Hygienic Pump

Vitaprime

Hygienic Side Channel Pump
for the Highest Requirements
on Cleanability

Installation/Operating Manual

Legal information/Copyright

Installation/Operating Manual Vitaprime

Original operating manual

Subject to technical modification without prior notice.

Contents

Glossary

Certificate of decontamination

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

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.

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

IE3

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

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

Self-priming ability

Ability of a filled pump to evacuate a suction line, i.e. to self-prime from an unfilled suction line.

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

1969.84/06-EN

1 General

1.1 Principles

This operating manual is supplied as an integral part of 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.

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
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

1969.84/06-EN

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.

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 instruction 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.

The safety information in all sections of this manual must be complied with.

The instruction manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.

The contents of this instruction manual must be available to the specialist personnel at the site at all times.

Information attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:

- Arrow indicating the direction of rotation
- Markings for connections
- Name plate

The operator is responsible for ensuring compliance with all local regulations not taken into account in this instruction manual.

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents. (⇨ Section 1.4, Page 6)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump 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.

1969.84/06-EN

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 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.

1969.84/06-EN

- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.1.6, Page 30) (⇨ Section 6.3, Page 36)
- 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 27)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

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

2.9.1 Marking

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

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

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants.

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 at the surface of the pump casing, at the shaft seal and in the bearing areas.
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.

1969.84/06-EN

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 EN 13463-1	Maximum permissible fluid temperature[2)]
T1	Temperature limit of the pump
T2	Temperature limit of the pump
T3	100 °C
T4	90 °C

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

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 35) 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 35) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

1969.84/06-EN

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.

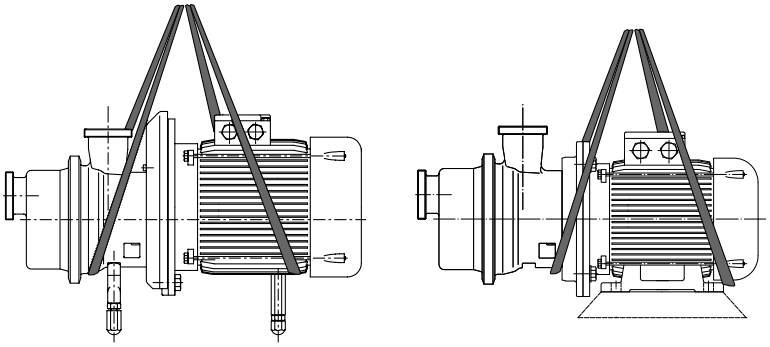

Fig. 1: Transporting the pump set

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.

1969.84/06-EN

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 36)

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 64)

NOTE

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

3.5 Disposal

⚠ WARNING

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

Hazard to persons and the environment!

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

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

4 Description of the Pump (Set)

4.1 General description

- Hygienic pump

Pump for handling fluids which are not chemically aggressive, are free from solids and do not require hermetic sealing.

Hygienic side channel pump for the food and beverage industry and the pharmaceutical industry

All pumps of this type series are fitted with standardised mechanical seals to EN 12756. This ensures reliable operation and interchangeability.

When different standardised mechanical seals are used, verify the axial length of the seal.
Type and material of the mechanical seal are specifically selected to match the nature and composition of the fluid to be handled.

NOTE

Before using the pump for any fluids different from those originally specified, check that the mechanical seals and joint rings are suitable for that fluid.
If certified seal types and/or materials are used, make sure that the replacement seals also meet the certification requirements.

Design

- Seal type T: internal single mechanical seal (standard design)
- Seal type VT: internal single mechanical seal with flushing system (quench, unpressurised)
- Seal type Q: external double mechanical seal with flushing system, with pressurised barrier fluid
- Seal type H: internal single mechanical seal, enclosed spring, balanced
- Seal type VH: internal single mechanical seal with flushing system (quench, unpressurised), enclosed spring, balanced

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
V	P			8	0	-	2	4	0	-	1	1	0	4	0	4	K	B	Q	T	8	2	M	E	C	C	O		O	A
See name plate and data sheet																												See data sheet		

Table 6: Designation key

Position	Code	Description
1-4	Pump type	
	VP	Vitaprime
5-13	Size, e.g.	
	80	Nominal nozzle diameter [mm]
	240	Nominal impeller diameter [mm]
	11	Load range
14-16	Motor rating P_N [kW]	
	007	0,70

1969.84/06-EN

Position	Code	Description	
14-16	040	4,00	
	185	18,50	
17	Number of motor poles		
18	Scope of supply		
	K	Ball feet	
	M	Motor foot	
	T	Round base feet	
	V	Trolley	
19-20	Shaft seal type		
	B	Single mechanical seal, dead-end arrangement, without flushing	
	BQ	Single mechanical seal, dead-end arrangement, external flushing (quench)	
	DB	Double mechanical seal in back-to-back arrangement	
21-23	Seal code, single mechanical seal		
	T00	BGEGG	
	T18	U2U2VGG	
	T19	U2U2EGG	
	T64	U2Q1EGG	
	T66	Q1Q1M3GG	
	T68	U2Q1VGG	
	T69	BQ1M3GG	
	T80	BQ1VGG	
	T81	Q1Q1VGG	
	T82	BQ1EGG	
	T83	Q1Q1EGG	
	T84	Q1U2EGG	
	T85	Q1U2VGG	
	Seal code, double mechanical seal in back-to-back arrangement		
	Q70	BGEGG	
		BGEGG	
	Q71	BU2EGG	
		BGEGG	
	Q72	U2U2EGG	
		BU2EGG	
	Q74	U2U2VGG	
		BU2VGG	
	Q78	U2U2VGG	
		U2U2EGG	
	Q79	U2U2M3GG	
		BU2EGG	
24	Pipe connection		
	A	Flange	APV
	B	Threaded connection	DIN 11864-1A
	C	Flange	DIN 11864-2A
	D	Clamped connection	DIN 11864-3A
	E	Threaded connection	DIN 11853
	F	Threaded connection	RJT
	G	Flange	Varivent
	I	Threaded connection	ISO 2853 (IDF)
	L	Flange	EN 1092-1

Position	Code	Description	
24	M	Threaded connection	DIN 11851 (hygienic pipe union)
	S	Threaded connection	SMS
	T	Clamped connection	DIN 32676-A
	U	Clamped connection	DIN 32676-C (Tri-Clamp)
	V	Clamped connection	ISO 2852
	Z	Flange	ANSI B16.5 Class 150
25	O-ring material (casing/impeller)		
	E	EPDM	
	F	FFKM (Kaflon)	
	K	FFKM (Kalrez)	
	M	FEP (encapsulated)	
	P	PTFE	
	V	FPM	
26	Pump casing material		
	C	Stainless steel	1.4409
27	Impeller material		
	C	Stainless steel	1.4409
28	Motor shroud		
	S	With shroud	
	O	Without shroud	
29	Design		
	[3)]	Standard	
	X	Non-standard (BT3D, BT3), including ATEX	
30	Drain		
	O	No drain	
	P	Casing drain via pipeline	
	V	Casing drain via valve	
	D	Casing drain with plug	
31	Product generation		
	A	Vitaprime	

4.4 Name plate

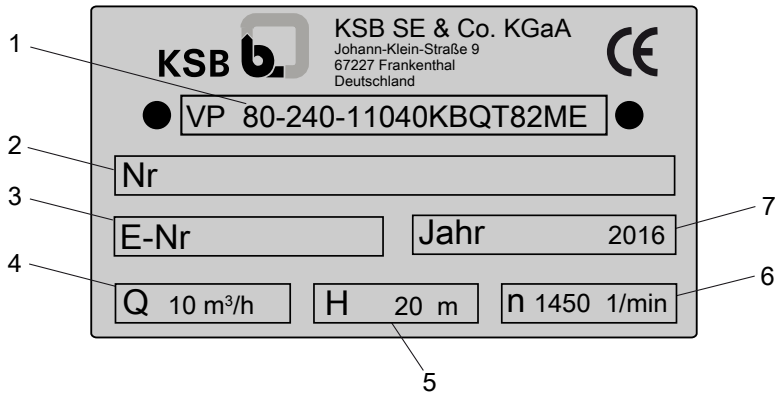

Fig. 2: Name plate Vitaprime (example)

1	Type series, size and version	2	KSB order number
3	Manufacturer's No.	4	Flow rate

1969.84/06-EN

[3] Blank

5	Head	6	Speed
7	Year of construction		

4.5 Design details

Design

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

Design

- Side channel pump
- Horizontal installation
- One or two stages
- Self-priming

Pump casing

- Casing with transfer passages

Impeller type

- Open star impeller

Bearings

- Grease-packed deep groove ball bearing

Shaft seal

- Single mechanical seal to EN 12756
  - Seal type T[4)]: pump-end seal with non-encapsulated spring surrounded by fluid handled, uni-directional
- Double mechanical seal to EN 12756
  - Seal type Q: back-to-back arrangement (pressurised barrier fluid)

Drive

- Efficiency class IE3 to IEC 60034-30

Standard design:

- KSB surface-cooled IEC three-phase current squirrel-cage motor
- 50 Hz winding, 220 - 240 V / 380 - 420 V ≤ 2.20 kW
- 50 Hz winding, 380 - 420 V / 660 - 725 V ≥ 3.00 kW
- 60 Hz winding, 440 - 480 V ≤ 2.60 kW
- 60 Hz winding, 440 - 480 V ≥ 3.60 kW
- Type of construction IM V1 ≤ 4.00 kW
- Type of construction IM V15 ≥ 5.50 kW
- Enclosure IP55
- Duty type: continuous duty S1
- Thermal class F with temperature sensor, 3 PTC thermistors

Explosion-proof version:

- KSB surface-cooled IEC three-phase current squirrel-cage motor
- 50 Hz winding, 220 - 240 V / 380 - 420 V ≤ 1.85 kW
- 50 Hz winding, 380 - 420 V / 660 - 725 V ≥ 2.50 kW
- Type of construction IM V1 ≤ 3.30 kW

