

SYSTEM JAKOŚCI
ISO 9001
ZGODNY Z NORMĄ



USER MANUAL
SELF-PRIMING PUMPS
TYPE **S**
(all constructional versions)

**The present manual
should be given to the final operator
and be present in the place
where the pump is mounted**

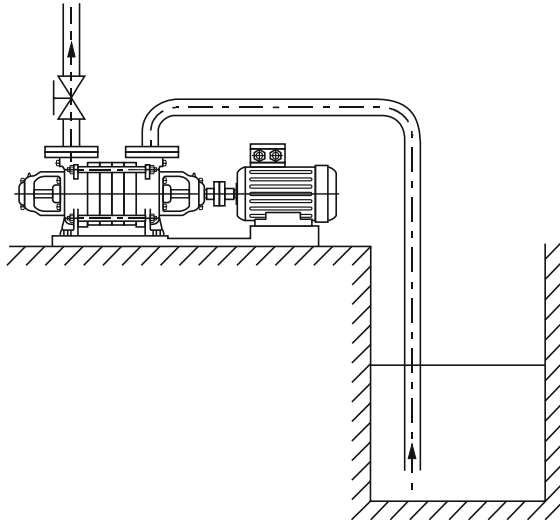


Fig.1 Lay-out of S pump, operating with suction

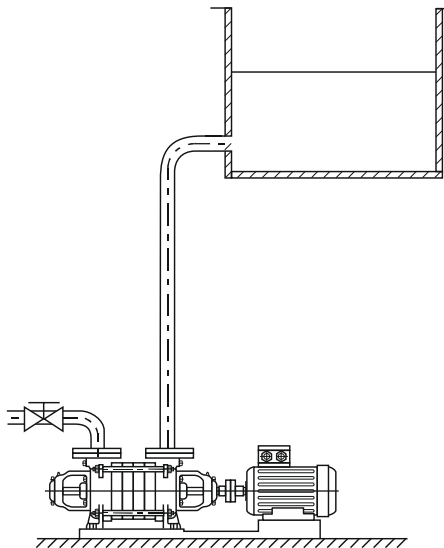


Fig.2 Lay-out of S pump, operating with inflow

1. GENERAL INFORMATION

This user manual includes general guidelines for the installation, operation and maintenance of a pump unit. Read this manual before installation and start-up to ensure reliable and long term operation.

Hydro-Vacuum pumps are manufactured very carefully, with manufacturing process controlled on each stage, according to ISO requirements. Before leaving our factory, every pump is thoroughly inspected and tested to assure its quality and performance. Proper installation, service and maintenance would ensure proper pump operation.

The present manual contains important instruction regarding safe, proper and economical exploitation of the pump. We suggest to read this manual carefully, with understanding, because acquaintance and compliance of this instructions will ensure a reliable and long life operation.

This manual does not contain the local requirements and regulations, so the responsibility for fulfilment of local rules belongs to the user.

The pump assembly shall not be exploited against its destination regarding physical and chemical properties of the handled medium, ie. efficiency, pressure, temperature, density, aggressiveness, abrasiveness, as well as operating parameters specified in the Technical Data of the pump or the contract documentation.

The data plate of the pump and of the motor specifies the type-size, the mean operating parameters and the serial number (identification number, which should be marked in correspondence, orders, especially in spare part orders). Compare these data with the data in your order and/or contract documentation.

All Hydro-Vacuum products are guaranteed according to the "Warranty Certificate"

Hydro-Vacuum is not liable for defects arising out of following causes:

- the pump has been damaged during transportation, by badly storage or incorrect installation;
- the pump is installed or operated against instruction given in this manual;
- the pump was used for handling liquid other than specified in its Technical Data, ie. aggressiveness of handled liquid exceeds corrosion resistance of materials used in the pump;
- pump was disassembled in the warranty period without manufacturer's permission.

CAUTION!

The manufacturer is not liable for any damage resulting from failure to comply with warranty terms and conditions.

In case of damage or malfunction please contact the nearest authorized service or representative of Hydro-Vacuum S.A.

1.1. Symbols



Safety guidelines and instructions; failure to comply may affect operation safety



Electrical safety guidelines and instructions; failure to comply may affect operation safety.



Hazards which may affect operation safety



Guidelines and instructions for use in explosive hazardous areas

1.2. Personnel qualifications

Maintenance, inspection, service and assembly personnel must have verified qualifications.

