SYSTEM JAKOŚCI ISO 9001 ZGODNY Z NORMĄ

USER MANUAL
SELF-PRIMING PUMPS
TYPE **SM**
(all constructional version)

SM/WE - **4C.2**
Issue 2/2006

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

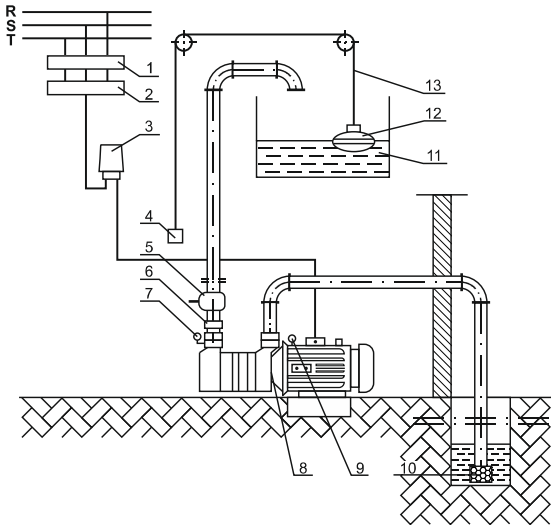
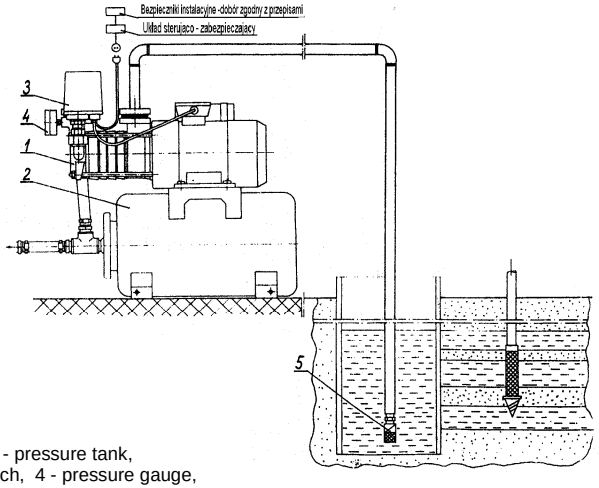


Fig.1. SM pump installation diagram - open water tank

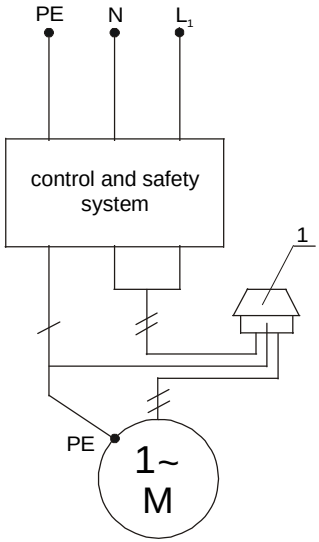
1- fuses, 2 - control and safety system, 3 - float switch or pressure switch, 4 - counterweight, 5 - throttle valve, 6 - check valve, 7 - pressure gauge, 8 - pump unit, 9 - vacuum gauge, 10 - strainer, 11 - open water tank, 12 - float, 13 - cord



1 - pump unit, 2 - pressure tank,
3 - pressure switch, 4 - pressure gauge,
5 - check valve

Fig.2. Pump installation diagram - pressure tank.

a)



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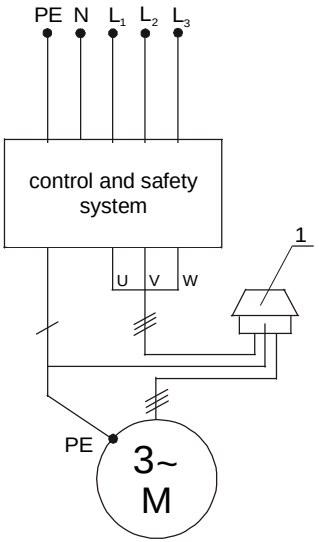

Fig.3. Electrical connections - Motor:
a) single-phase b) three-phase
1 - float switch or pressure switch

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.

CAUTION! Indicates hazards that can affect operation safety

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 authorised 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.

CAUTION!	Hazards which may affect operation safety

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 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.

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.) and mechanical impact.

Drain, dry and protect the pump against corrosion. Flush pumps for media that can form crystals. If freezing is possible, disassemble the pump and store in a heated area.

In case of long-lasting storage, make sure the impeller rotates before initial start-up. Manually rotate motor shaft after removing the fan cover and impeller cover.

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

Transport in original packaging.

The product shall be secured against damage, impact and weather conditions.

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.

Before moving the pump unit (with lines disconnected), drain and protect the pump against corrosion. Plug all ports.

3. PUMPING SET DESCRIPTION

CAUTION! Dimensions and layout of anchor bolts for SM.2, SM.3 and SM.4 pumps are specified in the data sheet.

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.

