Hygienic Pump in Close-coupled Design

Vitachrom

Installation/Operating Manual

KSB

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Installation/Operating Manual Vitachrom

Original operating manual

Contents

Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

CIP (cleaning in place)

Procedure during which the inside of the pump is cleaned with a cleaning agent. The pump does not need to be dismantled.

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

Quench liquid supply

Unpressurised liquid between the inboard and outboard shaft seal

SIP (steaming in place)

Procedure during which the inside of the pump is sterilised with steam. The pump does not need to be dismantled.

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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1 General

1.1 Principles

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

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

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

In the event of damage, immediately contact your nearest KSB Service centre 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 49)

1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇨ Section 2.3, Page 9)

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)
Installation plan/dimensional 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 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
Drawing for assembly[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 upon in 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.

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2 Safety

DANGER

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

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

2.1 General

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

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents. (⇨ Section 1.4, Page 7)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Never operate the pump without the fluid to be handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- 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.).
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

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- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.1.5, Page 33) (⇨ Section 6.3, Page 37)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇨ Section 6.1, Page 31)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

DANGER

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 11) to (⇨ Section 2.9.4, Page 12)
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 11)

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

Shaft coupling

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

Motor

The motor must be considered separately.

2.9.2 Temperature limits

In normal pump operation, the highest temperatures 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 flow rates indicated in (⇨ Section 6.2.5.1, Page 36) 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 6.2.5.1, Page 36) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

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2 Subject to further limitations for mechanical seal temperature rise

3 Transport/Temporary Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

DANGER

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

Danger to life from falling parts!

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

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

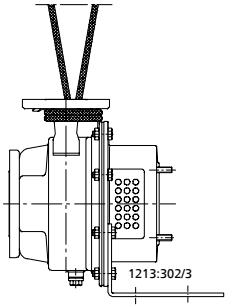

Fig. 1: Transporting the pump

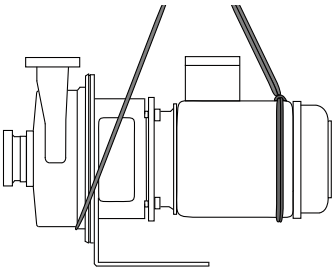

Fig. 2: Transporting the pump set (with angle foot, for motors ≤ 4 kW)

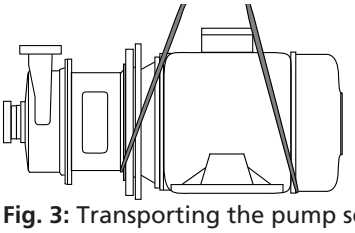

Fig. 3: Transporting the pump set (for motors ≥ 5.5 kW)

3.3 Storage/preservation

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

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of the pump (set)!

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

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

- ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

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 37)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇨ Section 7.3, Page 43)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
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 71)

NOTE

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

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3.5 Disposal

⚠ WARNING

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

Hazard to persons and the environment!

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

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

4 Description of the Pump (Set)

4.1 General description

- Close-coupled pump with shaft seal
- Hygienic pump for handling fluids in the food and beverages industry

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

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

4.3 Designation

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
V	C			0	5	0	-	0	5	0	-	1	2	5		C	C		I	0	1	M	A	1	3	0	0	2			A	P	D	2			K	S	B	I	E	3
V	C	I	1	0	5	0	-	0	5	0	-	1	6	0		C	C		I	0	2	A	B	1	1	0	0	2	e	x	A	P	D	2	E	M	S	I	E	I	E	4
See name plate and data sheet																									See data sheet																	

Table 6: Designation key

Position	Code	Description	
1-3	Pump type		
	VC	Vitachrom	
	VCI	Vitachrom Inducer	
4	Inducer		
	[3)]	Without inducer	
	0	Inducer 0	
	1	Inducer 1	
	2	Inducer 2	
5-16	Size, e.g.		
	050	Nominal suction nozzle diameter [mm]	
	050	Nominal discharge nozzle diameter [mm]	
	125	Nominal impeller diameter [mm]	
17	Pump casing material		
	C	Stainless steel	1.4409
18	Impeller material		
	C	Stainless steel	1.4404
19	Design		
	[3)]	Standard	
	X	Non-standard (BT3D, BT3)	
20-22	Seal code, single mechanical seal		
	I01	BQ1E1-04GG	Carbon/SiC/EPDM
	I02	BQ1V26GG	Carbon/SiC/Viton
	I03	Q12Q1E1-04GG	SiC/SiC/EPDM
	I04	Q12Q1V26GG	SiC/SiC/Viton
	I06	BQ1E1-04GG	Carbon/SiC/EPDM
	I07	BQ1V26GG	Carbon/SiC/Viton
	I08	Q12Q1E1-04GG	SiC/SiC/EPDM
	I09	Q12Q1V26GG	SiC/SiC/Viton
	I10	Q22Q2E1-04GG	Si-SiC/Si-SiC/EPDM

3 Blank

Position	Code	Description	
20-22	I21	Q12Q1M1GG	SiC/SiC/PTFE
	Seal code, double mechanical seal in tandem arrangement		
	T11	BQ1E1-04GG	Carbon/SiC/EPDM
		BQ1EGG	Carbon/SiC/EPDM
	T12	BQ1V26GG	Carbon/SiC/Viton
		BQ1EGG	Carbon/SiC/EPDM
	T13	Q12Q1E1-04GG	SiC/SiC/EPDM
		BQ1EGG	Carbon/SiC/EPDM
	T14	Q12Q1V26GG	SiC/SiC/Viton
		BQ1EGG	Carbon/SiC/EPDM
	T16	BQ1E1-04GG	Carbon/SiC/EPDM
		BQ1EGG	Carbon/SiC/EPDM
	T17	BQ1V26GG	Carbon/SiC/Viton
		BQ1EGG	Carbon/SiC/EPDM
	T18	Q12Q1E1-04GG	SiC/SiC/EPDM
		BQ1EGG	Carbon/SiC/EPDM
	T19	Q12Q1V26GG	SiC/SiC/Viton
		BQ1EGG	Carbon/SiC/EPDM
	T20	Q22Q2E1-04GG	Si-SiC/Si-SiC/EPDM
		BQ1EGG	Carbon/SiC/EPDM
	T31	Q12Q1M1GG	SiC/SiC/PTFE
		BQ1EGG	Carbon/SiC/EPDM
23	Scope of supply		
	A	Angle foot	
	B	Soleplate G1 / G2	
	K	Ball feet	
	M	Motor feet	
	T	Round base feet	
24	Pipe connection		
	A	Flange	APV FN
	B	Thread	DIN 11864-1A
	C	Flange	DIN 11864-2A
	D	Clamped connection	DIN 11864-3A
	G	Flange	Varivent
	I	Thread	ISO 2853 (IDF)
	J	Small flange	Kieselmann
	L	Flange	EN 1092-1
	M	Thread	DIN 11851 (hygienic pipe union)
	N	Flange	Neumo
	R	Flange	DIN 2633 (EN 1092-1) with recess
	S	Thread	SMS
	T	Clamped connection	EN 32676-A
25	O-ring material		
	1	EPDM	
	2	Viton	
	3	PTFE	
26-28	Motor rating P_N [kW]		
	075	7,50	
	...	...	

Position	Code	Description
26-28	100	10,00
29	Number of motor poles	
30-31	Explosion protection	
	ex	With explosion-proof motor
	--	Without explosion-proof motor
32	Product generation	
	A	Vitachrom
33-36	PumpDrive	
	[3]	Without PumpDrive
	PD2	PumpDrive 2
	PD2E	PumpDrive 2 Eco
37	PumpMeter	
	[3]	Without PumpMeter
	M	PumpMeter
38-40	Motor manufacturer	
	KSB	KSB
	SIE	Siemens
	LOH	Loher
	HAL	Halter
41-43	Efficiency class	

4.4 Name plate

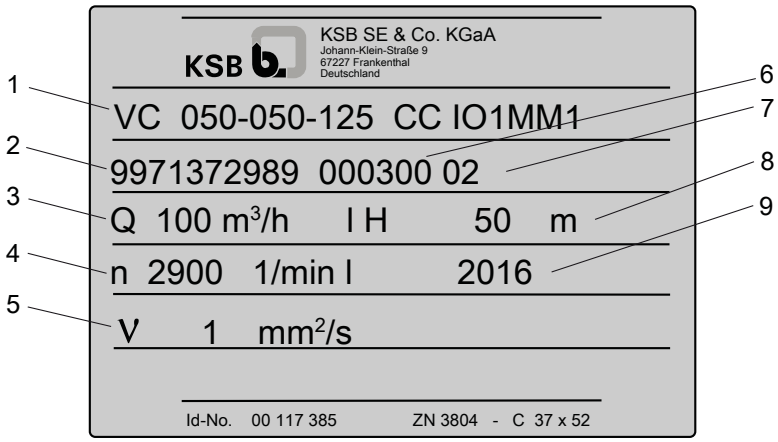

Fig. 4: Name plate Vitachrom (example)

1	Type series, size and version	2	KSB order number (ten digits)
3	Flow rate	4	Speed
5	Kinematic viscosity of the fluid handled	6	Order item number (six digits)
7	Consecutive number (two digits)	8	Head
9	Year of construction		

4.5 Design details

Design

- Standard design with materials to Regulation (EC) No. 1935/2004
- Design to ATEX

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Design

- Centrifugal pump
- Close-coupled design
- Single-stage
- Wetted parts made of stainless steel 1.4404/1.4409 (AISI 316L/CF3M)
- CIP/SIP-compatible
- Pump version with inducer for fluids pumped from vessels under vacuum (pump sizes 65-160-IND, 80-250-IND, 80-250.1-IND only) and for low NPSH values

Pump casing

- Circular casing

Impeller type

- Semi-open multi-vane impeller

Shaft seal

- Single mechanical seal surrounded by fluid handled EN 12756
- Double mechanical seal in tandem arrangement with quench to EN 12756
- Hygienic design or sterile design

Hygienic design:

- Inboard seal with spring surrounded by fluid handled, unidirectional

Sterile design:

- Inboard seal with covered spring, polished surface, bi-directional

Bearings

- No separate pump bearings

Drive

- Surface-cooled KSB squirrel-cage motor
- Type of construction V1, V15 / B5, B35
- Enclosure IP55
- Thermal class F
- 3 PTC thermistors
- Duty type: continuous duty S1
- Rated voltage (50 Hz) 220 - 240 V / 380 - 420 V ≤ 2.20 kW; 380 - 420 V / 660 - 725 V ≥ 3.00 kW
- Rated voltage (60 Hz) 440 - 480 V

Explosion-proof design:

- KSB surface-cooled IEC three-phase current squirrel-cage motor
- Rated voltage (50 Hz) 220 - 240 V / 380 - 420 V ≤ 1.85 kW
- Rated voltage (50 Hz) 380 - 420 V / 660 - 725 V ≥ 2.50 kW
- Type of construction IM V1 ≤ 3.30 kW
- Type of construction IM V15 ≥ 4.60 kW
- Enclosure IP55 or IP54
- Type of protection Ex de II
- Temperature class T3
- Duty type: continuous duty S1

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Automation

Automation options:

- PumpDrive
- PumpMeter

Connections

- Axial suction nozzle, tangential discharge nozzle
- Adjustable through 360°

Standard:

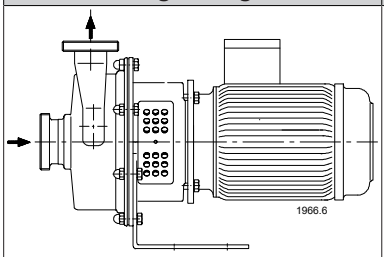
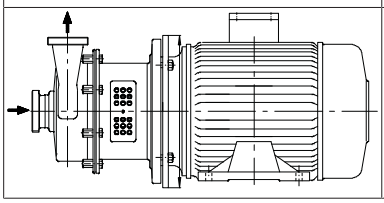
- Threaded connection to DIN 11851 (hygienic pipe union)
- Flange to EN 1092-1

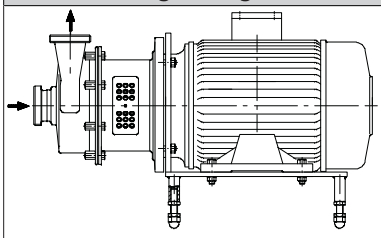
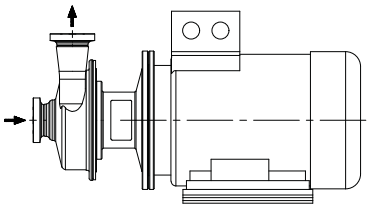
Alternative:

- Flange to DIN 11864-2-NF-A
- Flange to EN 1092-1-F
- Flange to APV-FN
- Threaded connection to DIN 11864-1-GS-A
- Threaded connection to IDF (ISO 2853)
- Threaded connection to SMS standard
- Clamped connection to DIN 32676-A
- Clamped connection to ISO 2852
- Other connection types on request

4.6 Mounting arrangements

Table 7: Mounting arrangements for horizontal installation

Mounting arrangement	Description
	Pump set angle foot mounted ▪ Motor frame size 90 to 112
	Pump set motor foot mounted ▪ Motor frame size 90 to 280

Mounting arrangement	Description
	Pump set ball feet mounted ▪ Motor frame size 90 to 280 ▪ Alternatively mounted on rubber-padded round base feet
	Pump set soleplate mounted ▪ Motor frame size 90 to 280