1.3. Risks associated with failure to comply with safety requirements

Failure to comply with safety requirements may result in the following risks for:

- personnel - electrical or mechanical,
- pump, pump unit
- environment - substances used for cleaning and maintenance.

1.4. Modifications and spare parts

Any modifications of the pump unit or the system require manufacturer's authorization. For safety reasons and to ensure rated parameters and safety, use genuine spare parts and equipment recommended by the manufacturer only. Manufacturer is not liable for any damage resulting from use of non-genuine spare parts.

1.5. Misuse

The reliability of a pump unit operation is guaranteed if used as intended. Do not exceed the limit values as specified in the Technical Data.

(operation outside the maximum efficiency range, due to a discharge line leakage).

2. TRANSPORT AND STORAGE

Check if the product has not been damaged in transport. Notify the carrier immediately if any damage is discovered.

If the product is not installed immediately after the delivery, store in a dry room and protect against impact and weather conditions (moisture, frost etc.).

In case of long term storage, make sure the impeller rotates freely before initial start-up. Manually rotate pump shaft by the clutch or motor shaft after removing the fan cover and the impeller cover.

CAUTION!

Lockout of an impeller may be eliminated by filling the pump unit with hot water, if this does not help, drain the water and contact the nearest service centre.



Do not use special tools (chain spanner) to unlock the pump, since it may damage the impeller and the seals

The product shall be secured against damage, impact and weather conditions. Products over 70 kg are fitted with transport lugs, see Fig.3.

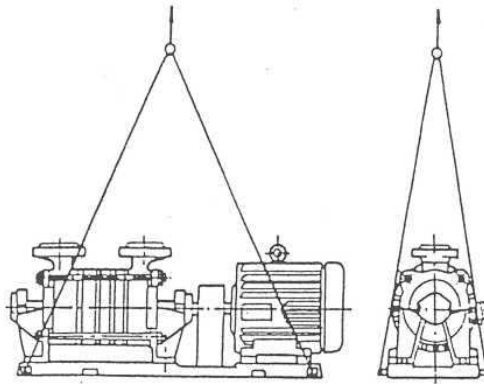


Fig.3 Product handling method

3. PUMPING SET DESCRIPTION

Before installation of the pump assembly, it is required that the operator checks and compares the data specified on the data plate with the data in the order (or contract documentation). The operator shall acknowledge himself carefully with the present User's Manual and Technical Data.

CAUTION!

Before installation and first starting up, the operator should indispensably acknowledge with the Technical Data of the delivered pump set.

3.1. The pump, pump set

Vacuum pump markings:

SA.80.02.1.1020

- S** - type
- A** - versions
- 80** - type size
- 02** - type dimensions (tag)
- 1** - material execution
- 1020** - constructional execution

The S type pumps are multi-stage, horizontal, impeller, self-priming, and liquid ring pumps with side channels and open impellers. The main feature of the S type pump is the ability to remove gases from the pump suction system after priming.

The S type pump includes a bearing housing, shaft, and suction and discharge port with shaft packing. The impellers (number corresponding to the number of pressure stages) are movably mounted on the shaft. The shaft is supported by the bearings. The sections are limited with each other and the entire unit is bolted.

Within the complete pump unit, the pump is coupled with a motor via a flexible coupling and mounted on a common mounting plate.

Version A of the S type pump is fitted with a sealed ball bearing at the suction and discharge side and a rope or mechanical end-face seal at the pump shaft outlet.

Version B of the S type pump is fitted with a sealed ball bearing at the suction side, a mechanical end-face seal at the pump shaft outlet and a sealed slide bearing at the discharge side. All sections and casings are sealed with a sealing compound.

3.2. Motor

The pumps are driven by 50 Hz electric motors with lugs at 1450 rpm available in different versions depending on the intended use of the pump unit e.g.: marine version, Ex version and 60 Hz at 1750 rpm version.

CAUTION!

Other power transmissions may be used, provided that the torque is the only load present at the pump shaft end.

CAUTION!

Electrical motor specifications, dimensions and weights are detailed in the motor Technical Data. The Technical Data is an integral part of the documents included with the product.



Wiring and inspection of electrical system must be carried out by an authorized electrician in accordance with local regulations.

Product dimensions, weights and specifications are specified in the product Technical Data.

3.3. Pump unit set-up

Install the pump unit on a concrete slab with at least 10 cm height and fasten with the anchor bolts.

