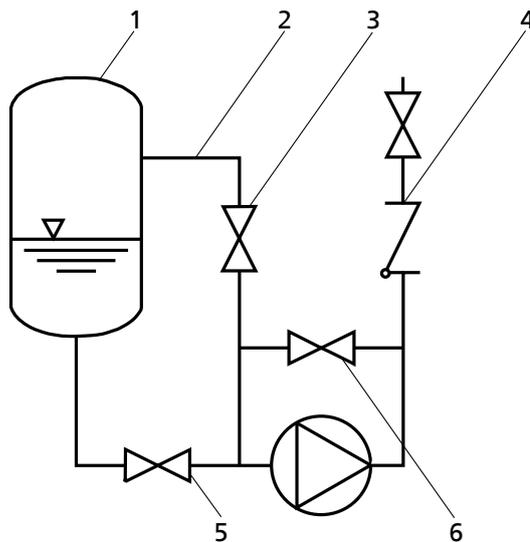


Fig. 10: Vacuum balance system

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
	<p>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.</p>

5.4 Enclosure/insulation

	⚠ DANGER
	<p>Explosive atmosphere forming due to insufficient venting Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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
	<p>The volute casing and casing/discharge cover take on the same temperature as the fluid handled Risk of burns!</p> <ul style="list-style-type: none"> ▷ Insulate the volute casing. ▷ Fit protective equipment.

	CAUTION
	<p>Heat build-up inside the drive lantern Damage to the bearing!</p> <ul style="list-style-type: none"> ▷ Never insulate the casing cover and the drive lantern.

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5.5 Electrical connection

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

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

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

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

5.5.1 Setting the time relay

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

Table 10: Time relay settings for star-delta starting:

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

5.5.2 Earthing

	⚠ DANGER
	<p>Electrostatic charging Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Connect the PE conductor to the earthing terminal provided.

5.5.3 Connecting the motor

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

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

5.6 Checking the direction of rotation

	⚠ DANGER
	<p>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.</p>

	⚠ WARNING
	<p>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.</p>

	CAUTION
	<p>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.</p>

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.

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

	CAUTION
	<p>Transport lock Damage to the shaft!</p> <p>▶ Remove the transport lock. (⇒ Section 6.1.1.1, Page 29)</p>

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

- The pump set has been mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇒ Section 5.5, Page 27)
- The pump has been primed with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked. (⇒ Section 5.6, Page 28)
- 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 35)

6.1.1.1 Removing the transport lock

Transport lock consisting of locking bolts

This type of transport lock is used for the following pump sizes:

050-025-125.1	050-032-125.1	065-040-125
050-025-125	050-032-125	065-040-160
050-025-160	050-032-160	065-040-200
050-025-200	050-032-200	065-050-125
		065-050-160

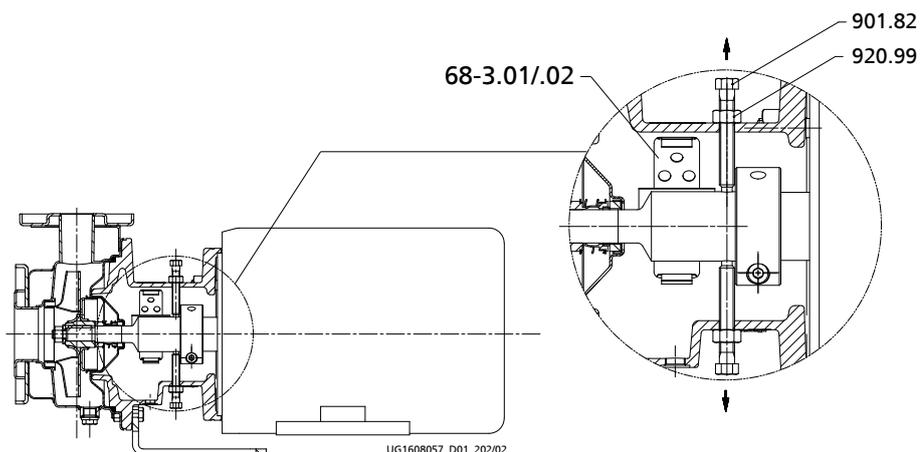


Fig. 11: Removing the transport lock

901.82	Hexagon head bolt	920.99	Hexagon nut
68-3.01/02	Cover plate		

1. Remove cover plates 68-3.01/02 from drive lantern 341.
2. Loosen both hexagon head bolts 901.82 of the transport lock in the drilled holes of the shaft by at least 4 turns.

3. Secure both hexagon head bolts by locking hexagon nuts 920.99.
4. Fit cover plates 68-3.01/02.

Transport lock consisting of lock washers

This type of transport lock is used for the following pump sizes:

050-025-250	065-040-250	080-065-200	100-080-200
050-032-250	065-050-200	080-065-250	100-080-250
	065-050-250		

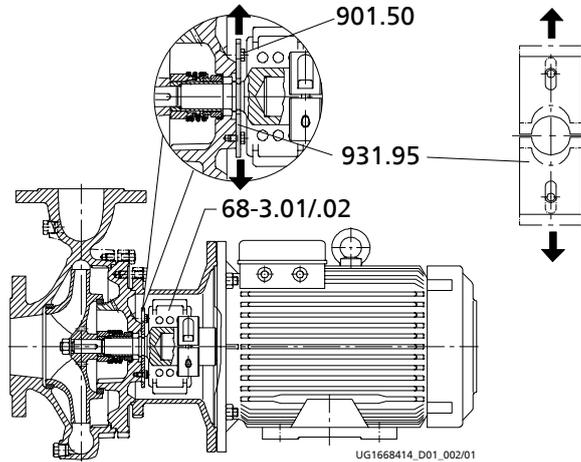


Fig. 12: Removing the lock washers

901.50	Hexagon head bolt	931.95	Lock washer
68-3.01/02	Cover plate		

1. Remove cover plates 68-3.01/02 from drive lantern 341.
2. Undo hexagon head bolts 901.50.
3. Pull lock washers 931.95 of the transport lock out of the stub shaft groove and secure them with hexagon head bolts 901.50.
4. Fit cover plates 68-3.01/02.

6.1.2 Priming and venting the pump

	<p>⚠ DANGER</p>
	<p>Risk of potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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.

	CAUTION
	<p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.

1. Vent the pump and suction line and prime both with the fluid to be handled. For vertical installation with the motor on top, use connection 5B (if provided) for venting (see drawing of auxiliary connections and (⇒ Section 9.1, Page 59) .
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any.
4. Open the shut-off valve (3), if any, in the vacuum balance line (2) and close the vacuum-tight shut-off valve (6), if any. (⇒ Section 5.3.3, Page 25)

	NOTE
	<p>For design-inherent reasons some unfilled volume in the hydraulic system cannot be excluded after the pump has been primed for commissioning/start-up. However, once the motor is started up the pumping effect will immediately fill this volume with the fluid handled.</p>

6.1.3 Start-up

	⚠ DANGER
	<p>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!</p> <ul style="list-style-type: none"> ▷ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed. ▷ Only start up the pump set with the discharge-side shut-off element slightly or fully open.

	⚠ DANGER
	<p>Excessive temperatures due to dry running or excessive gas content in the fluid handled Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Prime the pump as per operating instructions. ▷ Always operate the pump within the permissible operating range.

	CAUTION
	<p>Abnormal noises, vibrations, temperatures or leakage Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Switch off the pump (set) immediately. ▷ Eliminate the causes before returning the pump set to service.

- ✓ 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 pumped.
- ✓ The lines for priming and venting have been closed.

	CAUTION
	<p>Start-up against open discharge line Motor overload!</p> <ul style="list-style-type: none"> ▷ 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 comply with the duty point.

6.1.4 Checking the shaft seal

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

6.1.5 Shutdown

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

- ✓ The shut-off valve in the suction line is and remains open.
1. Close the shut-off valve in the discharge line.
 2. Switch off the motor and make sure the pump set runs down smoothly to a standstill.

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

- For prolonged shutdown periods:
1. Close the shut-off valve in the suction line.
 2. Close the auxiliary connections.

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

6.2 Operating limits

	! DANGER
	<p>Non-compliance with operating limits for pressure, temperature, fluid handled and speed Explosion hazard! Hot or toxic fluid could escape!</p> <ul style="list-style-type: none"> ▸ 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
	<p>Formation of a potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▸ When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring).

6.2.1 Ambient temperature

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

Observe the following parameters and values during operation:

Table 11: Permissible ambient temperatures

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

6.2.2 Frequency of starts

	! DANGER
	<p>Excessive surface temperature of the motor Explosion hazard! Damage to the motor!</p> <ul style="list-style-type: none"> ▸ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.

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The frequency of starts is usually determined by the maximum temperature increase of the motor. This largely depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL, star-delta, moments of inertia, etc). If the starts are evenly spaced over the period indicated, the pump set can be started up six times per hour (h) with the discharge-side gate valve slightly open.

	CAUTION
	<p>Re-starting while motor is still running down Damage to the pump (set)!</p> <ul style="list-style-type: none"> ▷ 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 12: Flow rate

Temperature range (t)	Minimum flow rate	Maximum flow rate
-30 to +70 °C	≈ 15 % of Q _{BEP} ⁶⁾	See hydraulic curves
> 70 to +110 °C	≈ 25 % of Q _{BEP} ⁶⁾	

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 13: 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	-
Δϑ	Temperature difference	K

6.2.3.2 Density of the fluid handled

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

	CAUTION
	<p>Impermissibly high density of the fluid handled Motor overload!</p> <ul style="list-style-type: none"> ▷ 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.

⁶⁾ Best efficiency point

The fluid handled may contain abrasive particles up to a maximum content of 5 g/dm³ and a maximum particle size of 0.5 mm.

 	 DANGER
	<p>Abraded casing wall Explosion hazard!</p> <ul style="list-style-type: none"> ▸ Use a pump with anti-swirl baffle. ▸ Adjust the inspection intervals to the increased abrasion. ▸ For combustible fluids: The fluids must not contain any abrasive particles.

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 piping and stored

- ✓ The pump has been properly drained. (⇒ Section 7.3, Page 41)
- ✓ The safety instructions for dismantling the pump have been observed. (⇒ Section 7.4.1, Page 41)
- ✓ 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, do not preserve the wetted components made of alloy materials.

Observe any additional instructions and information provided. (⇒ Section 3, Page 12)

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 29) (⇒ Section 6.2, Page 33)

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

	 WARNING
	<p>Failure to re-install or re-activate protective devices Risk of injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> ▸ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.



NOTE

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

7 Servicing/Maintenance

7.1 Safety regulations

	DANGER
	<p>Sparks produced during servicing work Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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
	<p>Improperly serviced pump set Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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
	<p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

	DANGER
	<p>Improper cleaning of coated pump surfaces Explosion hazard by electrostatic discharge!</p> <ul style="list-style-type: none"> ▷ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.