4.7 Configuration and function

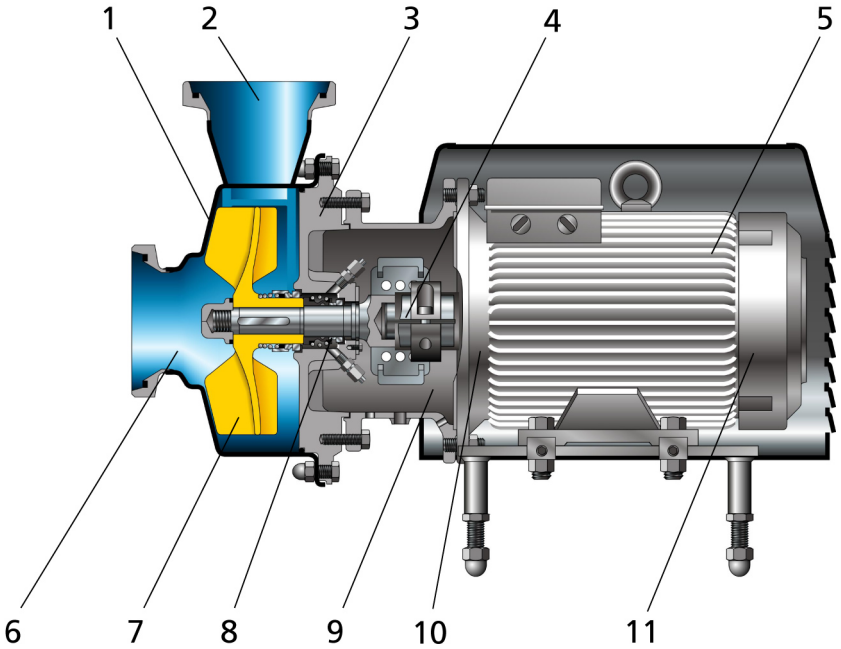


Fig. 5: Vitachrom sectional drawing

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

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

Function The fluid enters the pump via a suction nozzle (6) and is accelerated outward in a radial flow by the rotating impeller (7). The flow profile of the pump casing converts the kinetic energy of the fluid 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 into the inlet. The hydraulic system is closed with a casing cover (3) at the rear side of the impeller; the shaft (4) enters the casing via the casing cover (3). The shaft passage through the casing 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 via a drive lantern.

Sealing The pump is sealed by a standardised mechanical seal (option: two mechanical seals in tandem arrangement).

4.8 Noise characteristics

Table 8: Surface sound pressure level L_{pA} [4)]

Rated power input P_N	Pump set			
	1450 rpm	1750 rpm	2900 rpm	3500 rpm
[kW]	[dB]	[dB]	[dB]	[dB]
1,5	60	61	69	72
2,2	64	65	69	72
3	64	65	71	74
4	62	63	73	76
5,5	68	69	72	75
7,5	68	69	72	75
11	69	70	75	78
15	69	70	75	78
18,5	70	71	75	78
22	72	73	78	81
30	71	72	79	82
37	-	-	79	82
45	-	-	79	82
55	-	-	79	82
75	-	-	82	85
90	-	-	82	85

4.9 Scope of supply

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

- Pump
- Drive

Accessories

E.g.:

- Pump foot or vertically adjustable ball feet.
- Motor shroud (only in combination with vertically adjustable ball feet)
- Mechanical seal in tandem arrangement (quench arrangement)

4.10 Dimensions and weights

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

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

5 Installation at Site

5.1 Checks to be carried out prior to installation

Place of installation

⚠ WARNING

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

Personal injury and damage to property!

- ▹ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1.
- ▹ The mounting surface must be set, flat, and level.
- ▹ Observe the weights indicated.

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

5.2 Installing the pump set

⚠ DANGER

Static charging due to insufficient potential equalisation

Explosion hazard!

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

CAUTION

Ingress of leakage into the motor

Damage to the pump!

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

Fastening

Table 9: Types of fastening

Motor size	Type of fastening
Up to 112 M	Angle foot
All motor sizes	Motor feet
All motor sizes	Ball feet

NOTE

For installation on motor feet of motor sizes 132 or 160, the motor feet must be shimmed (20 mm shim height).

5.2.1 Removing the transport lock

Removing the transport lock

Removing the foam insert

✓ Delivery of pump without motor

1. Suspend or support the back pull-out unit to prevent it from tipping over.
2. Undo hexagon nut 920.02 and hexagon head bolt 901.02 at pump casing 103.
3. Remove discharge cover 163 and set it aside.
4. Pull the back pull-out unit out of the pump casing and place it on a clean, level surface.
5. Remove the foam insert from the pump casing.

6. Push the back pull-out unit into the pump casing.
7. Fit the discharge cover.
8. Tighten hexagon nut 920.02 and hexagon head bolt 901.02 at the pump casing. Tightening torque (⇨ Section 7.6.1, Page 51)

Loosening the locking bolts[5)]

1. Loosen the two locking bolts in drive lantern 341 by at least 4 turns and lock with the two hexagon nuts.
   ⇨ The locking bolts must no longer touch shaft 210.
2. Mount the motor. (⇨ Section 5.2.1.1, Page 24)

Loosening the lock washers[6)]

1. Loosen both lock washers 931 on the outside of the discharge cover, pull outward and secure with the two screws/bolts.
   ⇨ The lock washers must no longer touch shaft 210.
2. Mount the motor. (⇨ Section 5.2.1.1, Page 24)

5.2.1.1 Mounting the motor

DANGER

Incorrect shaft connection

Explosion hazard!

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

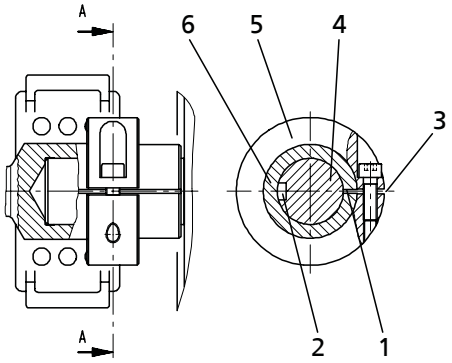

Fig. 6: Fitting the motor shaft stub on the shaft

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

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 46) have been observed/ carried out.

1. The motor has been installed and fastened if required. (⇨ Section 7.5.4, Page 49)
2. Fasten drive latern 341 on the motor.
3. Mount support foot 183, depending on the size.
4. Slip shaft 210 and locking ring 515 on motor shaft.
5. Adjust axial clearance between impeller and pump casing. (⇨ Section 7.5.5, Page 50)
6. Make sure that the slot of shaft 210 aligns with the slot of locking ring 515, and that they are located opposite the keyway of the motor shaft. (See illustration: Fitting the motor shaft stub on shaft 210)
7. Fasten the shaft to the motor shaft using the locking ring.

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5 Applies to Vitachrom 50-50-125/160/200, 65-65-125/160/200 and 80-80-125/160
6 Applies to Vitachrom 50-50-250, 65-65-250, 80-80-250, 100-100-200 and 125-125-200

5.2.2 Installing the pump set

✓ Delivery of a pump set

1. Position the pump set on the foundation and fasten it. (⇨ Section 5.2, Page 23)
2. Place a spirit level on the discharge nozzle to align the pump set.

5.3 Piping

5.3.1 Connecting the piping

DANGER

Impermissible loads acting on the pump nozzles

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

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

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

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

NOTE

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

✓ Suction lift lines have been laid with a rising slope, the suction head line with a downward slope towards the pump.

✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.

✓ The nominal diameters of the pipelines are equal to or greater than the nominal diameters of the pump nozzles.

✓ 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

Welding beads, scale and other impurities in the piping

Damage to the pump!

- ▹ Remove any impurities from the piping.
- ▹ If necessary, install a filter.
- ▹ Observe the information in (⇨ Section 7.2.2.2, Page 42) .

3. If required, install a filter in the piping (see drawing: Filter in the piping).

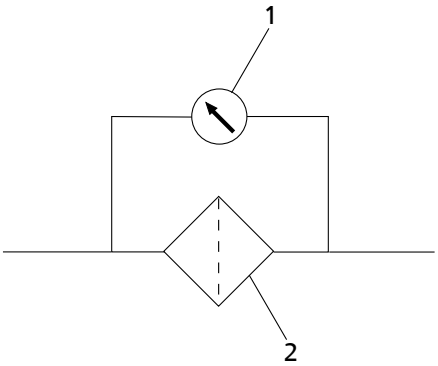

Fig. 7: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

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

4. Connect the pump nozzles to the piping.

CAUTION

Aggressive flushing liquid and pickling agent

Damage to the pump!

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

5.3.2 Permissible forces and moments at the pump nozzles

No piping-induced forces and moments (from warped pipelines or thermal expansion, for example) must act on the pump.

The discharge and suction-side pipes must be anchored in such a way that no forces and moments may act on the discharge and suction nozzle of the pump casing. Otherwise, there is a risk of the impeller rubbing against the pump casing on the suction-side, due to the narrow clearance between the impeller and the suction-side floor of the pump casing.

5.3.3 Vacuum balance line

NOTE

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

The following rules apply to vacuum balance lines:

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

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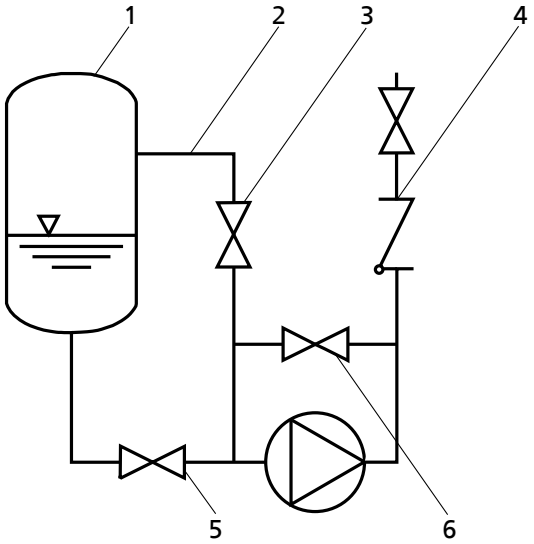

Fig. 8: Vacuum balance system

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

NOTE

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

5.3.4 Auxiliary connections

DANGER

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

Risk of burns!

Explosion hazard!

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

CAUTION

Failure to use or incorrect use of auxiliary connections (quench liquid)

Malfunction of the pump!

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

If a shaft seal with quench is used, fit the quench reservoir in the immediate vicinity of the pump set approximately 1 metre above the pump centreline. Fluid circulation is ensured by thermosyphon effect or forced circulation.

Suitable fittings are available as accessories. When mounting the fittings comply with the instructions provided by the fitting manufacturers.

Quench fluid supply

Connections

- Pipe to DIN 2391
- Compression-type fitting to DIN 2353

Suitable fittings are available as accessories. When mounting the fittings comply with the instructions provided by the fitting manufacturers.

NOTE

The flushing liquid feed line must be laid with a continuously rising slope towards the flushing liquid reservoir.

Arrangement Fit the quench reservoir (available as accessory) in the immediate vicinity of the pump set approximately one metre above the pump centreline.
Fluid circulation is ensured by thermosyphon effect or forced circulation.

5.4 Enclosure/insulation

DANGER

Risk of potentially explosive atmosphere due to insufficient venting

Explosion hazard!

- Make sure the space between the casing cover/discharge cover and the bearing cover is sufficiently vented.
- Never close or cover the perforation of the bearing bracket guards (e.g. by insulation).

WARNING

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

Risk of burns!

- Insulate the volute casing.
- Fit protective equipment.

CAUTION

Heat build-up in the bearing bracket

Damage to the bearing!

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

5.5 Electrical connection

DANGER

Electrical connection work by unqualified personnel

Risk of fatal injury due to electric shock!

- Always have the electrical connections installed by a trained and qualified electrician.
- Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.

WARNING

Incorrect connection to the mains

Damage to the mains network, short circuit!

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

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

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NOTE

A motor protection device is recommended.

5.5.1 Setting the time relay

CAUTION

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

Damage to the pump (set)!

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

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

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

5.5.2 Connecting the motor

NOTE

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

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

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

5.5.3 Earthing

DANGER

Electrostatic charging

Explosion hazard!

Damage to the pump set!

- ▹ Connect the PE conductor to the earthing terminal provided.
- ▹ Provide for potential equalisation between the pump set and the foundation.

5.6 Checking the direction of rotation

WARNING

Hands inside the pump casing

Risk of injuries, damage to the pump!

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

CAUTION

Incorrect direction of rotation with non-reversible mechanical seal

Damage to the mechanical seal and leakage!

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

CAUTION

Drive and pump running in the wrong direction of rotation

Damage to the pump!

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

The correct direction of rotation of 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 is running in the wrong direction of rotation, check the electrical connection of the motor and the control system if applicable.

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6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇨ Section 5.5, Page 28)
- The pump has been primed with the fluid to be handled. The pump has been vented. (⇨ Section 6.1.2, Page 31)
- The direction of rotation has been checked.
- All auxiliary connections required are connected and operational.
- The lubricants have been checked.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇨ Section 6.4, Page 38)
- The lock washers, if any, have been removed from the shaft groove.

6.1.2 Priming and venting the pump

⚠ DANGER

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

Risk of burns!

Explosion hazard!