CAUTION!

See pump Specification for dimensions and layout of the anchor bolts

The concrete slab must be level and the pump unit must be positioned horizontally. It is recommended to position the concrete slab on a cement mortar. After the unit is fastened to the concrete slab with anchor bolts and all hydraulic connections are completed, check if the pump and motor are in a correct position in relation to each other and the impeller rotates freely. Check coupling.

See Fig. 4 and Fig. 4a for the position two parts of the flexible coupling.

An allowable gap measured at the coupling circumference for type E, type A and type I couplings may not exceed values specified in Table 1.

Table 1

Coupling type	Dimension [mm]	
	a	b
E	2+0,5	0,2
A	5+0,5	0,3
I	3,8+0,5	0,2

The alignment of pump and motor shaft can be checked with a rule and a feeler gauge. Dimension "b" can be corrected with a washer installed under the pump or motor mounts. Install coupling guard and other safety guards, and do not run the pump unit without the safety components in place.



Do not run the pump unit without coupling guard and safety guards

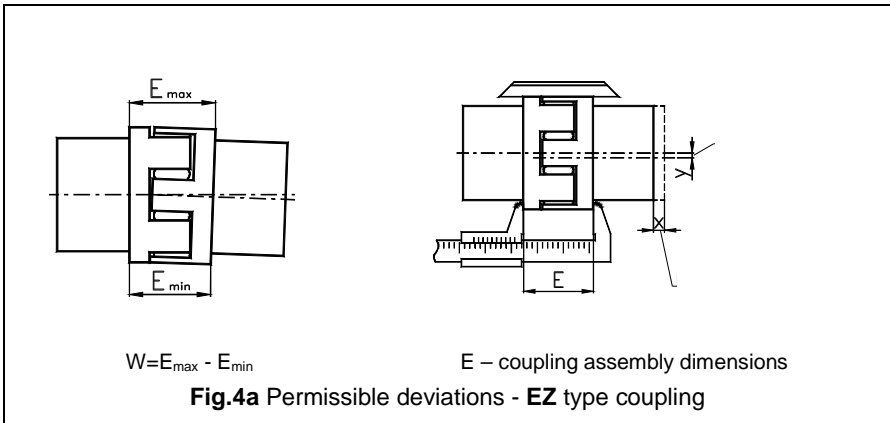
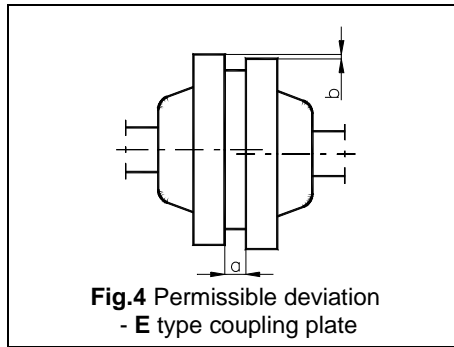


Table 2

Coupling type	Dimension			
	E [mm]	x [mm]	y [mm]	W [mm]
EZ 1	32	1,0	0,2	0,8
EZ 3	40	1,0	0,2	0,8
EZ 7	49	1,5	0,3	1,0
EZ 9	62	1,5	0,3	1,5
EZ 10	78	1,5	0,4	1,5

x, y, W- maximum deviation for couplings

CAUTION!

Correct shaft alignment guarantees long service life.

4. INSTALLATION AND ASSEMBLY.

4.1. Safety requirements for installation and inspection

User shall make sure, all installation and inspection works are made by an authorized and qualified personnel. Make sure the personnel understood the Operating Manual. Works shall be carried out with disconnected power supply only. The pump units for hazardous media are subject to neutralization.

All protective devices must be reinstalled and restarted before the compressor unit is reactivated. Follow the procedure.

4.2. Hydraulic connections

The pump may operate with suction (Fig.1) or with inflow (Fig.2).

- When pumping from a container placed below the pump, the whole suction line should be arranged upwards.
- Protect the pump against dry running.
- Keep the suction level according to the NPSH value of the pump.
- Take in mind that the altitude and temperature of the handled liquid affect the suction lift.

