

AKH. SIDE CHANNEL PUMP

Multicellular, self-priming, material cast iron
Shaft sealing by stuffing box packing

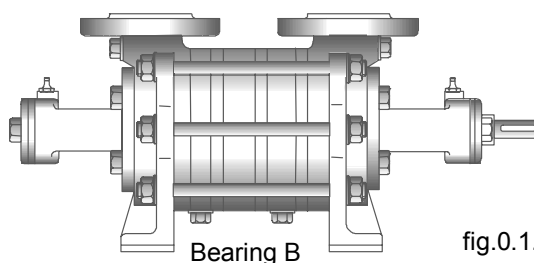
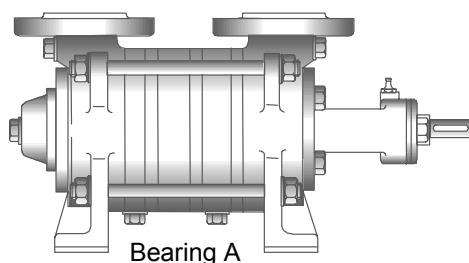


fig.0.1.1

Operating instructions

Security

Safety instructions, guarantee

Description and applications

Operating conditions, pump description, performance data

Planning the Installation

Piping system, electric connections, accessories

Unpacking, handling, storage

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Caution: This pump or this electric motor/pump assembly may be installed and put into operation by qualified and authorized personnel only. These personnel have to observe strictly the operating instructions in this manual and the laws and regulations in force related to the safety.

If you do not pay attention to these operating instructions,

- **danger** may be caused to the various persons working on the equipment and its users,
- **the pump or the electric motor / pump assembly** may be **damaged**,
- **the manufacturer is not liable** for accidents resulting from such non-observance!

Please be aware of your responsibility for neighboring personnel when working on the pump or the electric motor / pump assembly

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1.0 Safety

This operating manual gives basic instructions which are to be observed during installation, operation and maintenance of the pump. It is therefore imperative that this manual is read by the fitter, personnel/operator in charge of set-up and commissioning, as well as by the user. This manual is to be kept always available at the installation site of the pump or electric motor-pump assembly.

1.1 Meaning of safety symbols used in this manual

Safety instructions to be observed to avoid any danger to persons are shown by the symbol:



Electrical power risks are shown by the symbol:



Instructions where non-observance could cause damage to the machine, are shown by the word:

Caution

Signs affixed directly on the machine, such as the arrow indicating the direction of rotation or the arrows indicating fluid suction and discharge connections must be observed and kept legible.

1.2 Qualification and training of personnel

Authorized personnel for the use, maintenance, inspection and assembly must have the

qualifications needed for this work. Scope of responsibility, skills and monitoring of the personnel must be strictly controlled by the purchaser of the equipment. If the staff do not have the necessary knowledge, they must be trained. The manufacturer or the supplier can carry out this training. In addition, the purchaser is to make sure that the competent personnel read and fully understood the contents of this manual.

1.3 Non-compliance with safety instructions

Non-compliance with safety instructions may cause danger to personnel, as well as to the environment and the machine.

The manufacturer in such cases will not be held responsible.

Non-observance of these safety instructions may cause in particular:

- Failure of important functions of the machine or the installation,
- Failure of specified procedures for servicing and maintenance,
- Exposure of people to electrical, mechanical and chemical hazards,
- Risks of pollution of the environment owing to hazardous substances being released.

1.4 Accident prevention

The customer undertakes to respect the safety instructions shown in this manual, the national accident prevention regulations, as well as the internal regulations relating to the working conditions, the equipment operation and safety.

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1.5 Safety instructions for users

This pump was designed in compliance with the standard relating to the safety of the pumps.

- Parts subject to temperature variations and those where contact with them can be dangerous must be protected by suitable devices.
- Safety devices against accidental contact with moving parts (e.g. coupling guards) must not be removed from the machine while in operation.
The pump must never be started without these coupling guards.



The coupling guard is a safety component designed for its function; in no case, it must never be used as a step or other support point.

- In no case, is this pump to operate without fluid. The destruction of the shaft outlet sealing which could result from such use would cause fluid leakage endangering the safety of persons and the environment.
- Ensure that protection is provided against any hazard from electrical power (refer to regulations in force).

1.6 Safety instructions for maintenance, disassembly and assembly

It is the customer's responsibility to ensure that all maintenance, inspection and installation work is performed by qualified and authorized personnel who have studied this manual.

Any work on the machine shall only be performed when it is at a standstill. It is imperative that the

procedure for shutting down the machine described in this manual is to be followed.

Pumps and electric motor-pump assemblies, which convey hazardous fluids must be decontaminated.

Immediately after completion of work all safety and protective facilities must be re-installed and made operative again.

After a service or other operation, the instructions to re-start the machine given in paragraph 6 are to be observed.

1.7 Alteration of the machine and of spare parts

No alteration or modification may be undertaken without prior agreement of the manufacturer. Genuine spare parts and accessories specified by the manufacturer contribute to safety. The manufacturer of the machine cannot be held responsible in the event of accident related to the use of parts other than genuine parts.

During the guarantee period, any repairs or modifications can be made only by our fitters or with our agreement.

1.8 Non-observance of safety instructions

Safety related to the correct operation of the machine can be guaranteed only if the instructions in this manual are respected, as well as the conditions and operational limits mentioned in the data sheet attached.

1.9 Warranty / guarantee

The Sterling SIHI guarantee is satisfied only under the following conditions:

- The pump is installed and operated in perfect compliance with the instructions and under conditions approved by Sterling SIHI.
- All modifications will be submitted for Sterling SIHI's approval before implementation.

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2.0 Equipment application

The pump is to be used only for the operating conditions stated by the purchaser and confirmed by the supplier. The guarantee conditions are defined as per our general conditions of sale.

The conditions of use are defined in the attached data sheet.

The construction specifications are defined in chapter 9.

2.1 Safety instructions



- You may use the pump only for the application stated in the data sheet as otherwise accidents to people and the environment may occur.
- Do not exceed the density and viscosity stated in the data sheet. Otherwise there is danger of damage to the pump.

2.2 Accessories

The accessories delivered with the pump or the electrical pump unit are indicated in the data sheet. The corresponding operating and installation instructions can also be found in the appendix.

The installation of additional accessories may be carried out only after receiving approval from the manufacturer of the machine.

2.3 Construction and operation

AKH. pumps are side channel, multicellular, self-priming pumps designed with up to 4 stages, having a horizontal configuration. They allow for the simultaneous pumping of gas and liquid.

Heating and cooling chambers for the pump housing can be inserted in place of hydraulic stages.

Its flow vs. height curve allows for an accurate pressure regulation with low flow variations.

The hydraulic balancing of the impellor avoids the end thrusts.

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3.0 Planning of the Installation

3.1.1 Installation diagram

3.1 Piping system

ATTENTION

- Respect the direction of flow of the fluid (arrows on the pump flanges).
- The diameters of the pipes must not be smaller than the diameters of the corresponding pump orifices (see data sheet).
- Check that cleaning of all pipes has been carried out prior to installation of the pump.
- Adjust the piping positioning to ensure it does not cause any stress on the pump orifices.
- Avoid abrupt changes of piping diameter and short radius pipe elbows.
- In case of change of diameter, use asymmetrical (eccentric) convergent transition pieces in order to avoid the formation of air pockets in the pipes.
- Install a flow stabilising length before the suction branch of the pump; it should have the same diameter as the pump and a length 10 to 20 times the diameter of the pump.
- The flow velocity in the suction line must not exceed 2 m/s (6.6 Ft/s).
- The pipe holders and anchoring must be designed in such a way that thermal expansion in the pipe system does not have any effect on the pump flanges.
- Provide for connections for pressure gauges and for filling of pump with liquid.
- In critical applications, (liquids with impurities) the system must be protected by a fine-meshed strainer.

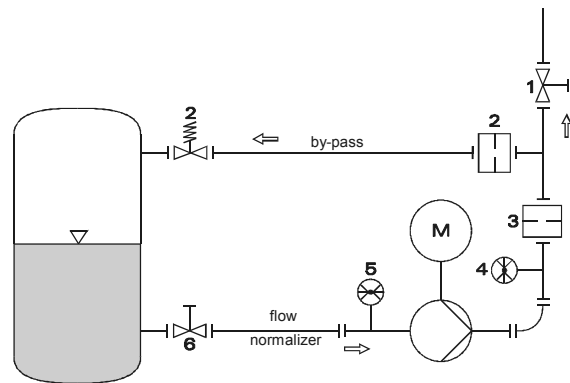


Fig. 3.1

- 1 – Gate-valve at the discharge
- 2 – Qmin-diaphragm or relief valve
- 3 – Qmax-diaphragm
- 4 – Pressure gauge
- 5 - Pressure gauge
- 6 – Gate-valve at the suction end

3.1.2 Suction line

In case of effective suction lift operation:

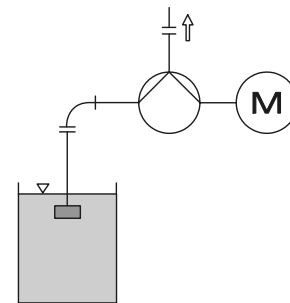


Fig.3.2

- The suction line is to be vertical and then must slightly ascend to the pump.
- If a foot valve is used, it must be installed at least 0.50 m (1.6 Ft) below the lowest pumping level.