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

⚠ DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.

▷ Provide sufficient inlet pressure.

▷ Provide an appropriate monitoring system.

CAUTION

Increased wear due to dry running

Damage to the pump set!

▷ Never operate the pump set without liquid fill.

▷ Never close the shut-off element in the suction line and/or supply line during pump operation.

1. Vent the pump and suction line and prime both with the fluid to be handled.
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any.

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NOTE

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.

6.1.3 Start-up

DANGER

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

Explosion hazard!

Hot or toxic fluids escaping!

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

DANGER

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

Explosion hazard!

Damage to the pump set!

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

CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

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

✓ The system piping has been cleaned.

✓ The pump, suction line and inlet tank, if any, have been vented and primed with the fluid to be pumped.

✓ The lines for priming and venting have been closed.

CAUTION

Start-up against open discharge line

Motor overload!

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

1. Fully open the shut-off element in the suction head/suction lift line.
2. Close or slightly open the shut-off element in the discharge line.

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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

Heat build-up inside the pump

Damage to the shaft seal!

- ▷ Depending on the type of installation, the pump set requires sufficient after-run time – with the heat source switched off – until the fluid handled has cooled down.

CAUTION

Backflow of fluid handled is not permitted

Motor or winding damage! Mechanical seal damage!

- ▷ Close the shut-off elements.

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

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

NOTE

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

For prolonged shutdown periods:

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

CAUTION

Risk of freezing during prolonged pump shutdown periods

Damage to the pump!

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

6.1.6 Quench liquid supply

Permissible quench liquids

The quench liquid should preferably form a solution with the fluid handled and be environmentally compatible.

Typical quench liquids:

- Water with a conductivity of 100-800 µS/cm
- Water/glycol mixtures
- Glycerine[7)]

Temperature and pressure limits

Table 11: Permissible temperature and pressure limits

	Minimum	Maximum
Temperature	-10 °C and $T_{Melting}$ +10 °C[8)]	60 °C and $T_{Boiling}$-10 °C[8)]
Pressure	Ambient pressure	0.5 bar gauge pressure

One-way quench

The one-way quench supply should be adjusted to a constant flow ≥ 0.3 l/min.

6.2 Operating limits

DANGER

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

Explosion hazard!

Hot or toxic fluid could escape!

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

DANGER

Formation of a potentially explosive atmosphere inside the pump

Explosion hazard!

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

6.2.1 Ambient temperature

CAUTION

Operation outside the permissible ambient temperature

Damage to the pump (set)!

- ▷ Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 12: Permissible ambient temperatures

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

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7 Make sure the circulation line diameter is ≥ ¼".
8 Depending on quench liquid used.

6.2.2 Frequency of starts

⚠ DANGER

Excessive surface temperature of the motor

Explosion hazard!

Damage to the motor!

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

The frequency of starts is 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

Re-starting while motor is still running down

Damage to the pump (set)!

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

6.2.3 Cleaning in place (CIP)

CAUTION

Elastomers do not have sufficient resistance

Damage to the pump!

- ▷ Effect cleaning/sterilisation only if the elastomer components used in the pump (e.g. O-rings, mechanical seals) are made of EPDM or other approved materials.

Application CIP may be effected with the pump running or with the pump stopped.

Cleaning agents When CIP cleaning a system where the pump set is installed, make sure to comply with the concentration limits, temperature limits and contact times given below for the cleaning agents and disinfectants:

Table 13: Cleaning agents for CIP

Cleaning agents	Concentration (% b.w.)	Temperature t [°C]	Contact time [h]
Sodium hydroxide (soda lye)	5	90	-
Phosphoric acid	3	90	≤ 1
Hot water	-	90	-
Lye (alkaline)	5	90	-
Nitric acid	2	50	≤ 0.5
Peracetic acid or hydrogen peroxide	0.5 1	40 20	≤ 0.5

6.2.4 SIP (steaming in place)

⚠ WARNING

Pump casing takes on the same temperature as the sterilisation fluid

Risk of burns!

- ▷ Fit additional protective devices.
- ▷ Observe the general safety rules and regulations for steam applications.

CAUTION

Elastomers do not have sufficient resistance

Damage to the pump!

▷ Effect cleaning/sterilisation only if the elastomer components used in the pump (e.g. O-rings, mechanical seals) are made of EPDM or other approved materials.

CAUTION

SIP with the pump running

Damage to the mechanical seals!

▷ Effect SIP (cleaning using superheated steam) only during standstill of the pump set.

Conditions Only effect SIP during standstill of the pump set.

Limits **Table 14:** SIP temperature requirements

Parameter	Value
Maximum temperature of saturated steam (SIP)	140 °C
Absolute pressure	3 bar

6.2.5 Fluid handled

6.2.5.1 Flow rate

Table 15: Flow rate

Temperature range (t)	Minimum flow rate	Maximum flow rate
-30 to +70 °C	≈ 15 % of Q_{BEP} [9)]	See hydraulic curves
> 70 to +110 °C	≈ 25 % of Q_{BEP} [9)]	

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 16: Key

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

6.2.5.2 Density of the fluid handled

The pump input power changes in proportion to the density of the fluid handled.

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9 Best efficiency point

CAUTION

Impermissibly high density of the fluid handled

Motor overload!

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

6.2.5.3 Viscosity of the fluid handled

The discharge head, flow rate and power input of the pump are influenced by the viscosity of the fluid handled.

CAUTION

The fluid handled has a higher viscosity than permitted.

Risk of motor overload!

- ▹ Observe the viscosity limits for the fluid handled given in the data sheet.
- ▹ Make sure the motor has sufficient power reserves.

6.2.5.4 Abrasive fluids

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. 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.

DANGER

Abraded casing wall

Explosion hazard!

- ▹ 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.

✓ The safety instructions for dismantling the pump have been observed. (⇨ Section 7.4.1, Page 43)

1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
2. Spray the preservative through the suction nozzle and discharge nozzle. It is advisable to then close the pump nozzles (e.g. with plastic caps).
3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil or grease, food-approved if required) to protect them against corrosion.
   Observe the additional instructions on preservation. (⇨ Section 3.3, Page 13)

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

Observe any additional instructions and information provided. (⇨ Section 3, Page 13)

6.4 Returning to service

For returning the equipment to service observe the sections on commissioning/start-up and the operating limits. (⇨ Section 6.1, Page 31) (⇨ Section 6.2, Page 34)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 39)

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

▹ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.

NOTE

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

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7 Servicing/Maintenance

7.1 Safety regulations

DANGER

Sparks produced during servicing work

Explosion hazard!

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

DANGER

Improperly serviced pump set

Explosion hazard!

Damage to the pump set!

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

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

WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

DANGER

Improper cleaning of coated pump surfaces

Explosion hazard by electrostatic discharge!

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

WARNING

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

Risk of injury!

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

WARNING

Insufficient stability

Risk of crushing hands and feet!

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

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

NOTE

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

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/Inspection

7.2.1 Supervision of operation

DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

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

DANGER

Incorrectly serviced shaft seal

Explosion hazard!

Hot, toxic fluid escaping!

Damage to the pump set!

Risk of burns!

Fire hazard!

- ▷ Regularly service the shaft seal.

DANGER

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

Explosion hazard!

Fire hazard!

Damage to the pump set!

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

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CAUTION

Increased wear due to dry running

Damage to the pump set!

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

CAUTION

Impermissibly high temperature of fluid handled

Damage to the pump!

- ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- ▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇨ Section 6.2, Page 34)

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 33)
- Check the static sealing elements for leakage.
- Check the rolling element bearings for running noises.
  Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
  To make sure that stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.
  The bearing temperature must not exceed 90 °C (measured on the motor housing).

CAUTION

Operation outside the permissible bearing temperature

Damage to the pump!

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

NOTE

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

7.2.2 Inspection work

DANGER

Excessive temperatures caused by friction, impact or frictional sparks

Explosion hazard!

Fire hazard!

Damage to the pump set!

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

DANGER

Static charging due to insufficient potential equalisation

Explosion hazard!

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

7.2.2.1 Checking the clearances

✓ Noise and vibrations suggest that the rotating vanes touch the pump casing.

1. Dismantle the pump casing.
2. Examine pump casing and impeller vanes for signs of seizure or rubbing contact.
3. Smoothen any signs of seizure or rubbing contact using a polishing cloth.
4. Remove any burrs from the impeller vane.
5. Re-adjust the axial clearance (distance between casing and impeller).
   Values see table below.
   Procedure (⇨ Section 7.5.5, Page 50)
6. Fit the pump casing.
   Tightening torque (⇨ Section 7.6.1, Page 51)
   Procedure (⇨ Section 7.5, Page 46)

Table 17: Axial clearance

	Axial distance[10)]
New (default setting)	0,7 mm
Maximum permissible enlargement	1,0 mm

7.2.2.2 Cleaning filters

CAUTION

Insufficient inlet pressure due to clogged filter in the suction line

Damage to the pump!

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

7.2.2.3 Checking the quench liquid

Periodically check the quench liquid for contamination.
Drain the quench liquid, if required. Clean the quench system and fill with new quench liquid.

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10 Between pump casing and impeller vane

7.2.2.4 Cleaning the strainer

To prevent contaminants from entering the valves and the mechanical seal (particulary during commissioning), an additional strainer has been installed in the quench piping.

CAUTION

Mechanical seals are not flushed sufficiently

Damage to the pump!

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

Table 18: Cleaning intervals

Cleaning	Interval
Following commissioning	Daily
After third check	Specify suitable interval as a function of the degree of contamination.

7.3 Drainage/cleaning

⚠ WARNING

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

Hazard to persons and the environment!

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

1. Use the relevant pump connections to drain the fluid handled.
2. Always flush the pump, in particular if it has been used to handle harmful, explosive and hot fluids or other fluids posing a high risk.
   Always flush and clean the pump before transporting it to the workshop.
   Provide a cleaning record for the pump.

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- ▹ Properly shut down the pump set. (⇨ Section 6.1.5, Page 33)
- ▹ Close the shut-off elements in the suction line and discharge line.
- ▹ Drain the pump and release the pump pressure.
- ▹ Shut off any auxiliary connections.
- ▹ Allow the pump set to cool down to ambient temperature.

⚠ WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

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

⚠ WARNING

Hot surface

Risk of injury!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

Always observe the safety instructions and information. (⇨ Section 7.1, Page 39)

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

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

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

NOTE

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

NOTE

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

7.4.2 Preparing the pump set

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

7.4.3 Removing the complete pump set from the piping

1. Disconnect the discharge nozzle and suction nozzle from the piping.
2. Depending on the pump size and motor size, unscrew the bolts that fix the support foot or motor foot to the foundation.
3. Remove the complete pump set from the piping.
   Alternative: Leave pump casing 101 installed in the piping. Undo clamping piece 81-44. Pull the remaining back pull-out unit out towards the back (back pull-out design).

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7.4.4 Dismantling the motor

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

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

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 43) to (⇨ Section 7.4.3, Page 44) have been observed/carried out.

1. Depending on the pump/motor size, unscrew the bolts that fix the motor foot to the foundation.
2. Undo nuts 920.01.
3. Remove cover plates 68-3 from drive lantern 341.
4. Undo hexagon head bolts 901.3.
5. Insert both lock washers 931 into the groove in shaft 210.
6. Tighten hexagon head bolts 901.3, if fitted.
7. Remove the motor.

7.4.5 Removing the back pull-out unit

⚠ WARNING

Back pull-out unit tilting

Risk of squashing hands and feet!

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

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 43) to (⇨ Section 7.4.4, Page 45) have been observed/carried out.

1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
2. Undo nut 920.02 (with bolted discharge cover) or 901.02 (with clamped discharge cover) at the volute casing.
3. Pull the back pull-out unit out of the volute casing.
4. Remove and dispose of O-ring 412.01.
5. Place the back pull-out unit on a clean and level surface.

7.4.6 Removing the impeller

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 43) to (⇨ Section 7.4.5, Page 45) have been observed/carried out.

✓ The back pull-out unit is kept in a clean and level assembly area.

1. Undo impeller nut 922.01 (right-hand thread).
2. Remove O-ring 412.02 from impeller nut.
3. Remove impeller 230.01 with an impeller removal device.
4. Place impeller 230.01 on a clean and level surface.
5. Remove key 940.01 from shaft 210.01.
6. Remove O-ring 412.03 from impeller hub and/or pull V-ring 411.05 off shaft 210.01.

7.4.7 Removing the mechanical seal

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 43) to (⇨ Section 7.4.6, Page 45) have been observed/carried out.

✓ The back pull-out unit is kept in a clean and level assembly area.

1. Remove the rotating part of the mechanical seal (spring-loaded ring) from impeller 230.01.
2. Remove second mechanical seal (rotating assembly), if any, from shaft 210.01.
3. Unscrew hexagon nuts 920.07, if fitted, on drive lantern 341.
4. Remove discharge cover 163.01 from drive lantern 341.
5. Remove the stationary assembly of the mechanical seal (seat ring 433.01) from discharge cover 163.01.
6. Remove stationary assembly of the second mechanical seal 433.02, if any, from discharge cover 163.01.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ DANGER

Wrong selection of motor

Explosion hazard!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

CAUTION

Improper reassembly

Damage to the pump!

- ▹ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.
- ▹ Use original spare parts only.

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

Sealing elements Always use new O-rings.