4 Hygienic design

- Type of construction IM V15 ≥ 4.60 kW
- Enclosure IP55 or IP54
- Duty type: continuous duty S1
- Type of protection EEx e II
- Temperature class T3

Automation

Automation options:

- PumpDrive

Connections

- Axial suction nozzle, tangential discharge nozzle

Types of connection:

- Threaded connection to DIN 11851 (hygienic pipe union)
- Threaded connection to DIN 11853
- Threaded connection to DIN 11864-1-GS-A
- Threaded connection to SMS standard
- Threaded connection to ISO 2853 (IDF)
- Threaded connection to RJT standard
- Clamped connection to DIN 32676-C (Tri-Clamp/Tri-Clover fitting)
- Clamped connection to DIN 11864-3-NKS-A
- Clamped connection to DIN 32676-A
- Clamped connection to ISO 2852
- Flange to EN 1092-1
- Flange to DIN 11864-2-NF-A
- Flange to ANSI B16.5 Class 150
- APV flange
- Varivent flange
- Other connection types on request

1969.84/06-EN

4.6 Configuration and function

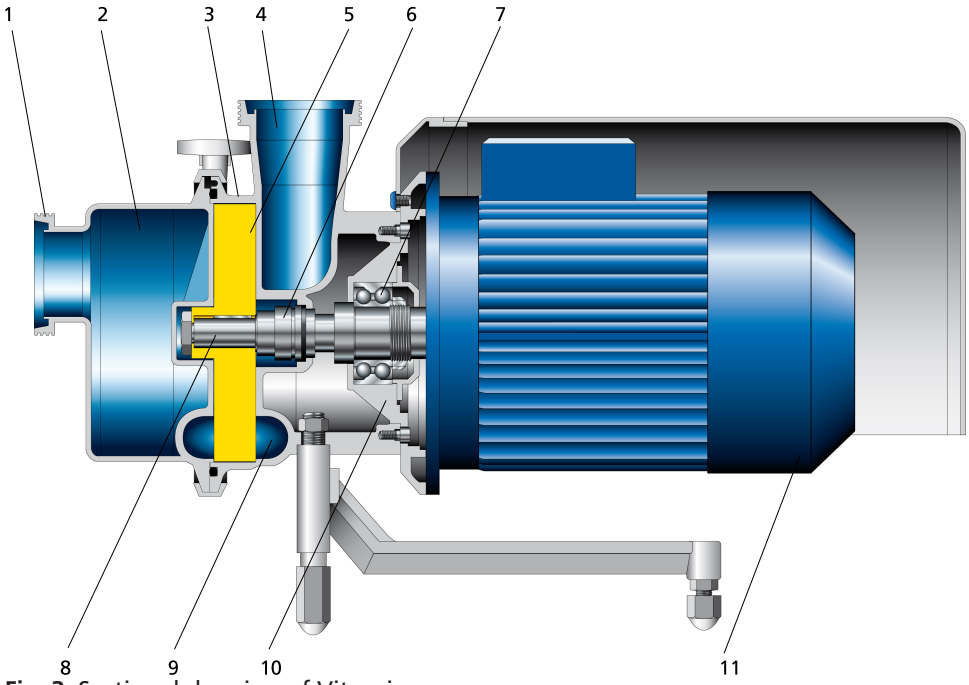

Fig. 3: Sectional drawing of Vitaprime

1	Suction nozzle	2	Inlet casing
3	Impeller casing	4	Discharge nozzle
5	Impeller	6	Shaft seal
7	Rolling element bearing	8	Drive shaft
9	Side channel	10	Bearing assembly
11	Motor		

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 inlet casing (2) of the pump via the suction nozzle (1) and then passes through an opening into the impeller casing (3). The rotating impeller (5) conveys the fluid into the side channel (9), so that a liquid ring is formed in the casing. Owing to the conical geometry of the side channel, i.e. a change in volume (positive displacement effect), the fluid is drawn from the inlet casing (2) and transferred to the discharge nozzle (4), where it leaves the pump. The drive shaft (8) enters the casing through an opening at the rear. The shaft passage is sealed with a dynamic shaft seal (6). The drive shaft runs in a rolling element bearing (7), which is supported by a bearing assembly (10). The motor shaft is inserted into the drive shaft (stub shaft). The motor (11) is bolted to the pump casing. The pump is self-priming once the inlet casing has been filled.

Sealing The pump is sealed by a mechanical seal.

Various seal designs can be used.

4.7 Noise characteristics

Table 7: Surface sound pressure level L_{pA} [5)]

Size	Noise characteristic [dB]
Vitaprime 40-146	< 80
Vitaprime 42-146	81 - 85
Vitaprime 50-164	81 - 85
Vitaprime 52-164	86 - 90

5 Measured at a distance of 1 metre, 1.6 metres above the installation surface

Size	Noise characteristic [dB]
Vitaprime 60-200	86 - 90
Vitaprime 65-200	86 - 90
Vitaprime 80-240	86 - 90

4.8 Scope of supply

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

- Pump
- Drive
- Frequency inverter
- Motor shroud
- Pump foot or foot base (e.g. 3-point ball feet)
- Trolley with switch and power cable
- Noise reduction valve

4.9 Dimensions and weights

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

1969.84/06-EN

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

Always install the pump set in a horizontal position.

⚠ DANGER

Excessive temperatures due to improper installation

Explosion hazard!

- ▷ Install the pump in a horizontal position to ensure self-venting of the pump.

CAUTION

Ingress of leakage into the motor

Damage to the pump!

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

1. Align the pump set with the help of a spirit level placed on the discharge nozzle.

5.3 Piping

5.3.1 Connecting the piping

⚠ DANGER

Impermissible loads acting on the pump nozzles

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

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

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

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

NOTE

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

CAUTION

When handling gaseous fluids or fluids which tend to froth, the pump will not be self-priming.

Pump is running, but does not deliver!

- ▷ Install a check valve in the suction line.

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
- ✓ The nominal diameters of the pipes 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 41) .

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.

3. Connect the pump nozzles to the piping.

1969.84/06-EN

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.

5.3.3 Auxiliary connections

⚠ DANGER

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

Risk of burns!

Explosion hazard!

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

CAUTION

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

Malfunction of the pump!

- ▷ Use and install any auxiliary connections in such a way that a proper flow is ensured.

If a shaft seal with flush connection is used, fit the flushing liquid 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.

When mounting the pipe unions comply with the instructions provided by the pipe union manufacturer.

NOTE

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

Make sure that the flushing liquid (if any) circulates properly also before starting up and after shutting down the pump (until the pump set comes to a complete stop).

5.4 Enclosure/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 system

5.5.1 Operation on a frequency inverter

The pump set is suitable for operation on a frequency inverter as per IEC 60034-17.

Selection

When selecting a frequency inverter, check the following details:

- Data provided by the manufacturer
- Electrical data of the pump set, particularly the rated current
- Only voltage source inverters (VSI) with pulse width modulation (PWM) and carrier frequencies between 1 and 16 kHz are suitable.

Setting

Observe the following instructions for setting a frequency inverter:

- Set the current limit to max. 1.2 times the rated current. The rated current is indicated on the name plate.

Start-up

Observe the following instructions for starting the frequency inverter:

- Ensure short start ramps (maximum 5 seconds).
- Only start variable speed control after 2 minutes at the earliest.
  Pump start-up with long start ramps and low frequency may cause clogging.

Operation

Observe the following limits during operation on a frequency inverter:

- Only utilise up to 95 % of the motor rating P_2 indicated on the name plate.
- Frequency range 25 to 60 Hz

Electromagnetic compatibility

Operation on a frequency inverter produces interference emissions whose level varies depending on the inverter used (type, interference suppression, make). To prevent the drive system, consisting of a submersible motor and a frequency inverter, from exceeding any given limits always observe the EMC information provided by the inverter manufacturer. If the inverter manufacturer recommends a shielded power cable, make sure to use a submersible motor pump with shielded power cables.

Interference immunity

The submersible motor pump generally meets interference immunity requirements. For monitoring the sensors installed the operator must ensure sufficient interference immunity by appropriately selecting and laying the power cables in the plant. No modifications are required on the power/control cable of the submersible motor pump. Suitable analysing devices must be selected. To monitor the leakage sensor inside the motor using a special relay available from KSB is recommended.

5.6 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.

1969.84/06-EN

⚠ 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.

NOTE

A motor protection device is recommended.

5.6.1 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 8: Time relay settings for star-delta starting:

Motor rating	Y time to be set
≤ 30 kW	< 3 s

5.6.2 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.

5.6.3 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.

5.7 Checking the direction of rotation

DANGER

Temperature increase resulting from contact between rotating and stationary components

Explosion hazard!

Damage to the pump set!

- ▷ Never check the direction of rotation by starting up the unfilled pump set.
- ▷ Separate the pump from the motor to check 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 the motor and pump is clockwise (seen from the drive end).

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

1969.84/06-EN

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 quality of the concrete foundation complies with the regulations.
- The pump set has been installed and aligned in accordance with the tolerances specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇨ Section 5.6, Page 24)
- The pump has been primed with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked. (⇨ Section 5.7, Page 26)
- All auxiliary connections required are connected and operational.
- The lubricants have been checked.
- The lock washers, if any, have been removed from the shaft groove.
- The pump (set) has been installed and connected as described in this manual.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇨ Section 6.4, Page 37)

6.1.2 Filling in lubricants

Grease-lubricated bearings

The bearings have been packed with grease at the factory.

6.1.3 Priming and venting the pump

⚠ DANGER

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

Explosion hazard!

Damage to the pump set!

▷ Prime the pump as per operating instructions.

⚠ 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.

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.

6.1.4 Start-up

DANGER

Formation of a potentially explosive atmosphere inside the pump

Explosion hazard!

- The fluid for priming the pump must not be combustible.
- When the fluid for priming the pump is taken from a potentially explosive atmosphere, make sure that no potentially explosive atmosphere can enter the pump.

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.

1969.84/06-EN

DANGER

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

Explosion hazard!

Damage to the pump set!