In case of pumping under load:

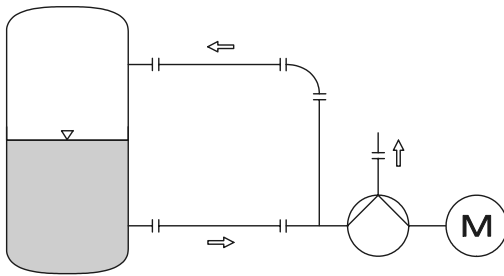


Fig.3.3

- The piping must slightly descend to the pump.
- The liquid level must be kept at least 0.50 m (1.6 Ft) above the axis of the suction line.

In both cases of pumping:

- The gate valve in the suction line must be kept completely open when starting, as well as during the operation of the pump.
- The suction line must be protected and insulated against heat.
- A filter must be installed in the piping in case of pumping of contaminated liquids. Its section must have at least three times the diameter of the pipe section with a mesh size equal to 0.1 mm (140 mesh).

3.1.3 Discharge line

Adjustment to the operating point of the pump is to be carried out by the means of a gate valve installed at the pump discharge line.

If there is a risk of exceeding the working pressure, a protective device must be installed, such as a bypass line with diaphragm or a pressure relief valve.

working pressure = pressure at pump discharge with zero flow + suction pressure

Installing a slow-closing non-return check valve will prevent hammering in high pressure installations with long piping.

Use constant diameter piping.

3.1.4 Installing a diaphragm

- Q-max-diaphragm

In order to avoid exceeding the permitted flow, a diaphragm should be fitted into the pump discharge line (see installation diagram).

This will prevent any danger of operating with cavitation.

- Q-min-diaphragm, relief valve

The installation of a relief valve or a diaphragm in the by-pass piping will ensure that the required minimum flow for the pump is present (see installation diagram). This will provide for sufficient cooling of the pump and avoid mechanical overloads.

3.1.5 Pressure checking

Pressure checks will be carried out by means of pressure gauges installed on the suction line and on the discharge line of the pump (see installation diagram)

3.2 Electrical connections

The connections and the protection system for the electric motor will be made in accordance with the requirements and regulations currently in force.

3.3 Accessories

Various accessories can be installed to contribute to the safety of the equipment.

These accessories make it possible to check, for example:

- The power absorbed by the motor. A load detector measures the power absorbed by the motor. If this power is too high, the motor is switched-off.
- The fluid temperature (PT100). The PT100 probe is a resistance thermometer intended for checking the temperature of bearings or pumped liquid. A threaded pipe connection is essential for it to be installed. The switch-off temperature has to be adjusted 10 C higher than the operating temperature.

- The level of the pumped liquid.
To protect the pump from a possible lack of liquid in the course of operation, it is possible to use a level detector.
- The gradual starting of the motor.

4.0 Unpacking, handling, storage

4.1 Safety measures



- Never stay below the suspended load.
- Keep a sufficient safety distance during transport of the load.
- Use only appropriate hoisting slings which are in perfect condition.
- Adjust the length of the hoisting slings in such a way that the pump or the electrical pump unit is suspended horizontally and stable.
- Do not use the eyebolts on the pump components or on the motor for lifting the assembled pump or the complete unit. They are intended only for handling spare parts during assembling or dismantling.
- Do not separate the documents attached to the pump.
- Do not remove the protection caps from the pump flanges.
- Handle the pump or the pump-motor-base plate assembly with care and avoid impacts.

4.2 Unpacking

Just after taking delivery of the equipment and before unpacking, a visual control of the packing is recommended. If transport damage is visible, its extent is to be noted on the receipt or on the delivery note. Possible claims are to be lodged immediately with the carrier.

4.3 Preservation and storage

After platform testing, every pump is drained and an internal corrosion-resistant protection is applied (except for pumps in stainless material or

specific conditions). This protection is designed for storage **duration of 3 months**.

4.3.1 Short-term storage, less than three months

If the pump or the electric pump unit is not to be installed immediately after delivery, the equipment will have to be stored in a dry location and free from vibrations, for a duration not exceeding three months. Moreover, it is advised to turn the pump shaft over manually and periodically to avoid any risks of seizing of mobile parts.

4.3.2 Long-term storage

If the storage duration exceeds three months, in addition to the precautionary measures specified in 4.3.1, it is necessary to wash the pump with fresh water and to re-apply the preserving fluid every three months. Make sure that the product used is compatible with the pump materials and complies with the environmental protection and personnel safety regulations currently in force.

4.3.3 Lengthy installation stoppage

In the event of installation stopping for more than 3 weeks (this period could be much more shorter in unfavorable climatic conditions), drain the pump, wash it with fresh water and spray the corrosion-resistant agent inside. Make sure that the product used is compatible with the pump materials and complies with the environmental protection and personnel safety regulations currently in force

4.4 Handling

The electric motor-pump assembly weights, as well as those of the various components, are specified on the drawings in the appendix attached.

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- During slinging and handling of the pump or the unit, make sure that the hoisting ropes or slings cannot escape from the hook.

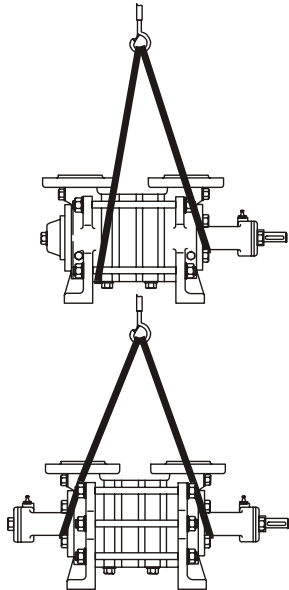


fig.4.1 Handling the pump

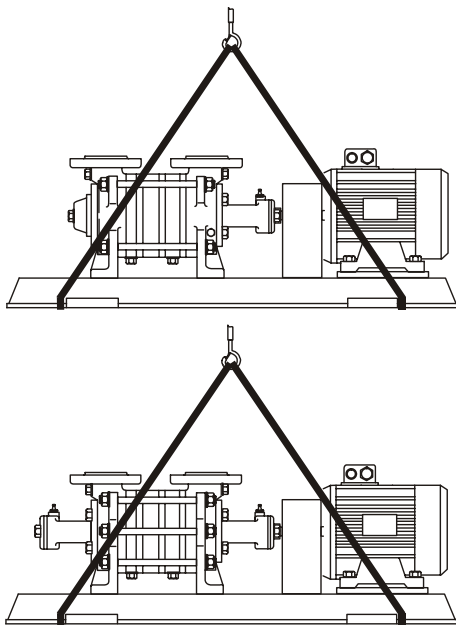


fig.4.2 Handling the pump unit



- When using a **single hoisting rope or sling**, it is necessary **to cross them** in the hook to prevent them slipping and the load tipping during handling.

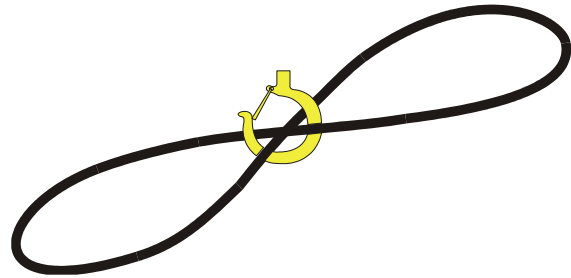


Fig.4.3

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5.0 Installing the pump

5.1 Preconditions

The pump or the electric motor-pump assembly must have been unpacked and transported in conformity with the recommendations shown in chapter 4.

5.2 Personnel qualifications

The work described in this chapter must be carried out by qualified and authorized personnel only.

5.3 Safety measures



- Remove the caps from the pump flanges only when connecting the pipes.
- Connect the pipes carefully as to avoid any leakage when subjected to pressure.
- Make sure that the gate-valves at the suction end and at the discharge end are closed.
- Observe internal regulations concerning conditions of operation.
- Wash off the corrosion-resistant substance as shown in chapter 4 to prevent any contamination of the plant.
- Provide an electric motor control switch and protection system.



- Check that all electrical connections are free from voltage and ensure that the installation cannot be switched on inadvertently.

5.4 Tools

The assembly and installation of the pump or of the electrical pump unit does **not require any special tools**, only regular tools of a mechanical and electrical workshop are needed.

5.4.1 Environmental conditions

The permissible ambient temperature is between **– 4°F and + 140 °F**. The humidity of the air should be as low as possible in order to avoid corrosion.

5.4.2 Base and foundation

The pump or the electrical pump unit must be installed always on a horizontal floor or foundation not subject to external vibration. In case of doubt use vibration dampening feet.

For the pumps equipped with shaft sealing by stuffing box, provide a seepage recovery pipe.

5.4.3 Space required

The space required for installing the pump unit is shown in the overall dimensions drawing attached. Make sure there is easy access to the shut-off gates and valves as well as to the measuring instruments.

5.5 Checks before installation

The following points must be checked before installing the pump or the electric motor-pump assembly:

1. Absence of voltage on the electrical connection and ensure that the installation cannot be switched on inadvertently.
2. Compatibility of the electric power cable with the power of the motor concerned.
3. Cleanliness and insulation of the suction line and discharge line and of the other related pipes.
4. It should be possible to rotate the pump easily by hand.

- Observance of instructions, regulations and internal precautions to be observed when carrying out the installation.