	WARNING
	<p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury!</p> <ul style="list-style-type: none"> ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.

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

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

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

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/Inspection

7.2.1 Supervision of operation

	<p>⚠ DANGER</p>
	<p>Risk of potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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.

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

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

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

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 6.1.4, Page 32)
- 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
	<p>Operation outside the permissible bearing temperature Damage to the pump!</p> <ul style="list-style-type: none"> ▷ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the motor housing).

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

7.2.2 Inspection work

	<p>⚠ DANGER</p>
<p>Excessive temperatures caused by friction, impact or frictional sparks Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Regularly check the coupling guard, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts. 	
	<p>⚠ DANGER</p>
<p>Static charging due to insufficient potential equalisation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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.

(⇒ Section 7.4.6, Page 45)

If the clearance is larger than permitted, fit a new casing wear ring 502.01 and/or 502.02 and/or 502.06 (WS35).

The clearances given refer to the diameter.

Table 14: Clearances between impeller and casing [mm]

Size	Suction side	Pressure side	Nominal impeller diameter [mm]			
			125	160	200	250
25	X	-	0,6	0,6	0,6	0,5
	-	X	-	-	0,5	0,5
32	X	-	0,6	0,6	0,6	0,5
	-	X	-	-	0,5	0,5
40	X	-	0,6	0,6	0,6	0,5
	-	X	-	0,5	0,5	0,5
50 ⁷⁾	X	-	0,6	0,6	0,5	0,5
	-	X	-	0,5	0,5	0,5
65	X	-	-	-	0,5	0,5
	-	X	-	-	0,5	0,5
80	X	-	-	-	0,5	0,5
	-	X	-	-	0,5	0,5

Maximum permissible enlargement: 1.2 mm

7.2.2.2 Cleaning filters

	<p>CAUTION</p>
<p>Insufficient inlet pressure due to clogged filter in the suction line Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge). ▷ Clean filter at appropriate intervals. 	

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⁷ For design-inherent reasons, Etachrom B 065-050-125 with free-flow impeller does not have any impeller clearances.

7.3 Drainage/cleaning

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

1. Use connection 6B to drain the fluid handled (see drawing of auxiliary connections).
2. Always flush the system if it has been used for handling noxious, explosive, hot or other hazardous fluids.
Always flush and clean the pump before transporting it to the workshop.
Provide a certificate of decontamination for the pump. (⇒ Section 11, Page 74)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

	<p>⚠ DANGER</p>
	<p>Insufficient preparation of work on the pump (set)</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▷ Properly shut down the pump set. (⇒ Section 6.1.5, Page 32) ▷ Close the shut-off elements in the suction line and discharge line. ▷ Drain the pump and release the pump pressure. (⇒ Section 7.3, Page 41) ▷ Shut off any auxiliary connections. ▷ Allow the pump set to cool down to ambient temperature.

	<p>⚠ WARNING</p>
	<p>Unqualified personnel performing work on the pump (set)</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.

	<p>⚠ WARNING</p>
	<p>Hot surface</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▷ Allow the pump set to cool down to ambient temperature.

	<p>⚠ WARNING</p>
	<p>Improper lifting/moving of heavy assemblies or components</p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

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

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

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

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

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

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

7.4.2 Preparing the pump set

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

7.4.3 Dismantling the complete pump set

	NOTE
	<p>The pump casing can remain installed in the piping for further dismantling.</p>

✓ The notes and steps stated in (⇒ Section 7.4.1, Page 41) to (⇒ Section 7.4.2, Page 42) 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.

7.4.4 Removing the motor

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

Transport lock consisting of locking bolts

This type of transport lock is used for the following pump sizes:

050-025-125.1	050-032-125.1	065-040-125
050-025-125	050-032-125	065-040-160
050-025-160	050-032-160	065-040-200
050-025-200	050-032-200	065-050-125
		065-050-160

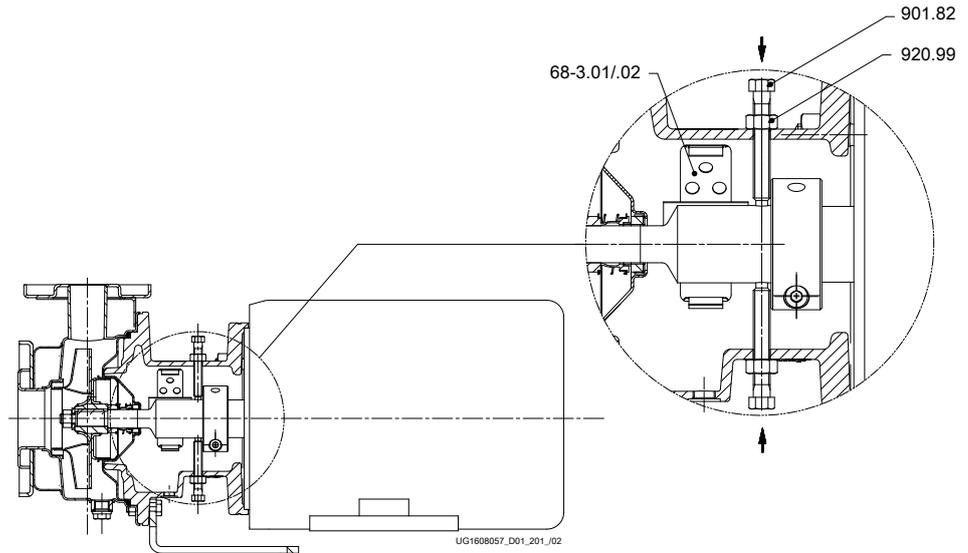


Fig. 13: Fitting the transport lock

68-3.01/02	Cover plate	901.82	Hexagon head bolts
		920.99	Hexagon nut

✓ The notes and steps stated in (⇒ Section 7.4.1, Page 41) to (⇒ Section 7.4.3, Page 42) have been observed/carried out.

1. Remove cover plates 68-3.01/02 from drive lantern 341.
2. Undo hexagon nuts 920.99.
3. Screw both hexagon head bolts 901.82 evenly into the shaft bores and tighten them.
4. Tighten hexagon nuts 920.99 at the drive lantern and secure the bolts of the transport lock with two nuts each.
5. Undo socket head cap screw 914.24 of locking ring 515 on shaft 210.
6. Undo hexagon nuts 920.11.
7. Remove the motor.

Transport lock consisting of lock washers

This type of transport lock is used for the following pump sizes:

050-025-250	065-040-250	080-065-200	100-080-200
050-032-250	065-050-200	080-065-250	100-080-250
	065-050-250		

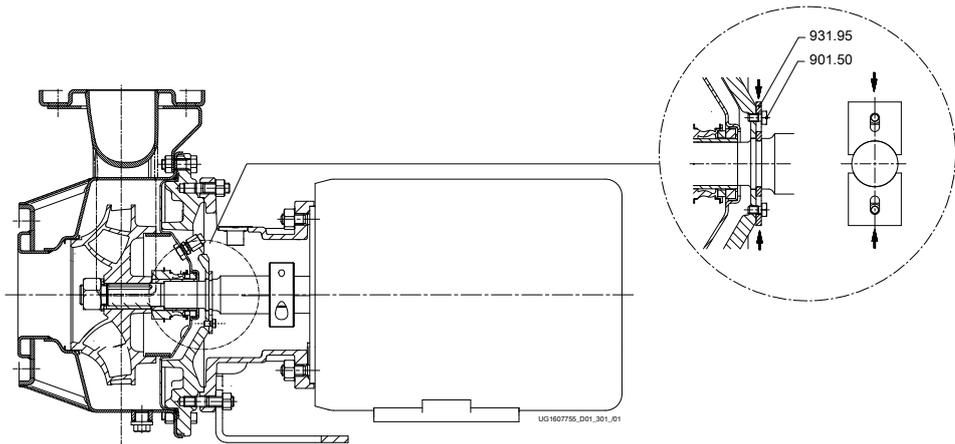


Fig. 14: Fitting the transport lock

901.50	Hexagon head bolts	931.95	Lock washer
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✓ The notes and steps stated in (⇒ Section 7.4.1, Page 41) to (⇒ Section 7.4.3, Page 42) have been observed/carried out.

1. Remove cover plates 68-3.01/02 from drive lantern 341.

	CAUTION
	<p>Back pull-out unit knocking against the pump casing Damage to the shaft/back pull-out unit!</p> <p>▷ With the motor removed, slide lock washers 931.95 into the shaft groove.</p>

2. Insert both lock washers 931.95 into the groove in shaft 210. (⇒ Section 7.5.5, Page 48)
3. Tighten hexagon head bolts 901.50.
4. Undo socket head cap screw 914.24 of locking ring 515 on shaft 210.
5. Undo hexagon nuts 920.11.
6. Remove the motor.

7.4.5 Removing the back pull-out unit

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

✓ The notes and steps stated in (⇒ Section 7.4.1, Page 41) to (⇒ Section 7.4.4, Page 42) have been observed/carried out.

1. Secure the back pull-out unit against tipping over, if required, e.g. by supporting or suspending it.
2. Undo hexagon nut 920.01 and bolts 901.99 at the pump casing.
3. Pull the back pull-out unit out of the volute casing.
4. Remove and dispose of O-ring 412.35.
5. Place the back pull-out unit on a clean and level surface.

7.4.6 Dismantling the impeller

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 41) to (⇒ Section 7.4.5, Page 44) 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) and remove safety device 930.95.
 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 Dismantling the mechanical seal

Procedure for the following sizes

050-025-125.1	050-032-125.1	065-040-125	065-050-125	080-065-200
050-025-125	050-032-125	065-040-160	065-050-160	
050-025-160	050-032-160	065-040-200	065-050-200	
050-025-200	050-032-200	065-040-250	065-050-250	
050-025-250	050-032-250			

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 41) to (⇒ Section 7.4.6, Page 45) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
- ✓ Impeller 230 has been removed.
 1. Pull mechanical seal 433 off shaft 210 by hand.
 2. Remove discharge cover 163 from drive lantern 341 or from intermediate piece 132.01.
 3. Remove the stationary assembly of the mechanical seal (mating ring) from discharge cover 163.

Procedure for the following sizes

080-065-250	100-080-200
	100-080-250

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 41) to (⇒ Section 7.4.6, Page 45) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
 1. Remove shaft sleeve 523 with the rotating assembly of the mechanical seal (primary ring) from shaft 210.
 2. Remove the rotating assembly of the mechanical seal (primary ring) from shaft sleeve 523.
 3. Remove discharge cover 163 from intermediate piece 132.01.
 4. Remove the stationary assembly of the mechanical seal (mating ring) from discharge cover 163.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

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

Sequence Always re-assemble 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. Make sure that new gaskets 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 Eppe 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 Installing the mechanical seal

Installing the mechanical seal

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

- Work cleanly and accurately.
 - Only remove the protective wrapping of the contact faces immediately before installation takes place.
 - Prevent any damage to the sealing surfaces or O-rings.
 - ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 46) have been observed or carried out.
 - ✓ The bearing assembly as well as the individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Clean the mating ring location in discharge cover 163.