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

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

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

Assembly adhesives Avoid the use of assembly adhesives, if possible.

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Only use food-grade lubricants (e.g. water) for pumps used in hygienic food applications.

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/ carried out.

✓ The assembled bearing as well as the individual parts are kept in a clean and level assembly area.

✓ All disassembled parts have been cleaned and checked for wear.

✓ Any damaged or worn parts have been replaced by original spare parts.
Seal size: (⇨ Section 7.5.2.1, Page 48)
Material composition: (⇨ Section 7.5.2.2, Page 48)

✓ The sealing surfaces have been cleaned.

1. Clean the seat ring locations in discharge cover 163.01.

CAUTION

Elastomers in contact with oil/grease

Shaft seal failure!

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

2. Carefully insert seat ring and second seat ring, if any.
   Make sure that pressure is applied evenly.
3. Fit discharge cover 163.01 in the recess of drive lantern 341. Please note:
   Single mechanical seal: Turn the discharge cover so that one of the quench connection holes (R 1/8) points downwards.
   Double mechanical seal: Fit the discharge cover so that the quench connections are in horizontal position on both sides, and the quench lines can be connected through the openings in the drive lantern.
4. Fit and tighten nuts 920.07, if any.

NOTE

Use water as a lubricant to reduce friction losses when assembling the seal.

5. Slip secondary mechanical seal, if any, on shaft 210.01.
6. Slip V-Ring 411.05, if any, on shaft 210.01.
7. Insert keys 940.01 into the shaft keyway.
8. Insert O-ring 412.03 in impeller.
9. Slip rotating assembly of the primary mechanical seal 433.01 onto impeller 230.
10. Slip impeller 230 onto shaft 210.01.
11. Insert O-ring 412.02 in impeller nut.
12. Fit and tighten impeller nut 922.

7.5.2.1 Seal sizes for double mechanical seals

Table 19: Seal sizes

Size	Sealing element	Nominal impeller diameter [mm]			
		125	160	200	250
50	Primary seal	KU038R	KU038R	KU038R	KU048R
	Secondary seal	KU022SO	KU022SO	KU022SO	KU028SO
65	Primary seal	KU038R	KU038R	KU038R	KU048R
	Secondary seal	KU022SO	KU022SO	KU022SO	KU028SO
80	Primary seal	KU038R	KU038R	-	KU048R
	Secondary seal	KU022SO	KU022SO	-	KU028SO
100	Primary seal	-	-	KU048R	-
	Secondary seal	-	-	KU028SO	-
125	Primary seal	-	-	KU048R	-
	Secondary seal	-	-	KU033SO	-

7.5.2.2 Material code for single and double mechanical seals

Table 20: Material code

Variant code		Primary seal						Secondary seal
		I01/T11 I06/T16	I03/T13 I08/T18	I02/T12 I07/T17	I04/T14 I09/T19	I10/T20	I21/T31	T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T31
Code sequence	Description	Code to DIN EN 12756						
1	Primary ring	B	Q12	B	Q12	Q22	Q12	B
2	Mating ring	Q1	Q1	Q1	Q1	Q2	Q1	Q1
3	Secondary seals	E1-04	E1-04	V26	V26	E1-04	M1	E
4	Spring	G	G	G	G	G	G	G
5	Other components	G	G	G	G	G	G	G

Table 21: Key to materials

Code[11)]	Material
B	Carbon, resin-impregnated (FDA-approved)
Q1/Q12	Silicon carbide, sintered without pressure (FDA-approved)
Q2/Q22	Silicon carbide, reaction-bonded (FDA-approved)
E1-04	EPDM (FDA-approved, 3-A, USP VI)
V26	FPM (FDA-approved, 3-A, USP VI)
M1	PTFE (FDA-approved)
G	CrNiMo steel

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11 DIN EN 12756

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/carried out.

✓ The pre-assembled unit (motor, shaft, drive lantern, discharge cover) as well as the individual parts are kept in a clean and level assembly area.

✓ All disassembled 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 O-ring 412.03, if fitted, in impeller 230.
2. Slip V-Ring 411.05, if any, on shaft 210.01.
3. Insert key 940.01 into shaft 210.01.
4. Slip rotating assembly of the primary mechanical seal 433.01 onto impeller hub 230.
5. Slip impeller 230 onto shaft 210.01.
6. Insert O-ring 412.02 in impeller nut.
7. Fit and tighten impeller nut 922.
   Tightening torque (⇨ Section 7.6.1, Page 51)

7.5.4 Installing the back pull-out unit

⚠ WARNING

Back pull-out unit tilting

Risk of squashing hands and feet!

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

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 46) to (⇨ Section 7.5.3, Page 49) have been observed/carried out.

✓ Any damaged or worn parts have been replaced by original spare parts.

✓ The sealing surfaces have been cleaned.

1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
2. If required, fit new O-rings 412.01 into the recess of discharge cover 163.01.
3. Insert the back pull-out unit into pump casing 103.
4. Depending on the pump size and motor size, fit support foot 183.
5. Tighten hexagon nut 920.02 and hexagon head bolt 901.02 at the pump casing.
   Tightening torque (⇨ Section 7.6.1, Page 51)

7.5.5 Adjusting the clearance gaps

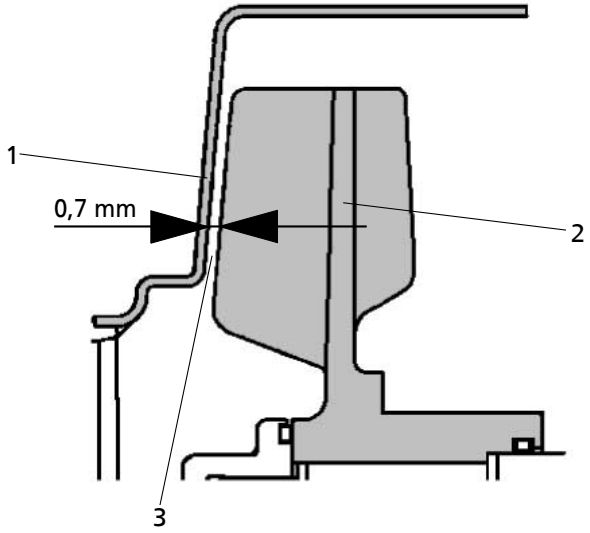

Fig. 9: Axial clearance between pump casing and impeller

1	Casing wall	2	Impeller
3	Axial clearance Clearance gap: 0.7 mm		

DANGER

Incorrect axial clearance

Explosion hazard!

- ▹ Re-adjust axial clearance between pump casing and impeller whenever assembly/installation work is carried out.

  ⇨ Use one of the methods described below to adjust the axial clearance.

Adjusting the clearance gap using a depth gauge

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 46) to (⇨ Section 5.2.1.1, Page 24) have been observed/carried out.

1. Firmly bolt casing 103.01 to drive lantern 341.01 or discharge nozzle 163.01. Tightening torque (⇨ Section 7.6.1, Page 51)
2. Shift the shaft in such a way that the impeller will run freely without rubbing on the casing when it is turned by hand several times.
   This marks the "O" position which serves as starting point for setting the actual clearance.
3. Introduce the depth gauge through the suction nozzle.
4. Set an axial distance of 0.7 mm between the inner pump wall (suction side) and the front edge of the impeller vanes by shifting the shaft towards the back.
5. Firmly fix the impeller using clamping ring 515.01 and hexagon socket head cap screw 914.01.
   Make sure that the shaft slot of shaft 210.01 aligns with the slot of locking ring 515.01, and that they are located opposite the keyway of the motor shaft end.
   Starting torque (⇨ Section 7.6.1, Page 51)

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Adjusting the clearance gap using a spacer plate

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 46) to (⇨ Section 5.2.1.1, Page 24) have been observed/carried out.

1. Clamp the spacer plate[12)] (0.7 mm thickness) between impeller and casing.
2. Firmly bolt casing 103.01 to drive lantern 341.01 or discharge nozzle 163.01. Tightening torque (⇨ Section 7.6.1, Page 51)
3. Slip the impeller onto the spacer plate.
4. Firmly fix the impeller using clamping ring 515.01 and hexagon socket head cap screw 914.01.
   Make sure that the shaft slot of shaft 210.01 aligns with the slot of locking ring 515.01, and that they are located opposite the keyway of the motor shaft end.
5. Dismantle the pump casing
6. Remove the spacer plate.
7. Fit the pump casing

7.5.6 Checking inducer run-out

On inducer version only:

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 46) bis (⇨ Section 7.5.5, Page 50) have been observed/carried out.

1. Once clamping ring 515.01 has been tightened, check inducer run-out.
   Maximum run-out: 0.15 mm

7.6 Tightening torques

7.6.1 Tightening torques for the pump set

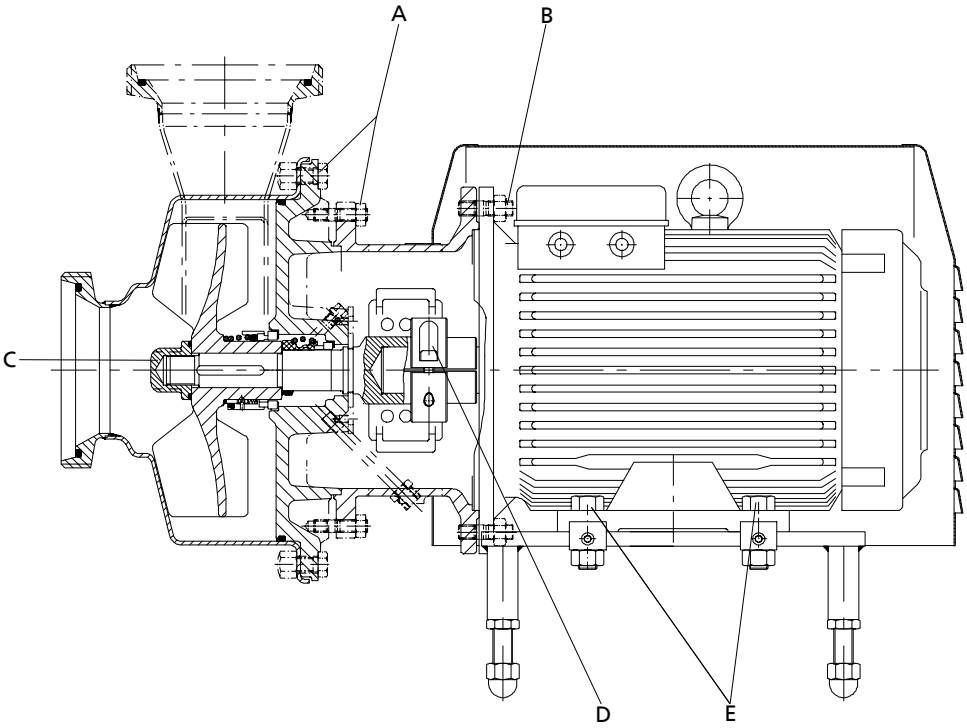

Fig. 10: Tightening points

Table 22: Tightening torques [NM] for bolted/screwed connections at the pump

Position	Thread	
A	M10	38

12 Spacer plates can be purchased from KSB.

Position	Thread	
A	M12	55
B	M10	38
	M12	55
	M16	130
C	M12 × 1,5	55
	M24 × 1,5	130
	M30 × 1,5	170
D	M6	21
	M8	28
	M10	53
E	M8	20
	M10	38
	M12	55
	M16	130
	M20	250

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 (⇨ Section 9.1, Page 56)
- 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 23: 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
210.01	Shaft	1	1	2	2	2	3	30 %
230.01	Impeller	1	1	1	2	2	3	30 %
412.01	O-ring (casing)	2	3	4	5	6	8	90 %
412.02	O-ring (impeller nut)	2	3	4	5	6	8	90 %
412.03	O-ring (impeller)	2	3	4	5	6	8	90 %
433.01	Mechanical seal (primary)	2	3	4	5	6	8	90 %
433.02	Mechanical seal (secondary)	2	3	4	5	6	8	90 %

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Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
411.01	Joint ring (suction side)	2	3	4	5	6	8	90 %
411.02	Joint ring (discharge side)	2	3	4	5	6	8	90 %

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

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

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

A Impeller rubs on the casing

B Pump delivers insufficient flow rate

C Motor is overloaded

D Motor protection switch trips the pump

E Increased bearing temperature

F Leakage at the pump

G Excessive leakage at the shaft seal

H Vibrations during pump operation

I Impermissible temperature increase in the pump

Table 24: Trouble-shooting

A	B	C	D	E	F	G	H	I	Possible cause	Remedy[13)]
-	✗	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller.[14)] Increase the speed (turbine, I.C. engine).
-	✗	-	-	-	-	-	✗	✗	Pump or piping are not completely vented or primed.	Vent and/or prime.
-	✗	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
-	✗	-	-	-	-	-	-	-	Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
-	-	-	-	✗	-	✗	✗	-	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.
-	✗	-	-	-	-	-	✗	✗	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 supply line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall.
-	✗	-	-	-	-	-	-	-	Wrong direction of rotation	Interchange two of the phases of the power cable.
-	✗	✗	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	-	-	-	-	✗	-	Defective bearing(s)	Replace.
-	-	-	-	-	-	-	✗	✗	Flow rate is too low.	Increase the minimum flow rate.