5.6 Mounting the electric motor-pump assembly in the installation

- Check that the general **instructions** given in **3.1** concerning piping are respected.
- Make the **unit** perfectly **level** on its **foundation block** by using metal shims; take care that these shims are as close as possible to the anchoring points.
- Carry out an even **diagonal tightening** of the **unit** retaining bolts on its **foundation block**, taking care not to cause deformation of the base.
- Check and adjust if necessary, the **pump/motor alignment** (see 5.7).
- Remove the **protective caps** from the pump flanges, taking care that no foreign body enters the pump.
- Check and adjust if necessary, the **positioning of the pipe flanges** on the pump flanges; no stress must be applied to the pump flanges during positioning and tightening. When using in conditions of **varying temperature**, take care particularly to avoid the transfer of **stresses** to the pump flanges due to piping expansion.
- Check the presence and the correct positioning of the **seals** between the flanges.
- Tighten the **piping flanges evenly and diagonally** on the pump.
- Check the **pump/motor alignment** (see 5.7) and readjust it, if necessary, by loosening the flanges and starting again at point 4.

5.7 Coupling

The couplings are to be assembled on the shafts taking care to avoid any impact. They can be heated to facilitate assembly. The shaft ends must be perfectly aligned, and the distance between the two Sterling SIHI half-couplings must be 2 to 3 mm.

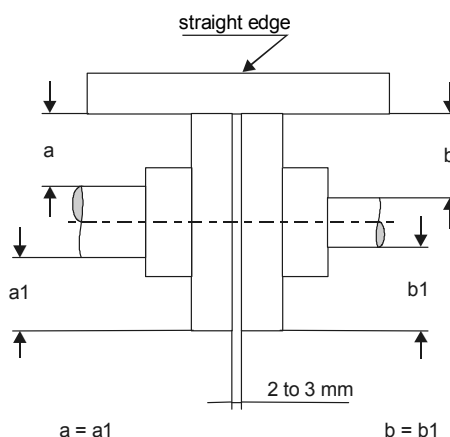


Fig.5.1

If couplings other than Sterling SIHI couplings are used, refer to the manufacturer's instructions.



- It is essential that the coupling is equipped with a guard in accordance with current regulations on the prevention of accidents and the protection of persons.

5.8 Monitoring and regulation

The monitoring / regulation accessories and instruments must be set up in accordance with their individual instructions (see appendix).

5.9 Final checks

The following final checks must be carried out:

- Check all tightening that has been carried out during the mounting of the pump in the installation, particularly the tightening of the connecting flanges.
- Check that the pump can be rotated easily by hand (turn the motor fan for this).
- Check the alignment.
- Verify the presence and check the fastening of the coupling guard.

5.10 Hydrostatic pressure test

When subjecting the piping system to a hydrostatic pressure test, exclude the pump from this test. Otherwise make that no foreign bodies can enter the pump.



The hydrostatic test pressure for the pump must not exceed **1.3 times the nominal pump pressure**. (See the data sheet in the appendix).

6.0 Commissioning and decommissioning

6.1 Preconditions

The pump or the electrical pump unit must have been installed according to the directions and instructions in chapter 5.

6.2 Personnel qualification

The work described in this chapter must be carried out by qualified and authorized personnel only.

6.3 Safety measures



- All electrical connections are to be carried out according to the rules of the trade, in accordance with current relevant requirements, laws and regulations.
- Only authorized and qualified personnel may carry out this work.



- Fill the pump correctly in order to avoid any damage due to dry operation (the shaft sealing or sleeve bearings could be destroyed and moving parts could seize).
- Check the direction of rotation only after filling the pump and at the precise moment described in 6.7.
- Fill the pump very slowly if hot pumping liquid is used in order to avoid distortions or thermal shock.
- When pumping explosive, harmful, hot, crystalline or corrosive products, ensure that persons and the environment are not endangered.



- As soon as the rated speed is attained, the flow adjustment will be done by means of the gate-valve placed at the discharge end of the pump. The gate-valve at the suction end must always be open during operation to prevent cavitation, both during effective suction and under load.

6.4 Filling the pump

CAUTION

To preserve the installation from pollution by the anti-corrosion product and to avoid any compatibility problem with the pumped substance, the pump must be rinsed out. The anti-corrosion product is water-soluble.

Before the first start, the pump and the suction line, must be completely filled with the pumping liquid to prevent the pump running dry and to avoid the formation of air pockets and thermal shock.

6.5 Electrical connection

The motor has to be connected according to the circuit diagram in the terminal box. (See safety measures in 6.3).

6.6 Accessories

The installation and connections of the accessories must be carried out in accordance with their attached commissioning instruction manuals. (See appendix).

6.7 Checking before switching-on

Before switching-on the pump unit, ensure that nobody can be endangered by starting the pump unit.

It is mandatory to check the following points:

1. The pipelines are all connected and the unions are leak proof.
2. The pump and pipes are correctly filled and air has been bled.
3. The **cooling system** supply (if applicable) is open and its system has been bled.
4. If the installation is protected by a **relief valve** make sure that its adjustment is correct, particularly in accordance with the pressure rating of the pump housing.
5. The regulating gate-valve at the discharge end is **fully** opened.
6. The gate-valve at the suction end is completely open.
7. The coupling alignment has been checked and is correct (see chapter 5).
8. The coupling guard is in place.
9. The motor is ready for operation.
10. At this point **check the direction of rotation** of the motor (short pressure on the switch), the **rotation** of the AKH. pump is **clockwise** when facing at the end of the pump drive shaft.

6.8 Commissioning

For commissioning proceed as follows:

1. Open the gate-valve at the suction end fully.
2. Open the regulating gate-valve at the discharge end fully.
3. Switch on the motor.
4. Check the pressure on the pressure gauge at the discharge end.
If the pumping pressure does not constantly rise with increasing speed, stop the motor again and bleed the pump carefully again.
5. After reaching operating speed, adjust the operating point of the pump by means of the regulating gate-valve in the discharge line.

CAUTION

Operating with the gate-valve closed at the discharge end, even for short durations, is possible only if the installation is equipped with a by-pass providing for circulation of the minimum flow necessary for the correct operation of the pump. If not, operating with the gate-valve closed at the discharge end quickly causes destruction of the sealing and seizing of the moving parts.

6.9 Frequency of switching on/off

The AKH. pump may be switched on up to 15 times per hour.

6.10 Checks during operation

During operation, the following points must be checked:

- Constant rotation speed and pressure at the discharge end.
- The pump runs regularly, smoothly, and without vibration.
- Check the liquid level in the tank at the suction end.
- Check the temperature of the pump bearing (maximum temperature 176 °F or 122 °F above the ambient temperature).
- Check the temperature of the shaft sealing coolant.
- If shaft sealing is provided by a stuffing box, 10 to 20 drops per minute leakage is necessary and normal to avoid overheating of the sealing system.
- If shaft sealing is provided by a rotating mechanical seal, a slight leak is possible at the first startup; if the conditions allow it, let it run for 30 minutes so that the components take up their positions. If the leak persists, dismantle.

CAUTION

In the event of significant leakage, stop the pump as soon as possible, and check the shaft sealing.

6.11 Decommissioning

When decommissioning the unit, proceed as follows:

1. Shut-off the motor power supply.
2. Close the regulating gate-valve at the discharge end.
3. Close the gate-valve at the suction end.
4. Close the shaft sealing coolant inlet.

Drain the pump if there is a risk of freezing.



If draining the pump produces explosive, harmful, or crystalline products, take the necessary measures to protect persons and the environment.

If the pump has to be dispatched elsewhere, it must be free of any dangerous product.

In the event of prolonged stoppage of the pump, it must be rinsed and then protected internally with a suitable anti-corrosion product.

7.0 Maintenance, disassembly, assembly

7.1 Preconditions

The pump or the electric motor / pump assembly must be put out of operation in accordance with the instructions in chapter 6.

7.2 Personnel qualification

The work described in this chapter must be carried out by qualified and authorized personnel only.

Any work on electrical connections must be carried out by authorized skilled staff only.

7.3 Safety measures



- If the pump has conveyed explosive, hot, toxic, crystalline, etc. products, the necessary measures must be taken so that persons and the environment are not endangered.
- In the event of the pump being dispatched elsewhere, it must be free from any trace of pumped product.
- Since the pump could still contain pumped product, it must be rinsed out carefully prior to disassembly.

7.4 Maintenance and inspection

After commissioning this kind of pump requires only little maintenance.

For checks during operation refer to 6.10.

Bearings

The ball bearings are factory lubricated and require a periodic lubrication each 3,000 hours at 1,450 rpm (quantity: 6 g per bearing). After 8,000 service hours, or at the latest after 2 years of operation, disassemble and clean the bearing, and grease it again. Replace it, if necessary.

Bearing A: after 8,000 service hours, or at the latest 2 years after commissioning, check the inner sleeve bearing for wear. Replace it, if necessary.

Shaft sealing

After prolonged use and frequent re-tightening, the stuffing-box packing rings can lose their original elasticity, and must be renewed.

After 2,500 hours of operation, we advise you to check the packing rings; if settling of the rings is equal to 20% or has a value of a half ring, they must be changed.

