

Standardised Pump for General Use

Megabloc

Installation / Operating Manual



Technical Information

Installation/Operating Manual Megabloc

Original operating manual

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Glossary

Pool of pumps

Pumps which are purchased and stored independently of their late use

Back pull-out unit

Pump without pump casing; partly completed machinery

Pump set

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

Back pull-out design

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

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.

Hydraulic system

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

Discharge line

The line which is connected to the discharge nozzle

Suction lift line/suction head line

The line which is connected to the suction nozzle

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 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 uniquely identify the pump (set) and serve as identification for all further business processes.

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

1.2 Equipment assembly

To install equipment supplied by KSB, refer to the sub-sections under Servicing/Maintenance.

(⇒ Section 7 Page 25)

1.3 Target group

This manual is aimed at the target group of trained and qualified specialist technical personnel

(⇒ Section 2.4 Page 8)

1.4 Other applicable documents


Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
General arrangement drawing/ outline drawing	Description of mating and installation dimensions for the pump (set), weights
Hydraulic characteristic curve	Characteristic curves showing head, NPSH required, efficiency and power input
General assembly drawing	Sectional drawing of the pump
Spare parts lists	Description of spare parts
List of components	Description of all pump components

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

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



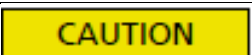



2 Safety



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

2.1 Identification of safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbols	Description
	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	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.

2.2 General

This manual contains general installation, operating and maintenance instructions that must be observed to ensure safe pump operation and prevent personal injury and damage to property.

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

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

The contents of this manual must be available to the specialist personnel at the site at all times. Information attached directly to the pump must always be complied with and be kept in a perfectly legible condition at all times. This applies to, for example::

- Arrow indicating the direction of rotation
- Markings for connections
- Nameplate

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

2.3 Intended use

The pump (set) must only be operated within the operating limits described in the other applicable documents.(Section 1.4 Page 6)

- Only operate 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.
- Never operate the pump without the fluid handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- Observe the minimum flow rates 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.

Prevention of foreseeable misuse

- Never open discharge-side shut-off elements further than permitted.
 - The maximum flow rate specified in the data sheet or product literature would be exceeded.
 - Risk of cavitation damage
- Never exceed the permissible operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.

2.4 Personnel qualification and training

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

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

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

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

2.5 Consequences and risks caused by non-compliance with these operating instructions

- 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

2.6 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 and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards and laws

2.7 Safety information for the operator/user

- The operator shall fit contact guards for hot, cold and moving parts and check that the guards function properly.
- Do not remove any 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.

2.8 Safety information for maintenance, inspection and installation work

- Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.

- Use only original spare parts or parts authorized by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that all maintenance, inspection and installation work is performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- The pump casing must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.5 Page 21)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 3.5 Page 11)
- As soon as the work is completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.2 Page 21).

2.9 Unauthorized 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 2.3 Page 7)

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 (as applicable) and the insurer about the damage in writing immediately.

3.2 Transport

	 DANGER
	<p>The pump (set) could slip out of the suspension arrangement Danger to life from falling parts!</p> <ul style="list-style-type: none"> ▶ Always transport the pump (set) in the specified position. ▶ Give due attention to the weight data and the centre of gravity. ▶ Observe the applicable local health and safety regulations. ▶ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

Transport the pump set as shown below.

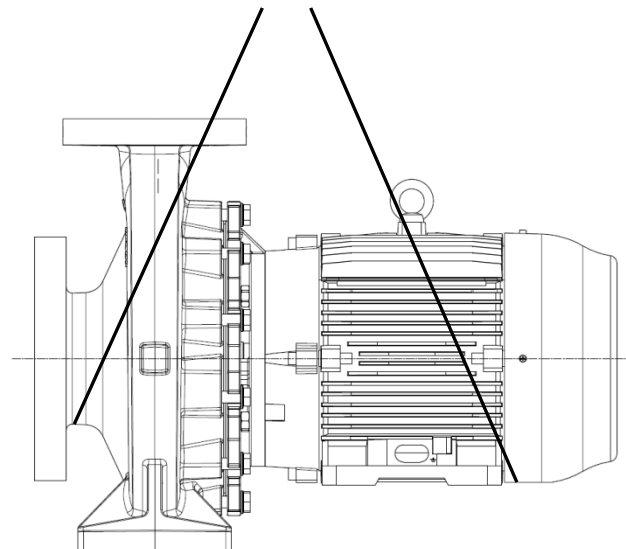




Fig. 1: Transporting the pump

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 by humidity, dirt, or vermin Corrosion/contamination of the pump (set)! ▶ For outdoor storage cover the packed or unpacked pump (set) and accessories with waterproof material
---	--

	CAUTION Wet, contaminated or damaged openings and connections Leakage or damage to the pump set! ▶ Only remove caps/covers from the openings of the pump set at the time of installation.
---	---

Store the pump (set) in a dry, protected room where the atmospheric humidity is as constant as possible.

Rotate the shaft by hand once a month, e.g. via the motor fan.

