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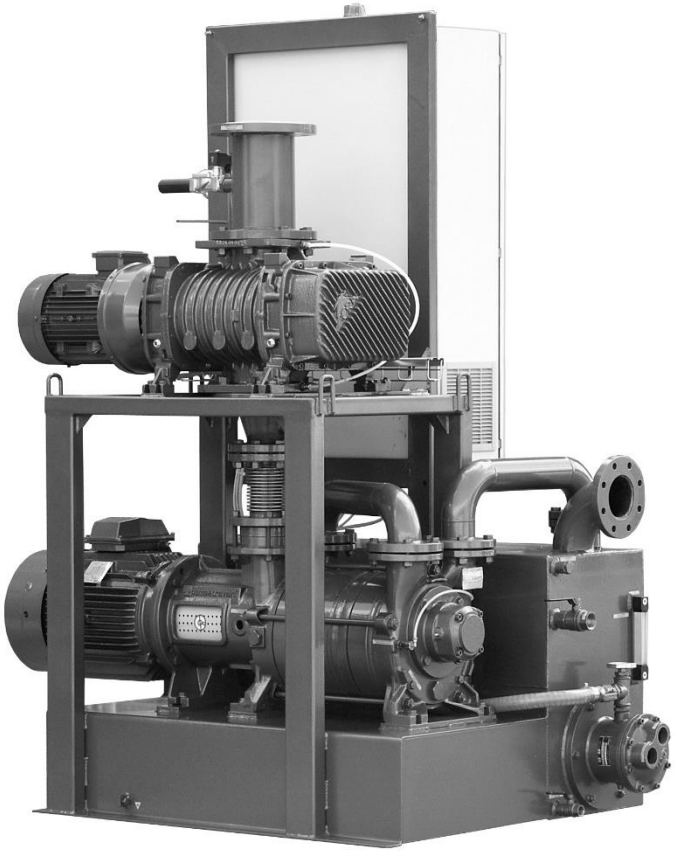
INTEGRATIVE NOTES
to the
OPERATING MANUAL FOR VACUUM SYSTEMS
HYDROTWIN



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INTEGRATIVE NOTES TO THE OPERATOR'S MANUAL FOR INSTALLATION, START-UP AND MAINTENANCE OF VACUUM SYSTEMS SERIES HYDROTWIN

This booklet is an integral part of the Operator's Manual and refers to the Liquid Ring Vacuum System indicated above. It is not intended to be used for other vacuum system without authorization of POMPETRAVAINI.

These pumps and the vacuum system are manufactured by:

POMPETRAVAINI S.p.A.

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The system must be installed and used only for the application specified in the Confirmation of Order made up by POMPETRAVAINI. This booklet must be read and understood in all its parts before carrying out the start-up of the system. This literature must be preserved and kept available to the operators who are involved with the pump.

POMPETRAVAINI does not assume any responsibility either for the use of this system in any applications different from the agreed ones or for any non-observance or faults of actuation of any indications shown in the Operator's Manual and in this Supplement.

GUARANTEE: All products from POMPETRAVAINI are guaranteed according to the General conditions of supply and guarantee shown in the Confirmation of order.
The non-observance of the prescriptions and of the instructions contained in this Manual makes the guarantee for the product invalid.

ATTENTION!
These instructions are valid only for the system and pumps with which they are supplied. They are NOT valid for the plant where they will be incorporated. The instructions for use and maintenance for the plant must be asked for from the manufacturer of the same. In any way the instructions for the plant must not be contradictory to those for the pump. In case of any doubt, please contact POMPETRAVAINI.

NOTE: The next pages refer to the Operator's Manual of the Liquid ring vacuum pumps simply called in the following "Operator's Manual". All drawings represented are only schematic and are not binding. The technical specifications shown may change due to a natural and continuous improvement of the equipment. For further information, please contact POMPETRAVAINI.

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When editing this manual, every effort has been made to help the customer to use the pump correctly in order to avoid any improper use or any damage. In case of lack of understanding, difficulties or errors, please inform us accordingly.

1 - GENERAL SPECIFICATIONS

The purpose of these notes is to be a reference for the safety on use, installation, maintenance, start-up and stopping of the Vacuum System HYDROTWIN.
Before reading these integrative Notes, the Operator's Manual supplied together with the liquid ring vacuum pump and the Booster pump and any documents about the accessories or instruments supplied together with the pump must be read and carefully understood.
These notes do not replace what is shown in the Operator's Manual, but complete it. This Manual must be carefully preserved and kept available to the skilled and qualified persons in charge with operation and maintenance of the pumps. The people involved are responsible for the operations carried out and therefore must CAREFULLY read this booklet. (Skilled and qualified personnel refers to those persons who, by their experience, training and knowledge also of the respective accident prevention rules, have been authorized by the safety manager to act for any necessary reason and are able to solve all specific problems efficiently. Also the capacity of these persons for first aid is required).