Table 3

Altitude (m)	Drop of suction lift (m)
0	0
500	0,60
1000	1,15
1500	1,70
2000	2,20
2500	2,65
3000	3,20

Table 4

Temperature °C	Drop of suction lift (m)
20	0,20
30	0,40
40	0,70
50	1,20
60	1,90
70	3,10
80	4,70
90	7,10
100	10,30



The above table refers to handling water. In case of other liquids, especially with high vapour pressure, check if your pump should not be installed with inflow.

- Before starting installation should the pipeline be thoroughly cleaned from dust, welding scale and other dirt and foreign matter..



Any foreign matter getting into the pump will cause its breakdown. To avoid this, install an adequate filter and/or separator in the suction pipe.

- The pipeline should be hanged up or supported in a way avoiding acting forces on the pump body (Table 5).
- The horizontal part of the suction pipe should be as short as possible. Unless necessary, avoid elements introducing hydraulic resistance (eg. curves, contractions, valves).
- The suction pipe should be equipped with a check valve with a strainer.

CAUTION!

The summary clearance of the strainer openings should be at least three times greater than the clearance of the suction pipe

CAUTION!

During installation make sure, that the applied washers do not obstruct the clearance of the suction pipe.

- Diameters of the suction and pressure pipelines shall not be smaller than the diameter of the pump stub (these data are included in the Technical Data of the pump).



If the above principles are not observed, the flow resistance will increase and the pump efficiency would be lower than given in the manual.

CAUTION!

The following terms and conditions apply. Any damage resulting from failure to comply with the terms and conditions are not covered by the warranty. Do not use the pump unit to deliver products with corrosive properties exceeding the corrosion resistance parameters of materials used for its construction.

**Permissible forces and moments exerted on ports of pumps type S version A, B
as per PN-EN-ISO -5199**

Table 5

Pump type	Stub pipe location	DN	Family no.	Material marking	Force [N]				Torque [Nm]			
		mm			F_y	F_z	F_x	ΣF^b	M_y	M_z	M_x	ΣM^b
SA SB	Pump port in vertical „z” axis	25	5A	cast iron, bronze	210	255	225	390	35	70	140	280
			5B	cast steel	420	510	450	780	70	140	280	560
		32	5A	cast iron, bronze	255	315	270	495	88	123	210	492
			5B	cast steel	510	630	540	990	176	246	420	984
		40	5A	cast iron, bronze	300	375	385	585	140	193	280	490
			5B	cast steel	600	750	770	1170	240	386	560	980
		80	5A	cast iron, bronze	615	750	675	1185	228	280	492	630
			5B	cast steel	1230	1500	1350	2370	456	560	984	1260

^b - ΣF and ΣM are vector totals of forces and torques.

If not all actual loads reach permissible maximum values, one of the loads may exceed permissible value, when an additional condition is met:

- no force or moment exceeds 1.4 x permissible value from table 5
- actual force and moment exerted on each port meets the following equation:

$$\left(\frac{\sum F_{rzeczywiste}}{\sum F_{dopuszcz.}} \right)^2 + \left(\frac{\sum M_{rzeczywiste}}{\sum M_{dopuszcz.}} \right)^2 \leq 2$$

The effect of material and temperature on permissible values of forces and moments.

Table 6

Material type	Temperature °C					
	20	60	100	140	180	220
	Correction factor „K”					
Grey iron	1	0.983	0.968	0.952	0.929	0.904
Alloy steel 18-8	1	0.990	0.987	0.974	0.964	0.953
Carbon steel	1	0.990	0.980	0.971	0.961	0.952

All force and moment data included in table 5 are specified for 20°C. For other temperatures, data must be corrected in accordance with:

$$F_i = K \times F [N]$$

$$M_i = K \times M [Nm]$$

4.3. Wiring



Wiring may be carried out by an authorized personnel in accordance with current regulations

- The voltage must correspond to the data specified in the motor rating plate. Follow the motor manufacturer specification.
- Use bimetallic thermal overload relay set to rated current, as per the rating plate.



Use electrical devices designed for use in explosive hazardous areas.

CAUTION!

Remember to connect the pump to the earth



Incorrect connection may cause motor damage. Check if the power supply line is able carry the starting current, which is 5 - 7 times higher than the nominal current. If possible use soft start or a star-delta array

- After electrical connection, check if the sense of rotation is consistent with arrows on the pump housing and/or on the motor fan cover.
- The sense of rotation can be checked by a short motor start.



It is not permitted to run the pump without liquid (dry).

CAUTION!

With wrong sense of rotational, will the pump not reach proper working parameters (Q and H).