3.1. Pump

Vacuum pump markings:
SM.4.02.1.1100

SM	-	type
4	-	type size
02	-	type dimension
1	-	material execution
1100	-	constructional execution

The SM type pumps are multi-stage, horizontal, impeller, self-priming, and liquid ring pumps with side channels and open impellers. Pump has a compact design and is coupled with a motor with flange end connection, feet-mounted with extended motor shaft made of corrosion resistant alloy steel. SM pump includes a suction casing with mechanical shaft seal mounted on the motor flange. Other components include a suction section, an impeller (with 3 holes), a suction/pressure section, another impeller (with 2 holes), a pressure section and a pressure casing.

Both impellers are slide-mounted on the extended motor shaft and limited by side surfaces of the hydraulic actuators, which coupled with the impeller convert the kinetic energy into pressure. The pump is a self-priming device with a liquid ring to allow air removal during start-up.

3.2. Motor

Monoblock pumps are driven by an electric motor with a special shaft end, supplied with 50 Hz / 220V or 380V at approx. 1450 rpm.

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 Data Sheet.

3.3. Pump unit set-up

Pump unit should be stored in a closed area at an ambient temperature higher than the medium freezing point. Level the pump unit on the foundation or on the rigid base plate. Use anchor bolts (included). Position horizontally and avoid stresses.

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 or with inflow . Fig.1 shows pump with a suction lift, and Fig. 2 shows pump with a closed tank.

CAUTION! Medium flow direction is shown by the arrows on the pump casing. Suction and pressure casing are fitted with pressure and vacuum gauge ports.

- Before connecting lines, cut the holes in rubber plugs to allow free flow between the system and the pump.
- Suction line must be tight and as short as possible without bends (elbows, valves, throats etc.).
- Suction line diameter must be at least equal to the pump inlet port diameter.
- Protect the pump against dry running.
- Install a check valve with a strainer on the suction line. It is especially important at high suction lift, since rapid reversal of a medium stream in the suction line at pump shutdown may drain the pump and prevent suction.

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

- Install the strainer at the distance of at least 0.5 m from the water level, walls and tank bottom.
- For pumps with inflow, install the strainer at the pump inlet.
- 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

- 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 1 and 2).

Table 1

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 2

Temperature ºC	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 pipeline should be hanged up or supported in a way avoiding acting forces on the pump body (Table 3).

Permissible forces and moments exerted on ports of pumps type SM.

Table 3

Pump type	DN mm	Family no.	Material marking	Force [N]				Torque [Nm]			
				F_y	F_z	F_x	$\sum F^b$	M_y	M_z	M_x	$\sum M^b$
SM.2	25	5A	cast iron, bronze	100	120	100	185	15	30	60	120
SM.3 SM.4	32			120	150	130	230	40	55	90	230

„b" - ∑F and ∑F are vector totals of forces and torques.

All data included in table are specified for liquid temperature 20ºC - 70ºC.

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.

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).
- Follow the same requirements as for the suction line installation. Install a check valve at pressure head >15 m and on long pressure lines.

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.

4.3. Wiring

Wiring may be carried out by an authorized personnel in accordance with current regulations .
Supply line must not touch any pipes and the pump and must be protected against moisture.

- 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.

CAUTION! Remember to connect the pump to the earth

Incorrect connection may cause health, life hazard and motor damage.

- 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 pomp without liquid (dry).

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

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

5.1. Operational requirements

CAUTION! 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.

CAUTION! Before first startup, prime the pump, open valve on the pressure line and start the pump.

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

Operation in dry run is not allowed

CAUTION! Do not start the pump with a discharge valve fully closed. Run the pump with the discharge valve partially closed. The higher the pressure head, the higher the power input.

CAUTION! 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 3 min.
For a continuous running pump shall the minimal flow not be smaller than 10% of the full pump output. Pump surface temperature must not exceed 70ºC.

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

If the suction head exceeds 5 m, allow for cavitation which may accelerate the pump wear.

Suction capacity may be improved by:

- using higher diameter suction line to reduce the flow rate below 2 m/s.

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 (see Fig. 4) should be used, in order to avoid damage of the O- ring. Sealing ring faces must be clean and free from cracks and scratches.

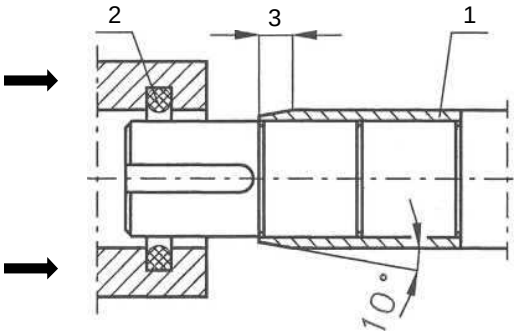

Fig.4. Installation of a mechanical seal using an auxiliary directing sleeve

1 - auxiliary directing sleeve; 2 - rubber sealing ring

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 unit operation, due to construction (monoblock) any 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.