	CAUTION
	<p>Elastomers in contact with oil/grease Shaft seal failure!</p> <ul style="list-style-type: none"> ▷ Use water as assembly lubricant. ▷ Never use oil or grease as assembly lubricant.

2. Carefully insert the mating ring.
Make sure to apply pressure evenly.

	NOTE
	<p>Fit the double PTFE encapsulated O-ring with the joint of the outer sheath pointing outwards.</p>

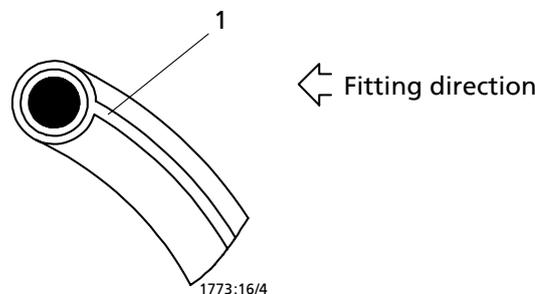


Fig. 15: PTFE encapsulated O-ring

1	Joint of the outer PTFE sheath
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3. Fit discharge cover 163 in the locating surface of drive lantern 341 or intermediate piece 132.01.
4. Clean shaft sleeve 523 and shaft 210, and touch up any score marks or scratches with a polishing cloth.
If score marks or scratches are still visible, replace shaft sleeve 523 and shaft 210 (shaft sleeve only for pump sizes 080-065-250, 100-080-200 and 100-080-250).
5. Guide shaft sleeve 523 with new gasket 400.75 onto shaft 210 (shaft sleeve and gasket only for pump sizes 080-065-250, 100-080-200 and 100-080-250).

	NOTE
	<p>To reduce friction forces when assembling the mating, wet the shaft sleeve and the mating ring location with water.</p>

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6. Fit the rotating assembly of the mechanical seal (primary ring) on shaft sleeve 523 or shaft 210.

7.5.3 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 46) to (⇒ Section 7.5.2, Page 47) have been observed or 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. Slip impeller 230 onto shaft 210.
 2. Fasten impeller nut 920.95 and safety device 930.95 to the tightening torques indicated.

7.5.4 Installing the back pull-out unit

	 WARNING
	<p>Back pull-out unit tilting Risk of squashing hands and feet!</p> <ul style="list-style-type: none"> ▷ Suspend or support the back pull-out unit at the pump end.

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 46) to (⇒ Section 7.5.3, Page 48) have been observed or carried out.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Secure the back pull-out unit against tipping over, if required, e.g. by supporting or suspending it.
 2. Fit new O-ring 412.35 on discharge cover 163.
 3. Insert the back pull-out unit into pump casing 101.
 4. Fasten the back pull-out unit to pump casing 101 with hexagon nut 920.01 and hexagon head bolt 901.99. (⇒ Section 7.6, Page 51)
 5. Depending on the pump size and motor size, fit pump foot 183.

7.5.5 Mounting the motor

	 DANGER
	<p>Incorrect shaft connection Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Connect the shafts between pump and motor as described in this manual.

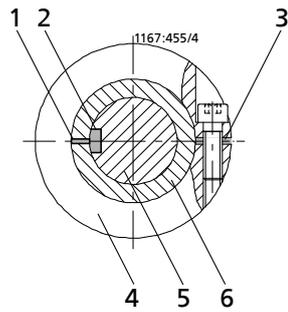


Fig. 16: Fitting the motor shaft stub on the shaft

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

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. The slot of locking ring 515 must be located opposite. (See illustration: Fitting the motor stub shaft on the shaft.)
2. Tighten hexagon socket head cap screw 914.24 as indicated in the Tightening torques table.

Transport lock consisting of locking bolts

This type of transport lock is used for the following pump sizes:

050-025-125.1	050-032-125.1	065-040-125
050-025-125	050-032-125	065-040-160
050-025-160	050-032-160	065-040-200
050-025-200	050-032-200	065-050-125
		065-050-160

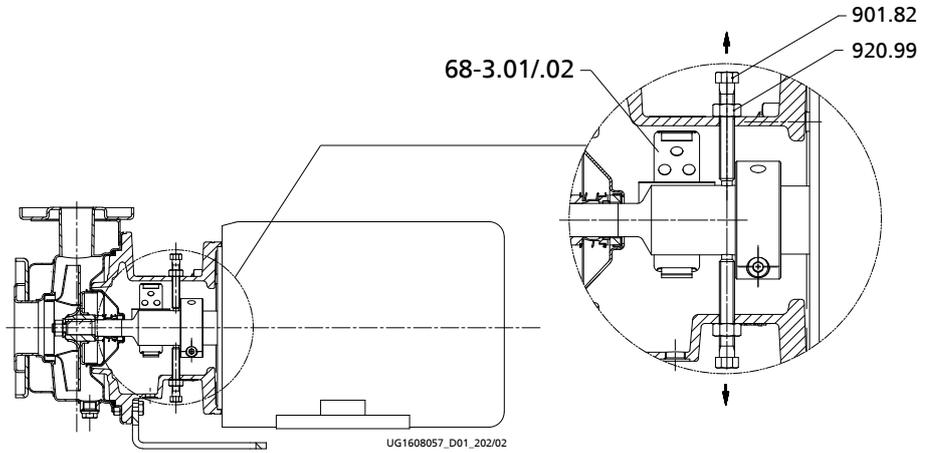


Fig. 17: Removing the transport lock

901.82	Hexagon head bolt	920.99	Hexagon nut
68-3.01/02	Cover plate		

1. Loosen all hexagon head bolts 901.82 of the transport lock in the drilled holes of the shaft by at least 4 turns.
2. Secure both hexagon head bolts by locking hexagon nuts 920.99.
3. Fit cover plates 68-3.01/02.

Transport lock consisting of lock washers

This type of transport lock is used for the following pump sizes:

050-025-250	065-040-250	080-065-200	100-080-200
050-032-250	065-050-200	080-065-250	100-080-250
	065-050-250		

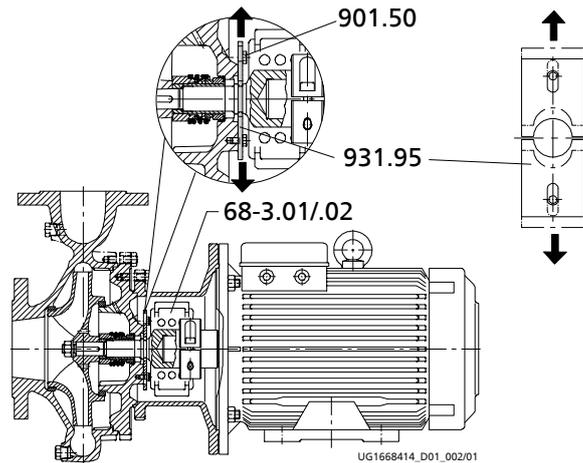


Fig. 18: Removing the lock washers

901.50	Hexagon head bolt	931.95	Lock washer
68-3.01/02	Cover plate		

1. Pull lock washers 931.95 of the transport lock out of the stub shaft groove. Secure them with hexagon head bolts 901.50.
2. Fit cover plates 68-3.01/02.

7.6 Tightening torques for the pump

Pump with impeller diameter 125, 160, 200

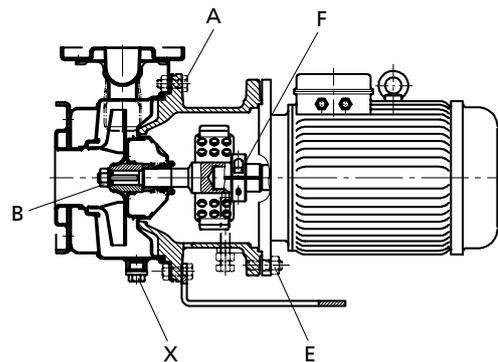


Fig. 19: Tightening points for Etachrom B 050-025-125.1, 050-025-125, 050-025-160, 050-025-200, 050-032-125.1, 050-032-125, 050-032-160, 050-032-200, 065-040-125, 065-040-160, 065-040-200, 065-050-125, 065-050-160

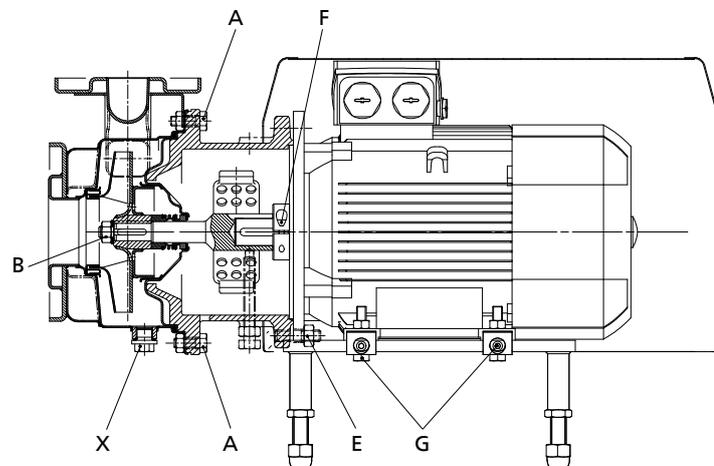


Fig. 20: Tightening points for Etachrom B 050-025-125.1, 050-025-125, 050-025-160, 050-025-200, 050-032-125.1, 050-032-125, 050-032-160, 050-032-200, 065-040-125, 065-040-160, 065-040-200, 065-050-125, 065-050-160

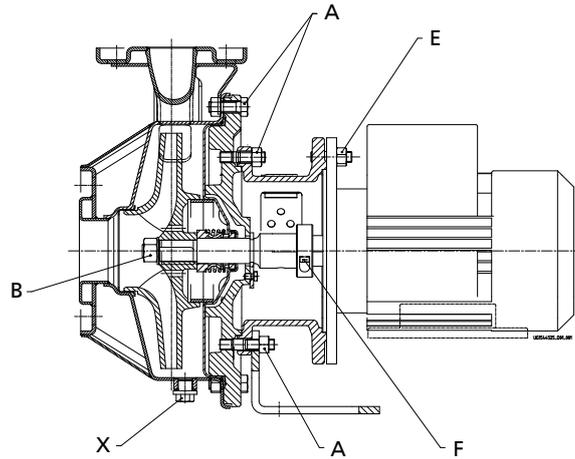
Pump with impeller diameter 200, 250


Fig. 21: Tightening points for Etachrom B 050-025-250, 050-032-250, 065-040-250, 065-050-200, 065-050-250, 080-065-200, 080-065-250, 100-080-200, 100-080-250