4.4. Safety requirements for assembly and installation

The user must make sure the pump unit is installed and inspected by authorized and qualified personnel only. Please read this user manual before use. Disconnect power supply before installing the pump unit.

All pump units for hazardous media require neutralization.

Replace and restart all protective devices before following the motor start-up procedure.

5. TECHNICAL ACCEPTANCE INCLUDING START-UP, OPERATION AND SHUTDOWN.

5.1. Operational requirements



The following terms and conditions apply. Damage resulting from failure to observe the terms and conditions are not covered by the warranty. Do not use the pump unit to deliver products with corrosive properties exceeding the corrosion resistance parameters of materials used for its construction.

- Each time before the compressor start-up check, if the compressor is filled with medium.



Operation in dry run is not allowed

- For pumps operating with suction (Fig. 1) install a check valve and a strainer at the suction line. Rapid reversal of a liquid stream at pump shutdown may lead to liquid drain, preventing suction. Prime the pump and the suction line. Open pressure valve.
- For pumps operating with inflow (Fig. 2), install a gate valve at the suction side (open during operation). Prime the pump. Open pressure valve.



Do not use the gate valve (at the suction side) to adjust pump parameters.



Before first start, fill up the pump and the seal chamber with the handled liquid. A chamber with double sealing should be exactly deaerated and a proper pressure should be applied.



Do not start the pump with a discharge valve fully closed. Run the pump with the discharge valve partially closed. The lower the pump efficiency, the higher the power input. (As opposed to the centrifugal pumps).



The pumps are factory filled with an inhibitor, readily soluble in water. Do not use water for food purposes for the first 5 minutes of initial pumping.



The pump shall not work without flow of liquid longer than 1 min. For a continuous running pump shall the minimal flow not be smaller than 10% of the full pump output

5.2. Operation

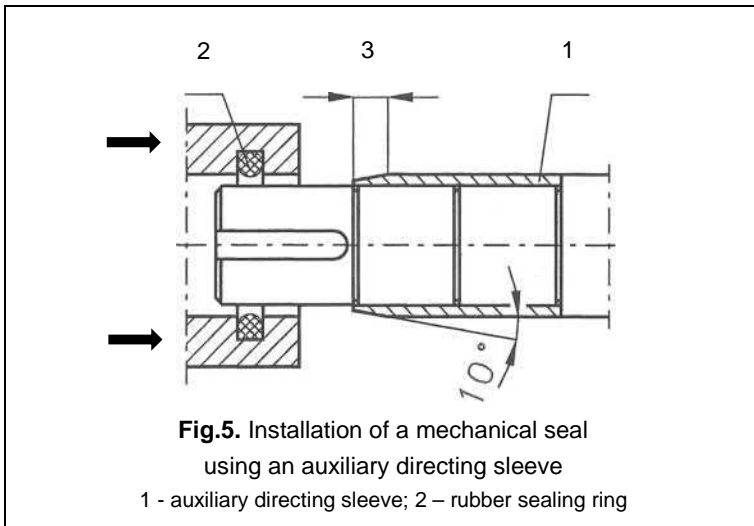
CAUTION!

Pumps equipped with mechanical seal need no service. Leakage evidences seal damage, which should be replaced immediately



Leakages of hazardous liquids should be drained off to avoid its dangerous effects for people and environment. The appropriate legal requirements should be observed

Mounting new mechanical seals make sure to install rubber washers in the chamber and in the sliding ring. When mounting the mechanical seal onto the shaft it is recommended to moisten the shaft with water. If the shaft shoulder has a sharp edge, an auxiliary directing sleeve "1" (see Fig. 5) should be used, in order to avoid damage of the O- ring "2". Sealing ring faces must be clean and free from cracks and scratches.



Pumps with gland packing demand regardful regulation

- Before the first start, must the nuts for tightening the packing be turned only manually, without excessive force. **Do not overstrain the packing!**

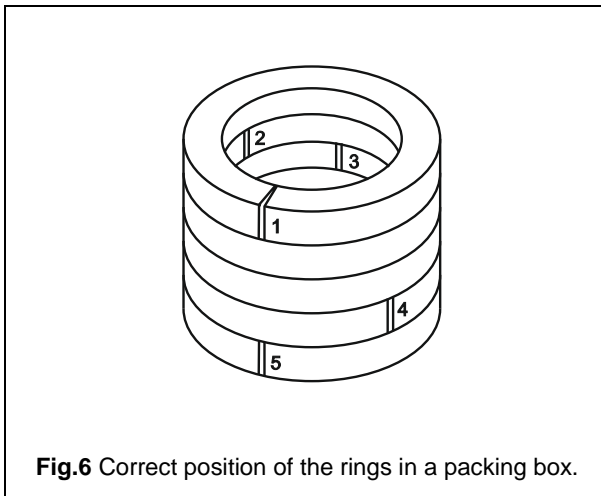
CAUTION!