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

CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

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

- ✓ The system piping has been cleaned.
- ✓ The pump, suction line and inlet tank, if any, have been vented and primed with the fluid to be handled.
- ✓ The 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.
3. If a mechanical seal with flushing system is used, make sure that the flushing liquid circulates properly.
4. Start up the motor.
5. 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. When the operating temperature has been reached and/or if there is any leakage, check the clamping ring/screw connection between casing and casing cover. If required, re-tighten it.

6.1.5 Checking the shaft seal

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

6.1.6 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.

6.1.7 Seal supply system

6.1.7.1 Application

In order to function properly, the mechanical seals require a flushing liquid. The flushing liquid completely fills the space between the inboard and the outboard mechanical seal.

6.1.7.2 Requirements to be met by the seal supply system

Pipework routing requirements

When routing pipework and flexible tubing, prevent any high points or ensure that high points can be vented separately to prevent dry running of the mechanical seal. The connecting pipes between the main pipe and the pump must be routed with a continuously rising slope to assure self-venting of the pipe and the mechanical seal, respectively.

1969.84/06-EN

6.1.7.3 Types of seal supply systems

Which of the two types of seal supply systems is used depends on the mechanical seal:

6.1.7.3.1 Quench liquid

6.1.7.3.1.1 Applications

A quench liquid is used in the following cases:

- Where a single mechanical seal without supportive measures would not work at all or unsatisfactorily.
- Where a double mechanical seal design with pressurised barrier fluid is not required.

6.1.7.3.1.2 Quench liquid requirements

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 mixture
- Glycerine[6)]

The quench liquid should be supplied to the mechanical seals unpressurised (at atmospheric pressure), if possible. Positive pressures of up to 0.5 bar are acceptable.

The one-way quench supply should be adjusted to a constant flow ≥ 0.4 l/min.

Periodically check the quench liquid for contamination (replace quench liquid and clean quench system if necessary).

6.1.7.3.1.3 Applications

For seal types T and H, operating mode BQ

6.1.7.3.2 Barrier fluid system

6.1.7.3.2.1 Applications

Barrier fluid systems serve to:

- Dissipate friction heat
- Prevent the fluid handled from entering the sealing gap

6.1.7.3.2.2 Barrier fluid requirements

The barrier fluid should preferably form a solution with the fluid handled and be environmentally compatible. The barrier fluid should be monitored: Any ingress of the fluid handled can be identified at an early stage by the barrier fluid becoming turbid.

The temperature differences between the barrier fluid and the fluid handled must not exceed 5 °C. A general minimum temperature of 0 °C applies to the barrier fluid.

The barrier fluid system must be set to a pressure which exceeds the pressure inside the pump by approximately 0.5 to 1 bar.

General rule: The maximum permissible pressure inside the barrier fluid system equals 10 bar. Actual maximum permissible pressure depending on the material combination and shaft diameter:

1969.84/06-EN

6 Make sure the circulation line diameter is ≥ ¼".

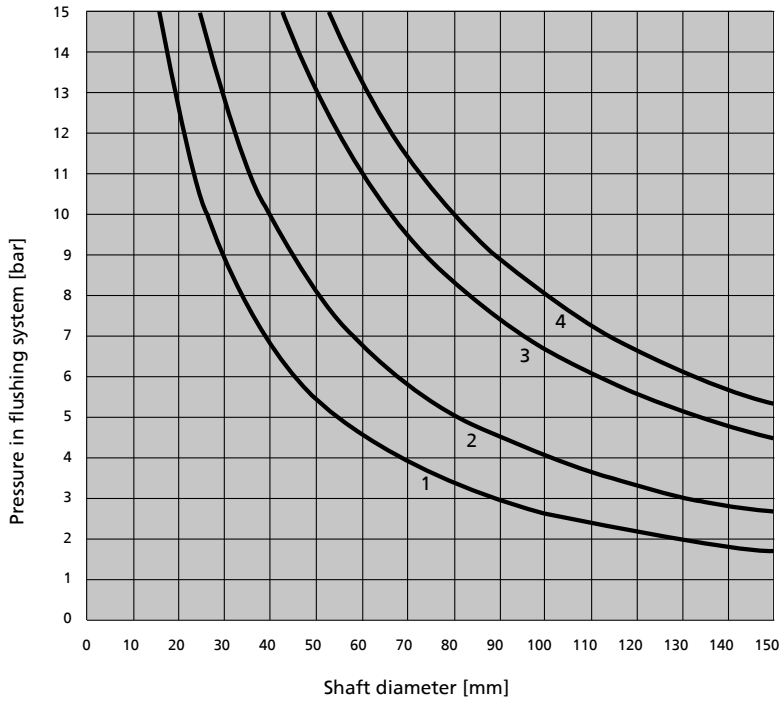

Fig. 4: Application limits for mechanical seals[7)] 2900 rpm

1	Hard-soft combination (steel/carbon)	2	Hard-soft combination (ceramic/carbon)
3	Hard-soft combination (silicon carbide/carbon; tungsten carbide/carbon)	4	Hard-hard combination (silicon carbide/silicon carbide; tungsten carbide/tungsten carbide)

The flow rate of the barrier fluid system depends on the shaft diameter, speed and fluid temperature.

Table 9: Flow rate of the flushing liquid

Material combination of seal faces	Hard-soft combination		Hard-hard combination	
Pump speed	1450 [rpm]	2900 [rpm]	1450 [rpm]	2900 [rpm]
Mechanical seal diameter [mm]	Flow rate flushing liquid [l/min]	Flow rate flushing liquid [l/min]	Flow rate flushing liquid [l/min]	Flow rate flushing liquid [l/min]
20	0,4 - 1,0	0,7 - 1,9	0,4 - 1,2	0,9 - 2,2
28	0,6 - 1,2	1,0 - 2,4	0,7 - 1,6	1,3 - 3,1
43	1,0 - 1,9	1,8 - 3,8	1,2 - 2,8	2,2 - 5,4
55	1,0 - 2,4	2,0 - 4,6	1,3 - 3,4	2,6 - 6,7

The lower flushing limit refers to a temperature of the fluid handled of 25 °C and a barrier pressure of 1 bar. The upper flushing limit refers to a temperature of the fluid handled of 100 °C and a barrier pressure of 10 bar. The flow rate of the flushing liquid must be adjusted to the actual conditions (pressure, temperature). The data refer to a temperature difference of 5 °C between the inlet and outlet of the flushing liquid.

1969.84/06-EN

6.1.7.3.2.3 Applications

For seal type Q, operating mode DB

7 Valid for unbalanced mechanical seals flushed with clean water of 20 °C.

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 10: Permissible ambient temperatures

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

6.2.2 Frequency of starts

DANGER

Excessive surface temperature of the motor

Explosion hazard!

Damage to the motor!

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

The frequency of starts is 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.

1969.84/06-EN

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.

Conditions CIP may be effected with the pump running or with the pump stopped.
Recommended flow velocity: between 2.5 and 3 m/s

Cleaning agent, cleaning process When performing CIP in the system the pump set is installed in, comply with the concentration limits, temperature limits and contact times given below for the cleaning agents and disinfectants:

Table 11: Cleaning sequence

Step	Process	Cleaning agent	Temperature	Contact time
			[°C]	[min]
1	Pre-flushing	Water	+15 to +25	10 to 15
2	Flushing	Water	+45 to +60	10
3	Flushing	Washing lye	+70 to +95	20 to 30
4	Intermediate flushing	Water	+60 max.	5 to 10
5	Flushing	See table below		10 to 15
6	Flushing	Water	+15 to +25	10 to 15

Table 12: Agent for cleaning step 5 "Flushing"

Cleaning agent	Concentration	Temperature
	[%]	[°C]
Sodium hydroxide (soda lye)	1 to 3	+70 to +90
Phosphoric acid	0,5	+45
Lye, alkaline	5	+95
Nitric acid	1 to 2.5	+45
Citric acid	0.5 to 3	+70

6.2.4 Steaming in place (SIP)

⚠ 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.

1969.84/06-EN

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 13:** SIP temperature requirements

Elastomer	Saturated steam	Chemical
EPDM	121 °C	82 °C
FPM/FKM	149 °C	82 °C

6.2.5 Fluid handled

6.2.5.1 Flow rate

Table 14: Flow rate

Temperature range (t)	Minimum flow rate	Maximum flow rate
0 to +70 °C	≈ 15 % of $Q_{BEP.}$ [8)]	See hydraulic characteristic Q_{BEP}.
> 70 °C	≈ 25 % of Q_{BEP} [8)]	

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 15: 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.

8 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

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

6.3 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.

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 12)

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 12)

1969.84/06-EN

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 27) (⇨ Section 6.2, Page 33)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 38)

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

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

NOTE

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

7 Servicing/Maintenance

7.1 Safety regulations

⚠ 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.

1969.84/06-EN

⚠ 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.

1969.84/06-EN

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 33)

While the system is in operation, observe or check the following:

- The pump must run quietly and free from vibrations at all times.
- Check the shaft seal. (⇨ Section 6.1.5, Page 29)
- In case of oil lubrication, ensure the oil level is correct.
- 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 at 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).

1969.84/06-EN

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

1. Remove pump casing 101.
2. Examine pump casing 101 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 pump casing 101 and impeller 230. (⇨ Section 7.5.2, Page 50)
6. Mount pump casing 101. (⇨ Section 7.5, Page 49)

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 flushing liquid

Periodically check the flushing liquid for contamination. If necessary, drain the flushing liquid. Clean the flushing system and fill it with new flushing liquid.

7.2.2.4 Checking the bearing seals

DANGER

Excessive temperatures caused by mechanical contact

Risk of explosion!

Damage to the pump set!

- ▹ Check correct seating of axial seal rings mounted on the shaft. Only gentle contact of the sealing lip shall be established.

7.2.3 Lubrication and lubricant change of rolling element bearings

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 condition of the lubricant.

7.2.3.1 Grease lubrication

The bearings are supplied packed with high-quality lithium-soap grease.

7.2.3.1.1 Intervals

NOTE

On some pump designs (motor ≤ 132) the rolling element bearings are lubricated for life. These pumps are not provided with a lubricating nipple on the bearing bracket.