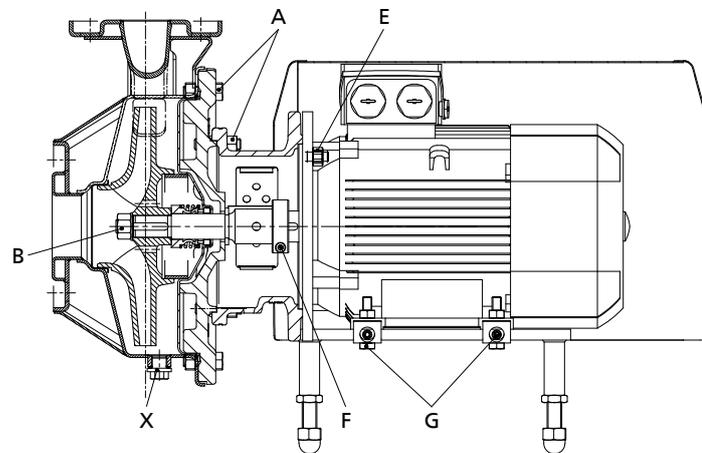


Fig. 22: Tightening points for Etachrom B 050-025-250, 050-032-250, 065-040-250, 065-050-200, 065-050-250, 080-065-200, 080-065-250, 100-080-200, 100-080-250

Table 15: Tightening torques for bolted/screwed connections at the pump

Position	Thread	Tightening torques
		[Nm]
A	M10	38
	M12	55
B	M12 × 1,5	55
	M16 × 1,5	55
	M24 × 1,5	130
	M30 × 1,5	170
E	M8	20
	M10	38
	M12	55
	M16	130
F	M6	15
	M8	38
	M10	85
G	M6	15
	M8	20
	M10	38
	M12	55

Position	Thread	Tightening torques
		[Nm]
G	M16	130
	M20	250
X	1/8	25
	1/4	55
	3/8	80
	1/2	130
	3/4	220

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data. (⇒ Section 4.4, Page 18)

Also specify the following data:

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

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

Table 16: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
210	Shaft	1	1	1	2	2	2	20 %
230	Impeller	1	1	1	2	2	2	20 %
412.35	O-ring	4	6	8	8	9	12	150 %
433	Mechanical seal	1	1	2	2	2	3	25 %
502.01 ⁸⁾	Casing wear ring, suction side	2	2	2	3	3	4	50 %
502.02 ⁹⁾	Casing wear ring, discharge side	2	2	2	3	3	4	50 %
502.06 ¹⁰⁾	Casing wear ring, impeller	2	2	2	3	3	4	50 %

⁸ Not for Etachrom B 065-050-125 with free-flow impeller

⁹ Not for Etachrom B 050-025-125.1, 050-025-125, 050-025-160, 050-032-125.1, 050-032-125, 050-032-160, 065-040-125, 065-050-125

¹⁰ Only for Etachrom B 080-065-250, 100-080-250

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
523 ¹¹⁾	Shaft sleeve	2	2	2	3	3	4	50 %
400.75 ¹¹⁾	Gasket	4	6	8	8	9	10	100 %

7.7.3 Interchangeability of Etachrom B and Etachrom L pump components

Table 17: Symbols key

Symbol	Description
*	Component interchangeable with Etachrom L; impellers must be of the same diameter
○	Components differ
✕	Component not fitted
□	Pump/motor combination not possible

Table 18: Etachrom B pump components¹²⁾

Size	Shaft unit	101	132.01	163	183	Shaft										230	412.35	433	502.01	502.02	523				
						Pump casing	Intermediate piece	Discharge cover	Pump foot ¹³⁾	210															
										Motor															
										80	90	100/112	132	160	180							200/225			
050-025-125.1	WS 25.1	1	✕	1*	1	1	2	□	□	□	□	□	□	1*	1*	1*	1*	✕	✕						
050-025-125	WS 25.1	1	✕	1*	1	1	2	3	□	□	□	□	2*	1*	1*	1*	✕	✕							
050-025-160	WS 25.1	○	✕	5*	2	1	2	3	4	□	□	□	3*	2*	1*	1*	✕	✕							
050-025-200	WS 25.1	○	✕	2*	3	1	2	3	4	5	□	□	4*	3*	1*	1*	1*	✕							
050-025-250	WS 25.2	○	1*	3*	4	6	7	8	9	10	□	□	5*	4*	2*	6*	2*	✕							
050-032-125.1	WS 25.1	2	✕	1*	1	1	2	□	□	□	□	□	1*	1*	1*	1*	✕	✕							
050-032-125	WS 25.1	2	✕	1*	1	1	2	3	□	□	□	□	2*	1*	1*	1*	✕	✕							
050-032-160	WS 25.1	○	✕	5*	2	1	2	3	4	□	□	□	3*	2*	1*	1*	✕	✕							
050-032-200	WS 25.1	○	✕	2*	3	1	2	3	4	5	□	□	4*	3*	1*	1*	1*	✕							
050-032-250	WS 25.2	○	1*	3*	4	6	7	8	9	10	□	□	5*	4*	2*	6*	2*	✕							
065-040-125	WS 25.1	○	✕	1*	1	1	2	3	□	□	□	□	○*	1*	1*	2*	✕	✕							
065-040-160	WS 25.1	○	✕	○*	2	1	2	3	4	5	□	□	○*	2*	1*	2*	1*	✕							
065-040-200	WS 25.1	○	✕	2*	3	□	2	□	4	5	□	□	○*	3*	1*	2*	1*	✕							
065-040-250	WS 25.2	○	1*	3*	4	□	7	8	9	10	11	□	○*	4*	2*	3*	2*	✕							

¹¹⁾ Only for Etachrom B 080-065-250, 100-080-200, 100-080-250

¹²⁾ Pump components featuring the same number in a column are interchangeable, i.e. same number = same component

¹³⁾ Up to motor size 112 = 4.0 kW only

Size	Shaft unit	Shaft														Impeller	O-ring	Mechanical seal	Casing wear ring, suction side	Casing wear ring, discharge side	Shaft sleeve				
		Pump casing				210								230	412.35							433	502.01	502.02	523
		101	132.01	163	183	Motor																			
						80	90	100/112	132	160	180	200/225													
065-050-125	WS 25.1	○	✗	○*	2	1	2	3	4	□	□	□	□	○*	2*	1*	2*	✗	✗						
065-050-160	WS 25.1	○	✗	○*	2	1	2	□	4	5	□	□	□	○*	2*	1*	2*	1*	✗						
065-050-200	WS 25.2	○	2*	○*	4	6	7	8	9	10	11	□	□	○*	5*	2*	3*	2*	✗						
065-050-250	WS 25.2	○	1*	3*	4	□	7	8	□	10	11	12	□	○*	4*	2*	3*	2*	✗						
080-065-200	WS 25.2	○	1*	○*	4	□	7	8	□	10	11	12	□	○*	4*	2*	4*	○*	✗						
080-065-250	WS 35	○	3*	4*	5	□	□	12	13	14	15	16	□	○*	4*	3*	4*	3*	1*						
100-080-200	WS 35	○	3*	4*	5	□	□	12	13	14	15	16	□	○*	4*	3*	5*	3*	1*						
100-080-250	WS 35	○	3*	4*	5	□	□	12	13	14	□	□	□	○*	4*	3*	5*	3*	1*						
														Drive lantern 341											
050-025-125.1	WS 25.1	-	-	-	-	1	1	□	□	□	□	□	□	-	-	-	-	-	-						
050-025-125	WS 25.1	-	-	-	-	1	1	2	□	□	□	□	□	-	-	-	-	-	-						
050-025-160	WS 25.1	-	-	-	-	3	3	4	5	□	□	□	□	-	-	-	-	-	-						
050-025-200	WS 25.1	-	-	-	-	7	7	8	9	10	□	□	□	-	-	-	-	-	-						
050-025-250	WS 25.2	-	-	-	-	11	11	12	13	14	□	□	□	-	-	-	-	-	-						
050-032-125.1	WS 25.1	-	-	-	-	1	1	□	□	□	□	□	□	-	-	-	-	-	-						
050-032-125	WS 25.1	-	-	-	-	1	1	2	□	□	□	□	□	-	-	-	-	-	-						
050-032-160	WS 25.1	-	-	-	-	3	3	4	5	□	□	□	□	-	-	-	-	-	-						
050-032-200	WS 25.1	-	-	-	-	7	7	8	9	10	□	□	□	-	-	-	-	-	-						
050-032-250	WS 25.2	-	-	-	-	11	11	12	13	14	□	□	□	-	-	-	-	-	-						
065-040-125	WS 25.1	-	-	-	-	1	1	2	□	□	□	□	□	-	-	-	-	-	-						
065-040-160	WS 25.1	-	-	-	-	3	3	4	5	6	□	□	□	-	-	-	-	-	-						
065-040-200	WS 25.1	-	-	-	-	7	7	□	9	10	□	□	□	-	-	-	-	-	-						
065-040-250	WS 25.2	-	-	-	-	□	11	12	13	14	14	□	□	-	-	-	-	-	-						
065-050-125	WS 25.1	-	-	-	-	3	3	4	5	□	□	□	□	-	-	-	-	-	-						
065-050-160	WS 25.1	-	-	-	-	3	3	□	5	6	□	□	□	-	-	-	-	-	-						
065-050-200	WS 25.2	-	-	-	-	11	11	12	13	14	14	□	□	-	-	-	-	-	-						
065-050-250	WS 25.2	-	-	-	-	□	11	12	□	14	14	13	□	-	-	-	-	-	-						
080-065-200	WS 25.2	-	-	-	-	□	11	12	□	14	14	13	□	-	-	-	-	-	-						
080-065-250	WS 35	-	-	-	-	□	□	15	16	17	17	16	□	-	-	-	-	-	-						
100-080-200	WS 35	-	-	-	-	□	□	15	16	17	17	16	□	-	-	-	-	-	-						
100-080-250	WS 35	-	-	-	-	□	□	□	16	17	□	□	□	-	-	-	-	-	-						

1213.8/22-EN

Table 19: Motor rating

Motor	Rating
80	.../054, .../074, .../072, .../112
90	.../114, .../154, .../152, .../222
100	.../224, .../304, .../302
112	.../404, .../402
132	.../552, .../554, .../752, .../754
160	.../1102, .../1104, .../1502, .../1852
180	.../2202
200	.../3002, .../3702
225	.../4502

8 Trouble-shooting

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

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 Motor protection switch trips the pump
- D Increased bearing temperature
- E Leakage at the pump
- F Excessive leakage at the shaft seal
- G Vibrations during pump operation
- H Impermissible temperature increase in the pump

Table 20: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy ¹⁴⁾
X	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller. ¹⁵⁾ Increase the speed (turbine, I.C. engine).
X	-	-	-	-	-	X	X	Pump and/or piping are not completely vented and/or primed.	Vent and/or prime.
X	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
X	-	-	-	-	-	-	-	Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
X	-	-	-	-	-	X	X	Suction lift is too high/NPSH _{available} (positive suction head) is too low.	Check/alter fluid level. Fully open the shut-off element in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening.
X	-	-	-	-	-	-	-	Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
X	-	-	-	-	-	X	-	Wear of internal components	Replace worn parts by new ones.
-	X	X	-	-	-	X	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point.
-	X	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
-	-	-	-	X	-	-	-	Defective gasket	Fit new gasket between volute casing and discharge cover.
-	-	-	-	-	X	-	-	Worn shaft seal	Fit new shaft seal.
X	-	-	-	-	X	-	-	Score marks or roughness on shaft sleeve	Fit new shaft sleeve. Fit new shaft seal.
-	-	-	-	-	X	-	-	Vibrations during pump operation	Correct the suction conditions. Increase the pressure at the pump suction nozzle.