The start-up period of a new pump has a significant influence on the gland packing service-life. It is recommended to allow at the beginning something greater leakage, and slowly reduce them in the course of time. The more leakage, the longer service life. During the first 15 min of work do not adjust the packing gland, even if the outflow is high. After some time adjust the packing gland stepwise and gently, to obtain a small drop outflow.

CAUTION!

A full stoppage of the outflow would cause the stuffing to wear out and a excessive shaft wearing.

When replacing the stuffing, take care not to scratch the shaft. The stuffing sections should be arranged as presented on Fig.6.



5.3. Shut-down

Make sure the liquid will not freeze; remove the liquid from the pump and the system.

6. SUPERVISION AND MAINTENANCE

During pump operation, special maintenance procedures are not necessary. The pump and its vicinity should be kept clean. If the temperature drops down below the freezing point, draw the water off the pump and pipelines. Fill the pump up with a non-freezing liquid, eg. glycol solution, to avoid blocking of the rotating assembly.

The bearings do not require lubrication.

CAUTION!

Mechanical packing does not require maintenance. Dry run is not allowed.

Do not exceed permissible torques (see Table 7) for bolted joints. Most of the threaded joints are secured with Loctite thread locker. It is recommended to heat the threaded joints with hot air (temp. 200°C) before removing.

Tightening torques - bolted joints.

Table 7

Size		M6	M8	M10	M12	M16	M20
Tightening torque	Nm	9,3	23	45	77	125	190

Do not use excessive force. Before disassembly, mark the position and order of each part.

Follow the assembly procedure (note different number of holes for the S type pumps). The running clearance between each section and the impeller must not exceed $0.1 \div 0.15$ mm.

CAUTION!

When mounting the coupling on the pump shaft, remove the bearing cover on the opposite side and support the pump on the shaft end to avoid damage to the bearing cover.

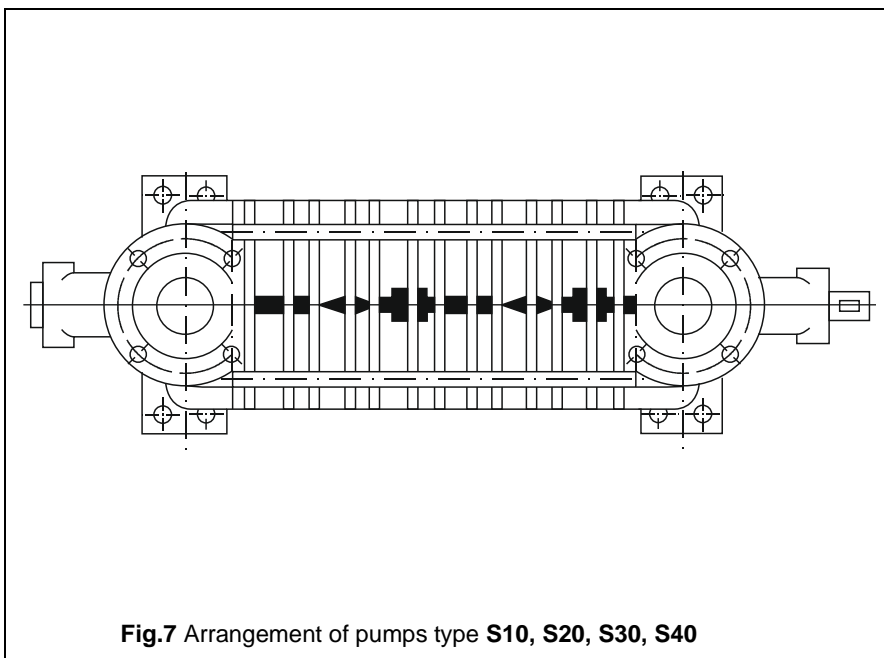
6.1. Spare part replacement.