The pumps and system must be used only for the applications specified in the Confirmation of order for which POMPETRAVAINI has provided the execution, the materials used for manufacturing and the test runs, which make the pump to be perfectly corresponding to the requirements. Therefore, the pump MUST NOT be utilised for different applications. In any other case, please contact POMPETRAVAINI, who declines any responsibility for any use different from the foreseen one, when the respective approval has not been given.

The specifications of conformity are shown on the identification plate of the pump, which can be easily identified on the pump and on the Service Card shown on the EC Declaration of conformity included in the central part of the Operator's Manual.
The purpose of this booklet and of the Operator's Manual is to give all information acquired by POMPETRAVAINI for a safe and long-lasting use of their equipment. We are sure that it will satisfy the user's need for information. If there is any matter requiring more details, please contact POMPETRAVAINI for further explanations.

2 – SAFETY RULES

ATTENTION!
Please, read carefully the following prescriptions. All precautions listed on this page must be strictly observed in order to avoid serious harm to the persons and/or damages to the pump.

- ALWAYS follow the performances and the intended use in our Confirmation of order for the pump involved.
- The electric connections on the pump motor must ALWAYS be carried out by authorized and skilled persons who must observe the provisions in force.
- Any job on the pump must ALWAYS be carried out in the presence of at least 2 persons.
- The pump must ONLY be approached by a person wearing suitable garments (garments with large sleeves, ties, necklaces, etc. must be avoided) and/or using other protective items (helmets, goggles, gloves, special footwear, etc.) which are suitable for the jobs to be carried out.
- ALWAYS be informed about the places for first aid inside of the company. Furthermore, read carefully the safety and the first-aid rules in force.
- ALWAYS disconnect the pump from the plant and switch the electric power off before any intervention on it.
- The pump must ALWAYS be stopped before the operator touches it for whatever reason.
- The pump must ALWAYS be cool or cooled down before doing any maintenance job on it.
- NEVER remove the safeguards from any rotary parts of the pump when it is running.
- ALWAYS remount the safeguards, which for whatever reason have been removed, as soon as the reason for this removal has ceased.
- NEVER touch the pump or the pipes connected to it when hot liquids over 80°C are conveyed.
- ALWAYS pay much attention when touching a pump which conveys or has conveyed toxic or acid liquids.
- ALWAYS have fire-preventing equipment available in the immediate vicinity.
- NEVER run the pump into the opposite sense of rotation than the one marked directly on the pump.
- NEVER put hands or fingers into the holes or openings of the electric pump unit.
- NEVER climb on the pump or the pipes connected with it.
- The pump and pipes fitted to it must NEVER be under pressure during any maintenance job on it.

NOTE: Inside the pump there are components which may present a hazard to persons who are exposed to a contact with them also during the normal procedures of use or maintenance. See tab. 1.

Tab. 1

MATERIAL	USE	MAIN HAZARDS
Oil and grease	General lubrication, rolling bearings	Irritation of skin and eyes
Components made of plastics and elastomers	O-Ring, V-Ring, lip seal-rings, splashguards	Release of fumes in case of heating
Synthetic fibres	Tress rings	Emission of toxic dust, release of fumes in case of heating
Paint	Outside surface of the pump	Release of dust and fumes during operation, flammability.
Protective liquid	Inside surface of the pump	Irritation of skin and eyes

The non-observance of the instructions shown on this booklet or in the Operator's Manual of the pump exempts POMPETRAVAINI from any responsibility in case of damage to objects or injuries to persons and makes any safety compliance for the pump invalid.

For maintaining the validity of the safety guarantees of the pump, only original spare parts from POMPETRAVAINI must be used. POMPETRAVAINI does not take any responsibility when non-original spare parts, components, accessories or those not authorized by POMPETRAVAINI are used on the pump. POMPETRAVAINI does not take any responsibility if any kind of modification is carried out on the pump, its components and accessories which has not purposely authorized.

3 – TECHNICAL FEATURES OF THE PUMPS

3.1 – VACUUM SYSTEM HYDROTWIN

The Hydrotwin vacuum system is built as an assembly of a Booster pump for the first stage and a liquid ring vacuum pump as second stage. The Booster pump carries out a first compression of the sucked gas from the high vacuum condition to a medium vacuum that is than take in charge from the liquid ring vacuum pump for the compression at atmospheric pressure.

The use of the two pump in series allow a compression from an high vacuum to the discharge in two passages, keeping both pump within optimal running conditions. The programmable interface DVD2 on the control panel control the Booster pump to get the better performances to reach the target vacuum keeping the pump always within safety conditions for its integrity.