The rolling element bearings of the pump must be re-lubricated or the grease in the bearings replaced at regular intervals.

The re-lubrication interval is 4000 hours for all sizes.

For correct re-lubrication the bearings must be removed, carefully cleaned and packed with new grease (up to half the volume).

7.2.3.1.2 Grease quality

Optimum grease properties for rolling element bearings

Table 16: Grease quality to DIN 51825

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

- Free of resin and acid
- Not liable to crumble
- Rust-preventive characteristics

If required, the bearings may be lubricated with greases of other soap bases. Make sure to remove any old grease and rinse the bearings thoroughly.

7.2.3.1.3 Changing the grease

CAUTION

Mixing greases of differing soap bases

Changed lubricating qualities!

- ▷ Thoroughly clean the bearings.
- ▷ Adjust the re-lubrication intervals to the grease used.

✓ The pump has been dismantled for changing the grease.

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

1969.84/06-EN

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. For draining the fluid handled use the pump connections or a valve for residual drainage, if fitted.
2. Always flush the pump if it has been used for handling harmful, explosive and hot fluids or other fluids posing a risk.
   Always flush and clean the pump before transporting it to the workshop.
   Provide a certificate of decontamination for the pump.

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

- ▹ 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 38)

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.

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.

DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- Properly shut down the pump set. (⇨ Section 6.1.6, Page 30)
- 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.

NOTE

After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use an appropriate pull-off device, if possible.

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).

7.4.4 Removing the pump casing and impeller

7.4.4.1 Sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15

1. For mechanical seal design T with operating mode BQ, or mechanical seal design Q with operating mode DB: Remove quench connections 710.
2. Undo screws 900.1 and remove shroud 683 if fitted.
3. Undo hexagon head bolts 901.1 to remove motor 801.
4. Carefully pull motor 801 out of bearing housing 350/shaft 210.

NOTE

Remove the foot base if necessary.
Ball feet:
Motors < IEC 112: Undo nuts 920.1 and hexagon socket head cap screws 914.1. Remove the foot base.
Motors > IEC 112: Undo nuts 920.1 and hexagon socket head cap screws 914.1. Remove the front foot base. Remove foot 182.2.
Motor feet:
Undo nuts (82) and bolts (81). Remove the feet.

5. Undo and remove clamping piece 81-44.
6. Remove pump casing 101.2 and O-ring 412.2.
7. Unscrew impeller nut 922 in anti-clockwise direction. Remove it together with O-ring 412.1.

1969.84/06-EN

8. Remove impeller 230 and key 940.
9. Remove spacer discs 551.

7.4.4.2 Sizes 42-146 and 52-164

1. For mechanical seal design T with operating mode BQ, or mechanical seal design Q with operating mode DB: Remove quench connections 710.
2. Undo screws 900.1 and remove shroud 683 if fitted.
3. Undo hexagon head bolts 901.1 to remove motor 801.
4. Carefully pull motor 801 out of bearing housing 350/shaft 210.

NOTE

Remove the foot base if necessary.
Ball feet:
Motors < IEC 112: Undo nuts 920.1 and hexagon socket head cap screws 914.1. Remove the foot base.
Motors > IEC 112: Undo nuts 920.1 and hexagon socket head cap screws 914.1. Remove the front foot base. Remove foot 182.2.
Motor feet:
Undo nuts (82) and bolts (81). Remove the feet.

5. Undo screw 900.
6. Remove pump casing 101.2.
7. Remove first impeller 230 and key 940.
8. Remove the interstage plate with guide vanes 172 and O-ring 412.2.
9. Remove second impeller 230 and key 940.

7.4.5 Removing the mechanical seal

7.4.5.1 Mechanical seal design T, operating mode B

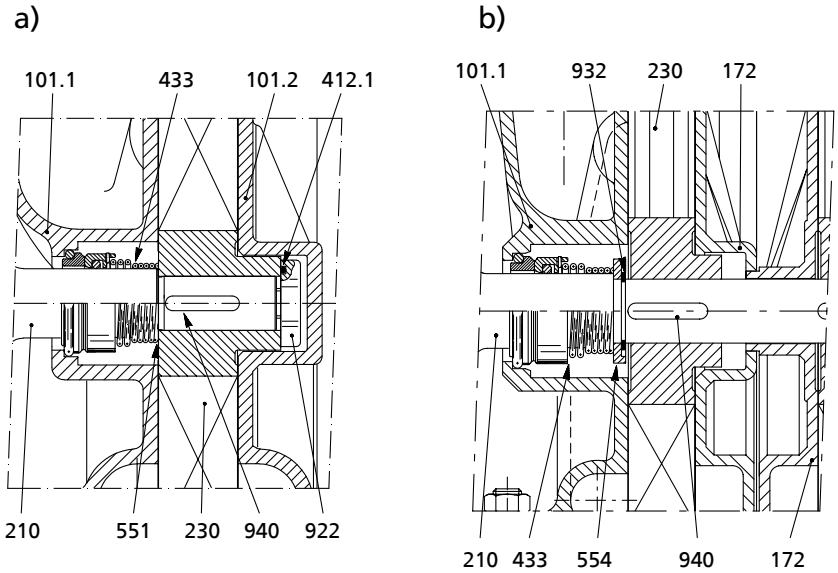

Fig. 5: Mechanical seal design T, operating mode B
a) Sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15
b) Sizes 42-146 and 52-164

1. Slide back the ring retainer [9]. Remove circlip 932 from shaft 210.
2. Remove the primary ring of mechanical seal 433. To do so, rotate the primary ring and the spring in clockwise direction while pulling them off the end of the shaft.
3. Undo hexagon socket head cap screws 914.2. Take pump casing 101.1 carefully off bearing housing 350.
4. Take the mating ring of mechanical seal 433 out of its seat in pump casing 101.1.
5. Pull thrower 507 off shaft 210.

1969.84/06-EN

9 Sizes 42-146 and 52-164 only

7.4.5.2 Mechanical seal design T, operating mode BQ

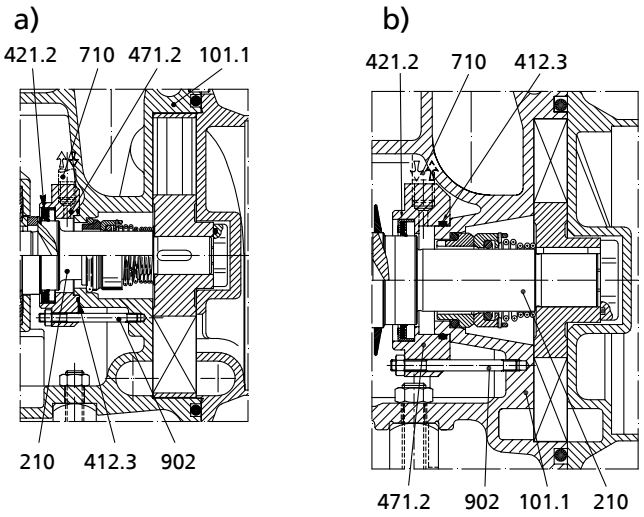

Fig. 6: Mechanical seal design T, operating mode BQ
a) Sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15
b) Sizes 42-146 and 52-164

1. Slide back the ring retainer[10)]. Remove circlip 932 from shaft 210.
2. Remove the primary ring of mechanical seal 433. To do so, rotate the primary ring and the spring in clockwise direction while pulling them off the end of the shaft.
3. Undo hexagon socket head cap screws 914.2. Take pump casing 101.1 carefully off bearing housing 350.
4. Undo nuts 920.4 and studs 902.
5. Carefully remove seal cover 471.2 from pump casing 101.1.
6. Remove lip seal 421.2 from seal cover 471.2.
7. Take the mating ring of mechanical seal 433 out of its seat in pump casing 101.1.

1969.84/06-EN

10 Sizes 42-146 and 52-164 only

7.4.5.3 Mechanical seal design Q, operating mode DB

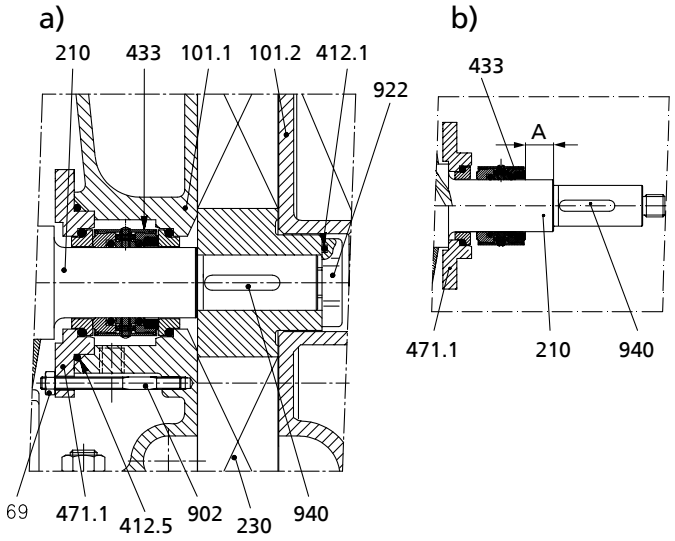

Fig. 7: Mechanical seal design Q, operating mode DB
a) Sectional drawing
b) Installation dimension A

1. **On sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15**: Undo nuts (69) and studs 902.
   On sizes 42-146 and 52-164: Undo grub screws 904.4.
2. Move back seal cover 471.1 to separate it from pump casing 101.1.
3. Undo hexagon socket head cap screws 914.2. Take pump casing 101.1 carefully off bearing housing 350.
4. Remove the mating ring of mechanical seal 433 from the rear section of pump casing 101.1.

NOTE

Observe distance "A" when re-installing the mechanical seal. Note down this distance to be able to re-install the mechanical seal accurately.

5. Undo the grub screws at the primary ring and pull the primary ring off shaft 210.
6. Remove seal cover 471.1.
7. Press the mating ring of mechanical seal 433 out of seal cover 471.1. Remove O-ring 412.5.
8. Pull thrower 507 off shaft 210.