¹⁴ Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

¹⁵ Contact KSB.

A	B	C	D	E	F	G	H	Possible cause	Remedy ¹⁴⁾
-	-	-	X	-	X	X	-	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.
-	-	-	X	-	-	-	-	Increased axial thrust ¹⁵⁾	Clean balancing holes in the impeller. Replace the casing wear rings.
-	-	-	X	-	-	X	-	Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
X	X	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	-	-	-	X	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	X	-	Defective bearing(s)	Replace.
-	-	-	-	-	-	X	X	Flow rate is too low.	Increase the minimum flow rate.
-	-	X	-	-	-	-	-	Incorrect setting of motor protection switch	Check setting. Fit new motor protection switch.
-	X	X	-	-	-	-	-	Transport lock has not been removed from the shaft groove.	Remove.

9 Related Documents

9.1 Installation types

Horizontal installation

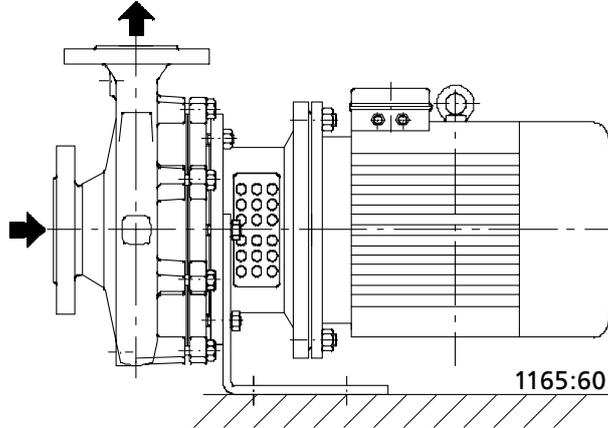


Fig. 23: Pump foot, fastened below, up to motor size 112 = 4 kW

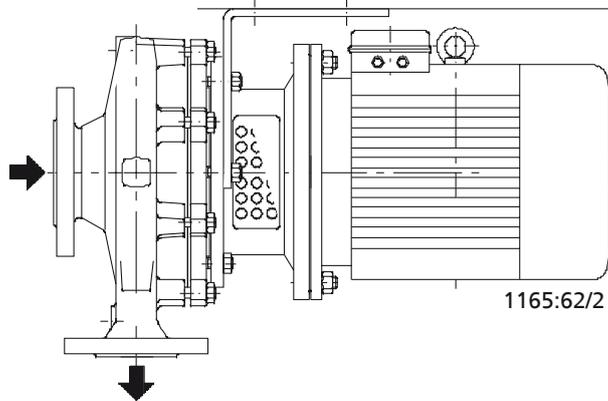


Fig. 24: Pump foot, fastened above, up to motor size 112 = 4 kW
The motor must be turned by 180°.

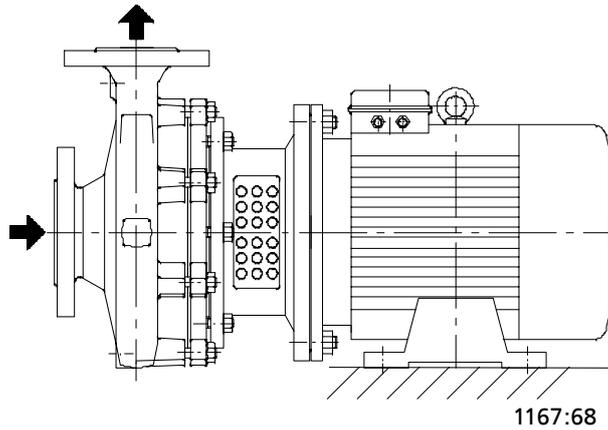


Fig. 25: Motor foot, fastened below, motor sizes 132 = 5.5 kW to 225 = 45 kW

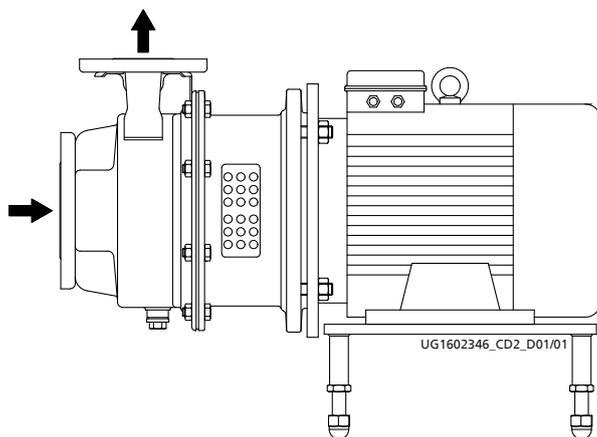


Fig. 26: Ball feet, motor sizes 80 = 0.55 kW to 225 = 45 kW

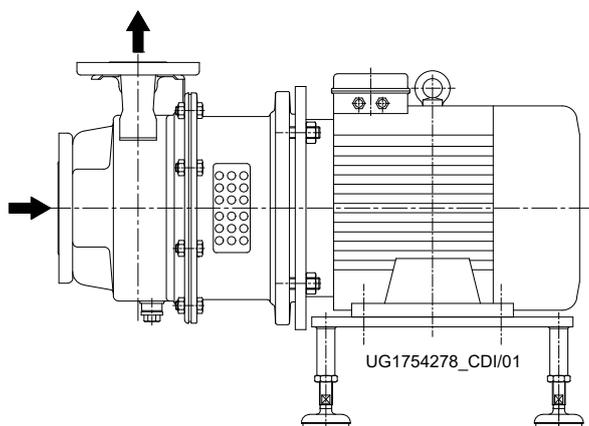


Fig. 27: Machine mount, motor sizes 80 = 0.55 kW to 225 = 45 kW

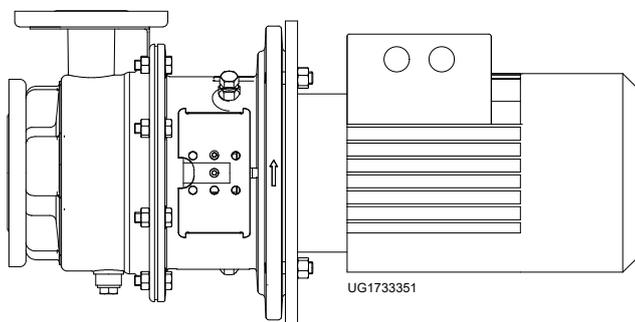


Fig. 28: Bottle rinsing variant, motor sizes 80 = 0.55 kW to 132 = 7.5 kW

Vertical installation¹⁶⁾ For vertical installation with the motor on top, use connection 5B for venting.

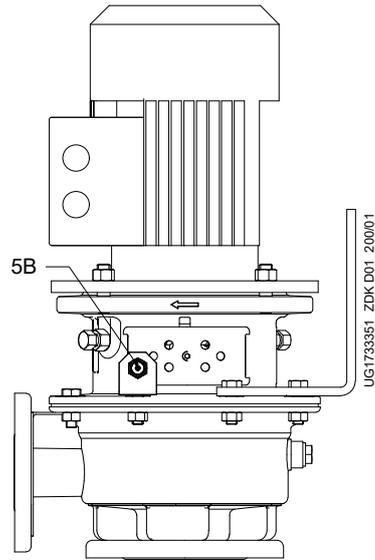


Fig. 29: Illustration of closing element with vent function

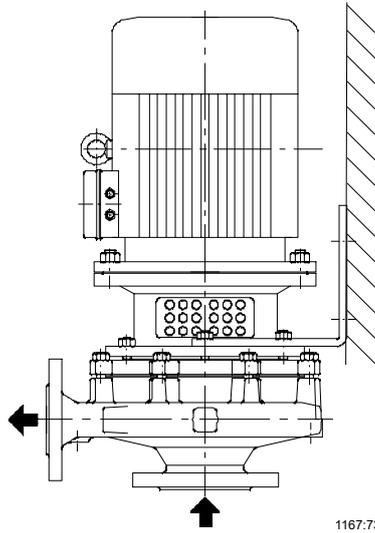
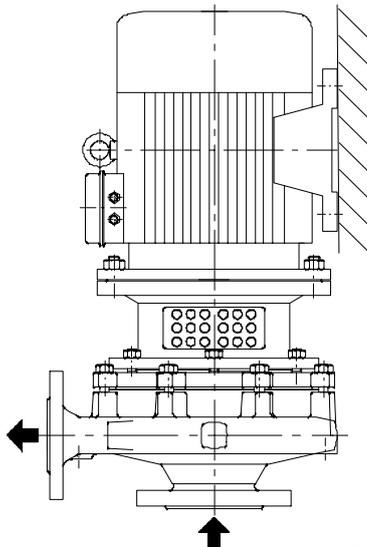


Fig. 30: Pump foot, fastened at the side, up to motor size 112 = 4 kW

¹⁶⁾ A vent valve must be fitted to prevent dry running of the mechanical seal.



1167.74

Fig. 31: Motor foot, fastened at the side, motor sizes 132 = 5.5 kW to 225 = 45 kW

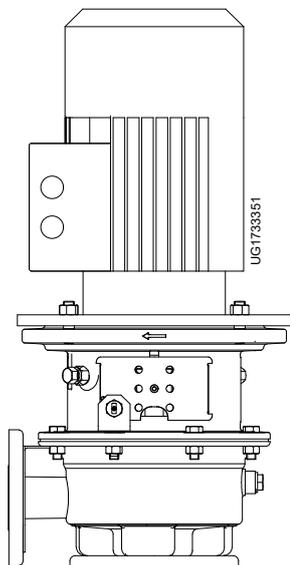


Fig. 32: Bottle rinsing variant, motor sizes 80 = 0.55 kW to 180 = 22 kW

Part No.	Description	Part No.	Description
515	Locking ring	Connections	
68-3.01/02	Cover plate	6B	Fluid drain

9.2.2 Design for shaft unit 25.2

This view applies to the following pump sizes:

050-025-250/... 050-032-250/... 065-040-250/... 065-050-200/... 080-065-200/...
065-050-250/...