If properly stored indoors, the pump set is protected for a maximum of 6 months.

New pumps/pump sets are supplied by our factory duly prepared for storage.

For storing a pump (set) which has already been operated, observe the instructions in (⇒ Section 6.3 Page 23).

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3 Page 27)
2. Always flush and clean the pump, particularly if it has been used for handling noxious, hot or other hazardous fluids.
3. If the fluids handled by the pump set leave residues which might lead to corrosion damage when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the pump set must also be neutralised, and anhydrous inert gas must be blown through the pump for drying purposes.
4. Always complete and enclose a certificate of decontamination when returning the pump (set).
Always indicate any safety and decontamination measures taken. (⇒ Section 10 Page 32).



NOTE

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

3.5 Disposal



WARNING

Fluids and supplies posing a health hazard and/or hot fluids and supplies
Hazard to persons and the environment!

- ▶ Collect and properly dispose of flushing medium and any residues of the fluid handled.
- ▶ 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

Pump is designed for pumping clean or turbid liquids and it is used in:

- Water supplies for industries
- Irrigation
- Circulation of condensates
- City property installations
- Air conditioning
- Cooling services
- Industries in general

4.2 Designation

Code	Description
Megabloc	Model/type
32	Discharge nozzle diameter (mm)
125	Nominal impeller diameter (mm)
2	Motor rating (hp)
2	Number of poles

4.3 Nameplates



KSB

KSB BOMBAS HIDRAULICAS S/A
VARZEA PAULISTA-SP
PHONE (55) 1145968500
MADE IN BRAZIL
CNPJ: 60.680.873/0001-14

KSB MEGABLOC

Size
Impeller

Ø


mm

OPYear

WeightKg

TORN
103 BRN 37

or



KSB

KSB BOMBAS HIDRAULICAS S/A
VARZEA PAULISTA-SP
PHONE (55) 1145968500
MADE IN BRAZIL
CNPJ: 60.680.873/0001-14

KSB

OPYear

Q

m³/h

H

m

n

rpm

Weightkg

581
168 BRN 37

Fig.5: Nameplates (examples)

4.4 Design details

Casing – Single volute, with top centerline discharge in standard assembly, which is also possible in others positions.

Suction and discharge may be threaded (BSP) or flanged (ANSI B. 16.1 250 # FF for sizes 32-250.1, 32-250, 40-250, 50-250, 50-315, 65-250, 80-250 and ANSI B.16.1 125 # FF for the other sizes).

The casing is fitted to the discharge cover.

The casing is radially split with back-pull-out design, which allows the pump disassembly without dismounting the suction and discharge pipings.

Standard material – Cast iron

Optional material – Stainless steel

For stainless steel material suction and discharge nozzles are flanged (ANSI B16.5 150#RF).

Sizes available upon consult.

Impeller - Radial, single suction, closed type, casted in one piece, directly driving by the electric motor shaft through fix bolt.

Standard material – Cast iron

Optional material – Stainless steel, upon consult.

Discharge Cover – Keeps pump casing firmly aligned with the electric motor flange.

Standard material – Cast iron

Optional material – Stainless steel upon consult.

Mechanical Seal – Standardized for use with water to 90°C, as well as for most hydrocarbons. For others temperatures and liquids refers to KSB.

Standard material – Carbon/ Stainless steel or Ceramics / Stainless steel.

Optional material – Tungsten carbide / Tungsten carbide.

Shaft Protecting Sleeve – Elongated, protecting the shaft on the sealing region, which prevents the pumped liquid to get in contact with the shaft. With a keyway end it is fixed to the shaft through the impeller bolt.

Standard material – Bronze

Optional material – AISI 316.

Electric Motor – Supplied as an integrating part of the set. Standard with flange and JM/JP shaft end according to NEMA norm. Appropriate bearings are provided to withstand radial and axial loads acting over them. Pump set is supported by the electric motor feet.



Protecting degree:	TFVE
Insulation class:	B
Service factor:	1,10 / 1,15 (up to 50 hp) 1,00 (60 and 75 hp)
Rotation:	3500 rpm / 1750 rpm
Phase / frequency:	3 / 60 Hz
Voltage:	220 / 380 / 440 / 760 V
Constructive form:	B34D (standard) B34E (under consult)

5 Installation at site

A poorly performed assembly will result in operation disturbances, causing vibrations and wears on internal parts.

5.1 Checks to be carried out prior to installation

Place of installation

	 WARNING
	<p>Installation on mounting surface which is unsecured and cannot support the load Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▶ Use a resistant concrete. ▶ The mounting surface must have set and must be completely horizontal and even. ▶ Observe the weights indicated.

Preferably the pump shall be assembled on a concrete foundation or over a metallic base with flat surface on the fastening area.



Fastening will be performed through 4 screws on the electric motor feet.


NOTE: For pumps with flanged suction and discharge pump casing has feet. Fastening to base however, shall be performed through the 4 screws on the electric motor feet.