7.4.6 Dismantling the bearing assembly

1. If applicable, undo screws 900.2 and remove holder 732.
2. Undo hexagon head bolts 901.2.
3. Remove bearing cover 360.
4. Press the assembly consisting of shaft 210 and rolling element bearing 320 and – for motor sizes IEC 160 and above – lip seal 421.1 out of bearing housing 350.
5. Undo and remove nut 920.3.
6. Guide shaft 210 out of rolling element bearing 320. Remove lip seal 421.1 if fitted.

1969.84/06-EN

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.

Match the lubricants to the fluid handled (e.g. water for foodstuff applications).

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual.
Tightening torque of the impeller nut: 70-80 Nm

7.5.2 Adjusting the clearances

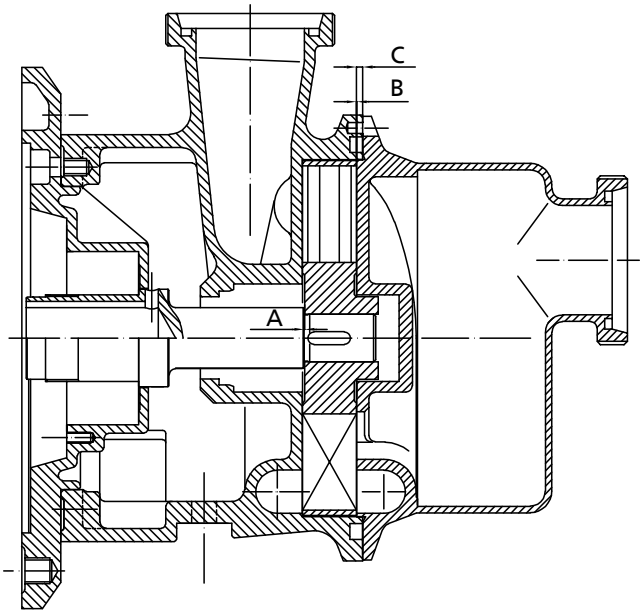

Fig. 8: Pump clearances

A	Rear side of impeller, distance between impeller and pump casing	B	Distance between pump casing and pump inlet casing
C	Distance between front side of impeller and pump inlet casing		

Explanation:

Distance C is set at the factory; distance B is achieved by using spacer discs which are fitted to adjust distance A (on the rear side of the impeller).

Should any problems occur, particularly verify distance A as this is the most significant value. The only distance for which a deviation is permissible is distance B.

Table 17: Impeller and casing clearances

Size	A	B	C
40-146	0,15	0,15	--
50-164	0,15	0,15	2,85
60-200	0,20	0,20	2,80
65-200	0,20	0,20	2,80
80-240-11	0,30	0,30	4,20
80-240-11	0,30	0,30	4,20

7.5.3 Fitting the bearing assembly

1. Check shaft 210 for any wear. Clean it thoroughly.
2. Fit rolling element bearing 320 on shaft 210.
3. Fit and tighten nut 920.3.
4. Insert the assembly consisting of shaft 210 and rolling element bearing 320 into bearing housing 350. For motor size IEC 160 and above: Fit lip seal 421.1.
5. Fit bearing cover 360. Fasten it with hexagon head bolts 901.2.
6. Slide thrower 507 onto shaft 210.
7. Fit holder 732 (if applicable). Fasten screws 900.2.

1969.84/06-EN

7.5.4 Installing the mechanical seal

7.5.4.1 Mechanical seal design T, operating mode B

	CAUTION
	The keyway could damage the seal faces and O-rings Damage to the mechanical seal! ▷ Always handle seal faces with utmost care.

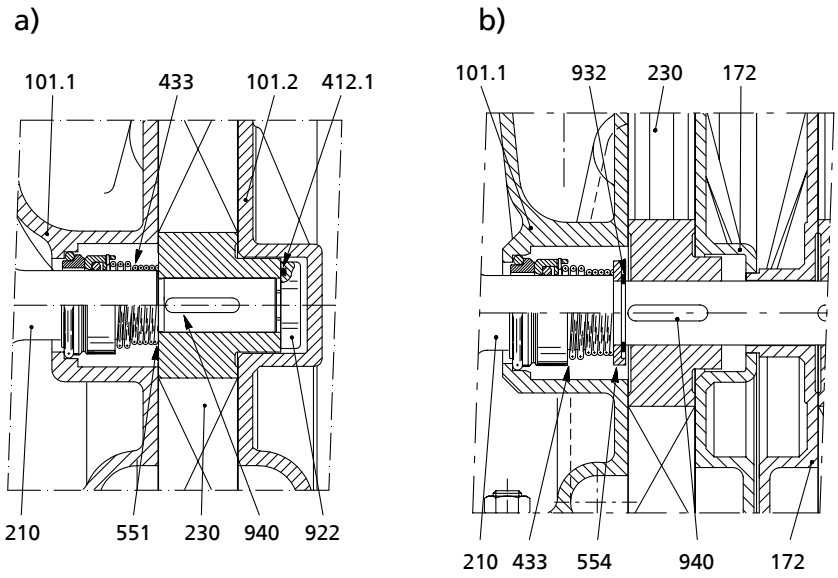

Fig. 9: Mechanical seal design T, operating mode B
a) Sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15
b) Sizes 42-146 and 52-164

1. Carefully insert the mating ring of mechanical seal 433 into pump casing 101.1.
2. Place pump casing 101.1 on bearing housing 350. Slide the seal carefully over shaft 210.
3. Fasten pump casing 101.1 with hexagon socket head cap screws 914.2 to bearing housing 350 .
4. Slide the primary ring of mechanical seal 433 onto shaft 210.
5. Fit the ring retainer[11)] on shaft 210. Use the ring retainer to compress the spring of mechanical seal 433. Lock the spring with circlip 932.

7.5.4.2 Mechanical seal design T, operating mode BQ

	CAUTION
	The keyway could damage the seal faces and O-rings Damage to the mechanical seal! ▷ Always handle seal faces with utmost care.

11 For sizes 42-146 and 52-164 only.

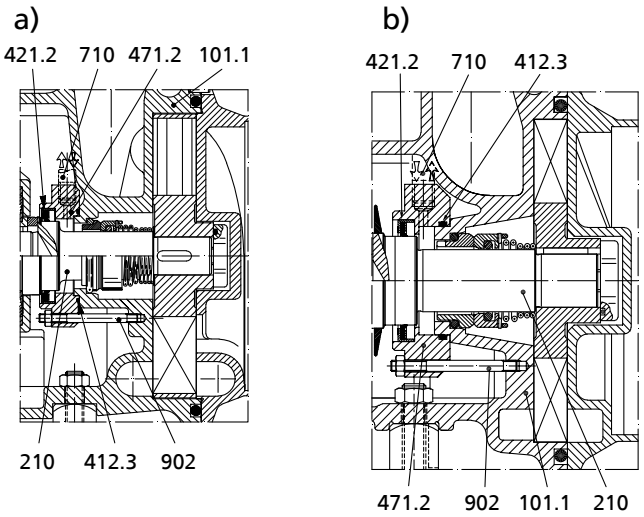

Fig. 10: Mechanical seal design T, operating mode BQ
a) Sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15
b) Sizes 42-146 and 52-164

1. Fit lip seal 421.2 in seal cover 471.2.
2. Fit studs 902 in pump casing 101.1. Tighten the studs.
3. Place seal cover 471.2 on studs 902. Fasten the studs with nuts (69).
4. Carefully insert the mating ring of mechanical seal 433 into pump casing 101.1.
5. Place pump casing 101.1 on bearing housing 350. Make sure not to damage lip seal 421.2 and mating ring.
6. Fit and tighten hexagon socket head cap screws 914.2.
7. Slide the primary ring of mechanical seal 433 onto shaft 210.
8. Fit the ring retainer[12)] on shaft 210. Use the ring retainer to compress the spring of mechanical seal 433. Lock the spring with circlip 932.

7.5.4.3 Mechanical seal design Q, operating mode DB

	**CAUTION**
	The keyway could damage the seal faces and O-rings Damage to the mechanical seal! ▷ Always handle seal faces with utmost care.

1969.84/06-EN

12 For sizes 42-146 and 52-164 only.

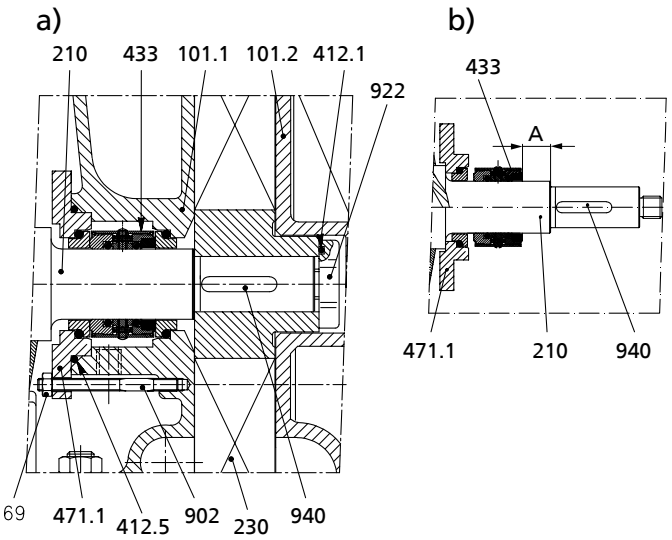

Fig. 11: Mechanical seal design Q, operating mode DB
a) Sectional drawing
b) Installation dimension A

1. Fit O-ring 412.5 in seal cover 471.1.
2. Insert the mating ring (motor end) of mechanical seal 433 into seal cover 471.1.
3. **On sizes 42-146 and 52-164**: Fit hexagon head bolts 901.4 in seal cover 471.1.
   On sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15: Fit and tighten studs 902 in pump casing 101.1.
4. Fit seal cover 471.1 on shaft 210. Slide it right to the end of the shaft.
5. Slide the primary rings of mechanical seal 433 onto shaft 210.
6. Check distance A: This value must be observed to make sure the load on the mechanical seal is evenly distributed.
   Correct values:
   Size 40-146: A = 16 mm
   Size 50-164: A = 17.5 mm
   Size 60-200: A = 15.5 mm
   Size 65-200: A = 15.5 mm
   Size 80 240-11: A = 19.5 mm
   Size 80 240-15: A = 19.5 mm
7. If value A is correct, tighten the grub screws of the primary ring.
8. Fit the mating ring (pump end) into the rear end of pump casing 101.1.
9. Carefully place pump casing 101.1 on bearing housing 350. Make sure not to damage the seal.
10. Fasten pump casing 101.1 to bearing housing 350 with hexagon socket head cap screws 914.2.
11. Slide seal cover 471.1 right against pump casing 101.1. Fasten the seal cover.
12. **On sizes 42-146 and 52-164**: Fasten it with hexagon head bolts 901.4.
    On sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15: Fasten it with nuts (69).