Rings replacement: see 7.7.5

7.5 Disassembly

7.5.1 Preparation for disassembly

Proceed as follows:

1. Make sure that the power supply is switched-off and cannot be **switched-on inadvertently during the operation**.
2. Disconnect the motor in the terminal box.
3. Shut off the isolation gate-valves at the suction and discharge ends, and carefully drain this part of the installation.
4. If necessary, disconnect and dismantle the measuring and checking instruments.
5. Disassemble the pump flanges and disassemble the pump from the base plate.
6. Drain the pump, and then rinse it again, if necessary.

7.5.2 Spare parts

When ordering spare parts, note the information given on the pump identification plate, that is to say:

1. The exact type of pump.
 2. The complete pump identification number.
- Use the attached cross-sectional drawing to note the identification references of the items required. The spare parts must meet the manufacturer's technical requirements, and the guarantee is only valid when genuine original parts are used.

Sterling SIHI will not admit liability in the event of failure or accident related to the use of parts other than genuine parts.

7.5.3 Disassembly of the pump

Version A

1 sleeve bearing + 1 ball bearing

See the sectional drawing in appendix.

The working surface must be clean, free from dirt, filings etc. and be perfectly clear.

1. To facilitate later assembly make a mark on the pump body and number the parts.
2. Disassembly starts at the discharge end (sleeve bearing).
3. Unscrew the nuts 0188 and remove the washers 0189. Disassemble the tie bolts 0160 and extract the discharge flange 0002 and the shell bearing 0241 if necessary.
4. Disassemble, successively, the extension piece 0020 (one stage pump, sizes 11/12/31/3600), the discharge body 0012 (0011), the impellor 0030 with its key 0250 and the suction body 0010. Repeat this procedure as many times as there are stages.
5. Loosen the gland 0320 unscrewing the nuts 0180. Unscrew the screws 0172 and remove the suction flange 0001. Remove the gland; extract the three stuffing box packing rings 0400 and the bottom washer 0403.
6. Disassemble the ball bearing cover 0221 unscrewing the screws 0178. Remove the circlip 0260. Using a hub puller, extract the shaft 0200 from the bearing casing 0210, with the ball bearing 0230, the spacer 0266 and the lip sealing ring 0426 if necessary.

7.5.4 Disassembly of the pump

Version B

2 ball bearings

See the sectional drawing in appendix.

The working surface must be clean, free from dirt, filings etc. and be perfectly clear.

1. To facilitate later assembly make a mark on the pump body and number the parts.
2. Disassembly starts at the suction end (drive).
3. Unscrew the nuts 0188, remove the washers 0189 and disassemble the tie bolts 0160.
4. Disassemble the ball bearing cover 0223 unscrewing the screws 0178. Unscrew the screws 0172 and using a hub puller, extract the bearing casing 0210. If necessary, remove the ball bearing 0230 and the lip sealing ring 0426.
5. Remove the gland 0320 unscrewing the nuts 0180. Extract the suction flange 0001. Remove the stuffing box packing rings 0400 and the bottom washer 0403.
6. Disassemble the suction body 0010, the key 0250, the impellor 0030, the discharge body 0012 (0011) and the extension piece 0020 (one stage pump, sizes 11/12/31/3600). Repeat this procedure as many times as there are stages.
7. Disassemble the gland 0320 (free end) unscrewing the nuts 0180. Unscrew the screws 0172 and extract the discharge flange 0002. Remove the stuffing box packing rings 0400 and the bottom washer 0403.
8. Remove the ball bearing cover 0222 unscrewing the screws 0178. Remove the circlip 0260. Using a hub puller, extract the shaft 0200 from the bearing casing 0210. If necessary extract the ball bearing 0230, the spacer 0266 and the lip sealing ring 0426.

7.6 Work after the disassembly

7.6.1 Cleaning instructions



The use of some solvents requires special precautions. Refer to the supplier's recommendations and to current regulations.

Clean all parts using an appropriate solvent.

A scraper can be used to remove the residue of adhesive on the mating faces of the bodies; take care not to damage the surface finish during this operation.

7.6.2 Repair instructions

The following parts must be checked carefully:

1. Ball bearing 0230

Check it for wear and change it if necessary.

2. Lip sealing ring 0426

If the shaft is marked at the corresponding location, change the lip sealing ring; pay attention to the correct mounting position to prevent the grease from escaping and to prevent dirt entering.

3. Stuffing box packing rings 0400

Change the rings in accordance with the directions given in 7.7.5.

4. Shaft 0200

Any pronounced mark on the shaft, at the stuffing box rings, at the lip sealing ring or bearing bush positions requires it to be changed

5. Shell bearing 0241 (version A)

The shell bearing replacement needs a complete cleaning of parts before mounting it with special glue.

6. Body 0010, 0011, 0012

Body surfaces in contact with the wheel may be re-machined to a max. of 0.5 mm with a plane parallelism defect of 10 µm in relation to the mating surfaces. The max. admissible roughness height of the re-worked surface will be $R_t = 6 \mu\text{m}$. The mating surface of the body 0010 has to be re-machined also, in such a way that the depth is greater by min. 0.10 mm to max. 0.13 mm (sizes 1200/3100/3600) and by min. 0.15 mm to max. 0.20 mm (sizes 4100/5100/6100) in relation to the thickness of the vane impellor. Since hydraulic performance is linked to the depth of the bodies, do not re-machine more than necessary.

N.B.: For multi-stage pumps and for a complete overhaul, it is preferable to mix new stages and old re-machined stages to avoid out-of-line keying, losses of efficiency or out-of-line pump mounting brackets in relation to the base plate mounting holes.

7. Vane impeller 0030

Re-machining the wheel produces uncontrolled changes in specifications and interchangeability is no longer guaranteed.

7.7 Assembly

7.7.1 Instructions before assembly

- Make sure that all the parts have been checked and are perfectly clean (mating planes, faces of the bodies).
- Coat all sliding surfaces with molybdenum disulfide paste, except for carbon surfaces.
- Sealing of the mating surfaces on the hydraulic part bodies is done by:
 - Adhesive EPPL 33 or equivalent for cast iron pumps.
- It is mandatory to ensure that the bodies are correctly orientated to ensure correct operation of the pump (use the bodies assembly diagram attached). The reference marks traced before disassembly simplify this aspect.
- For pumps which require adhesive, immediately coat the mating faces of the bodies 1140,

0010, 0011, and 0012 so as to allow the adhesive to cure slightly before assembly.

7.7.2 Tightening torque

Nuts and bolts must be tightened using a torque wrench. The following tightening torques must be applied:

Rated Ø	M5	M6	M8	M10	M12	M16	M20
Torque Nm	4.5	8.5	12	25	40	90	175

7.7.3 Assembling the pump

Version A

1 sleeve bearing + 1 ball bearing

The reassembly starts at the drive end.

- Place the lip sealing ring 0426, the spacer 0266 and the ball bearing 0230 into the bearing casing 0210.
- Slip the bottom washer 0403 and the stuffing box packing rings 0400 into the suction flange 0001. Secure the gland 0320 and gently screw in the two nuts 0180.
- Assemble the suction flange 0001 and the bearing casing 0210 with the screws 0172.
- Pass the shaft 0200 through the flange 0001 and the assembled bearing casing. Place the circlip 0260 and secure the ball bearing cover 0221 with the screws 0178.
- Mount the suction body 0010, the key 0250, the impellor 0030 and the discharge body 0011 (0012). Repeat this procedure as many times as there are stages and place the extension piece 0020 (one stage pump, sizes 11/12/31/3600).
- Mount the discharge flange 0002 with its shell bearing 0241.
- Place the tie bolts 0160 with the washers 0189 and the nuts 0188. Grease the tie bolt ends, the washers and nuts for better tightening torque transmission.
- Place the lip sealing ring 0426.
- Place the pump on a surface plate, straighten it and tighten the nuts 0188 diagonally, observing the tightening torque (see 7.7.2.).
- Insert the half-coupling, without hitting it, heat it if necessary.

7.7.4 Assembling the pump

Version B

2 ball bearings

The reassembly starts at the discharge end (free end).

- The reassembly starts at the end opposite to the drive.
- Place the lip sealing ring 0426, the spacer 0266 and the ball bearing 0230 into the bearing casing 0210.
- Slip the bottom washer 0403 and the stuffing box packing rings 0400 into the flanges 0001 and 0002. Secure the gland 0320 and gently screw in the two nuts 0180.
- Assemble the flange 0002 and the bearing casing 0210 with the screws 0172. Pass the shaft 0200 through the bearing casing/flange assembly. Place the circlip 0260 and secure the ball bearing cover 0222 with the screws 0178. Position the pump vertically.
- Mount the extension piece 0020 (one stage pump, sizes 11/12/31/3600), the discharge body 0012 (0011), the key 0250, and then the suction body 0010. Repeat this procedure as many times as there are stages.
- Fit the flange 0001. Check the presence of the screw plugs 0130.
- At the drive end, place the lip sealing ring 0426 into the bearing casing and the ball bearing 0230. Mount this assembly on the flange 0001 and secure it with the screws 0172. Secure the ball bearing cover 0223 with the screws 0178.
- Place the tie bolts 0160 with the washers 0189 and the nuts 0188. Grease the tie bolt ends, the washers and nuts for better tightening torque transmission.

9. Place the pump on a surface plate, straighten it and tighten the nuts 0188 diagonally, observing the tightening torque (see 7.7.2.).
10. Insert the half-coupling, without hitting it, heat it if necessary.