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

14 Contact KSB.

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A	B	C	D	E	F	G	H	I	Possible cause	Remedy[13)]
-	✗	-	-	-	-	-	✗	-	Wear of internal components	Replace worn components by new ones.
-	✗	✗	-	-	-	-	✗	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point.
-	-	✗	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
-	-	-	-	-	✗	-	-	-	Defective gasket	Fit new gasket between pump casing and discharge cover.
-	-	-	-	-	-	✗	-	-	Worn shaft seal	Fit new shaft seal.
-	-	-	-	-	-	✗	-	-	Score marks or roughness on shaft	Fit new shaft. Fit new shaft seal.
-	-	-	-	-	-	✗	-	-	Vibrations during pump operation	Correct the suction conditions. Increase the pressure at the pump suction nozzle.
-	-	-	-	✗	-	-	✗	-	Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
-	-	-	-	-	-	-	✗	-	Rotor out of balance	Clean rotor. Re-balance rotor.
-	-	✗	-	-	-	-	-	-	Incorrect setting of motor protection switch	Check setting. Fit new motor protection switch.
✗	-	-	-	-	-	-	-	-	Axial clearance (specified = 0.7 mm) is too narrow.	Adjust axial clearance to 0.7 mm (minimum).
-	✗	-	-	-	-	-	-	-	Axial clearance is too large.	Adjust axial clearance to 0.7 mm.

9 Related Documents

9.1 Exploded view / List of components

9.1.1 Vitachrom standard design

The standard design (without inducer) of the Vitachrom hygienic pump is available in two size groups which differ in design details.

Size group I

- 50-125, 50-160, 50-200
- 65-125, 65-160, 65-200
- 80-125, 80-160

Size group II

- 50-250
- 65-250
- 80-250
- 100-200
- 125-200

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9.1.1.1 Exploded view, size group I with ball feet

This illustration applies to the following pump sizes:

050-050-125	065-065-125	080-080-125
050-050-160	065-065-160	080-080-160
050-050-200	065-065-200	

[Supplied in packaging units only

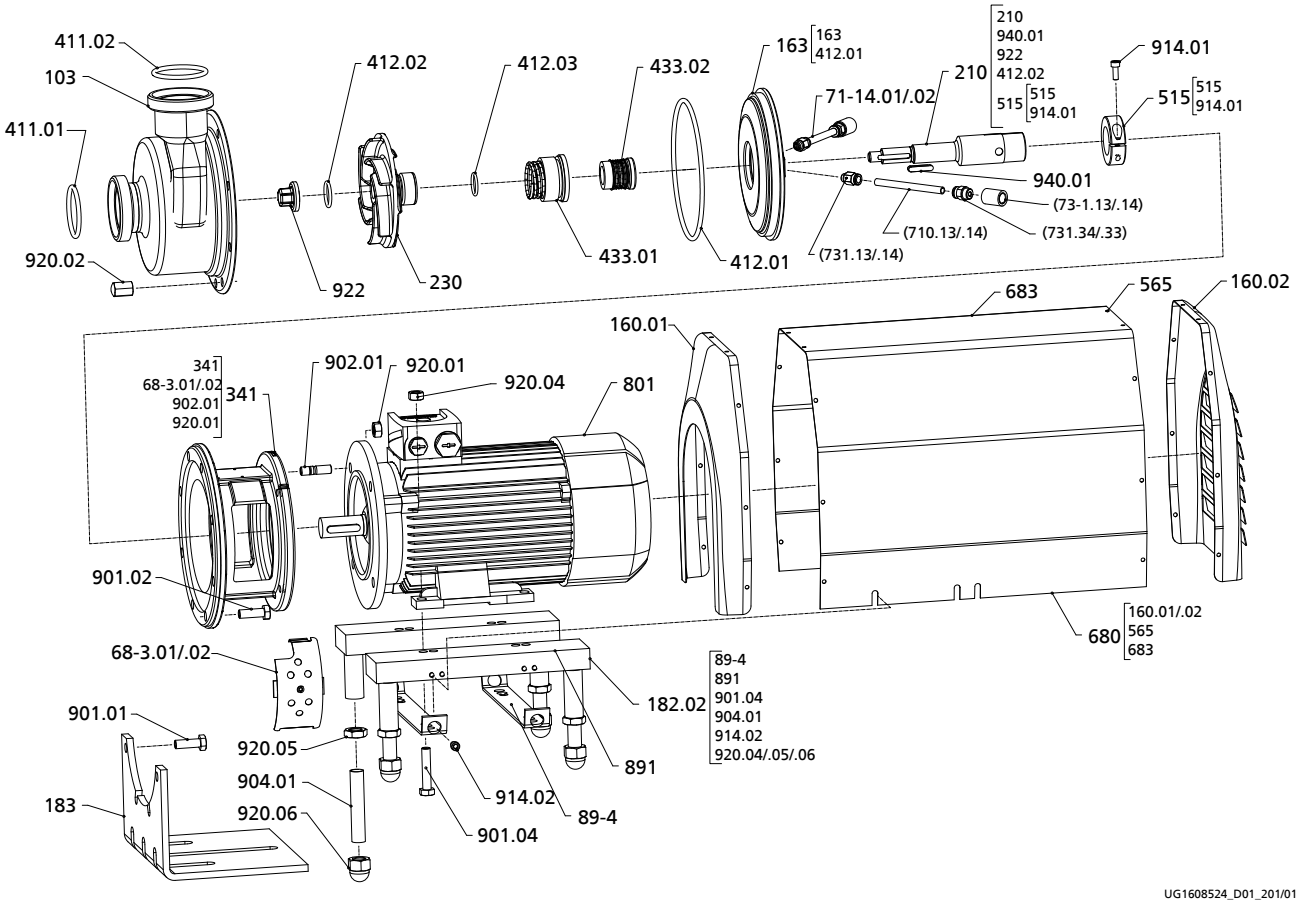

Fig. 11: Exploded view

Table 25: List of components

Part No.	Description	Part No.	Description
103	Pump casing	683	Hood
160.01/.02	Cover	71-14.01/.02	Connection pipe
163	Discharge cover	73-1.13/.14	Socket
182.02	Ball feet	710.13/.14	Pipe
183	Support foot[15)]	731.13/.14/.33/.34	Pipe union
210	Shaft	89-4	Shim
230	Impeller	801	Flanged motor
341	Drive lantern	891	Base frame
411.01/.02	Joint ring	901.01/.02/.04	Hexagon head bolt
412.01/.02/.03	O-ring	902.01	Stud
433.01/.02	Mechanical seal	904.01	Grub screw
515	Locking ring	914.01/.02	Hexagon socket head cap screw
565	Rivet	920.01/.02/.04/.05/.06	Nut

15 Up to motor size 112M

Part No.	Description	Part No.	Description
68-3.01/.02	Cover plate	922	Impeller nut
680	Guard	940.01	Key

9.1.1.2 Exploded view, size group I with levelling feet

This illustration applies to the following pump sizes:

050-050-125	065-065-125	080-080-125
050-050-160	065-065-160	080-080-160
050-050-200	065-065-200	

[Supplied in packaging units only

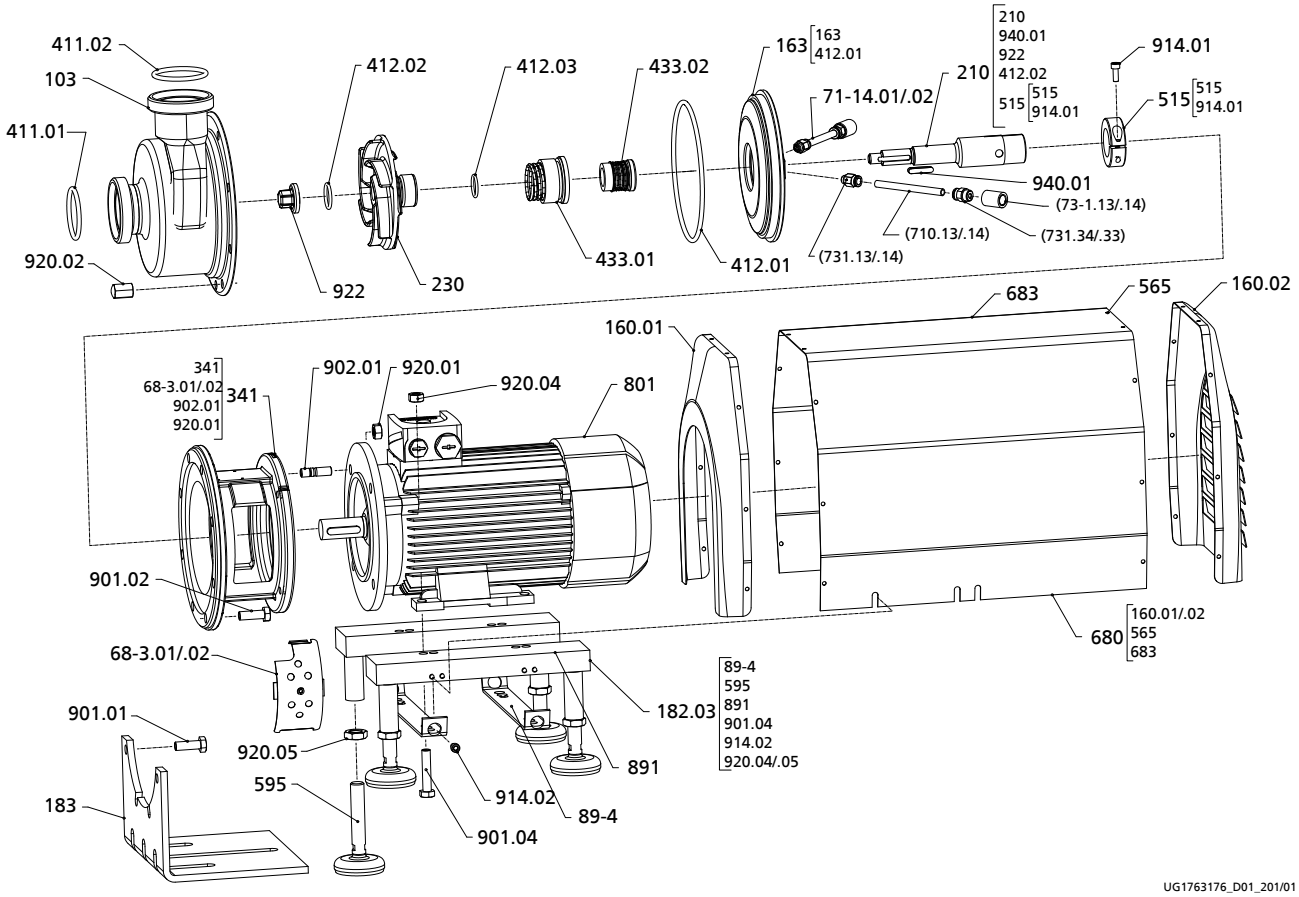

Fig. 12: Exploded view

Table 26: List of components

Part No.	Description	Part No.	Description
103	Pump casing	680	Guard
160.01/.02	Cover	683	Hood
163	Discharge cover	71-14.01/.02	Connection pipe
182.03	Levelling feet	73-1.13/.14	Socket
183	Support foot[16)]	710.13/.14	Pipe
210	Shaft	731.13/.14/.33/.34	Pipe union
230	Impeller	89-4	Shim
341	Drive lantern	801	Flanged motor
411.01/.02	Joint ring	891	Base frame
412.01/.02/.03	O-ring	901.01/.02/.04	Hexagon head bolt

16 Up to motor size 112M

Part No.	Description	Part No.	Description
433.01/.02	Mechanical seal	902.01	Stud
515	Locking ring	914.01/.02	Hexagon socket head cap screw
565	Rivet	920.01/.02/.04/.05	Nut
595	Support	922	Impeller nut
68-3.01/.02	Cover plate	940.01	Key

9.1.1.3 Exploded view, size group II with ball feet

This illustration applies to the following pump sizes:

050-050-250 065-065-250 080-080-250 100-100-200 125-125-200

[Supplied in packaging units only

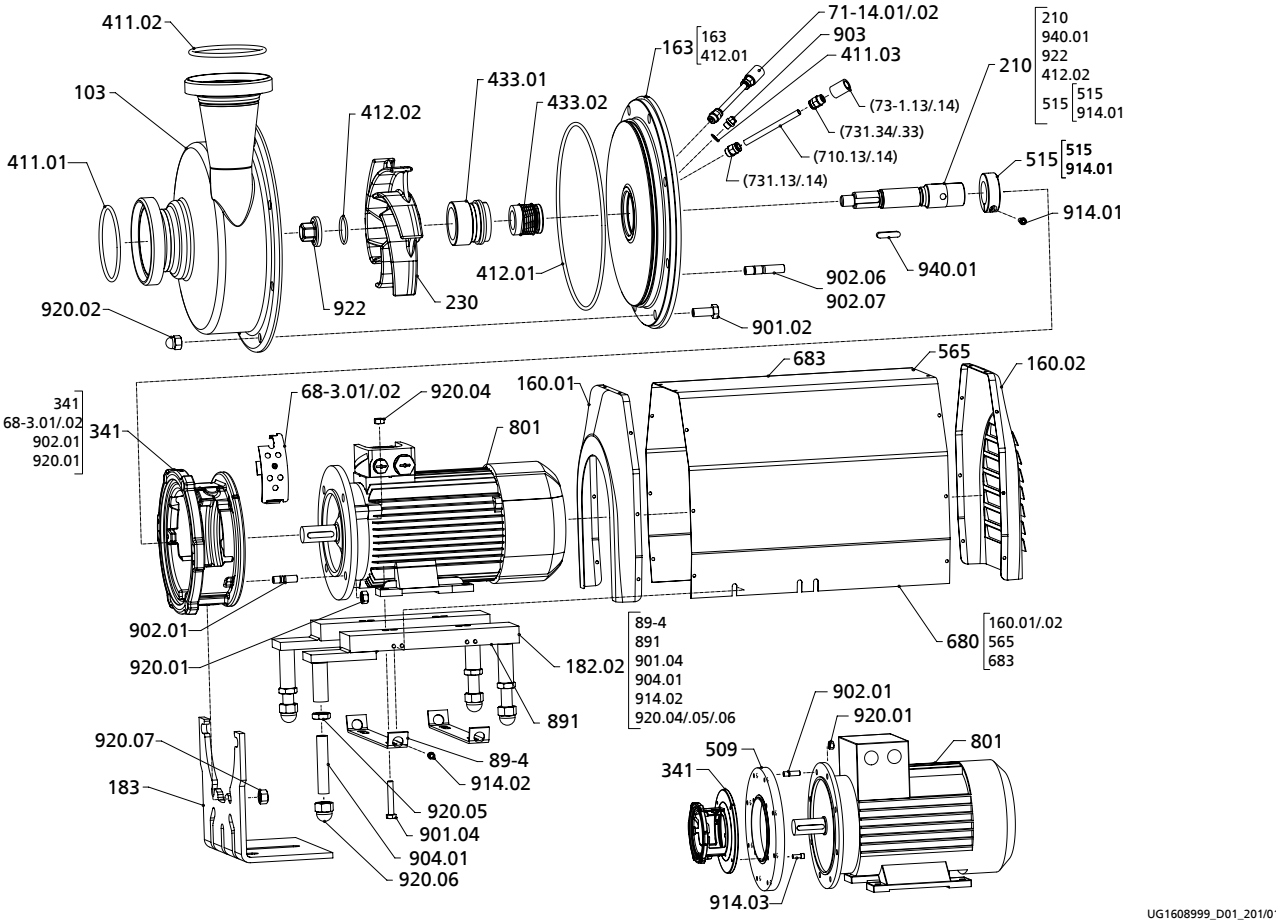

Fig. 13: Exploded view

Table 27: List of components

Part No.	Description	Part No.	Description
103	Circular casing	683	Hood
160.01/.02	Cover	71-14.01/.02	Connection pipe
163	Discharge cover	73-1.13/.14	Socket
182.02	Ball feet	710.13/.14	Pipe
183	Support foot	731.13/.14/.33/.34	Pipe union
210	Shaft	801	Flanged motor
230	Impeller	89-4	Shim
341	Drive lantern	891	Base frame
411.01/.02/.03/.04	Joint ring	901.02/.04	Hexagon head bolt
412.01/.02	O-ring	902.01/.06/.07	Stud
433.01/.02	Mechanical seal	903	Screw plug
509	Intermediate ring	904.01	Grub screw
515	Locking ring	914.01/.02/.03	Hexagon socket head cap screw
565	Rivet	920.01/.02/.04/.05/.06/.07	Nut
68-3.01/.02	Cover plate	922	Impeller nut
680	Motor shroud	940.01	Key

9.1.1.4 Exploded view, size group II with levelling feet

This illustration applies to the following pump sizes:

050-050-250 065-065-250 080-080-250 100-100-200 125-125-200

[Supplied in packaging units only

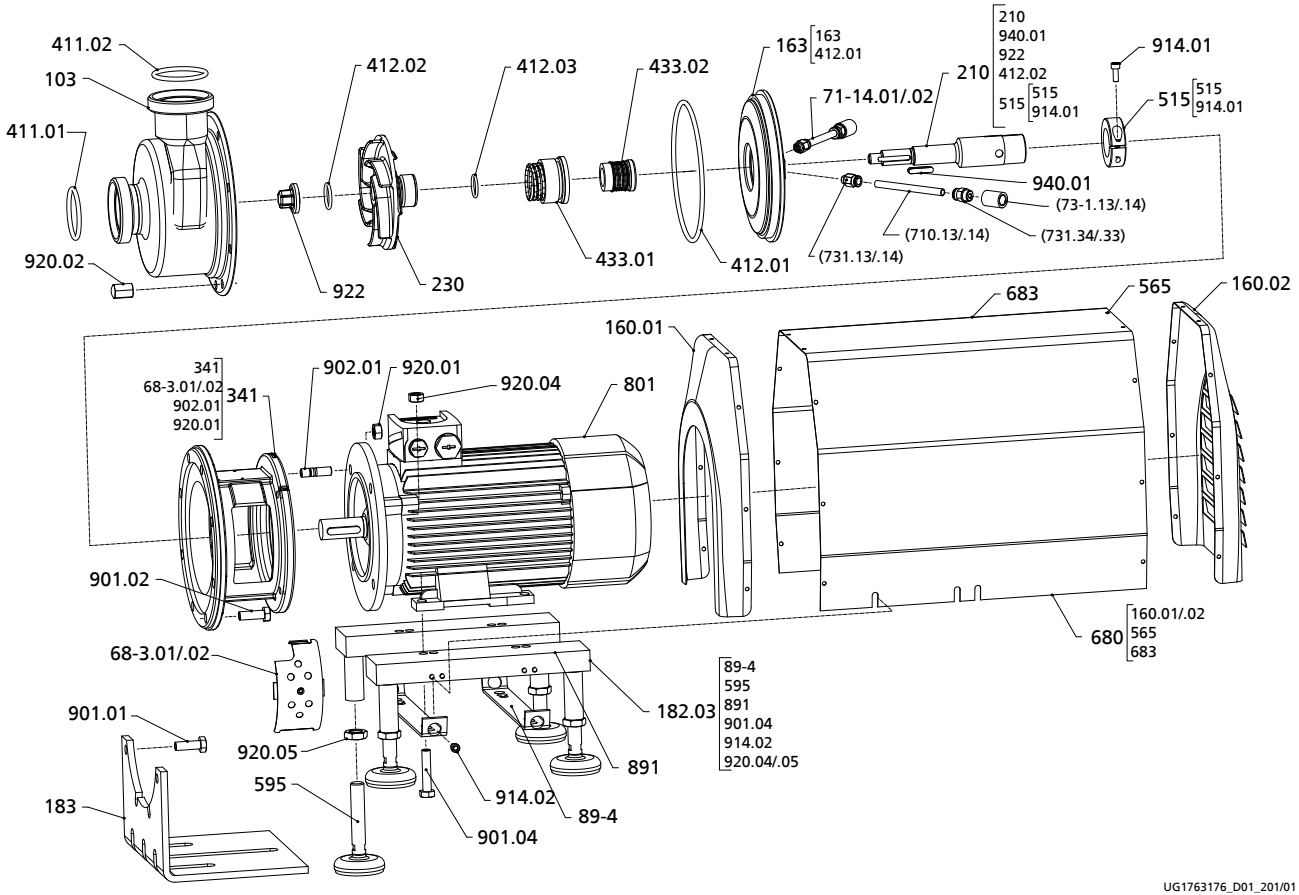

Fig. 14: Exploded view

Table 28: List of components

Part No.	Description	Part No.	Description
103	Circular casing	680	Motor shroud
160.01/.02	Cover	683	Hood
163	Discharge cover	71-14.01/.02	Connection pipe
182.03	Levelling feet	73-1.13/.14	Socket
183	Support foot	710.13/.14	Pipe
210	Shaft	731.13/.14/.33/.34	Pipe union
230	Impeller	801	Flanged motor
341	Drive lantern	89-4	Shim
411.01/.02/.03	Joint ring	891	Base frame
412.01/.02	O-ring	901.02/.04	Hexagon head bolt
433.01/.02	Mechanical seal	902.01/.06/.07	Stud
509	Intermediate ring	903	Screw plug
515	Locking ring	914.01/.02/.03	Hexagon socket head cap screw
565	Rivet	920.01/.02/.04/.05/.07	Nut
595	Support	922	Impeller nut
68-3.01/.02	Cover plate	940.01	Key

9.1.2 Vitachrom with inducer

9.1.2.1 Sectional drawing, Vitachrom with ball feet

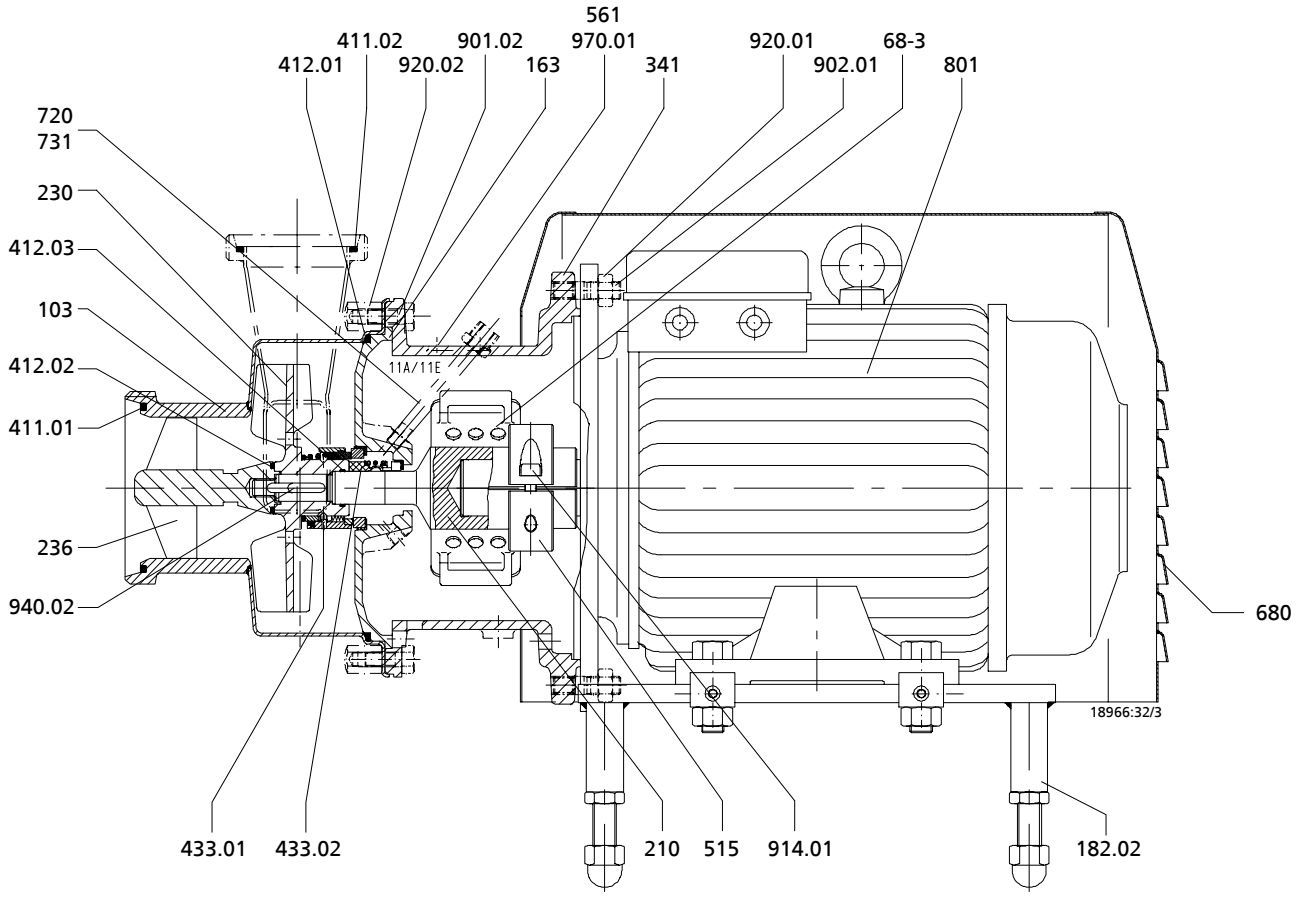

Fig. 15: Size 65-160-Ind

Table 29: List of components

Part No.	Description	Part No.	Description
68-3	Cover plate	561	Grooved pin
103	Circular casing	680	Motor shroud
163	Discharge cover	720	Fitting
182.02	Ball feet	731	Pipe union
210	Shaft	801	Flanged motor
230	Impeller	901.02	Hexagon head bolt
236	Inducer	902.01	Stud (drive lantern)
341	Drive lantern	914.01	Hexagon socket head cap screw
411.01/.02	Joint ring	920.01	Nut (motor)
412.01/.02/.03	O-ring	920.02	Nut (cap nut, pump casing)
433.01/.02	Mechanical seal	940.02	Key
515	Locking ring	970.01	Label/plate