7.5.5 Fitting the impeller and the pump casing

7.5.5.1 Sizes 40-146, 50-164, 60-200, 65-200, 80-240-11 and 80-240-15

1. Slide a suitable spacer disc 551 onto shaft 210.
2. Insert key 940 into the keyway of shaft 210. Fit impeller 230.
3. Fit O-ring 412.1 in impeller nut 922. Secure impeller 230 with the nut.
4. Fit O-ring 412.2 in the groove of pump casing 101.1.
5. Fit pump casing 101.2. Secure it with clamping piece 81-44.

NOTE

Fit the foot base if applicable.
Ball feet:
Motors < IEC 112: Fasten the foot base to pump casing 101.1 with hexagon socket head cap screws 914.1 and nuts 920.1.
Motors > IEC 112: Fasten the front foot base to pump casing 101.1 with hexagon socket head cap screws 914.1 and nuts 920.1. Fasten foot 182.2 to motor 801.
Motor feet:
Fasten the feet to motor 801 with bolts (81) and nuts (82).

6. Mount motor 801. To do so, insert the motor shaft into shaft 210. Fasten motor 801 with hexagon head bolts 901.1.
7. If applicable, place shroud 683 onto the motor. Fasten it to holder 732 with screws 900.1.
8. For mechanical seal design T with operating mode BQ and mechanical seal design Q with operating mode DB: Fit quench connections 710 in seal cover 471.1/.2.

7.5.5.2 Sizes 42-146 and 52-164

1. Insert the first key 940. Slide the first impeller 230 onto shaft 210.
2. Insert O-ring 412.2 into the groove in the pump casing. Then fit interstage plate with guide vane 172.
3. Insert O-ring 412 in interstage plate with guide vane 172. Fit the second interstage plate with guide vane 172.
4. Insert the second key 940. Slide the second impeller 230 onto shaft 210.
5. Insert O-ring 412 in interstage plate with guide vane 172. Fasten pump casing 101.2 with screws 900.

NOTE

Fit the foot base if applicable.
Ball feet:
Motors < IEC 112: Fasten the foot base to pump casing 101.1 with hexagon socket head cap screws 914.1 and nuts 920.1.
Motors > IEC 112: Fasten the front foot base to pump casing 101.1 with hexagon socket head cap screws 914.1 and nuts 920.1. Fasten foot 182.2 to motor 801.
Motor feet:
Fasten the feet to motor 801 with bolts (81) and nuts (82).

6. Mount motor 801. To do so, insert the motor shaft into shaft 210. Fasten motor 801 with hexagon head bolts 901.1.
7. If applicable, place shroud 683 onto the motor. Fasten it to holder 732 with screws 900.1.
8. For mechanical seal design T with operating mode BQ and mechanical seal design Q with operating mode DB: Fit quench connections 710 in seal cover 471.1/.2.

1969.84/06-EN

7.6 Spare parts stock

7.6.1 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 16)

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 57)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 18: 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
230	Impeller	1	1	1	2	2	2	20%
210 + 940	Shaft with key	1	1	1	2	2	2	20%
433	Mechanical seal set	2	3	4	5	6	7	90%
320	Rolling element bearing set	1	1	2	2	2	3	25%
412.1	O-ring (impeller nut)	4	6	8	8	9	10	100%
412.2	O-ring (casing)	4	6	8	8	9	12	150%
412.5	O-ring (seal housing)	4	6	8	8	9	10	100%
421.1	Lip seal set	4	6	8	8	9	10	100%
421.2	Lip seal set	4	6	8	8	9	10	100%

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 Pump is running, but does not deliver

B Insufficient flow rate

C Discharge pressure below specified value

D Excessive power consumption

E Excessive current consumption

Table 19: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy
✗	✗	-	-	-	Air ingress into the suction line	Check integrity of all pipe connections and re-seal if necessary.
✗	-	-	-	-	Suction line not submerged in fluid	Check fill level.
✗	✗	✗	-	-	Clearance tolerances between impeller and casing exceeded	Re-adjust impeller or replace if worn.
✗	-	-	-	-	No fluid inside the pump casing	Fill in fluid.
✗	-	-	-	-	Cavitation caused by excessive suction lift	Reduce suction lift.
✗	-	-	-	-	Air pocket in discharge line	Fit a vent valve.
✗	-	-	-	-	Pump does not prime.	Check the points mentioned in section (⇨ Section 6.1, Page 27) .
✗	-	-	-	-	Wrong direction of rotation	Change electrical connection of motor.
✗	✗	-	-	-	Suction line clogged	Check suction line and clean if necessary.
✗	-	-	-	-	The shut-off valves are closed.	Open all valves.
-	✗	-	-	-	System pressure too high	Check discharge-side piping; increase nominal piping diameter if necessary.
-	✗	-	-	-	Air intake at the mechanical seal	Check mechanical seal arrangement.
-	✗	-	-	-	Fluid viscosity is higher than specified for pump selection.	Consult the manufacturer.
-	-	✗	-	-	System pressure lower than specified	Throttle the discharge-side valve.
-	-	-	✗	-	Power input lower than permitted	Check all system conditions.
-	-	-	✗	-	Pump speed too high (frequency inverter operation)	Reduce speed.
-	-	-	✗	-	Impeller does not rotate freely.	Eliminate clogging, re-adjust impeller.
-	-	-	✗	-	Viscosity and/or density of fluid higher than specified	Consult the manufacturer.
-	-	-	✗	-	Bearings run sluggishly.	Replace rolling element bearings, replace lubricant.
-	-	-	-	✗	Flow rate too high	Check items listed above.
-	-	-	-	✗	Excessive drop of electrical voltage	Check voltage supply (trained specialist personnel only).
-	-	-	-	✗	Fault in electrical system	Shut down pump.

1969.84/06-EN

9 Related Documents

9.1 General assembly drawing with list of components (single-stage pumps)

9.1.1 Pump size 40-146, motor size 90

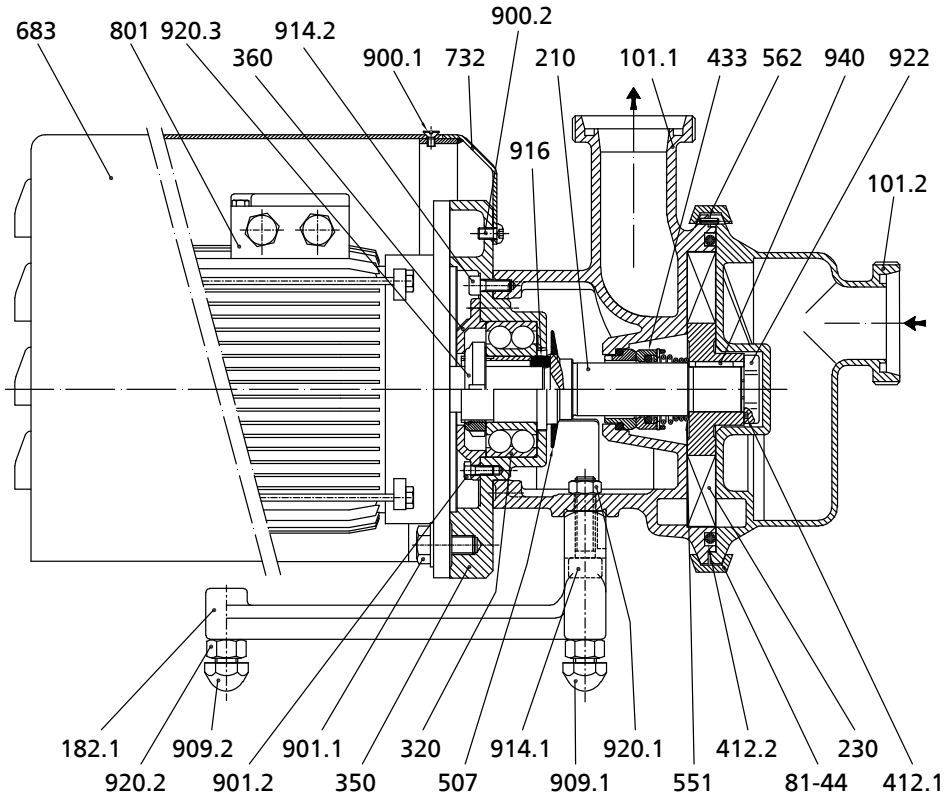

Fig. 12: Size 40-146, motor 90

Table 20: List of components for pump size 40-146, motor size 90

Part No.	Description	Part No.	Description
81-44	Clamping piece	562	Parallel pin
101.1/.2	Pump casing	683	Shroud
182.1	Foot	732	Holder
210	Shaft	801	Flanged motor
230	Impeller	900.1/.2	Bolt/screw
320	Rolling element bearing	901.1/.2	Hexagon head bolt
350	Bearing housing	909.1/.2	Adjusting screw
360	Bearing cover	914.1/.2	Hexagon socket head cap screw
412.1/.2	O-ring	916	Plug
433	Mechanical seal	920.1/.2/.3	Nut
507	Thrower	922	Impeller nut
551	Spacer disc	940	Key