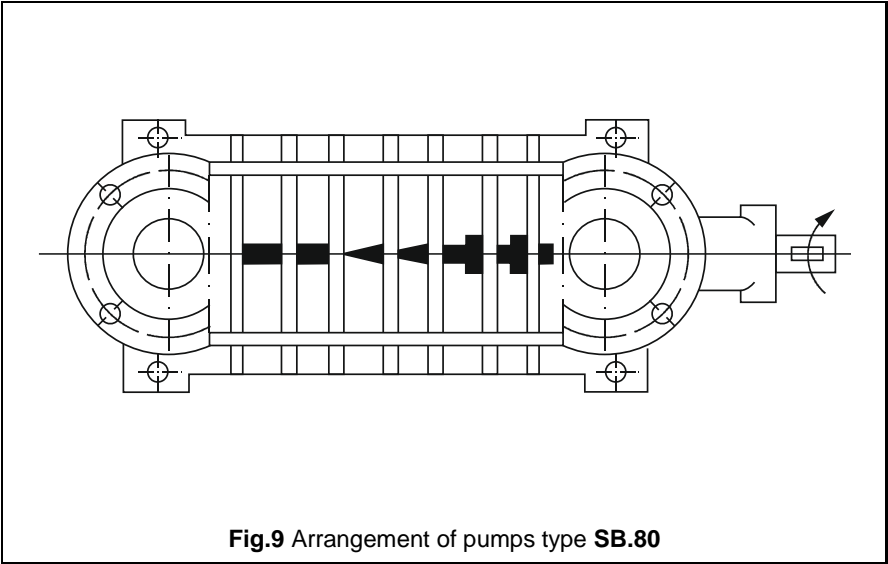
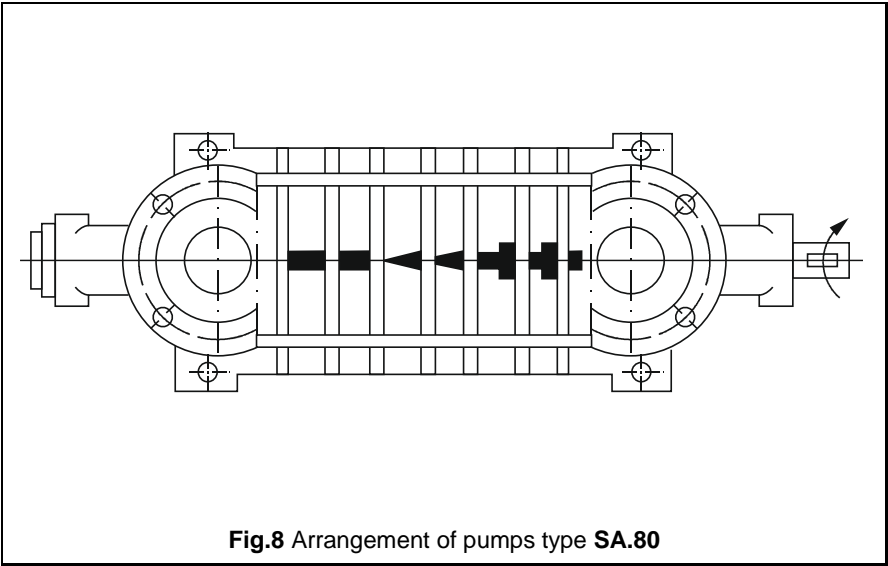
CAUTION!

The frequency of replacing spare parts depends in a high degree on the pump operating conditions. Therefore are the values given below only approximate values. Taking under consideration the complex structure of the whole pump assembly, the information in the table concern only to the following elements: the pump and motor bearings, mechanical packing and the motor winding

Table 8

Wearing part		Mechanical seal	Motor bearings Pump bearings	Motor winding
Durability		10 000 h to 20 000 h	15 000 h to 30 000 h	20 000 h for outside temperature up to 40°C
Replacing frequency according to the working load	Continuous work	1 - 2 years	2-3 years	3 years
	15 h/day 9 months/year	2-5 years	4-8 years	6 years





7. TROUBLESHOOTING.

Any works on the compressor within the warranty period without manufacturer's authorization will void the warranty.

CAUTION!

Switch off the compressor before commencing any operations.