Before placing the pump on installation site turn its shaft and see if it is turning freely. After fastening and installation of suction and discharge piping, check again if shaft is still turning freely. Be sure that pipings are not transferring stresses to the pump nozzles.

5.2 Piping

5.2.1 Connecting the piping

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

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

	NOTE
	<p>It is recommended to install check and shut-off elements in the system, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.</p>

Correct operation of a pump depends on dimensions and correct arrangement of piping to be used.

Suction and discharge pipings shall be supported by suitable means. Herewith, mechanical efforts are prevented to be transferred to pump nozzles.

5.2.2 Suction piping

The suction piping shall be sized according to the following criterion:

- Nominal diameter never smaller than the suction nozzle
- Maximum liquid speed of 2 m/s.
- Install piping straight and short as possible.
- In case of negative suction, install piping in slope towards the pump.
- Try to minimize the pressure losses at the suction piping and respective accessories (valves, curves, reductions, strainer, etc.).
- Avoid the making up of air pockets caused by siphon concentric reducers etc., when laying out suction piping specially in case of negative suction.

5.2.3 Discharge piping

The discharge piping shall be sized taking into account the following criterion:

- a) Economy:
 - Pump investment;
 - Investment of piping and its relevant accessories;
 - Investment amortization time.
- b) Technical:
 - Maximum recommended velocity of 5 m/s.
 - Installation of a check valve after discharge nozzle.
 - Prevent air pockets making up in piping. If that is not possible the highest piping point shall be provided with an air vent device to facilitate air exit.