9.1.2 Pump size 50-164, motor size 132

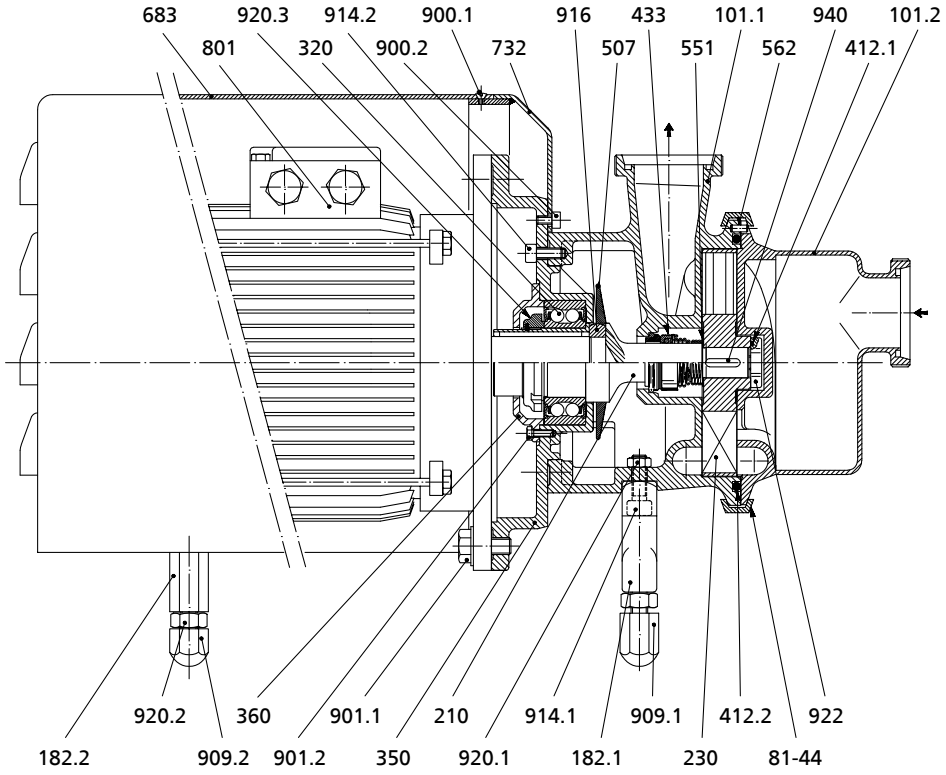

Fig. 13: Pump size 50-164 / motor size 132

Table 21: List of components for pump size 50-164, motor size 132

Part No.	Description	Part No.	Description
81-44	Clamping piece	562	Parallel pin
101.1/.2	Pump casing	683	Shroud
182.1/.2	Foot	732	Holder
210	Shaft	801	Flanged motor
230	Impeller	900.1/.2	Bolt/screw
320	Rolling element bearing	901.1/.2	Hexagon head bolt
350	Bearing housing	909.1/.2	Adjusting screw
360	Bearing cover	914.1/.2	Hexagon socket head cap screw
412.1/.2	O-ring	916	Plug
433	Mechanical seal	920.1/.2/.3	Nut
507	Thrower	922	Impeller nut
551	Spacer disc	940	Key

1969.84/06-EN

9.1.3 Pump size 60/65-200, motor size 160

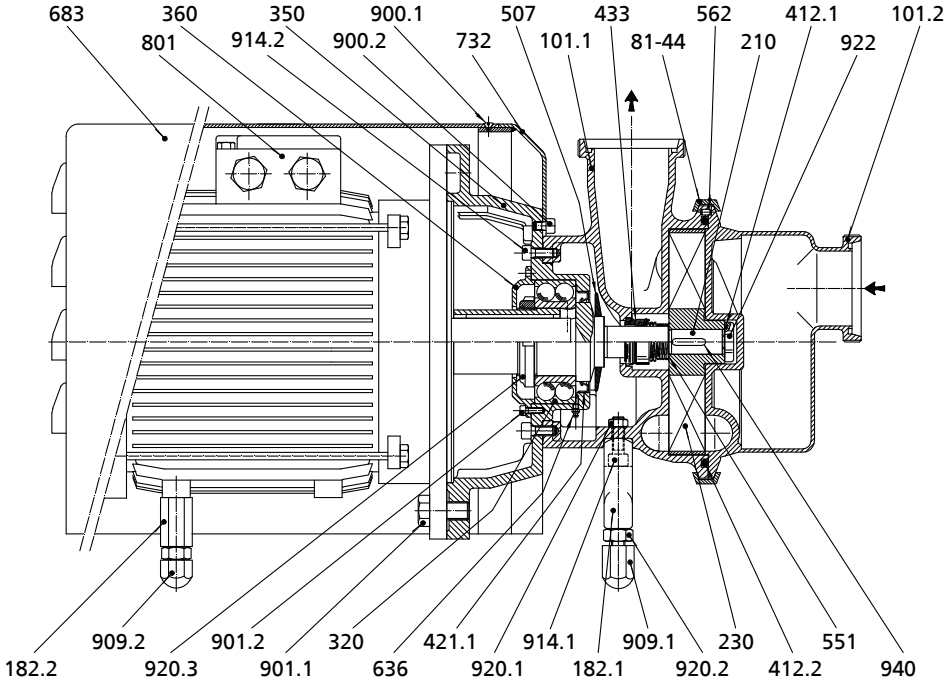

Fig. 14: Pump size 60/65-200, motor size 160

Table 22: Pump size 60/65-200, motor size 160

Part No.	Description	Part No.	Description
81-44	Clamping piece	562	Parallel pin
101.1/.2	Pump casing	636	Lubricating nipple
182.1/.2	Foot	683	Shroud
210	Shaft	732	Holder
230	Impeller	801	Flanged motor
320	Rolling element bearing	900.1/.2	Bolt/screw
350	Bearing housing	901.1/.2	Hexagon head bolt
360	Bearing cover	909.1/.2	Adjusting screw
412.1/.2	O-ring	914.1/.2	Hexagon socket head cap screw
421.1	Lip seal	920.1/.2/.3	Nut
433	Mechanical seal	922	Impeller nut
507	Thrower	940	Key
551	Spacer disc		

9.1.4 Pump size 80-240, motor size 160

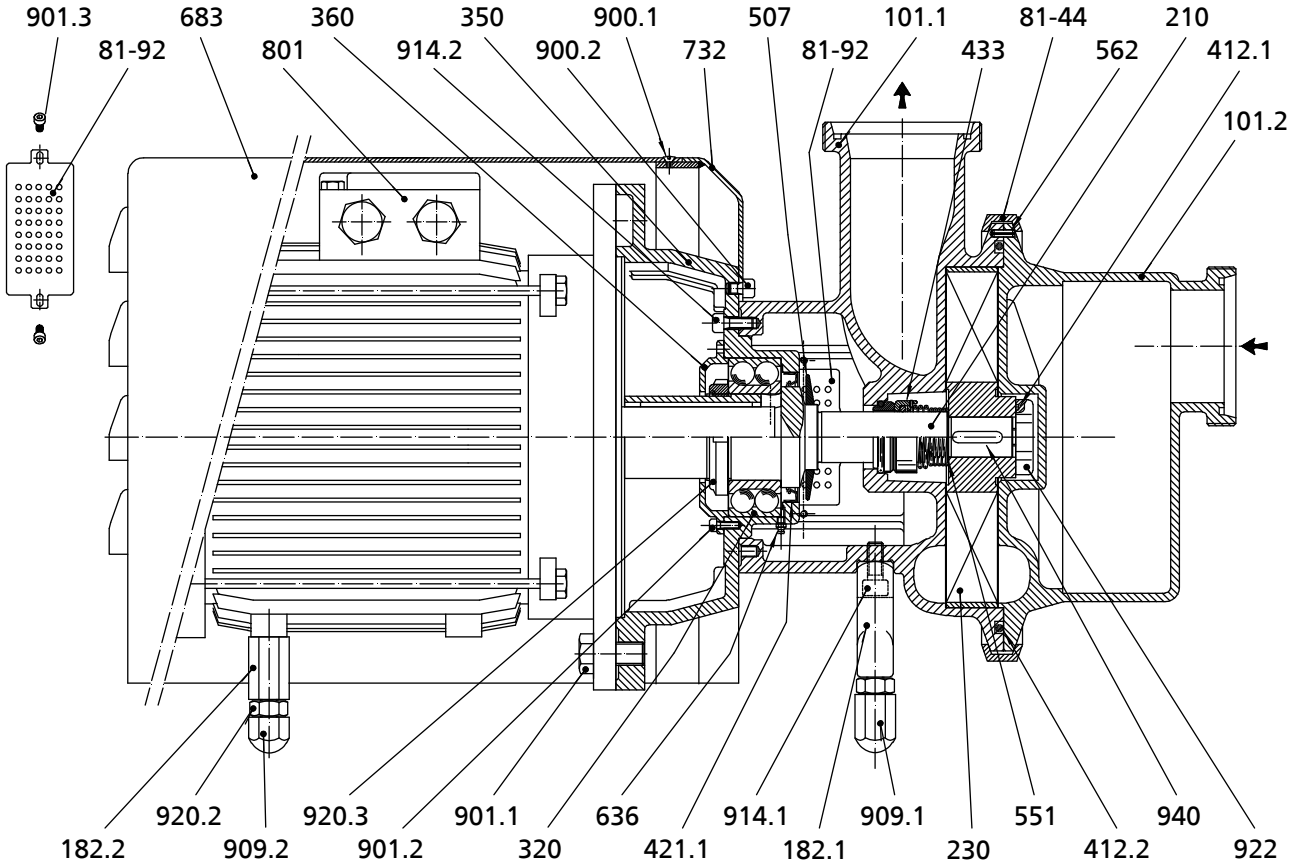

Fig. 15: Pump size 80-240, motor size 160

Table 23: List of components for pump size 80-240, motor size 160

Part No.	Description	Part No.	Description
81-44	Clamping piece	551	Spacer disc
81-92	Cover plate	562	Parallel pin
101.1/.2	Pump casing	636	Lubricating nipple
182.1/.2	Foot	683	Shroud
210	Shaft	732	Holder
230	Impeller	801	Flanged motor
320	Rolling element bearing	900.1/.2	Bolt/screw
350	Bearing housing	901.1/.2/.3	Hexagon head bolt
360	Bearing cover	909.1/.2	Adjusting screw
412.1/.2	O-ring	914.1/.2	Hexagon socket head cap screw
421.1	Lip seal	920.2/.3	Nut
433	Mechanical seal	922	Impeller nut
507	Thrower	940	Key