Table 9

Trouble	Cause	Remedy
1	2	3
Pump does not supply medium	<ul style="list-style-type: none"> a) Obstruction by foreign matter b) Suction side blocked c) Leaky suction side, air is sucked d) Pump not filled with water e) Too low pressure on suction side (cavitation) f) Wrong sense of rotation g) Supply voltage too low 	<ul style="list-style-type: none"> a) Dismount and clean the pump b) Clean the pump c) Remove leakage d) Fill up e) Suction head to high f) Exchange two phase conduits in the motor g) Check and correct
Pump vibrates	<ul style="list-style-type: none"> a) Pump not proper mounted on the basement b) Improper basement c) Foreign matter in the pump 	<ul style="list-style-type: none"> a) Make steady b) Reinforce the foundation c) Dismount and clean the pump
Motor warmed up	<ul style="list-style-type: none"> a) Pump blocked b) Voltage too low c) Foreign matter in the pump d) Improper outside temperature e) Improper connection 	<ul style="list-style-type: none"> a) Locate the reason and correct b) Check voltage on clamps. It should not differ from nominal value more than $\pm 5\%$ c) Dismount and clean the pump d) Outer temperature cannot exceed 115°C e) Check and put right
Pressure too low	<ul style="list-style-type: none"> a) Wrong pump selected b) Wrong motor speed (foreign matter, wrong power supply etc.) c) Wrong sense of rotation 	<ul style="list-style-type: none"> a) Exchange the pump b) Dismount the pump and put right c) Exchange connection of two phase conduits in the motor
Self-acting motor shut off	<ul style="list-style-type: none"> a) Too low thermal relay setting b) Too low voltage c) Thermal relay defected d) Rotating impeded 	<ul style="list-style-type: none"> a) Set value specified on data plate b) Check conduit section c) Replace relay d) Check and remove blockage

8. RELEVANT DOCUMENTS

To be agreed upon between the Client and the Manufacturer. The following documents are included with the pump unit: User Manual, Technical Data, and Warranty Card.

9. GUIDELINES AND INSTRUCTIONS FOR USE IN HAZARDOUS AREAS.

9.1. Maintenance schedule for pump and coupling for use in hazardous areas.



Table 10

Explosion proof class	Inspections
H2GcIIBT4-T3	<ol style="list-style-type: none"> 1. Check circumferential clearance of a flexible insert after 2,000 hours of operation from the initial start-up. Or every 4 months. 2. If no wear of the flexible insert is observed, next inspection after 4,000 hours of operation. Or every 12 months. 3. If excessive wear of flexible insert is observed, identify the cause and replace the insert. 4. Replace rolling bearings (lower values, see Table 8). 5. Replace end face seals (lower values, see Table 8).

9.2. Coupling wear.

CAUTION!

Use feeler gauge to check the gap between the hub centres and a flexible insert. If acceptable wear is exceeded, replace the insert irrespective of maintenance schedule.



Correct shaft alignment guarantees long service life and safe operation in the hazardous areas.

Table 11

Coupling type series EZ	Acceptable wear Δ_{max} [mm]
1	1,5
3	2
7	2
9	3
10	3

9.3. Coupling materials for hazardous areas.

For Class II B hazardous areas, the following coupling hub materials are acceptable:

EN-GJ5-400-15-(GGG40) – ductile cast-iron, alloy steel, carbon steel

CAUTION! Coupling hubs made of light metal alloys e.g. aluminium are not allowed.

9.4. Start-up.

To prevent dry run: Check the following before pump unit start-up: correct tightening of coupling hub bolts, pump and motor shaft alignment.



For hazardous areas, apply Loctite thread locker on the coupling hub retaining screw.

CAUTION! Provide protection against accidental contact with the coupling.



Coupling protection in hazardous areas.
Protect the coupling against falling objects with guards.

CAUTION! The distance between the guard and the coupling must be at least 5 mm.
Guards can be removed with the pump unit completely stopped.



Immediately deactivate the drive in case of coupling malfunction.
Identify the cause.
Remedy the problem.

9.5. Leakage

The pump or pump unit for flammable, toxic, caustic or other hazardous liquids or liquids with temperature over 60°C must be fitted with components, e.g. tubes for collecting and draining the liquid leaking from the packing box or discharged by the pressure safety valve.

Protect the environment against leakage with fixed guards, screens and other safety devices.

9.6. Electrostatic discharge

Connect the pump unit to the earthing terminals to prevent accumulation of positive charges. The earthing terminal must be directly connected to the earth conductor. Do not use pipes as the earth conductors.



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