[Supplied in packaging units only

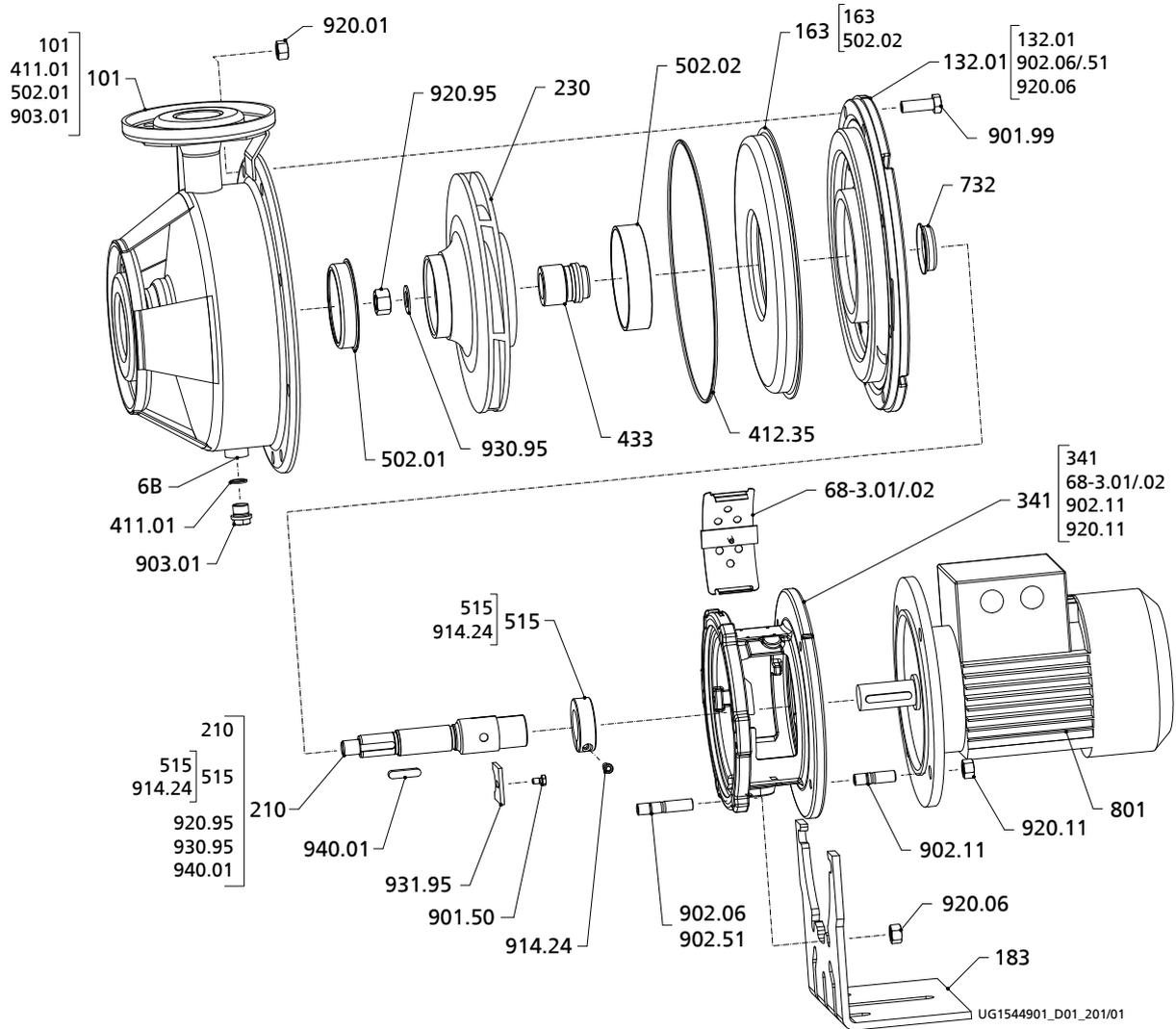


Fig. 34: Exploded view of version with shaft unit 25.2

Table 22: List of components

Part No.	Description	Part No.	Description
101	Pump casing	732 ²⁰⁾	Holder
132.01	Intermediate piece	801	Flanged motor
163	Discharge cover	901.50/.99	Hexagon head bolt
183 ²¹⁾	Foot	902.06/.11/.51	Stud
210	Shaft	903.01	Screw plug
230	Impeller	914.24	Hexagon socket head cap screw
341	Drive lantern	920.01/.06/.11/.95	Nut
411.01	Joint ring	930.95	Safety device
412.35	O-ring	931.95	Lock washer
433	Mechanical seal	940.01	Key

²⁰⁾ Only for versions with mechanical seal type C05

²¹⁾ Up to motor size 112 with pump foot; from motor size 132 with motor foot

Part No.	Description	Part No.	Description
502.01/02	Casing wear ring		
515	Locking ring	Connections	
68-3.01/02	Cover plate	6B	Fluid drain

9.2.3 Design for shaft unit 35

This view applies to the following pump sizes:

- 080-065-250/... 100-080-200/...
- 100-080-250/...

[Supplied in packaging units only

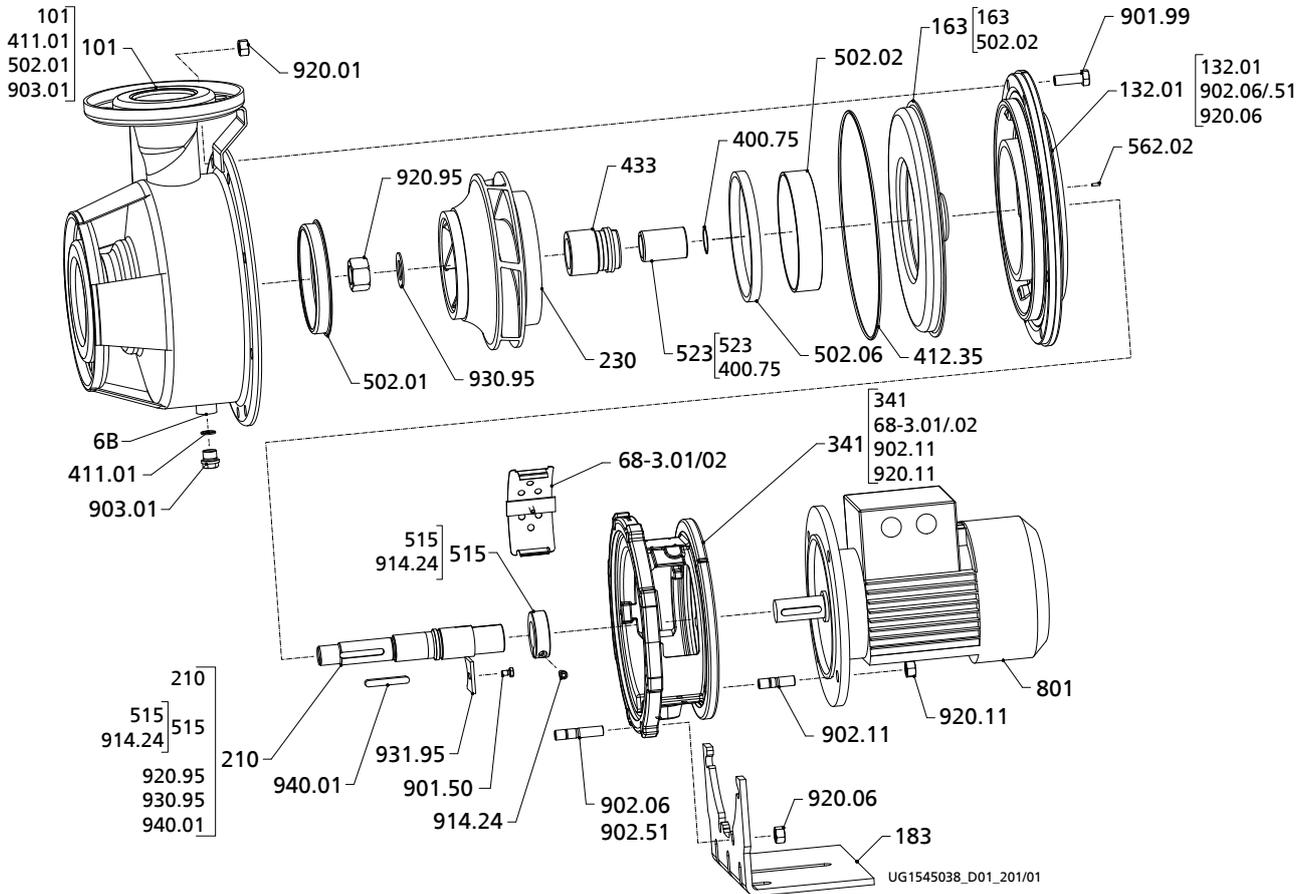


Table 23: List of components

Part No.	Description	Part No.	Description
101	Pump casing	562.02 ²²⁾	Parallel pin
132.01	Intermediate piece	68-3.01/02	Cover plate
163	Discharge cover	801	Flanged motor
183 ²³⁾	Foot	901.50/99	Hexagon head bolt
210	Shaft	902.06/11/51	Stud
230	Impeller	903.01	Screw plug
341	Drive lantern	914.24	Hexagon socket head cap screw
400.75	Gasket	920.01/06/11/95	Nut
411.01	Joint ring	930.95	Safety device
412.35	O-ring	931.95	Lock washer
433	Mechanical seal	940.01	Key
502.01/02/06 ²⁴⁾	Casing wear ring		
515	Locking ring	Connections	
523	Shaft sleeve	6B	Fluid drain