1969.84/06-EN

9.2 General assembly drawing with list of components (two-stage pumps)

9.2.1 Pump size 42-146, motor size 112

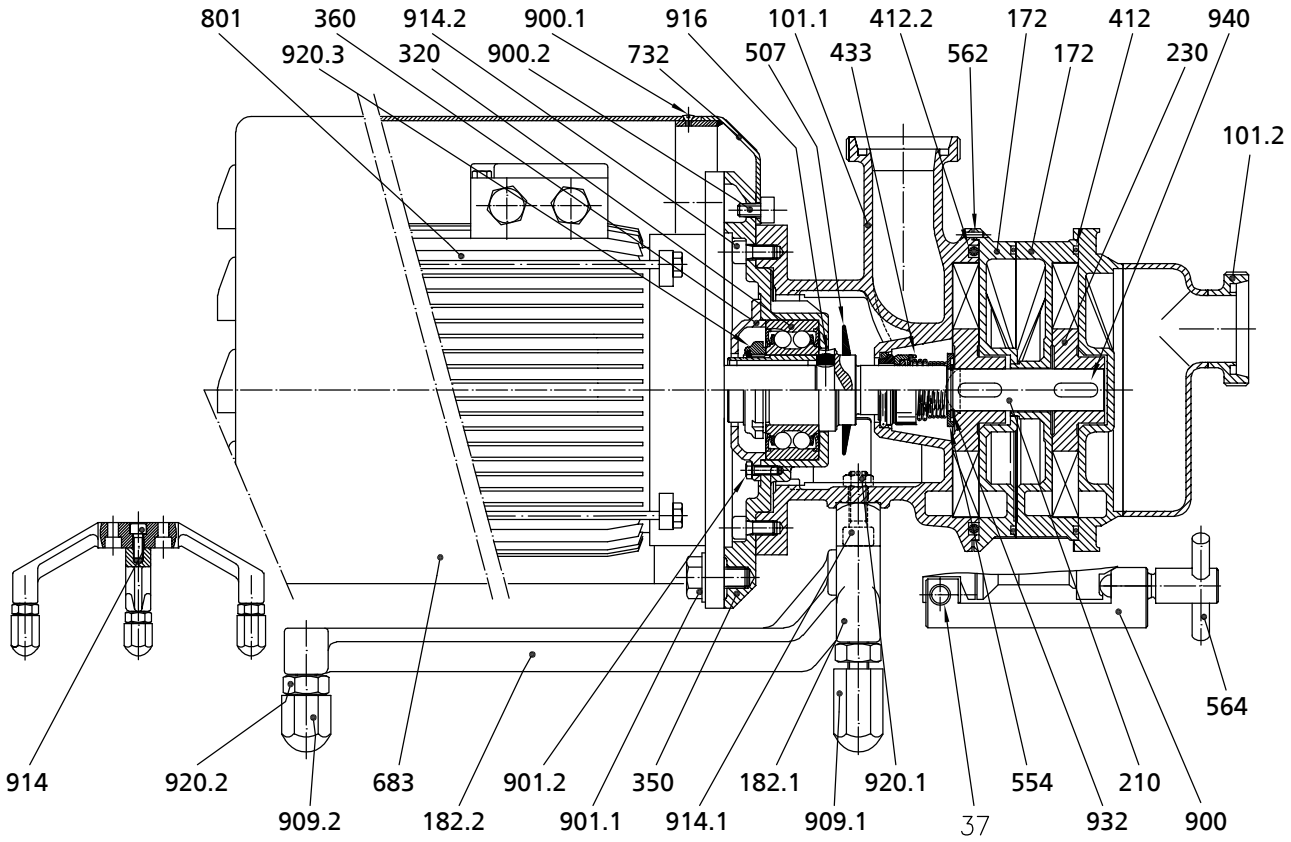

Fig. 16: Pump size 42-146, motor size 112

Table 24: List of components for pump size 42-146, motor size 112

Part No.	Description	Part No.	Description
101.1/.2	Pump casing	564	Pin
172	Interstage plate with guide vane	683	Shroud
182.1/.2	Foot	732	Holder
210	Shaft	801	Flanged motor
230	Impeller	900.1/.2	Bolt/screw
320	Rolling element bearing	901.1/.2	Hexagon head bolt
350	Bearing housing	909.1/.2	Adjusting screw
360	Bearing cover	914.1/.2	Hexagon socket head cap screw
412.2	O-ring	916	Plug
433	Mechanical seal	920.1./2/.3	Nut
507	Thrower	932	Circlip
554	Washer	940	Key
562	Parallel pin		

9.2.2 Pump size 52-164, motor size 132

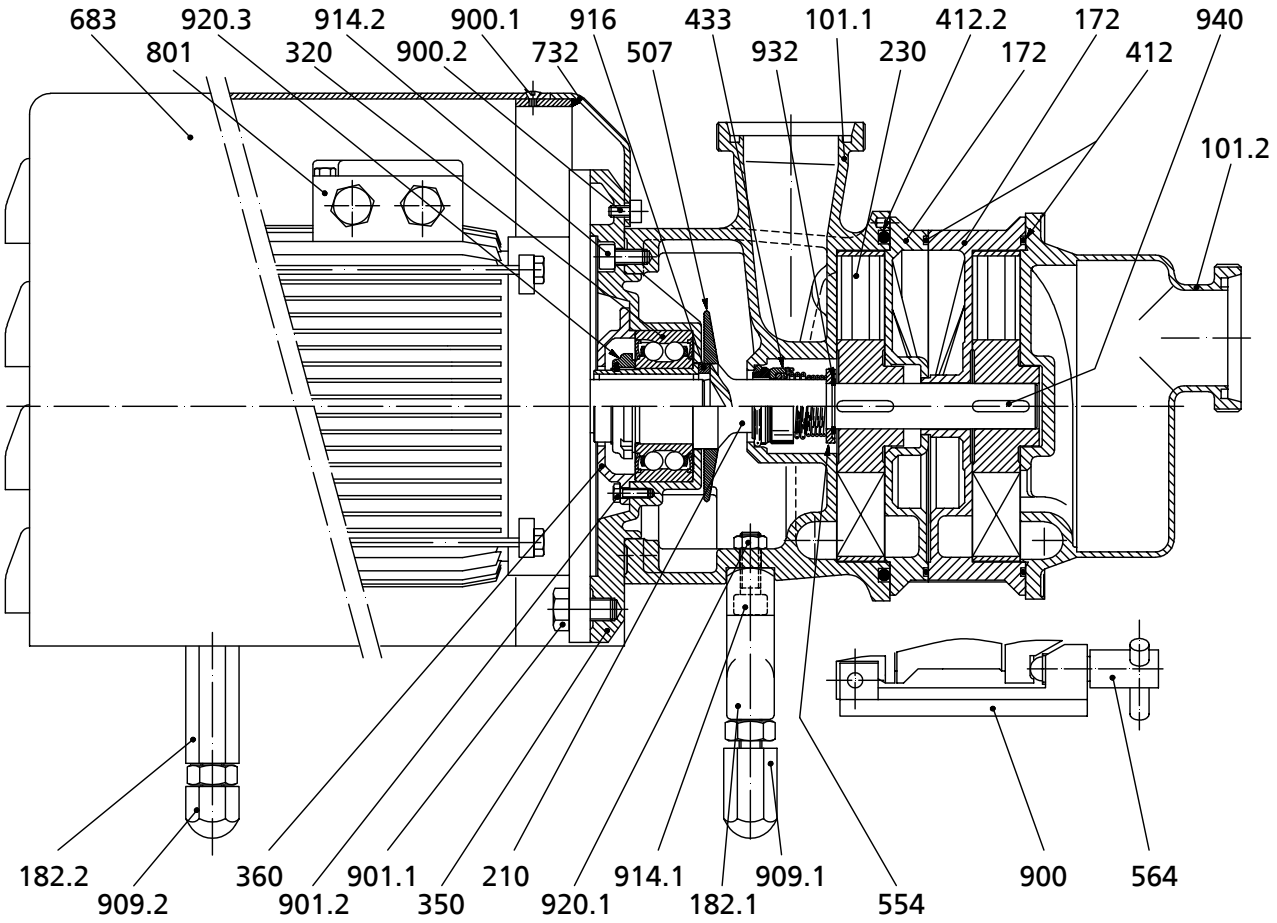

Fig. 17: Pump size 52-164, motor size 132

Table 25: List of components for pump size 52-164, motor size 132

Part No.	Description	Part No.	Description
101.1/.2	Pump casing	564	Pin
172	Interstage plate with guide vane	683	Shroud
182.1/.2	Foot	732	Holder
210	Shaft	801	Flanged motor
230	Impeller	900.1/.2	Bolt/screw
320	Rolling element bearing	901.1/.2	Hexagon head bolt
350	Bearing housing	909.1/.2	Adjusting screw
360	Bearing cover	914.1/.2	Hexagon socket head cap screw
412.1/.2	O-ring	916	Plug
433	Mechanical seal	920.1/.3	Nut
507	Thrower	932	Circlip
554	Washer	940	Key

1969.84/06-EN

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, Vitaprime, Vitastage

KSB order number: .....

- is in conformity with the provisions of the following Directives as amended from time to time:
  - Pump (set): EC Machinery Directive 2006/42/EC
  - Pump (set): Regulation 1935/2004/EG on Materials and Articles Intended to Come into Contact with Food

The manufacturer also declares that

- the following harmonised international standards 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

.....[13)].....

Name

Function

Company
Address

1969.84/06-EN

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

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[14]: .....

Delivery date: .....

Application: .....

Fluid handled[14]: .....

Please tick where applicable[14]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[14]: .....

Comments: .....

.....

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

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

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

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

☐ No special safety precautions are required for further handling.

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

.....

.....

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

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

1969.84/06-EN

14 Required field

Index

1969.84/06-EN

1969.84/06-EN (01532028)

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