7.7.5 Changing the stuffing box packing rings

Changing the stuffing box rings can be done without disassembling the pump entirely.

1. Loosen the gland and move it out of the way.
2. Extract the worn rings, taking care not to damage the surface finish of the shaft.
3. The rings are preformed and pre-cut; position the rings with their gaps staggered.
4. The rings must be pushed back using the stuffing box gland.
5. Tighten the gland nuts until you feel a slight friction when turning the pump shaft by hand.
6. Loosen the gland again and tighten it slightly.

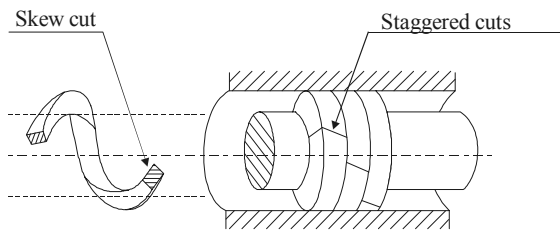


Fig. 7.2

Positioning the preformed rings

CAUTION

When running, the stuffing box should not exceed a temperature which is bearable to the touch and should leak in small drops.

7.8 Checking after assembly

1. Check that the pump rotates freely by hand.
2. Check and if necessary correct the tightening torque on the tie bolt nuts. Leave the pump several hours before operating it (to allow the sealing compound to dry).
3. Perform a hydrostatic test under maximum pressure equal to 1.3 times the rated pressure (see the data sheet for the definition of the rated pressure). Choose a test liquid which is compatible with the pumped product.
4. After the test, check the tightening torque of the tie-bolts, correct it if necessary.

7.9 Installing in the plant

When installing in the plant, follow the notes shown in chapter 5.

8.0 Troubleshooting

8.1 Personnel qualifications

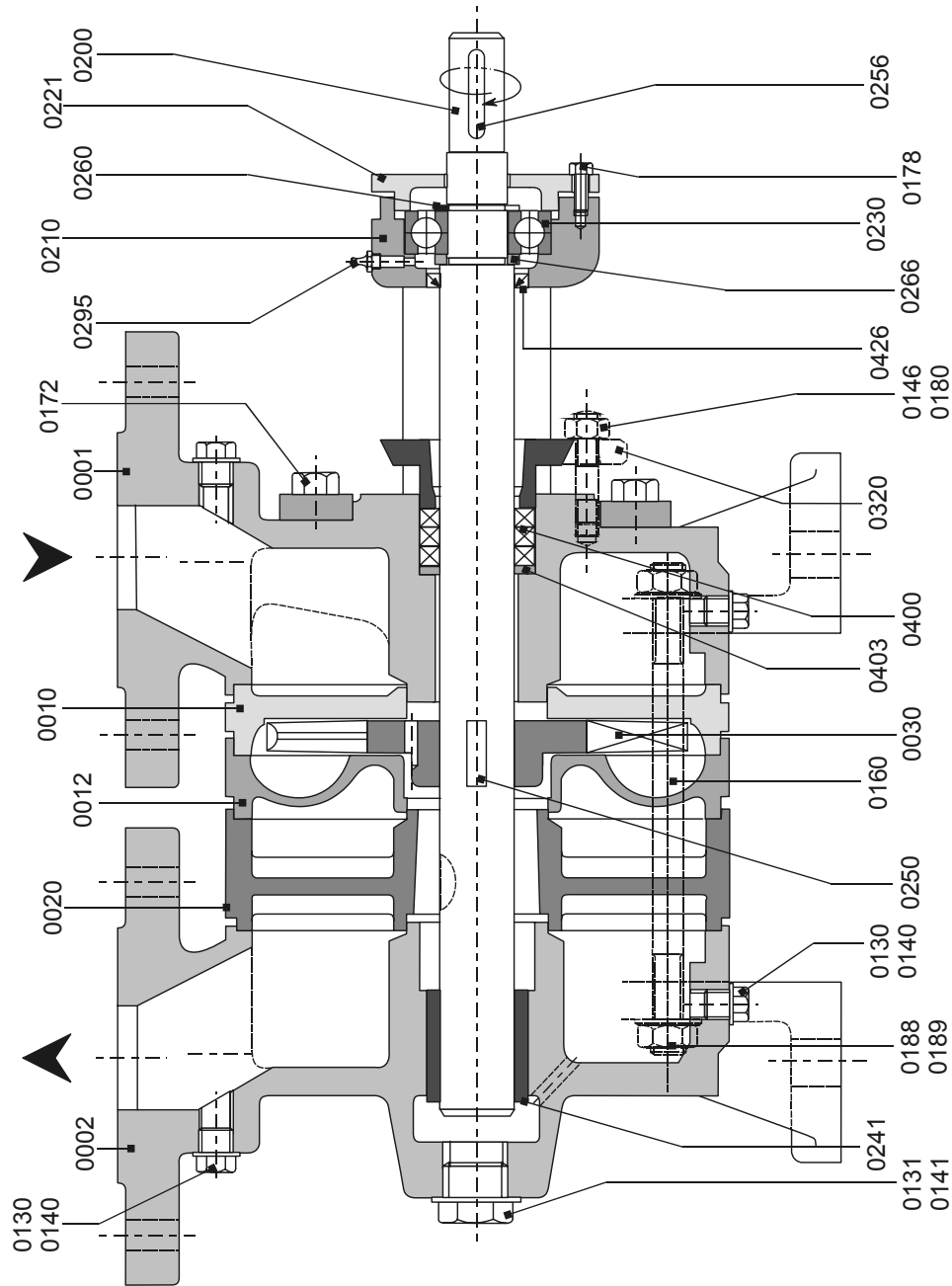
Troubleshooting must be carried out by qualified, authorized personnel only.

Problem	Cause	Solution
Poor performance	- Counter pressure too high.	Check and readjust the operating point. Clean the pipes.
	- Pump or pipe not full or not completely free of gas.	Bleed and fill the pump and the suction line.
	- Suction lift too high or positive suction head too low.	Check the level of liquid in the tank; open the gate-valve at the suction end. Clean the filter at the suction end.
	- Clearances too large due to wear.	Replace worn pump parts.
	- Wrong direction of rotation.	Reverse two phase wires on the motor.
	- Foreign body in pump.	Open and clean pump.
	- Stuffing box too loose.	Re-tighten the gland.
	- Air leakage between bodies or at flanges on the suction line.	Re-machine the bodies sealings. Replace the flange seals.
Pump runs irregular or noisy	- Bodies, shaft sealing, foot valve or suction line leaking.	Check the body seals. Check the shaft sealing. Check the flange mating.
	- Suction lift too high or positive suction head too low.	Check the liquid level in the tank; open the gate at the suction end. Clean the filter at the suction end.
	- Stresses on the pump or on the electric motor /-pump assembly.	Check the mounting of the pump, the coupling alignment and the pipe coupling.
	- Foreign body in the pump.	Open and clean the pump.
Pump leaking	- Leak between the bodies due to loose tie-bolts.	Check the tightening torque of the tie bolts nuts, if the leakage remains re-work the intermediate pieces sealing.
	- Leak at mechanical seal.	Check the friction surfaces, replace the sealings if necessary.
	- Leak at stuffing box too large.	Adjust the stuffing box. Change the stuffing box packing rings.
High pump temperature	- Pump or pipe not completely filled.	Bleed and fill the pump and the suction line.
	- Suction lift too high or positive suction head too low.	Check the liquid level in the tank; open the gate-valve at the suction end. Clean the filter at the suction end.
	- The pump operates with the discharge gate closed without by-pass or the minimum rated output is not respected.	Open the discharge gate-valve or install a by-pass, check the minimum output.
Motor protective circuit breaker opens	- Stresses on the pump or on the electric motor / pump assembly.	Check the mounting of the pump, the coupling alignment and the pipe coupling.
	- The specified operating point is not correct.	Check and adjust the operating point (see data sheet).
	- Absorbed current higher than the specified max. limit value of the thermal relay.	Check the motor protective circuit breaker and the electrical connections.
	- Stuffing box too tight.	Adjust the stuffing box.
	- Foreign body in the pump.	Check the pump for free rotation, dismantle and clean the pump.