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

Do not exceed permissible torques (see Table 4) for bolted joints.

Table 4

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.

CAUTION! Pump and motor disassembly in the warranty period without the manufacturer's approval will void the warranty

To avoid pump face damage, start the disassembly from the pressure port. Clean all surfaces, openings and channels. Replace or repair all worn parts. Protect the faces of mechanical seal rings against scratching or contamination. The running clearance between each section and the impeller must not exceed 0.1 ÷ 0.15 mm.

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 5

Wearing part		Mechanical seal	Motor bearings	Motor winding
Durability		10.000 h to 20.000 h	20.000 h to 30.000 h	20 000 h for outside temperature up to 40ºC
Replacing frequency according to the working load	Continuous work	1 to 2 years	2 to 3 years	3 years
	15 h/day 9 months/year	2 to 5 years	4 to 8 years	6 years

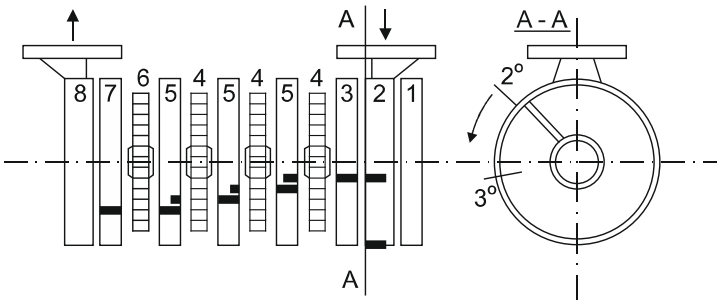

Fig.5. Arrangement of pump type **SM.1**

1 - distance member, 2 - suction casing, 3 - suction member, 4 - impeller (with 3 relief holes), 5 - suction-discharge member, 6 - impeller (with 1 relief hole), 7 - discharge member, 8 - discharge casing

The numbers are showing from which part to start to assembly the pumps of the appropriate number of stages

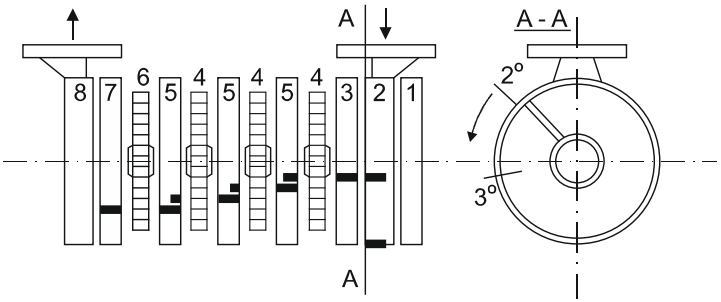

Fig.6. Arrangement of pump type **SM.2**

1 - distance member, 2 - suction casing, 3 - suction member, 4 - impeller (with 3 relief holes), 5 - suction-discharge member, 6 - impeller (with 1 relief hole), 7 - discharge member, 8 - discharge casing

The numbers are showing from which part to start to assembly the pumps of the appropriate number of stages

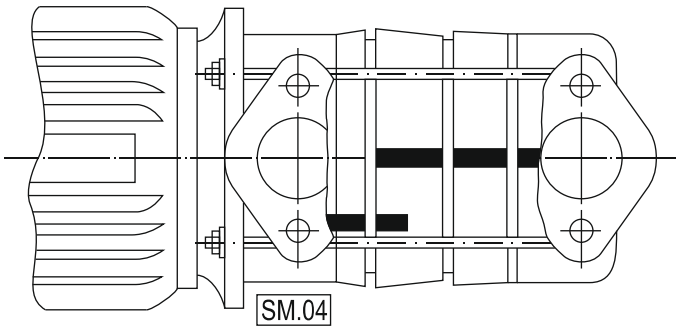

Fig.7. Arrangement of pumps type **SM.3** and **SM.4**

7. TROUBLESHOOTING

CAUTION! Before commencing any operations, shut the pump down and secure it against accidental activation.

Pump failure is most likely to occur due to electric and hydraulic system failure and incorrect pump size selected.

Table 6

Trouble	Cause	Remedy
1	*2*	*3*
Pump does not supply medium	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	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	a) Pump not proper mounted on the basement b) Foreign matter in the pump c) Damaged bearing d) Damaged impeller	a) Make steady b) Dismount and clean the pump. c) Exchange the bearing d) Exchange the impeller
Motor warmed up	a) Pump blocked b) Voltage too low c) Foreign matter in the pump d) Improper outside temperature e) Improper connection	a) Locate the reason and correct b) Check voltage on clamps. It should not differ from nominal value more than + 5%; -10% c) Dismount and clean the pump d) highest temperature cannot exceed 115ºC e) Check and put right

Pressure too low	a) Wrong pump selected b) Wrong motor speed (foreign matter, wrong power supply etc.) c) Wrong sense of rotation	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	a) Too low thermal relay setting b) Too low voltage c) Thermal relay defected d) Rotating impeded	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.

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