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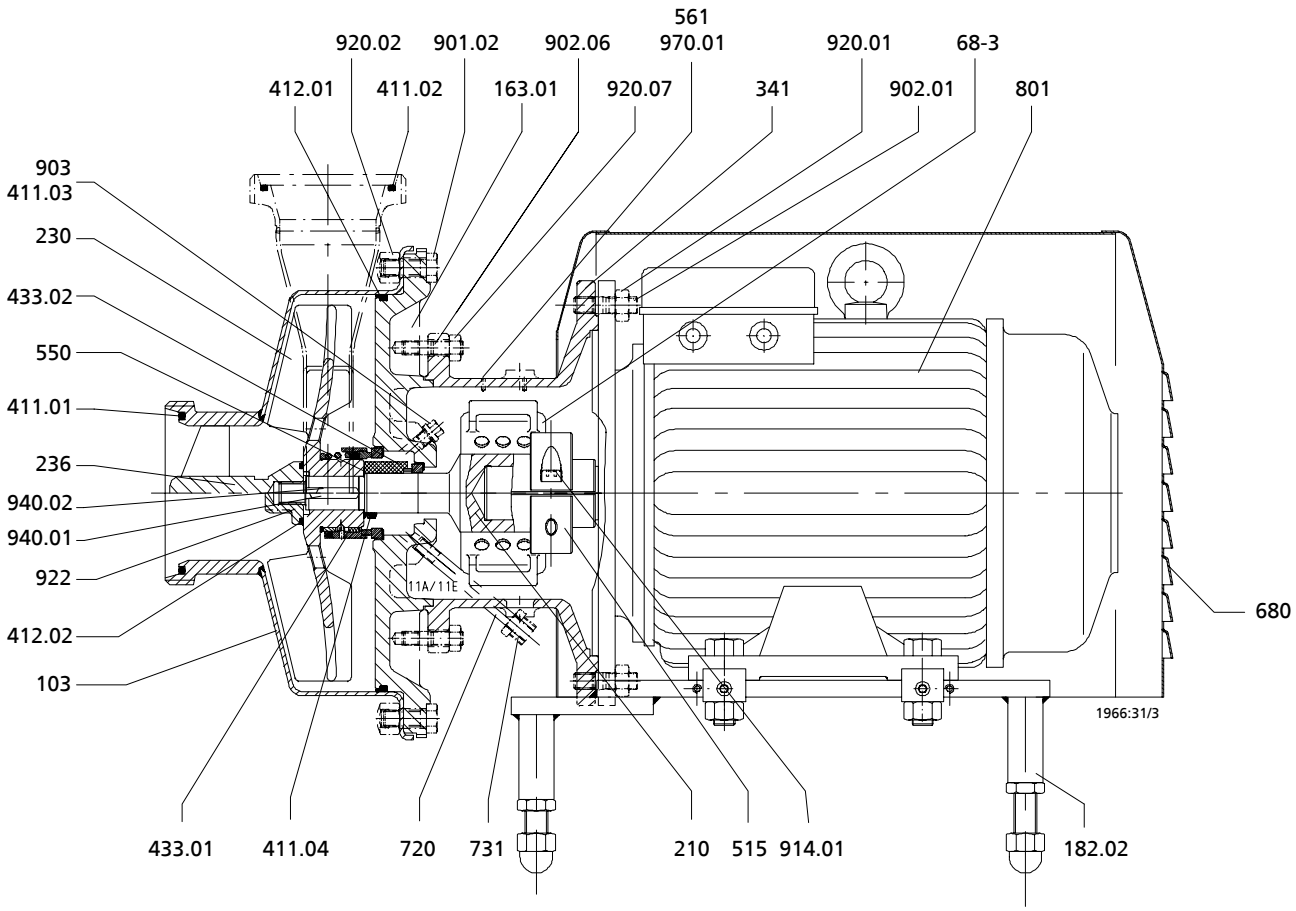

Fig. 16: Size 80-250-Ind

Table 30: List of components

Part No.	Description	Part No.	Description
68-3	Cover plate	561	Grooved pin
103	Circular casing	680	Motor shroud
163.01	Discharge cover	720	Fitting
182.02	Ball feet	731	Pipe union
210	Shaft	801	Flanged motor
230	Impeller	901.02	Hexagon head bolt
236	Inducer	902.01/.06	Stud
341	Drive lantern	903	Screw plug
411.01/.02/.03/.04	Joint ring	914.01	Hexagon socket head cap screw
412.01/.02	O-ring	920.01/.02/.07	Nut
433.01/.02	Mechanical seal	922	Impeller nut
515	Locking ring	940.01/.02	Key
550	Disc	970.01	Label/plate

9.1.2.2 Sectional drawing, Vitachrom with levelling feet

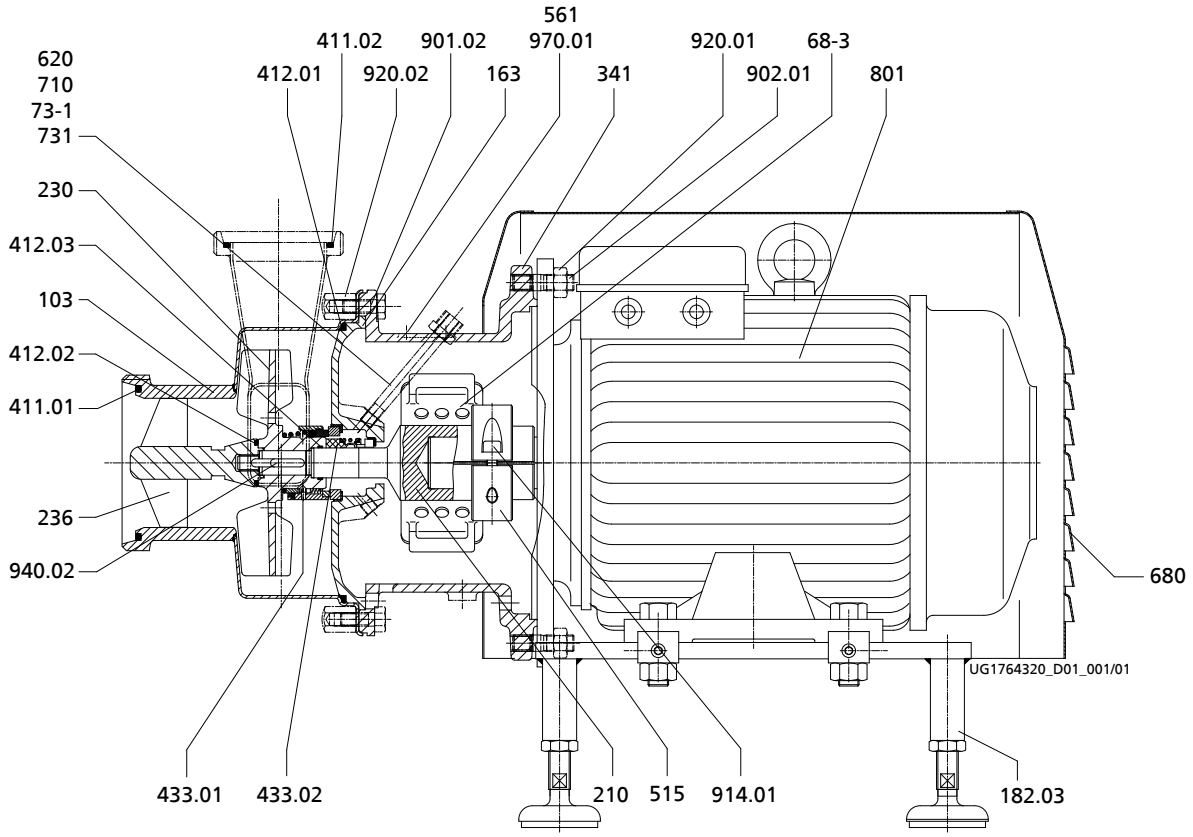

Fig. 17: Size 65-160-Ind

Table 31: List of components

Part No.	Description	Part No.	Description
68-3	Cover plate	561	Grooved pin
73-1	Socket	620	Indicator
103	Circular casing	680	Motor shroud
163	Discharge cover	710	Pipe
182.03	Levelling feet	731	Pipe union
210	Shaft	801	Flanged motor
230	Impeller	901.02	Hexagon head bolt
236	Inducer	902.01	Stud (drive lantern)
341	Drive lantern	914.01	Hexagon socket head cap screw
411.01	Joint ring (suction side)	920.01	Nut (motor)
411.02	Joint ring (discharge side)	920.02	Nut (cap nut, pump casing)
412.01/.02/.03	O-ring	940.02	Key
433.01/.02	Mechanical seal	970.01	Label/plate
515	Locking ring		

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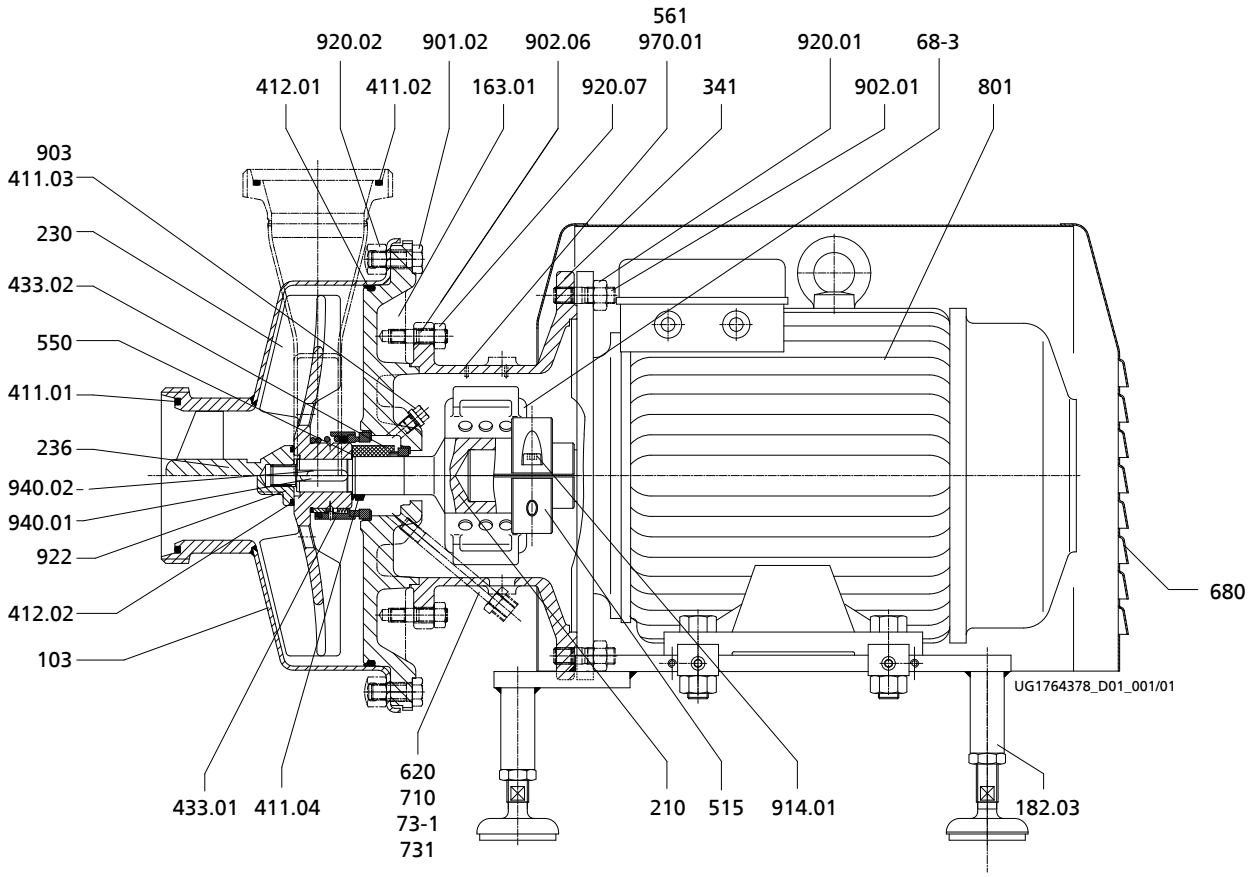

Fig. 18: Size 80-250-Ind

Table 32: List of components

Part No.	Description	Part No.	Description
68-3	Cover plate	620	Indicator
73-1	Socket	680	Motor shroud
103	Circular casing	710	Pipe
163.01	Discharge cover	731	Pipe union
182.03	Levelling feet	801	Flanged motor
210	Shaft	901.02	Hexagon head bolt
230	Impeller	902.01/.06	Stud
236	Inducer	903	Screw plug
341	Drive lantern	914.01	Hexagon socket head cap screw
411.01/.02/.03/.04	Joint ring	920.01	Nut (motor)
412.01/.02	O-ring	920.02	Nut (cap nut, pump casing)
433.01/.02	Mechanical seal	920.07	Nut
515	Locking ring	922	Impeller nut
550	Disc	940.01/.02	Key
561	Grooved pin	970.01	Label/plate