5.3 Typical installation

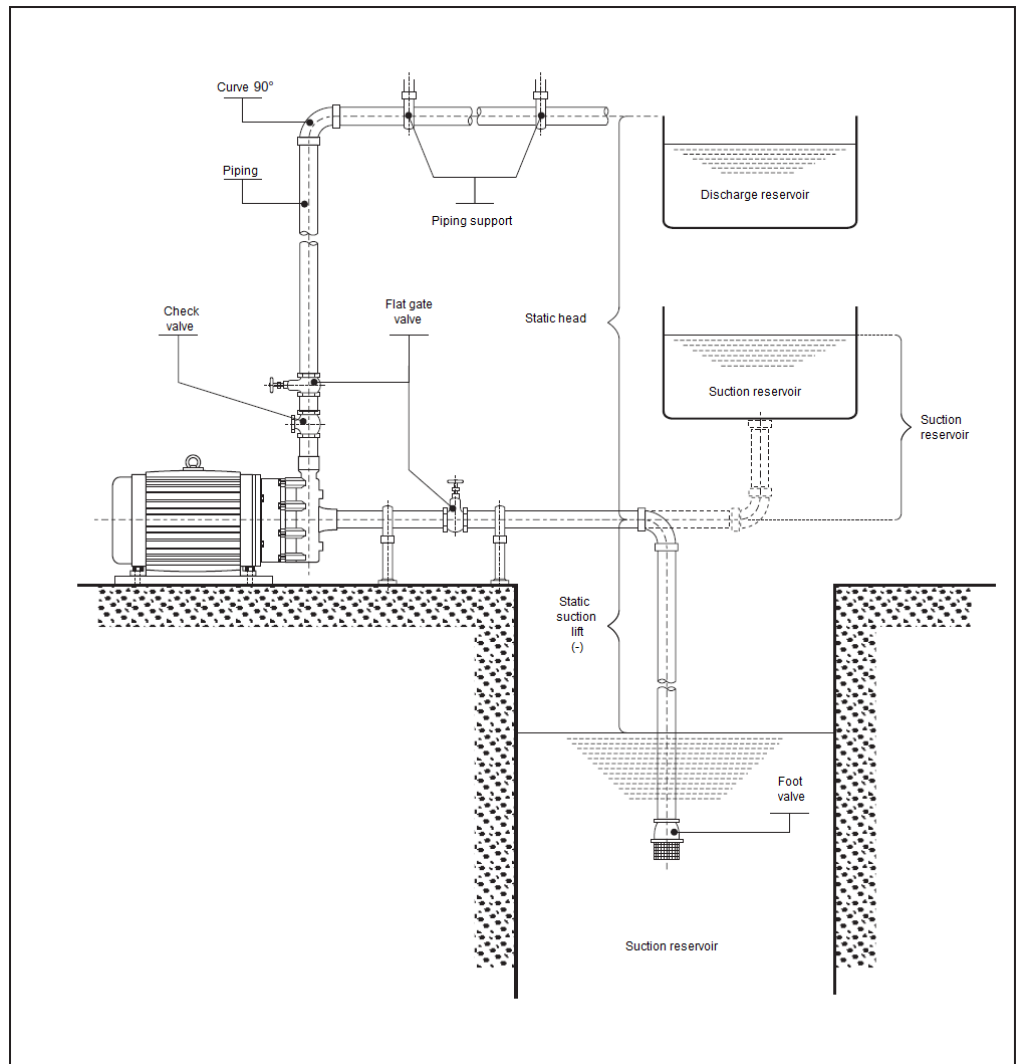


Fig. 3: Example of horizontal installation

5.4 Installation availability

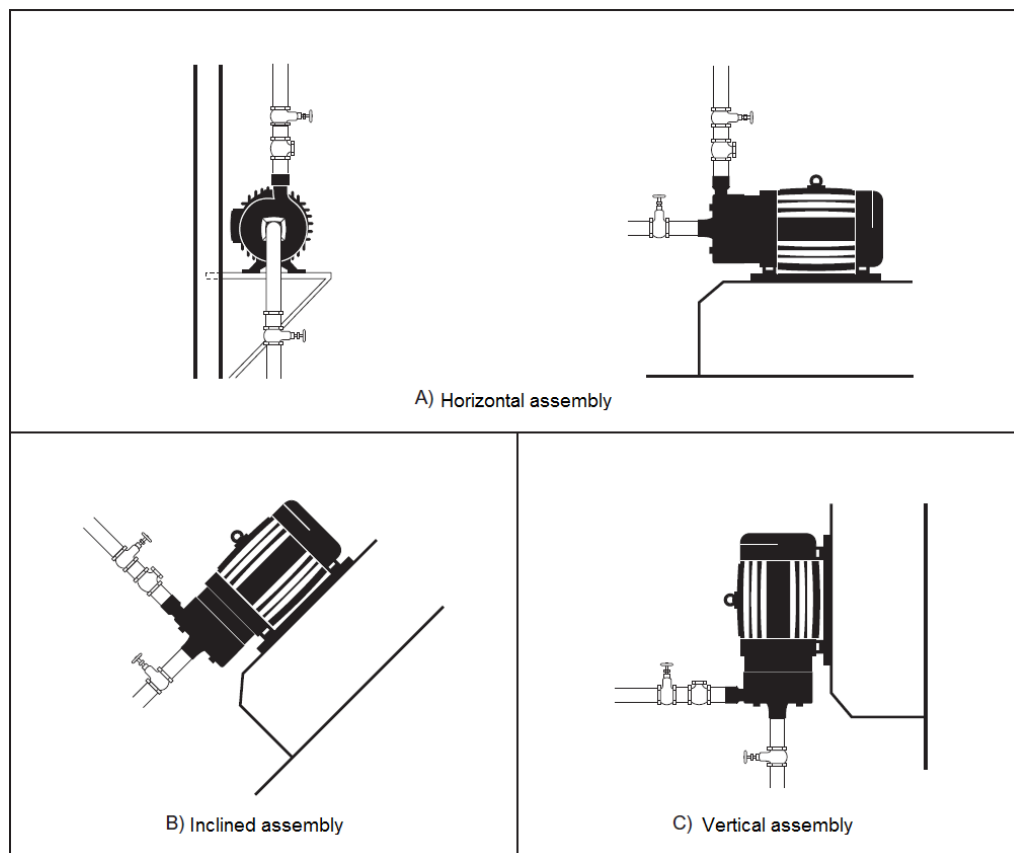





Fig. 4: Other installation possibilities

5.5 Electrical connection

	<p>⚠ DANGER</p> <p>Work on the pump set by unqualified personnel Danger of death from electric shock!</p> <p>► Always have the electrical connections installed by a trained and qualified electrician.</p>
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	<p>⚠ WARNING</p> <p>Incorrect connection to the mains Damage to the mains network, short circuit!</p> <p>► Observe the technical specifications of the local energy supply companies.</p>
---	---

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

	<p>NOTE</p> <p>It is recommended to fit a motor protection device.</p>
---	---

5.5.1 Setting the time relay



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


Table 4: Time relay settings for star-delta starting:

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

5.5.2 Earthing


	<p>DANGER</p> <p>Electrostatic charging Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Connect the potential equalisation conductor to the earthing terminal provided. ▶ Provide for potential equalisation between the pump set and foundation.
---	---


5.5.3 Connecting the motor


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


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

5.6 Checking the direction of rotation

	<p>DANGER</p> <p>Temperature increase resulting from contact between rotating and stationary components Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Never check the direction of rotation by starting up the unfilled pump set. ▶ Separate the pump from the motor to check the direction of rotation.
---	--

	<p>WARNING</p> <p>Hands inside the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▶ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.
---	---

	<p>CAUTION</p> <p>Incorrect direction of rotation with non-reversible mechanical seal Damage to the mechanical seal and leakage!</p> <ul style="list-style-type: none"> ▶ Separate the pump from the motor to check the direction of rotation.
---	--

	<p>CAUTION</p> <p>Drive and pump running in the wrong direction of rotation Damage to the pump!</p> <ul style="list-style-type: none"> ▶ Refer to the arrow indicating the direction of rotation on the pump. ▶ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.
---	---




The correct direction of rotation of 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.