²²⁾ Only for versions with mechanical seal type C12

²³⁾ Up to motor size 112 with pump foot; from motor size 132 with motor foot

²⁴⁾ Only for sizes 080-065-250, 100-080-250

9.2.4 Design of size 065-050-125 with free-flow impeller

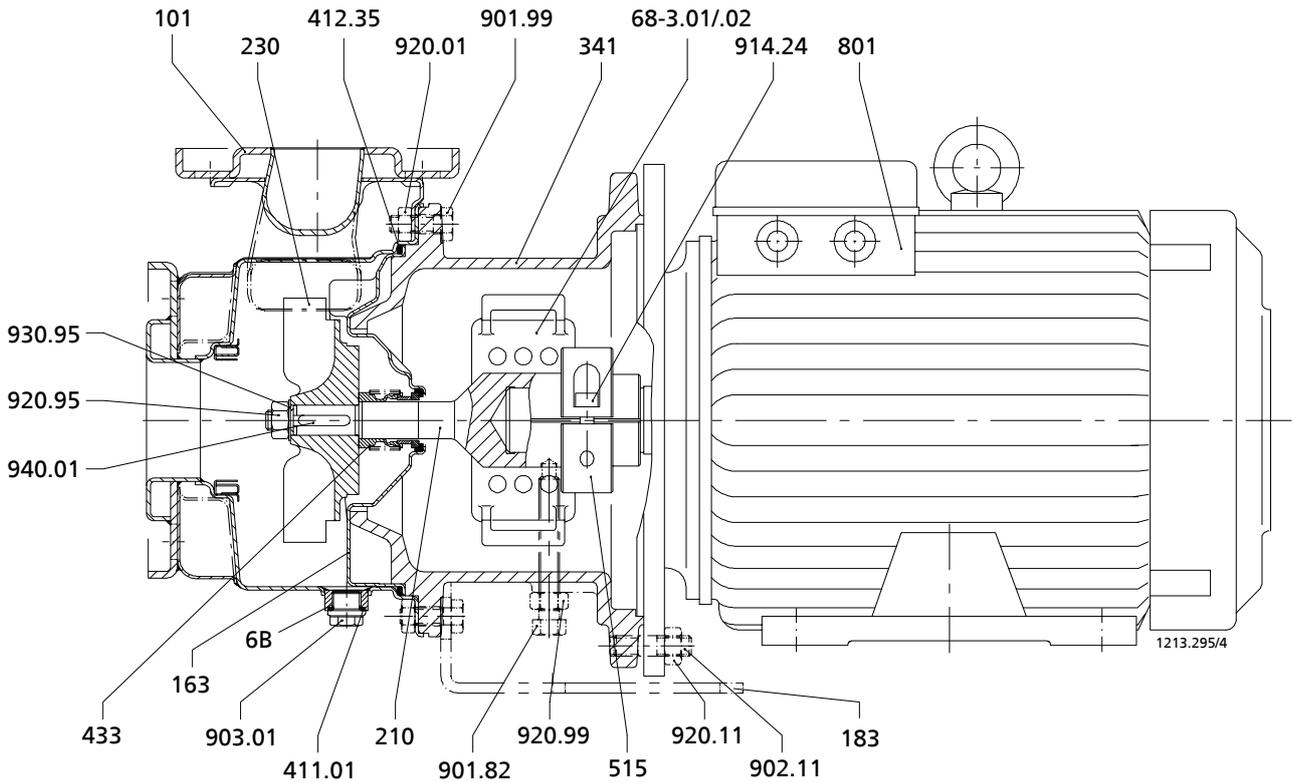


Table 24: List of components

Part No.	Description	Part No.	Description
101	Pump casing	801	Flanged motor
163	Discharge cover	901.82/.99	Hexagon head bolt
183 ²⁵⁾	Foot	902.11	Stud
210	Shaft	903.01	Screw plug
230	Impeller	914.24	Hexagon socket head cap screw
341	Drive lantern	920.01/.11/.95/.99	Nut
411.01	Joint ring	930.95	Safety device
412.35	O-ring	940.01	Key
433	Mechanical seal		
515	Locking ring	Connections	
68-3.01/.02	Cover plate	6B	Fluid drain

²⁵⁾ Up to motor size 112 with pump foot; from motor size 132 with motor foot

9.2.5 Design with ball feet and motor shroud

This view applies to the following pump sizes with motor sizes 80M to 132M:

- | | | |
|-------------|-------------|-------------|
| 050-025-250 | 065-050-200 | 080-065-250 |
| 050-032-250 | 065-050-250 | 100-080-200 |
| 065-040-250 | 080-065-200 | 100-080-250 |

[Supplied in packaging units only

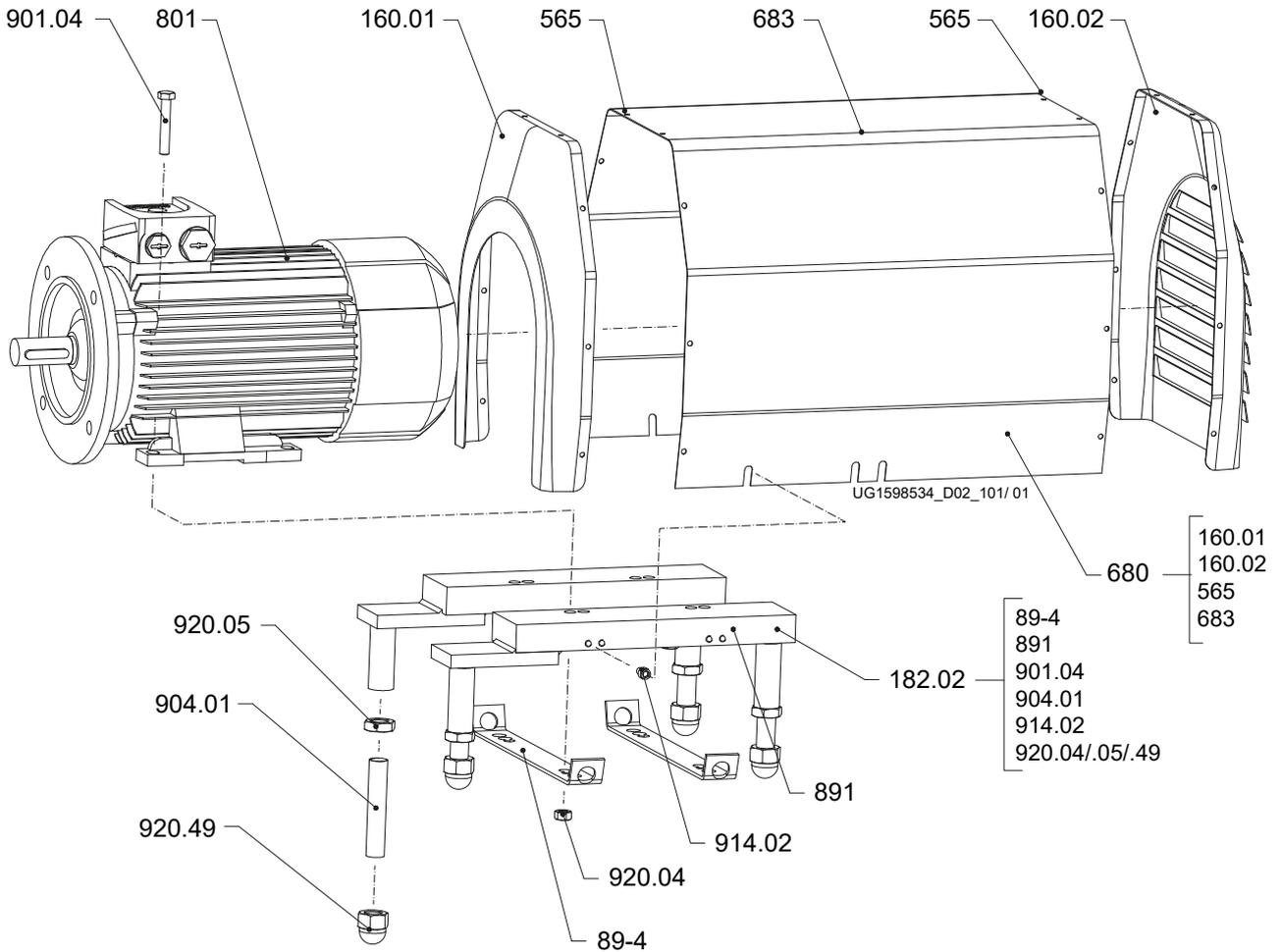


Table 25: List of components

Part No.	Description	Part No.	Description
160.01	Cover, drive-end	89-4	Shim
160.02	Cover, non-drive end	891	Base frame
182.02	Foot base (ball feet)	901.04	Hexagon head bolt
565	Rivet ²⁶⁾	904.01	Grub screw
680	Guard	914.02	Hexagon socket head cap screw
683	Hood	920.04/.05/.49	Nut
801	Flanged motor		

1213.8/22-EN

²⁶ Up to motor size 160L

9.2.6 Design with ball feet and motor shroud

This view applies to the following pump sizes with motor sizes 160M to 225M:

050-025-125.1	050-032-125.1	065-040-125	065-050-125	080-065-200
050-025-125	050-032-125	065-040-160	065-050-160	080-065-250
050-025-160	050-032-160	065-040-200	065-050-200	100-080-200
050-025-200	050-032-200	065-040-250	065-050-250	100-080-250
050-025-250	050-032-250			

[Supplied in packaging units only

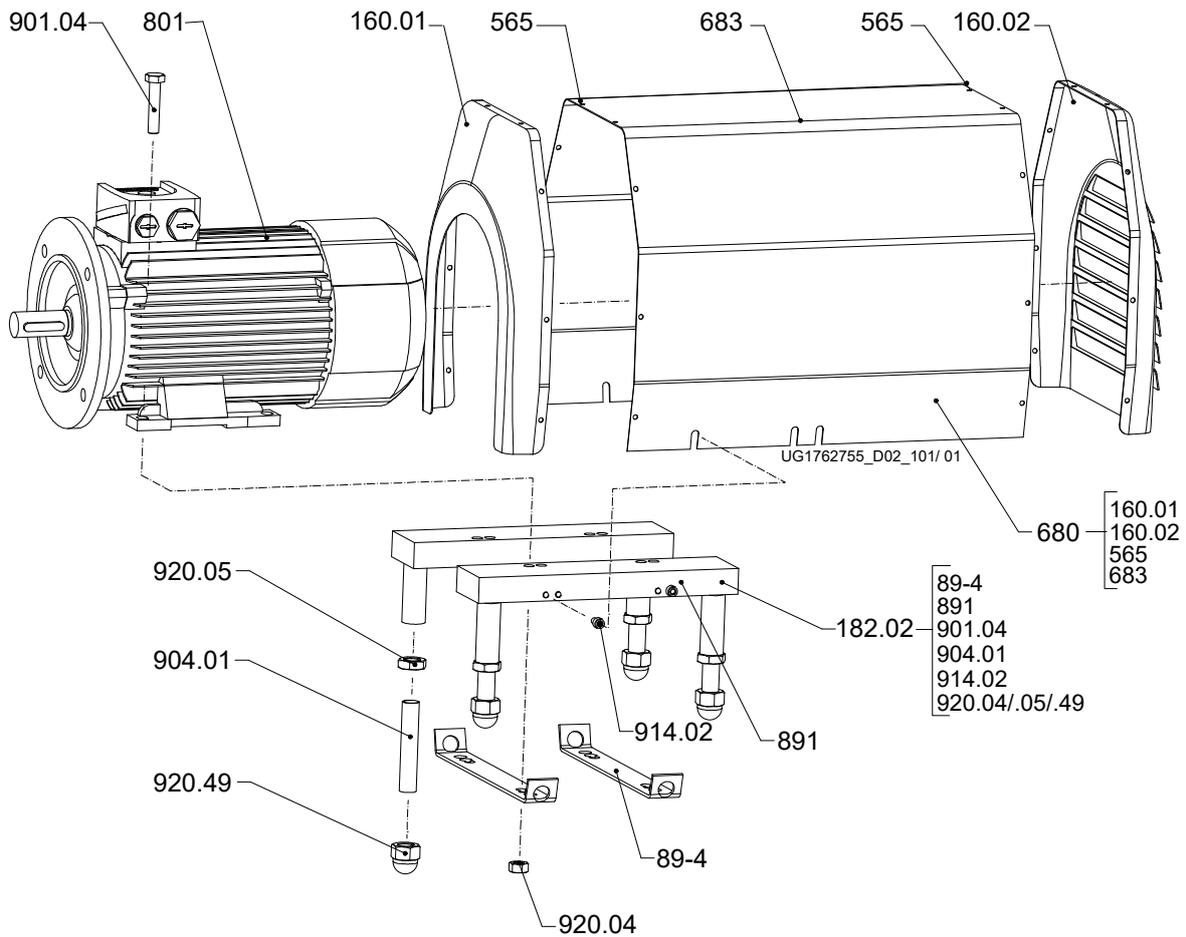


Table 26: List of components

Part No.	Description	Part No.	Description
160.01	Cover, drive-end	89-4	Shim
160.02	Cover, non-drive end	891	Base frame
182.02	Foot base (ball feet)	901.04	Hexagon head bolt
565	Rivet ²⁷⁾	904.01	Grub screw
680	Guard	914.02	Hexagon socket head cap screw
683	Hood	920.04/.05/.49	Nut
801	Flanged motor		