9.0 Appendices

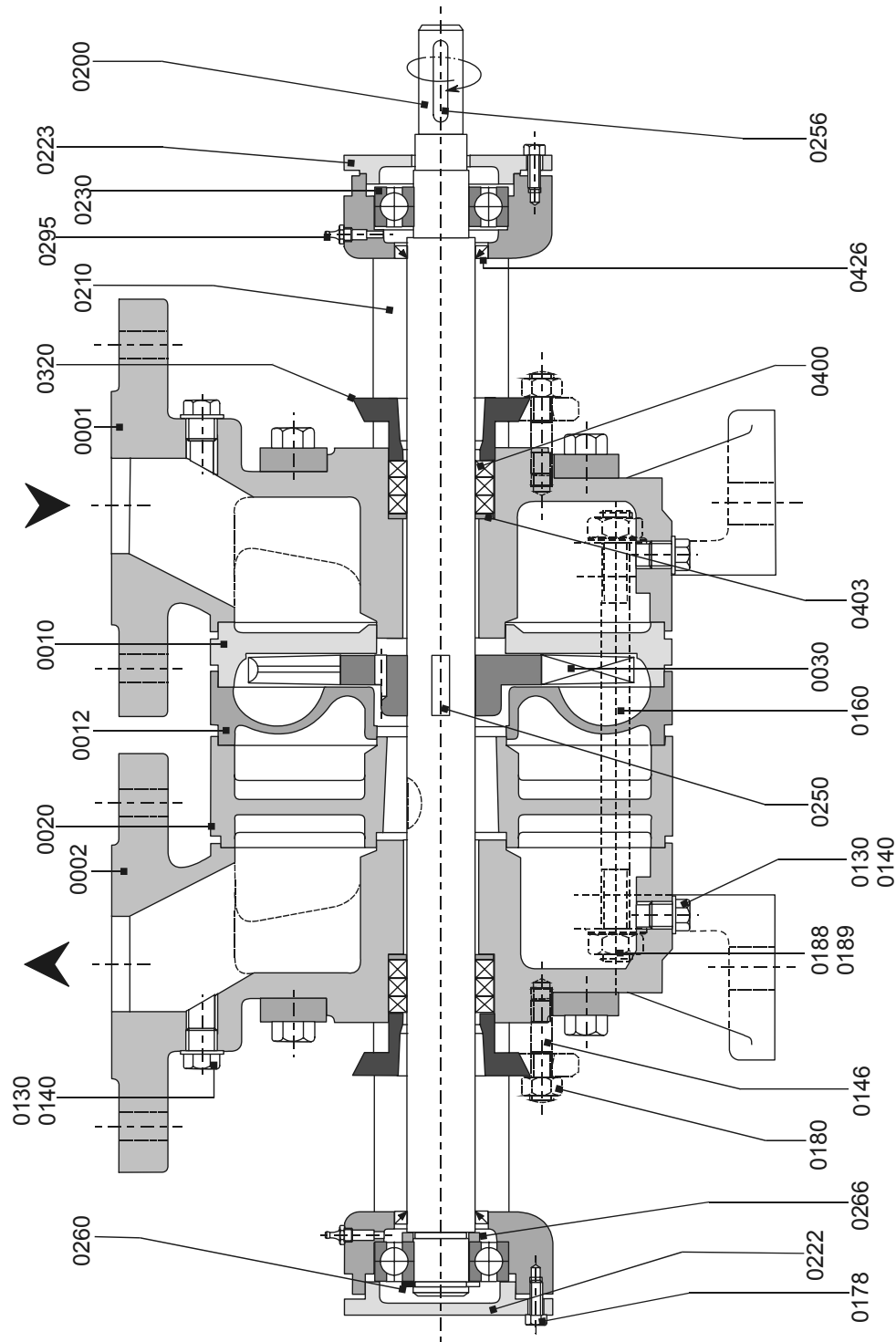
9.1 Cross sectional drawing –AKH pump, bearing A, cast iron, 1 stage, sizes 11/12/31/3600, shaft sealing by stuffing box