6 Start-up/shutdown

	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed.</p> <ul style="list-style-type: none"> ▶ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed. ▶ Only start up the pump set with the discharge-side shut-off element slightly or fully open.
	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures due to dry running or excessive gas content in the fluid handled Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Never operate the pump set without liquid fill. ▶ Prime the pump as specified. (⇒ Section 6.1 Page 20) ▶ Always operate the pump within the permissible operating range.
	<div style="background-color: #ffff00; padding: 5px;">CAUTION</div> <p>Abnormal noises, vibrations, temperatures or leakage Damage to the pump!</p> <ul style="list-style-type: none"> ▶ Switch off the pump (set) immediately. ▶ Eliminate the causes before returning the pump set to service.

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

6.1 Start-up

6.1.1 Priming

Before starting up it is necessary to fill completely the suction piping and the pump with liquid. This operation is called priming and it can be made by using one of the following methods:

- If the liquid level on suction reservoir is above the pump suction nozzle, you only have to open the suction and discharge valves and let the liquid flow by gravity until complete filling of pump.
- When the liquid level in suction reservoir is at suction nozzle elevation or below it and suction piping is equipped with a foot valve, both pump and piping shall be primed by using one of the following methods:
 - Remove plug (part n° 903) and install a priming funnel (with valve) in its place. After opening the suction valve fill with the liquid to the pumped through the priming funnel until filling of pump and suction piping. When the operation is completed, close the funnel valve.
 - When an external source of pumped liquid is available, a permanent connection piping with valve shall be adapted, as well as provided an air vent also just after discharge nozzle and before any valve, allowing air release. Priming is carried out by opening the external source valve and letting the liquid flows until pour out through the air vent. Once the priming is performed, close the air vent and also the external source valve.
- Other priming methods may be used depending on the installation location availability. Most of these methods are based on the creation of a differential pressure between suction piping, the pump and the discharge piping, being used mainly when there is not a foot valve available.

6.1.2 Preparation for starting

- Open totally the suction valve.
- Close the discharge valve.
- Prime the pump and suction piping (see item 6.1).

6.1.3 Start-up

After the above steps have been done, start the motor for a very short time and switch it off observing whether the rotation direction is identical to that one indicated on the pump casing; for the pumps that it is not possible to check the shaft, it is necessary to install a manometer in the discharge piping and check if the pressure is according the specification; if not, revert the motor phases and repeat the process from the item 6.2.

Once controlled the rotation direction, switch on the motor and let it reach its full speed. Then open slowly the discharge valve.

The pump cannot operate with discharge valve closed after the motor reach full speed, for more than few minutes

Caution: Never dry running the pump.

6.1.4 Operation

At the start-up the pump mechanical seal may leak a little. Such leakage should cease after accommodation of sealing faces.

The pump running should be soft. In case of operation difficulties refer to item 8 of this manual.


6.1.5 Shutdown procedure

To shutdown the pump the below procedure should be followed:


A–Close the valve on the discharge side.

B–Switch off the electric motor.

6.2 Operating limits

	! DANGER
<p>Non-compliance with operating limits for pressure, temperature, fluid handled and speed</p> <ul style="list-style-type: none"> ▸ 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. 	

6.2.1 Ambient temperature


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


Observe the following parameters and values during operation:

Table 5: Permissible ambient temperatures:

Permissible ambient temperature	Value
maximum	50° C
minimum	0° C

6.2.2 Frequency of starts





DANGER

Excessive surface temperature of the motor
Damage to the motor!

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 start-ups are evenly spaced over the period indicated, the following limits can be used for orientation for start-up with the discharge-side gate valve slightly open:

Table 6: Frequency of starts

Motor rating [kW]	Maximum number of start-ups [start-ups/hour]
Up to 12	15
Up to 100	10



CAUTION

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

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

6.2.3 Fluid handled

6.2.3.1 Flow rate

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

- Short-time operation: $Q_{min}^{1)} = 0,15 \times Q_{opt}^{2)}$
- Continuous operation: $Q_{min}^{1)} = 0,3 \times Q_{opt}^{2)}$
- 2-pole operation: $Q_{max}^{3)} = 1,1 \times Q_{opt}^{2)}$
- 4-pole operation: $Q_{max}^{3)} = 1,25 \times Q_{opt}^{2)}$
- 6-pole operation: $Q_{max}^{3)} = 1,25 \times Q_{opt}^{2)}$

The data refer to water and water-like fluids. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperature on the pump surface. However, if the physical properties of the fluids handled are different from water, the calculation formula below must be used to check if an additional heat build-up may lead to a dangerous temperature increase at the pump surface. If necessary, the minimum flow must be increased.

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

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


Table 7: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Gravitational constant	m/s ²
H	Pump head	M
T _f	Temperature of the fluid handled	° C
T _o	Temperature at the casing surface	° C
η	Pump efficiency at duty point	-
Δθ	Temperature difference	K

- 1) Minimum permissible flow rate
- 2) Flow rate at best efficiency point
- 3) Maximum permissible flow rate

6.2.3.2 Density of the fluid handled

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



CAUTION

Impermissibly high density of the fluid handled
Motor overload!

- ▶ Observe the information on fluid density indicated in the data sheet.
- ▶ Make sure the motor has sufficient power reserves.

6.2.3.3 Abrasive fluids

Do not exceed the maximum permissible solids content specified in the data sheet.