9.1.3 Mechanical seal variants

Single mechanical seal

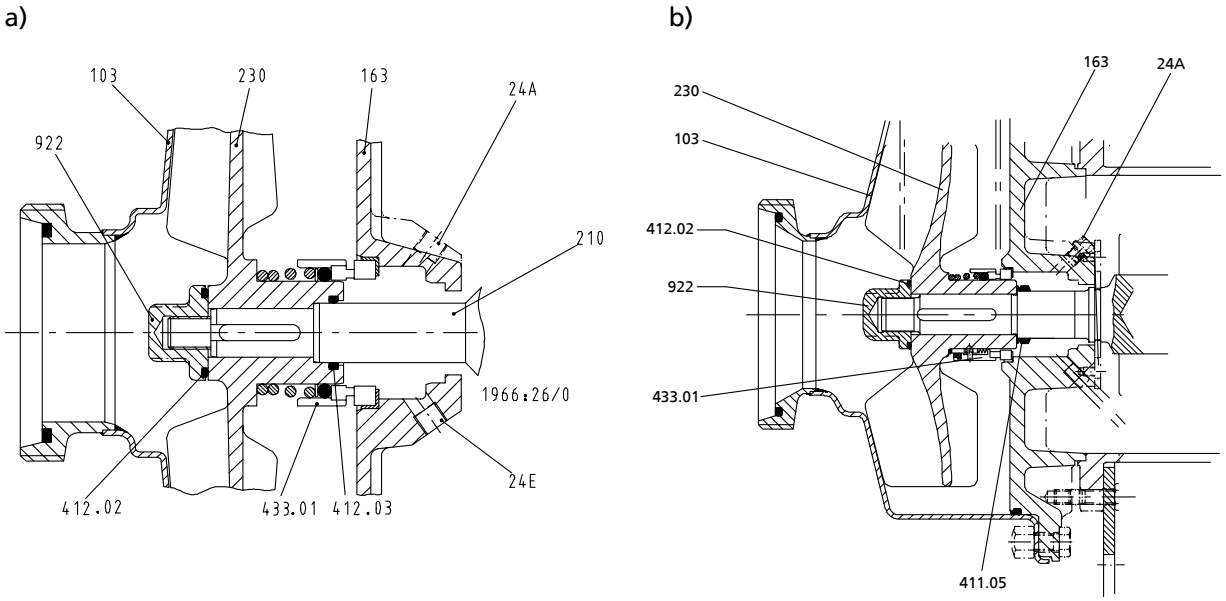

Fig. 19: Single mechanical seal a) with O-ring (size group I) b) with V-ring (size group II)

Part No.	Description	Part No.	Description
103	Circular casing	412.03	O-ring[17)]
163	Discharge cover	433.01	Mechanical seal (inboard)
210	Shaft	922	Impeller nut
230	Impeller	24A	Quench liquid outlet (G1/8[18)])
411.05	V-ring[19)]	24E	Quench liquid inlet (G1/8[18)])
412.02	O-ring		

17 Size group I only
18 To ISO 228/1
19 Size group II only

Double mechanical seal in tandem arrangement

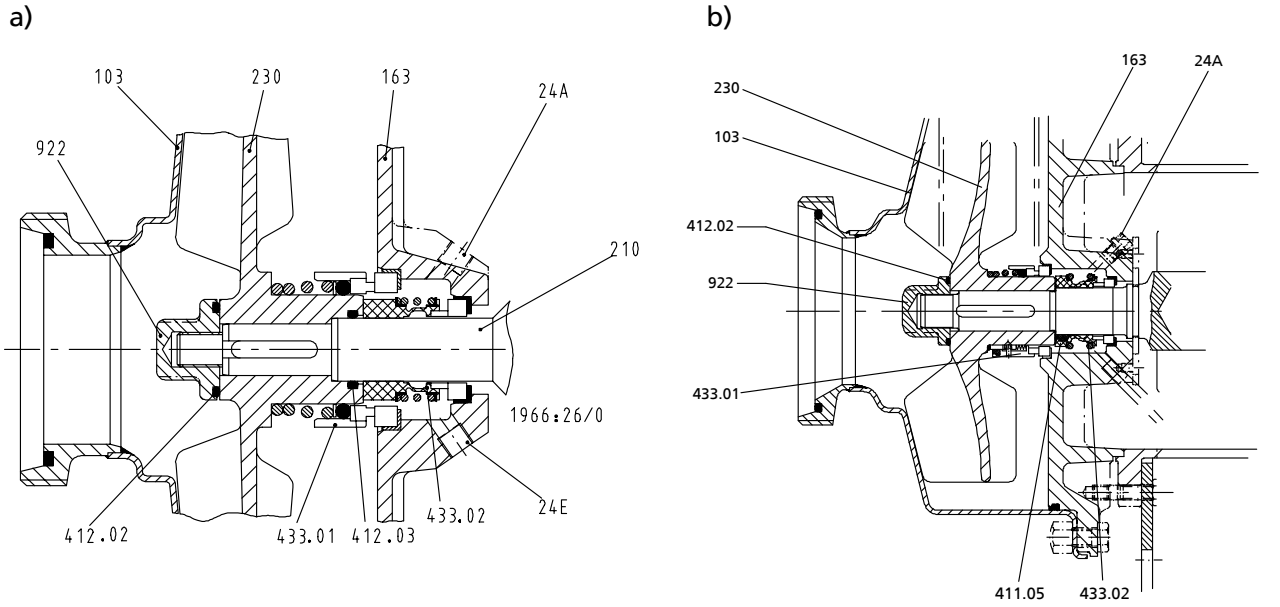

Fig. 20: Double mechanical seal a) with O-ring (size group I) b) with V-ring (size group II)

Part No.	Description	Part No.	Description
103	Circular casing	412.03	O-ring[17)]
163	Discharge cover	433.01	Mechanical seal (inboard)
210	Shaft	433.02	Mechanical seal (outboard)
230	Impeller	922	Impeller nut
411.05	V-ring[19)]	24A	Quench liquid outlet (G1/8[18)])
412.02	O-ring	24E	Quench liquid inlet (G1/8[18)])

Supply system for mechanical seals in tandem arrangement
(⇨ Section 9.1.4, Page 68)

Anti-rotation device

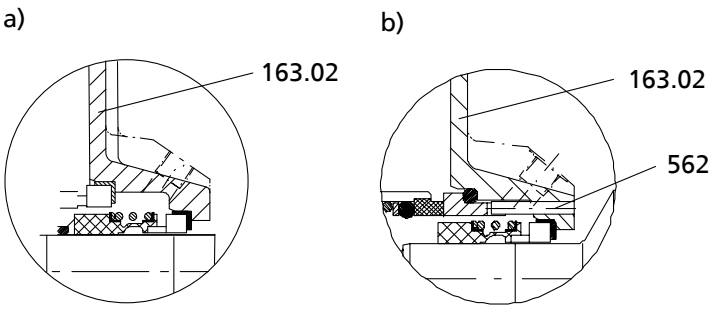

Fig. 21: Single or double mechanical seal a) without anti-rotation device, b) with anti-rotation device

Part No.	Description	Part No.	Description
163.02	Discharge cover	562	Parallel pin of anti-rotation device

9.1.4 Supply system for mechanical seals in tandem arrangement

Quench reservoir

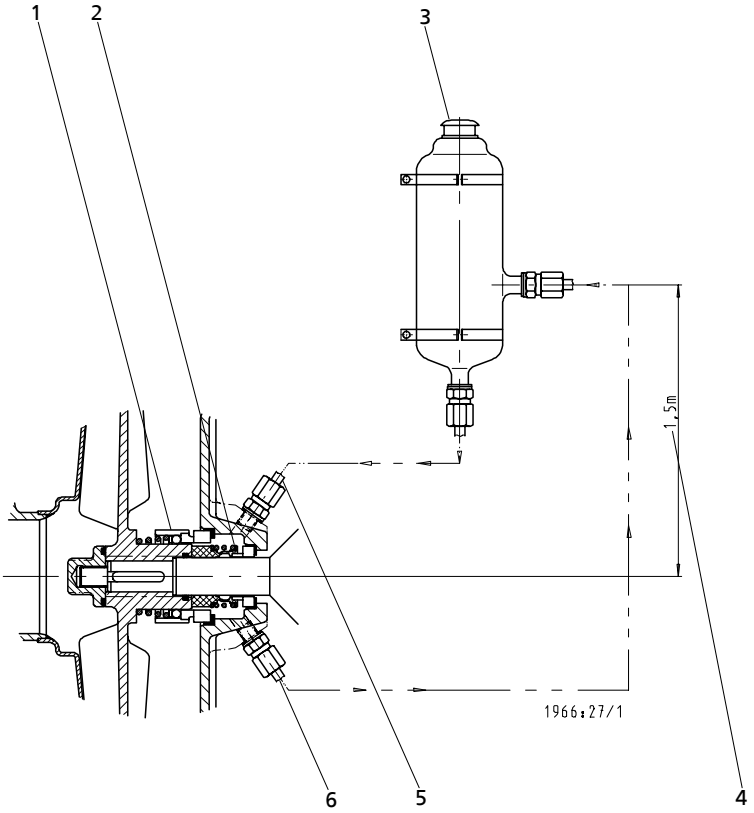

Fig. 22: Supply system with quench reservoir

1	Primary mechanical seal	2	Secondary mechanical seal
3	Filling in the quench liquid	4	Difference in height between pump shaft and quench reservoir approx. 1.5 m
5	Quench liquid inlet Connection 24E	6	Quench liquid outlet Connection 24A

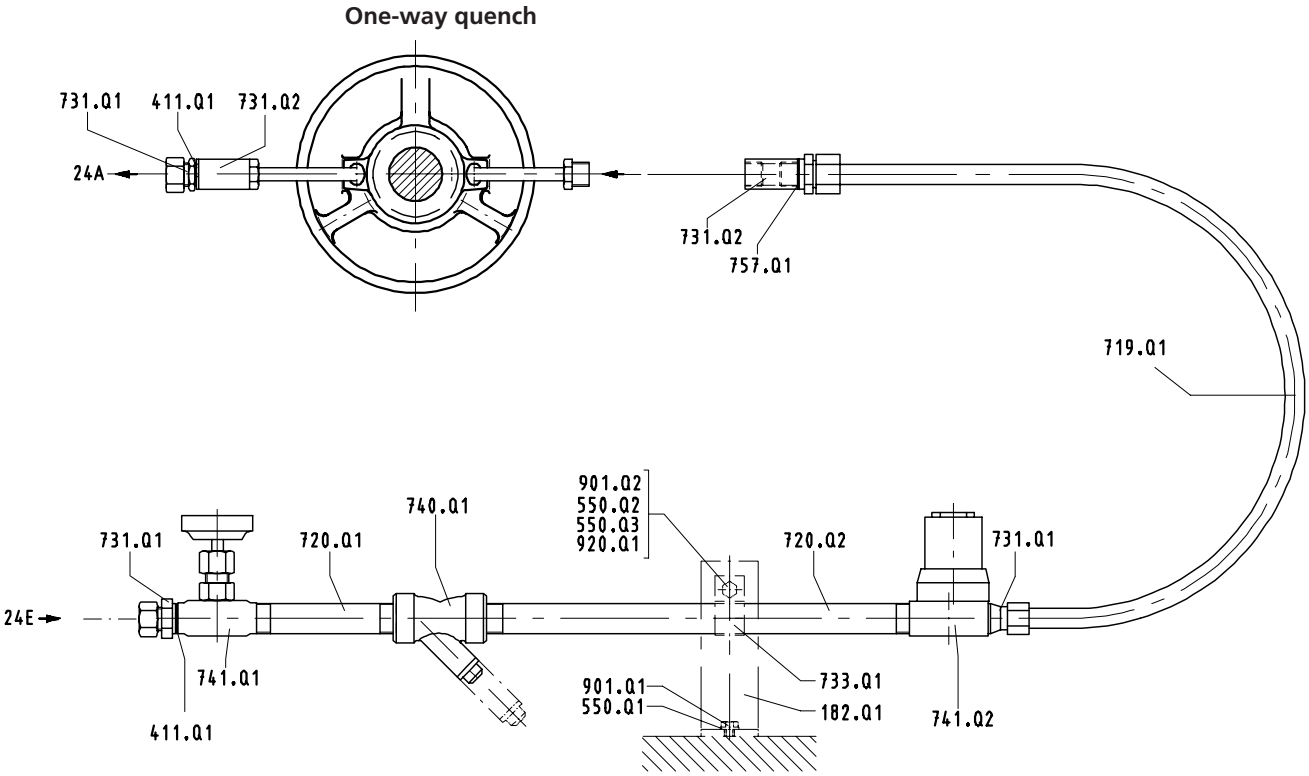

Fig. 23: Quench piping for one-way quench supply system

Part No.	Description	Part No.	Description
182.01	Foot	733.01	Pipe clamp
411.01	Joint ring	740.01	Strainer
550.01	Disc	741.01	Needle valve
550.02	Disc	741.02	Solenoid valve
550.03	Disc	757.01	Throttle
719.01	Corrugated pipe hose	901.01	Hexagon head bolt
720.01	Barrel nipple	901.02	Hexagon head bolt
720.02	Barrel nipple	920.01	Nut
731.01	Reducing nipple	24A	Quench outlet
731.02	Socket	24E	Quench inlet

10 EU Declaration of Conformity

Manufacturer:

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

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

Vitacast, Vitacast-Bloc, Vitachrom, Vitaprime, Vitastage

KSB order number: .....

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

The manufacturer also declares that

- the following harmonised international standards[20)] 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

.....[21)].....

Name

Function

Company
Address

20 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.

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

11 Certificate of Decontamination

Type: .....

Order number/

Order item number[22]: .....

Delivery date: .....

Field of application: .....

Fluid handled[22]: .....

Please tick where applicable[22]:

☐ Radioactive

☐ Explosive

☐ Corrosive

☐ Toxic

☐ Harmful

☐ Bio-hazardous

☐ Highly flammable

☐ Safe

Reason for return[22]: .....

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, 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 adapter have also been cleaned.

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

☐ No special safety precautions are required for further handling.

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

.....

.....

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

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

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22 Required fields

Index

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