fig.9.1.a.1

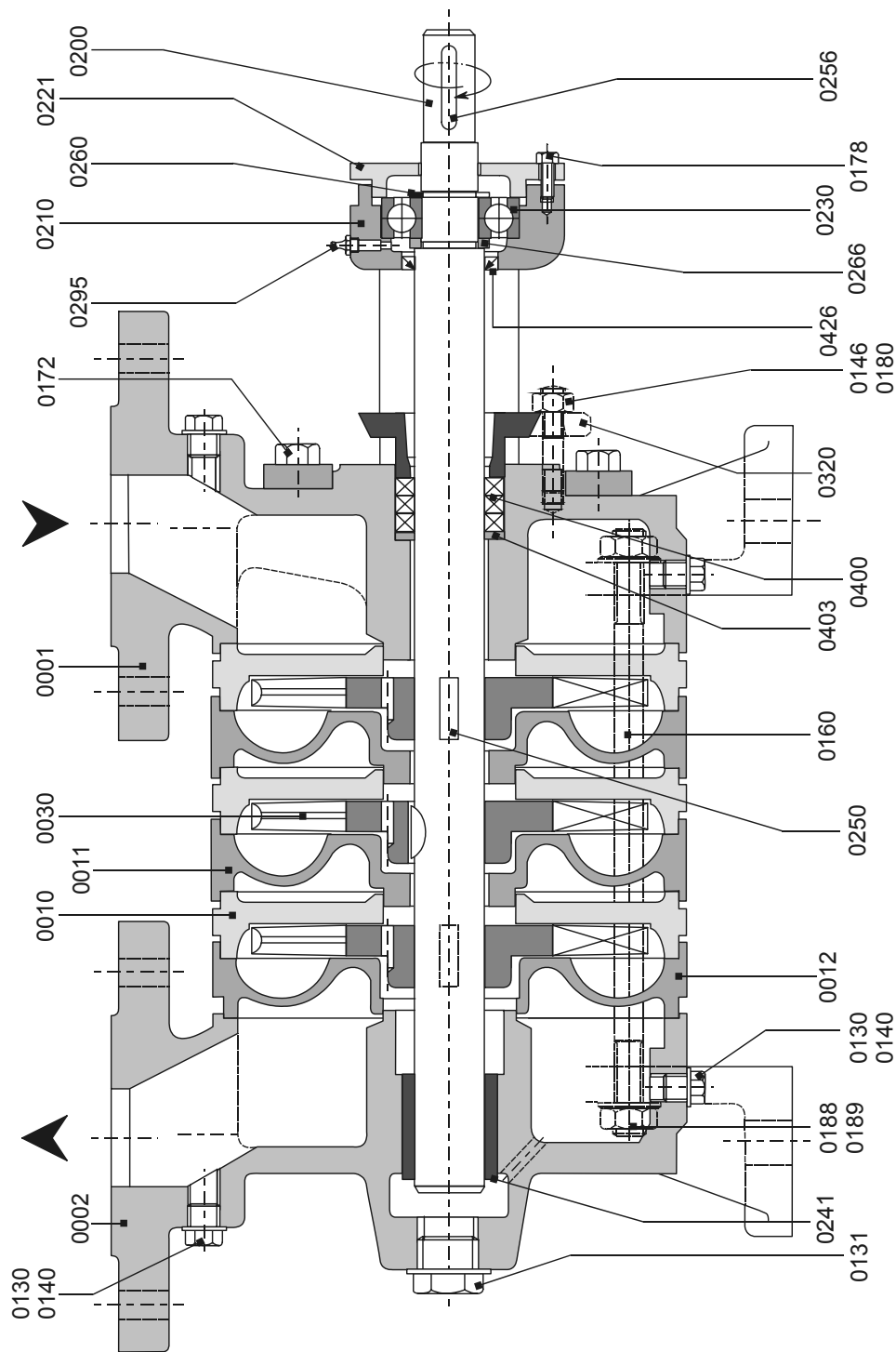


9.2 Cross sectional drawing –AKH pump, bearing B, cast iron, 1 stage, sizes 11/12/31/3600, shaft sealing by stuffing box

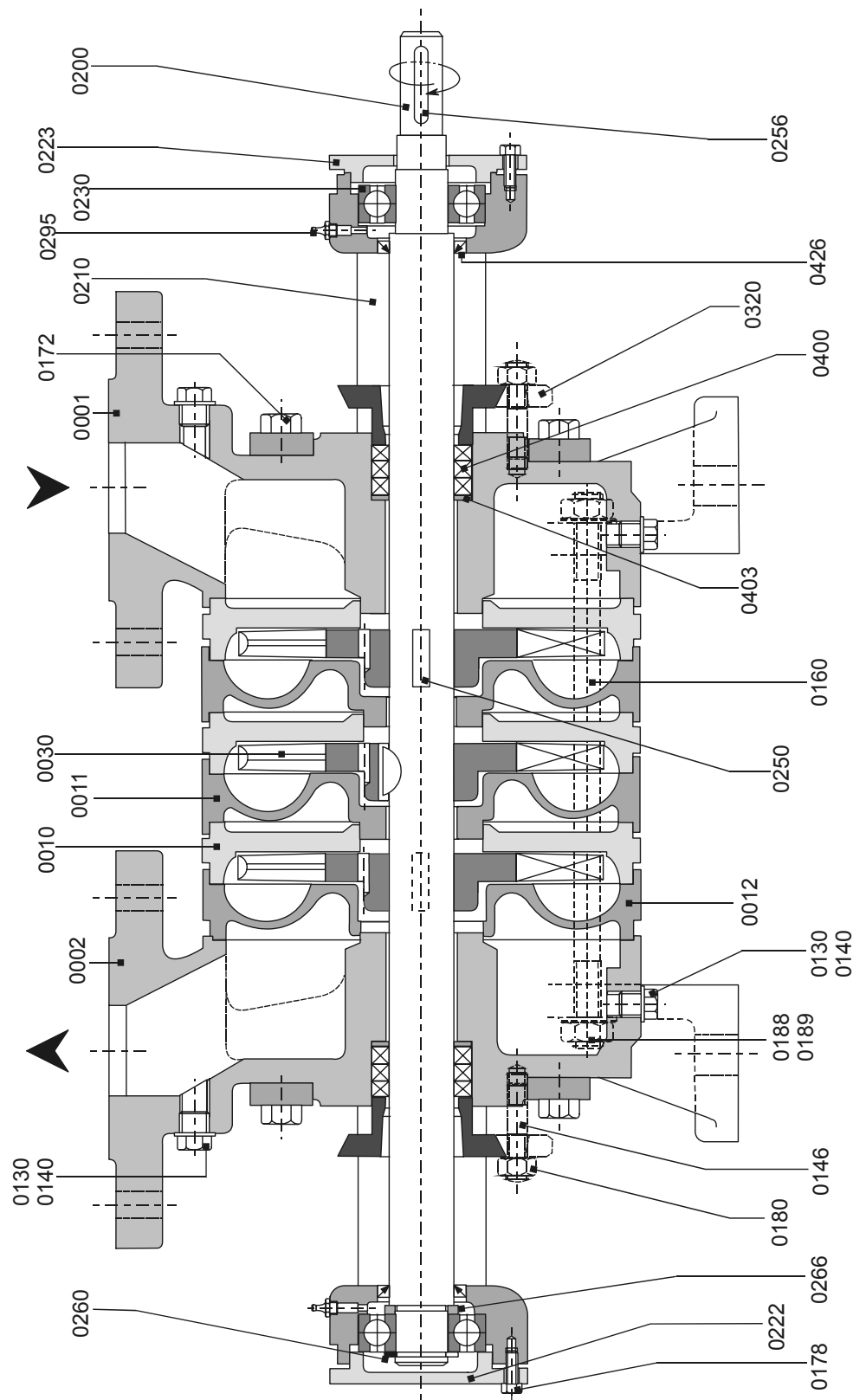
fig.9.2.a.1



9.3 Cross sectional drawing –AKH pump, bearing A, cast iron, 2 to 4 stages, shaft sealing by stuffing box
 fig.9.3.a.1



9.4 Cross sectional drawing –AKH pump, bearing B, cast iron, 2 to 4 stages, shaft sealing by stuffing box fig.9.4.a.1



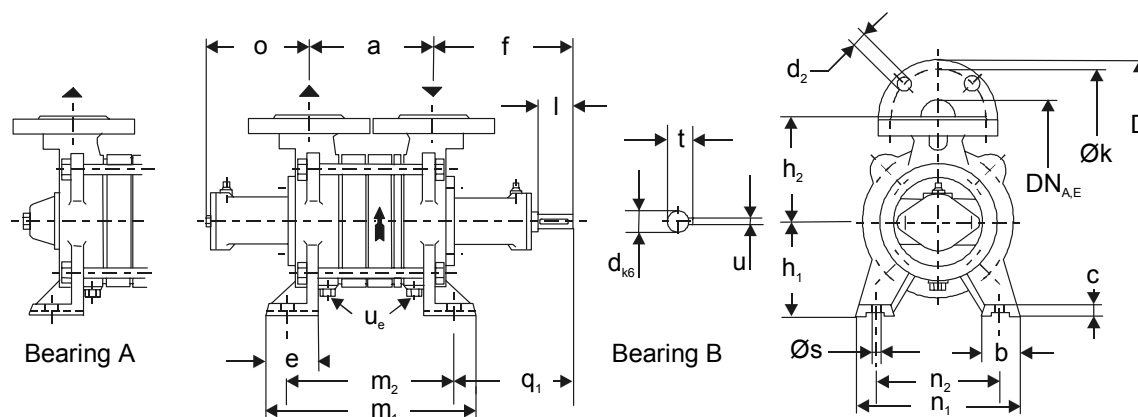
9.5 Appendix – Parts list

AKH.pump , bearing A et B , cast iron, shaft sealing by stuffing box

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9.6 Appendix – Dimensional drawing-AKH.pump, bearing A and B, cast iron



U_e: draining hole G1/4" 1200 to 5100, G3/8" 6100

fig.9.5.a/b.1

Sizes	DN _{AE}	f	h ₁	h ₂	o	b	c	e	n ₁	n ₂	Q ₁	s	d	l	t	u
11/1200	25	145	90	100	119	36	13	50	156	120	132	13	11	25	12,6	4
31/3600	32	159	112	112	125	47	15	55	218	160	142	13	16	40	18,1	5
4100	40	205	132	132	157	47	20	55	218	160	203	13	19	45	21,5	6
5100	50	217	150	140	168	47	20	55	218	160	210	13	24	50	26,9	8
6100	65	251	150	150	188	50	20	65	250	200	234	15	28	65	30,9	8

Sizes	1 stage			2 stages			3 stages			4 stages		
	a	m1	m2	a	m1	m2	a	m1	m2	a	m1	m2
11/12..	120	182	146	120	182	146	154	216	180	188	250	214
31/36..	145	214	178	145	214	178	185	254	218	225	294	258
41..	155	195	159	210	250	214	265	305	269	320	360	324
51..	170	220	185	245	295	260	320	370	335			
61..	190	276	220	280	366	310	370	456	400			

DNA/E	25	32	40	50	65
Øk	85	100	110	125	145
ØD	115	140	150	165	185
Ød2 x n	14 x 4	18 x 4	18 x 4	18 x 4	18 x 8

AS per DIN 2501 PN16

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Grand Island, NY

9.7 Appendix –AKH.pump – Forces and permissible moments on the flanges

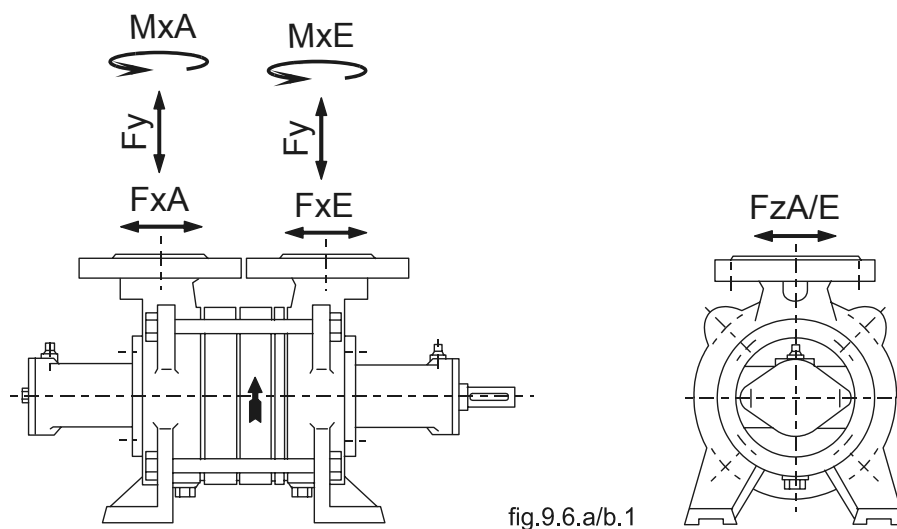


fig.9.6.a/b.1

If several individual forces are developed, the components of the resultants of these forces should not exceed the acceptable values in each direction.

The pump brackets must be fixed on a plane base plate with uniform tightening.

If these conditions are not met, it is no longer possible to guarantee either the sealing or the general mechanical behaviour of the pump.

Sizes	Suction / Discharge N			Nm
	$F_{xA,E}$	$F_{yA,E}$	$F_{zA,E}$	$M_{xA,E}$
11/1200	2000	4000	2000	75
3100	2500	4500	2200	120
3600	2500	4500	2200	120
4100	3000	5000	2400	160
5100	3500	6000	2600	210
6100	4000	7000	3000	290

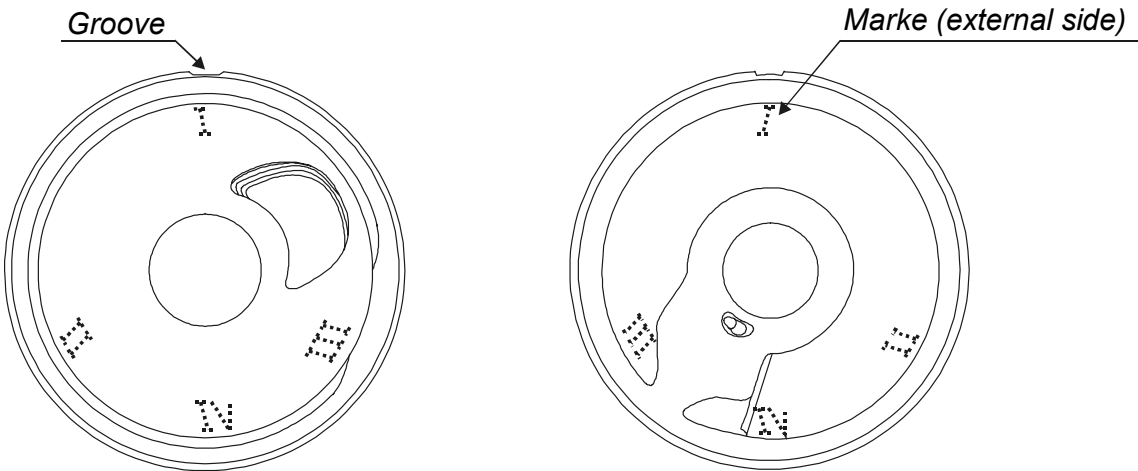
9.8 Appendix –AKH.pump – Identification coding