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

6.3 Measure to be taken for shutdown

The pump set remains installed

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

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

The pump set is removed and stored

- ✓ The pump has been properly drained (⇒ Section 7.3 Page 27) and the safety instructions for dismantling the pump have been observed. (⇒ Section 7.4 Page 27)
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 and discharge nozzles.
It is advisable to then close the pump nozzles (e.g. with plastic caps or similar).
 3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil or grease) to protect them against corrosion.
Observe the additional instructions (⇒ Section 3 Page 10).



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


Observe any additional instructions and information provided. (⇒ Section 3 Page 10)

6.4 Returning to service

For returning the pump to service, observe the sections on start-up (⇒ Section 6.2 Page 21) and the operating limits (⇒ Section 6.2 Page 21).

In addition, carry out all servicing/maintenance operations before returning the pump set to service. (⇒ Section 7 Page 25)

	 WARNING
	<p>Failure to re-install or re-activate protective devices Risk of personal injury from moving parts or escaping fluid!</p> <p>► As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.</p>

	NOTE
	<p>If the pump has been out of service for more than one year, replace all elastomer seals.</p>

6.5 Electric motor installation and use instructions

When installing the electric motor, follow these important recommendations carefully:

- Rated voltage and frequency
- Environmental temperature not higher than 40 °C. ⁴⁾
- Location at shade
- Altitude not over 1.000 m. ⁴⁾
- Correct power supply wire gauge.
- Thermal protection switch application.


In order the motor operate satisfactorily and with total efficiency, it is imperative that these and the following conditions are carefully met:


- a) The motor should perform satisfactorily with nominal load, provided that percent voltage variations are not over $\pm 10\%$ of the rated voltage. In the same way, the allowable frequency variation is 5% of nominal frequency. Sum of frequency and voltage variations shall not be over 10%.
- b) The temperature measurement shall be performed preferably by the method of winding electric resistance variation.
- c) Besides the temperature and environment recommendations it is very important to note that normal motors should not be installed at an altitude higher than 1.000 m above sea level, and location in the shadow shall be preferably complied with ⁴⁾.
- d) It is very important to meet the correct electric power supply, by using the gauges recommended for connection cables. When proceeding to connection of the terminals be sure of the network voltage and frequency. Check whether motor corresponds to these characteristics, then complete connection, in accordance with the scheme printed on the nameplate.
- e) It is recommended that a switch with thermal protection is applied, thus preventing possible burns because of lack of phase, overload or excessive voltage and frequency fluctuation. Check if current and rotation with load do not deviate from the values mentioned on nameplate, which can be verified by means of electric measurement through a volt-ammeter, to prevent overload and other abnormalities which could impair the motor life.


⁴⁾ In case of altitude higher than 1.000 m and or temperature over 40 °C refer to KSB.

7 Maintenance

7.1 Safety regulations

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

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


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

Observe the general safety instructions and information.

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


For dismantling and reassembly refer to the general assembly drawing.


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



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


7.2 Maintenance / inspection


7.2.1 Supervision of operation

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

	<p>DANGER</p> <p>Incorrectly serviced shaft seal Damage to the pump set! Risk of burns! Fire hazard!</p> <ul style="list-style-type: none"> ▶ Regularly service the shaft seal.
---	---


	 DANGER
	<p>Incorrectly serviced barrier fluid system Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Service the barrier fluid system regularly. ▶ Monitor the barrier fluid pressure.


	CAUTION
	<p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Never operate the pump set if not primed. ▶ Never close the shut-off element in the suction line and/or supply line during pump operation.

	CAUTION
	<p>Impermissibly high temperature of fluid handled Damage to the pump!</p> <ul style="list-style-type: none"> ▶ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid). ▶ Observe the temperature limits in the data sheet and in the section on operating limits. (Section 6.2.1 Page 21)

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

- The pump must run quietly and free from vibrations at all times.
- Check the shaft seal.
- Check the static seals 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 stand-by pump.
To make sure that stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature of electric motor.

	CAUTION
	<p>Operation outside the permissible bearing temperature Damage to the pump!</p> <ul style="list-style-type: none"> ▶ The work temperature should never exceed the temperature difference of 60° C, with a maximum ambient temperature of 40° C.

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

7.2.2 Inspection work

7.2.2.1 Checking the clearances

The back pull-out unit must be removed to check the clearances.


If the clearance is larger than permitted (see the following table), fit a new casing wear ring 502.01 and/or 502.2.

The clearances specified refer to the diameter.


Table 8: Clearances between impeller and casing/between impeller and casing wear ring

Casing material	Clearances	
	new	Maximum permissible enlargement
G	0,3 mm	0,9 mm

7.2.2.2 Cleaning filters

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

7.3 Drainage/cleaning

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

If the fluids handled by the pump (set) leave residues which might lead to corrosion damage when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the pump set must be flushed through, neutralized, and anhydrous inert gas must be blown through the pump for drying purposes.

For flanged volute casings use connection to drain the fluid handled (not applicable for screwed volute casings) .