²⁷ Up to motor size 160L

9.2.7 Design with levelling feet and motor shroud

This view applies to the following pump sizes with motor sizes 80M to 132M:

- | | | |
|-------------|-------------|-------------|
| 050-025-250 | 065-050-200 | 080-065-250 |
| 050-032-250 | 065-050-250 | 100-080-200 |
| 065-040-250 | 080-065-200 | 100-080-250 |

[Supplied in packaging units only

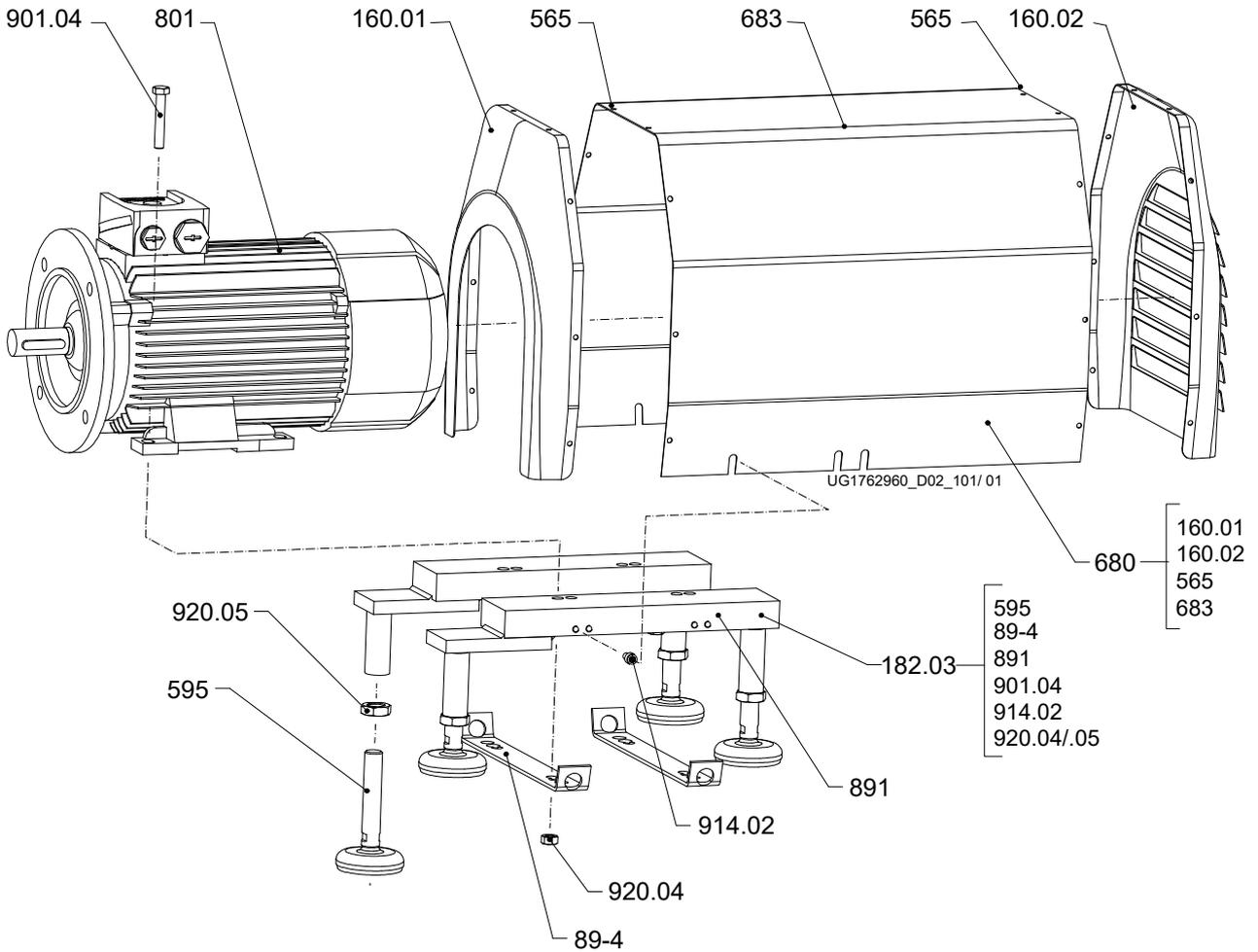


Table 27: List of components

Part No.	Description	Part No.	Description
160.01	Cover, drive-end	89-4	Shim
160.02	Cover, non-drive end	801	Flanged motor
182.03	Foot base (levelling feet)	891	Base frame
565	Rivet ²⁸⁾	901.04	Hexagon head bolt
595	Support	914.02	Hexagon socket head cap screw
680	Guard	920.04/.05	Nut
683	Hood		

1213.8/22-EN

²⁸ Up to motor size 160L

9.2.8 Design with levelling feet and motor shroud

This view applies to the following pump sizes with motor sizes 160M to 225M:

050-025-125.1	050-032-125.1	065-040-125	065-050-125	080-065-200
050-025-125	050-032-125	065-040-160	065-050-160	080-065-250
050-025-160	050-032-160	065-040-200	065-050-200	100-080-200
050-025-200	050-032-200	065-040-250	065-050-250	100-080-250
050-025-250	050-032-250			

[Supplied in packaging units only

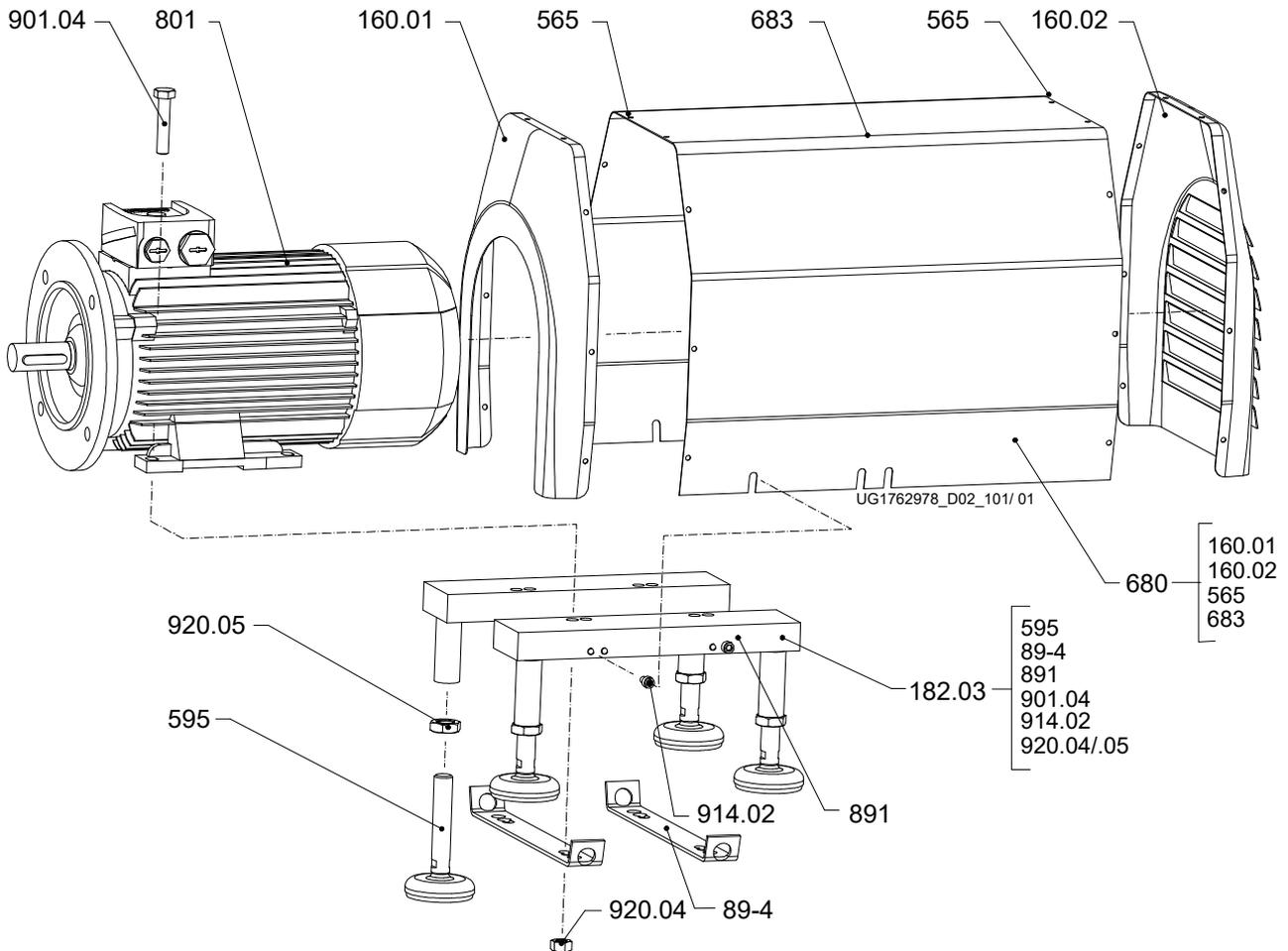


Table 28: List of components

Part No.	Description	Part No.	Description
160.01	Cover, drive-end	89-4	Shim
160.02	Cover, non-drive end	801	Flanged motor
182.03	Foot base (levelling feet)	891	Base frame
565	Rivet ²⁹⁾	901.04	Hexagon head bolt
595	Support	914.02	Hexagon socket head cap screw
680	Guard	920.04/.05	Nut
683	Hood		

²⁹⁾ Up to motor size 160L

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 standards³⁰⁾ 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

.....³¹⁾.....

Name
Function
Company
Address

³⁰⁾ 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.

³¹⁾ A signed, legally binding EU Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type:

Order number /
Order item number³²⁾:

Delivery date:

Application:

Fluid handled³²⁾:

Please tick where applicable³²⁾:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:³²⁾

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

³²⁾ Required field

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