Position	Characteristic	Code	Definition
1-3	Type	AKH	Horizontal self-priming side channel pump capable of handling gas along with liquid
4	Construction	A	
5-10	Size	1201-6103	Size and number of stage
11	Hydraulic	A	First hydraulic
12	Bearing	A	One groove ball bearing to DIN 625 and one liquid surrounded sleeve bearing
		B	Two grooved ball bearings as per DIN 625
13-15	Shaft sealing	001	Stuffing box flushed from internal source
		AAE	Unbalanced standard mechanical seal, flushed from internal source : Make : SFS – Type : FN - Mat. : EBP GG
		AA1	Unbalanced standard mechanical seal, flushed from internal source : Make : SFS – Type : FN – Mat. : GBV GG
		AF3	Balanced standard mechanical seal, flushed from internal source Make : SFS – Type Sterling GNZ – Mat. : Q1AEGG
		AF8	Balanced standard mechanical seal, flushed from internal source Make : SFS – Type Sterling GNZ – Mat. : Q1BEGG
		AF4	Balanced standard mechanical seal, flushed from internal source Make : SFS – Type Sterling GNZ – Mat. : Q1Q1EGG
		AFU	Balanced standard mechanical seal, flushed from internal source Make : SFS – Type Sterling GNZ – Mat. : Q1AVGG
		AFJ	Balanced standard mechanical seal, flushed from internal source Make : SFS – Type Sterling GNZ – Mat. : Q1BVGG
		AFS	Balanced standard mechanical seal, flushed from internal source Make : SFS – Type Sterling GNZ – Mat. : Q1Q1VGG
		AFV	Balanced standard mechanical seal, flushed from internal source Make : SFS – Type Sterling GNZ – Mat. : Q1AM1GG
		AFK	Balanced standard mechanical seal, flushed from internal source Make : SFS – Type Sterling GNZ – Mat. : Q1AVGG
		AFT	Balanced standard mechanical seal, flushed from internal source Marque : SFS – Type Sterling GNZ – Mat. : Q1Q1M1GG
		BF3	Unbalanced standard mechanical seal, flushed from internal source : Make : Burgmann – Type : M7N – Mat. : Q1AEGG
		BFJ	Unbalanced standard mechanical seal, flushed from internal source : Make : Burgmann – Type : M7N – Mat. : Q1BVGG
		BFT	Unbalanced standard mechanical seal, flushed from internal source : Make : Burgmann – Type : M7N – Mat. : Q1Q1TGG
		DAJ	Unbalanced standard mechanical seal, flushed from internal source : Make : Pacific – Type : PA600 – Mat. : Q1BVGG
		DAK	Unbalanced standard mechanical seal, flushed from internal source : Make : Pacific – Type : PA600 – Mat. : Q1BTGG

9.8.1 Appendix –AKH.pump – Identification coding

16-17	Material	0A	Main parts in GG, impeller in brass
		OB	Main parts in GG, impeller in stainless steel
		OF	Main parts in GG, impeller in PEAK
		2H	Casing in GG, intermediate in bronze, impeller in bronze chrome
		3B	Main parts in bronze, impeller in stainless steel
		4B	Main parts in CrNiMo-steel or cast, impeller in stainless steel
		4F	Main parts in CrNiMo-steel or cast, impeller in PEAK
18	Casing seal	0	Liquid sealing compound
		4	Soft Teflon cord
19			
20			

9.9 Appendix – AKH.pump – Assembling bodies



Suction body 0010

Discharge body 0011 / 0012

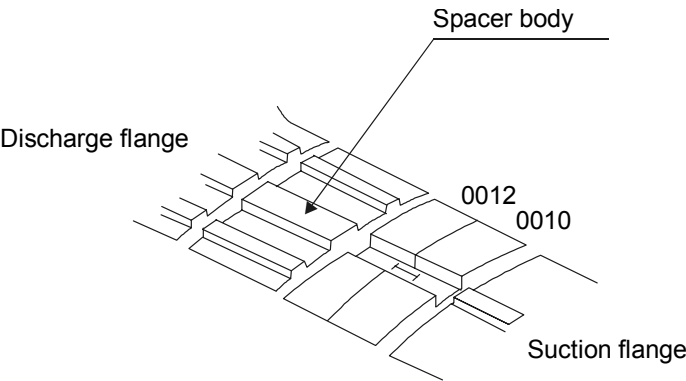
fig.9.7

The suction bodies 0010, and discharge bodies 0011 and 0012, together with a vane impellor, form a stage. The foundry marks I, II, III, IV, are visible on the external sides of the bodies. Assembly is carried out by juxtaposing the marks with the upper generating line as indicated on the assembly drawing; for this purpose, use the foundry groove visible outside the bodies.

CAUTION

If the specified angular position of the stages, as defined, is not respected, pump performance will be adversely affected.

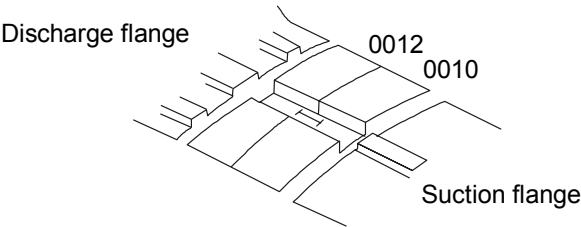
AKHA pumps can comprise up to 4 stages in regular models.



1 stage pump, sizes 11/12/31/3600

fig.9.8

9.9.1 Appendix – AKH.pump – Assembling bodies



1 stage pump, sizes 41/51/6100
fig.9.9

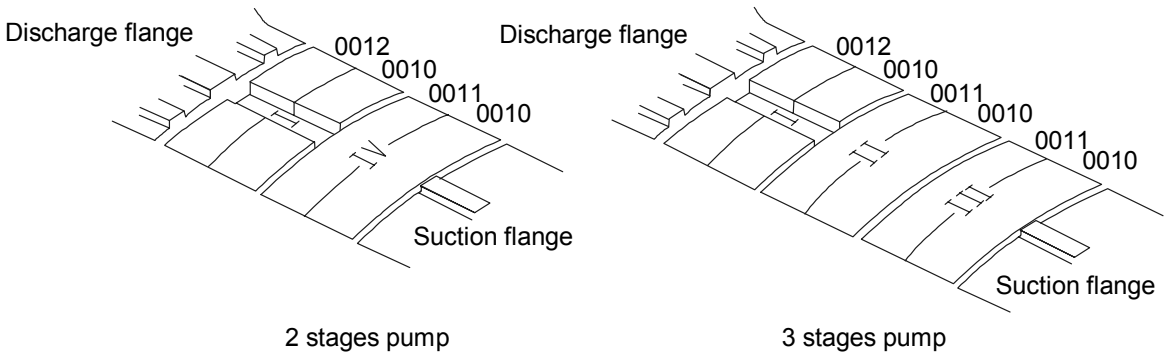
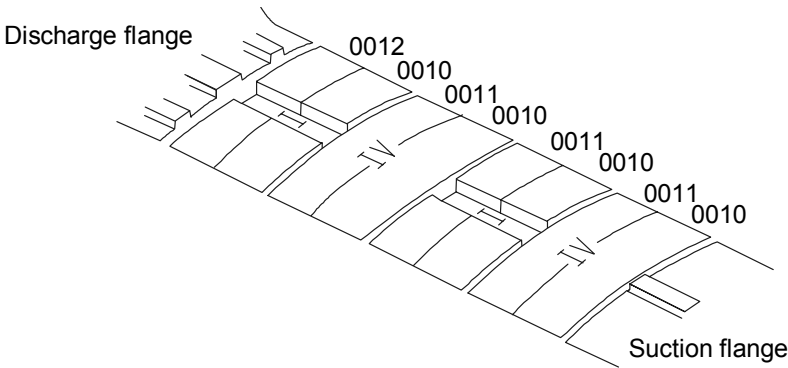


fig.9.10



4 stages pump
fig.9.11

9.10 Appendix – Technical data summary

When using AKH. pumps, the following technical data must be taken into account

Self-priming pump

Direction of rotation : clockwise facing the end of the pump drive shaft

PN : 16 bar

Max.admissible P* : 16 at 120°C / 13 bar at 160°C (232 PSI at 248 °F/188 PSI at 320 °F)

Test pressure : 21 bar (1,3 times the rated pressure) (304.5 PSI)

Max.admissible viscosity* : 300 mm²/s (CST)

Max.*n : 1800 tr/min

**These limits are not valid for all products or all types of construction. For use in conformity and complete safety, take into account the existing requirements (standards) concerning the type of sealing and cooling.*

Number of stages : 1 to 4 stages

Connecting flanges : as per DIN 2501, PN 16, (positions and dimensions see dimension drawing)

Bearings :

Bearing A : 1 plain bearing at the pump end lubricated by the pumped liquid, 1 ball bearing at the drive end

Bearing B : 2 ball bearings

Sizes	Ball bearing as per DIN 625 Cast iron pumps	Ball bearing as per DIN 625 Inox / bronze pumps
11/1200	6201	6201
3100	6303	6203
3600	6303	6203
4100	6304	6204
5100	6305	6205
6100	6306	6206

Lubrication bearing A : 1 plain bearing at the pump end lubricated by the pumped product, 1 ball bearing at the drive end, lubrication see 7.4

Lubrication bearing B : two ball bearings, lubrication see 7.4

Weight of the pump :

Sizes	Approximate weight in kg (multiply by 2.2 to obtain lbs.)			
	1 stage pump weight		Add per additional stage	
	Cast iron	Inox/bronze	Cast iron	Inox/bronze
11/1200	14	15	1,7	2,9
3100	22	26	3,9	4,6
3600	22	26	3,9	4,6
4100	28	33	6,4	6,8
5100	36	45	10,1	11,1
6100	54	62	13,1	16,1

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