7.4 Disassembly

Before starting pump disassembly observe Fig. 6.

1. Remove the 4 screws which are fastening the electric motor to foundation.
2. Remove the screws (901.06) which are fastening the casing (102) on discharge cover (163).
3. Separate the set from the casing.
4. Hold the impeller (230) to keep it from turning and remove impeller screw (906) and the flat gasket (400.19) so you can remove the impeller.
5. Remove the shaft protecting sleeve (524) together with mechanical seal parts (433) mounted on shaft protecting sleeve.
6. Remove the discharge cover (163) removing screws (901.18) which are fastening it to electric motor (801).
7. Remove the mechanical seal part (433) which is fixed on discharge cover (163).

7.5 Assembly

The assembly of pump is the opposite of disassembly already described, but some precautions are necessary:

Aggregates up to 5,5 hp can be fixed by the piping or by motor feet. For sizes bigger than 6 hp, fixation is provided only by motor feet.


1. Anoint with some fine oil (SAE 10 or SAE 20) or pure vasline the mechanical seal contact parts.
2. Clean all pieces.
3. Use a new set of gaskets at each assembly.
4. When placing the flat gasket (400.2) on casing (102) it is advisable for a better fitting that some grease or oil is anointed on contact region of casing with gasket .

Once finished the assembly turn the shaft and check if it rotates freely. Otherwise, disassemble the pump and reassemble it. Should the problem remains refer to nearest authorized dealer.

7.6 Electric motor maintenance and lubrication

We recommend the periodical checking of switch contacts preventing worst consequences caused by oxidation, or bad contact of elements.

The electric motor bearings are supplied with sufficient grease for a long operation period. According to the size and design, the motors may be provided with lubrication holes or with shielded bearings. For lubrication use tables 8 and 9.

	CAUTION
	<p>Do not use much grease ▶ For bearings, the excess of grease is more damaging than failing.</p>

7.6.1 Grease type

Manufacturer	Type
ESSO	Beacon 2
SHELL	Alvania R2
PETROBRÁS	Lubrax GM Industrial A2
ATLANTIC	Litholine 2
IPIRANGA	Isaflex EP2
TEXACO	Multifak 2

Table 9

7.6.2 Lubrication interval

Power (CV)	Interval (h)
2,0 up to 3,0	8.000
4,0 up to 7,5	6.000
10 up to 25	4.500
above 25	3.000

Table 10

7.6.3 Tightening torques

7.6.3.1 Tightening torques for the pump

Use a torque wrench to tighten the bolted connections between the volute casing, casing cover and electric motor.

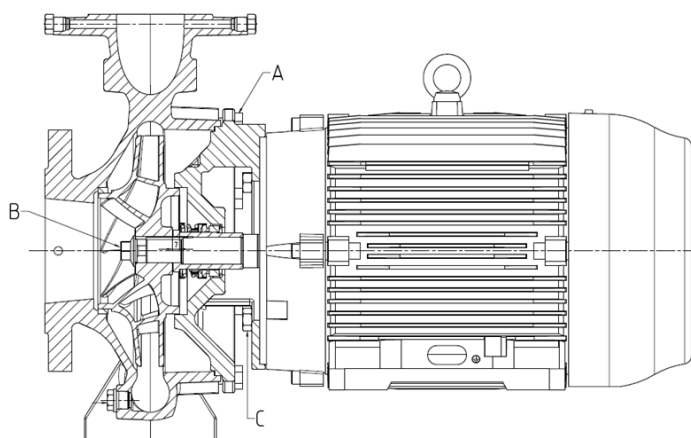


Fig. 5 Tightening torque

Position	Thread size	Nominal value (Nm)
A	M12	50
	M16	125
B	3/8UNC	33
	1/2UNC	105
C	3/8UNC	33
	1/2UNC	105
	5/8UNC	163

Table 11: Tightening torques

8 Operation abnormalities and troubleshooting

8.1 Abnormalities

Abnormalities	Probable causes
Pump does not pump or pumped flow is insufficient	01- 02 - 03- 04 - 05- 06 - 07- 08 - 09- 10 - 11- 12 - 15- 16 - 17
Pump does not work after start-up	01 - 02 - 03 - 04 - 05 - 06 - 07 - 08
Insufficient discharge pressure	01- 02 - 03- 04 - 05- 07 - 09- 10 - 11- 12 - 15- 16 - 17
Electric motor overloaded	11- 13 - 14- 15 - 16- 19 - 20
Leakage on mechanical seal	12 - 18 - 19 - 20 - 22 - 24 - 25 - 26
Reduced mechanical seal life	01 - 18 - 19 - 20 - 21 - 22 - 23 - 24 - 25 - 26
Vibration/ noises	01 - 02 - 04 - 11 - 12 - 17 - 18 - 19 - 20 - 21 - 27 - 28 - 29 - 31 - 32
Overheating	01 - 02 - 03 - 10 - 13 - 18 - 19 - 20 - 27 - 30 - 32

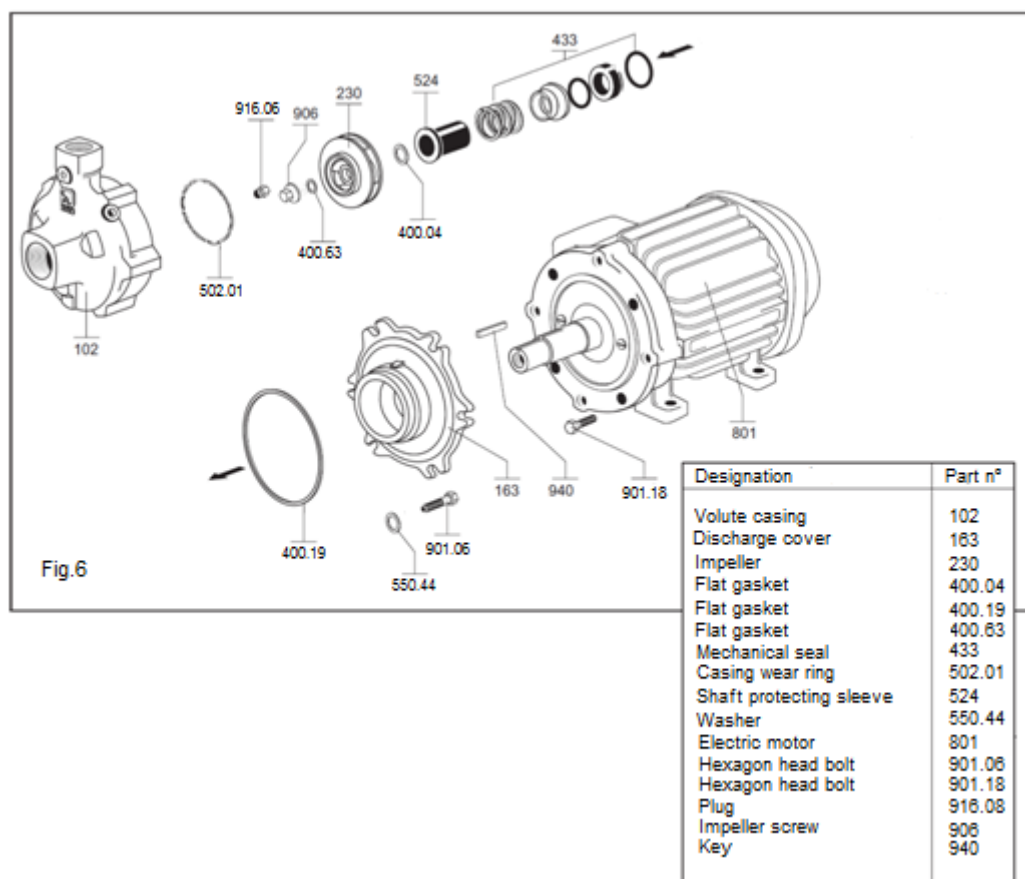
Table 12

8.2 Possible cause

1. The pump has not been primed or priming was poorly done.
2. The installation requires a suction condition over one of the pump (available NPSH is lower than required NPSH).
3. Excessive suction slope.
4. Air pockets in suction piping.
5. Air is leaking into suction piping.
6. Suction valve closed or partially opened.
7. Foot valve too small or clogged.
8. Suction piping is not sufficiently immersed.
9. Rotation in reverse direction.
10. Total head higher than that one informed by occasion of selection.
11. Foreign bodies on impeller.
12. Excessive wear of internal parts.
13. Electric motor operating in two phases.
14. Total head lower than that one informed by occasion of selection.
15. Liquid viscosity is different of the one informed by occasion of selection.
16. Liquid density is different of the one informed by occasion of selection.
17. Damaged or worn down impeller.
18. Warped shaft.
19. Friction of rotary parts with stationary parts.
20. Damaged or worn down bearings.
21. Misalignment due to forces or expansions of piping.
22. Mechanical seal assembled incorrectly.
23. Abrasive elements in pumped liquid.
24. Shaft protecting sleeve worn down.
25. Internal misalignment of parts restraint stationary seat to accommodate with mechanical seal rotary seat.
26. Mechanical seal has operated dry.
27. Operation with reduced flows.
28. Set fastening in not sufficiently steady.
29. Lack of lubrication on bearings.
30. Excessive grease on bearings.
31. Impurities on bearings or on lubricant.
32. Oxidation of bearings due to water penetration.

9 Related documents

9.1 Exploded view



10 Certificate of Decontamination

Type
 Order number /
 Order item number ¹⁾
 Delivery date
 Field of application:
 Fluid handled ¹⁾:

Please tick where applicable "X" ¹⁾:



☐ radioactive



☐ explosive



☐ corrosive



☐ toxic



☐ harmful



☐ bio-hazardous



☐ highly flammable



☐ safe

Reason for return ¹⁾

 Comments:

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

On seal-less pumps, the rotor has been removed from the pump for cleaning.

- ☐ 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

¹⁾ Required fields



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