3.2 – LIQUID RING VACUUM PUMPS

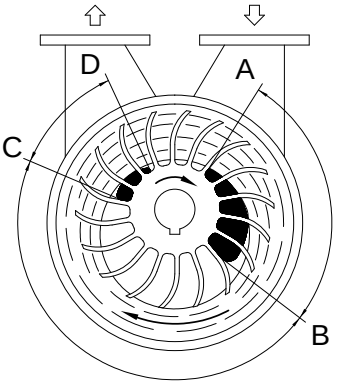
The instructions shown in this booklet refer to the following single-stage Liquid ring vacuum pumps (tab. 2).

NOTE: The capacity and the pressure rates must be considered as a guideline and correspond to the maximum values which can be reached in standard conditions of use at ambient temperatures.

Tab. 2

SERIES	FEATURES
TRV	Single stage Liquid ring vacuum pumps. Capacity to 1050 m^3/h, max vacuum 33 mbar.
TRM	Single stage Liquid ring vacuum pumps. Capacity to 350 m^3/h, max vacuum 33 mbar.
TRH	Double stage Liquid ring vacuum pumps. Capacity to 3500 m^3/h, max vacuum 33 mbar.

Fig. 1



3.3 – OPERATION PRINCIPLE

The gas sucked in by the suction flange (fig. 1)is conveyed though chamber A-B into the inside of the pump and is trapped between 2 blades of the impeller, which rotates eccentrically as to the Liquid ring vacuum that is generated peripherally in the spacer. The progressive variation of the volume, which occurs between the 2 blades and the Liquid ring, first of all creates a depression and afterwards a compression of the gas in the B-C cycle until it is expelled through chamber C-D together with a part of the liquid. Therefore this must be continuously reintegrated.

3.4 – CHARACTERISTICS OF THE OPERATING LIQUID

For a correct operation of the liquid-ring vacuum pumps, these must be fed with a clean liquid which does not contain suspended solid particles.

The temperature of the operating liquid must be kept as low as possible to ensure the optimum performances. The density of the operating liquid must be between 800 and 1200 g/dm^3 and the viscosity must be under 40 cSt (the performances of the pump vary if the operating liquid has characteristics different from water at 15 °C, used as a reference in the technical literature. For more information, please consult chapter 17).

For any values different from the above, please contact POMPETRAVAINI.

For special applications, particular versions of a pump may be taken into account. For this purpose, please contact POMPETRAVAINI.

3.5 – BOOSTER PUMP

The booster pump has two three-lobed rotors. The gas is sucked on inlet side and driven to the outlet discharge flange toward the liquid ring vacuum pump. The pump works dry keeping the gas oil free. The booster pump could work at different rotational speeds and at a very high vacuum level. It is used as a booster for the liquid ring vacuum pump to reduce the Vacuum System suction pressure below the 33 mbar that are typical for the liquid ring vacuum pump alone.
The suction gas must be free of particles and a suction temperature must be below 80°C.
For more details, please refer to the Operator's Manual of the Booster pump.

4 – TECHNICAL FEATURES OF THE VACUUM SYSTEM

The instructions shown in this booklet refer only to the vacuum system indicated above and must not be used for other vacuum systems or pumps. The vacuum system is a total recirculation water unit HYDROTWIN for the POMPETRAVAINI catalogue.

4.1 – COMPONENTS OF THE VACUUM SYSTEM

The main components of the vacuum system are:
- n° 1 vacuum pump
- n° 1 vacuum pump electrical motor
- n° 1 booster pump
- n° 1 booster pump electrical motor
- n° 1 separator tank
- n° 1 tube heat exchanger
- n° 1 switch-board.

On the system there are different control instruments and valves:
- n° 1 solenoid air flushing valve on suction pipe with silencer
- n° 1 vacuum transducer on the booster pump suction flange
- n° 1 vacuum transducer on the booster pump discharge flange
- n° 1 vacuum retain valve on the vacuum pump suction flange
- n° 1 glass level on the separator tank
- n° 1 drain valve on the separator tank
- n° 1 temperature indicator on pipe from heat exchanger to vacuum pump
- n° 1 pressure indicator on pipe from heat exchanger to vacuum pump
- n° 1 anti-cavitations valve from the separator tank to the second stage of the vacuum pump
- n° 1 refilling valve on separator tank
- n° 1 solenoid valve for lubricating system (optional).

For a detailed description refers to the overall dimension drawing that contain also a P&I draft.
Copy of the P&I is included at the last page of this booklet.

The switchboard has the function of start and stop of the vacuum system and monitor of the vacuum system working conditions. On the front panel of the switchboard there are:
- booster pump hour counter
- vacuum pump hour counter
- booster pump operating green lamp
- booster pump anomaly red lamp
- switchboard supply on green lamp
- vacuum pump operating green lamp
- vacuum pump anomaly red lamp
- 1 booster pump switch (0 booster pump turned off – 1 booster pump turned on)
- START green button
- STOP red button
- Auto/0/Man pump switch (Auto = system operating – 0 = vacuum pump turned off – Man = vacuum pump turned on manually)
- Data display and programmable interface DVD2
- emergency stop button
- 0/1 disconnecting switch (On-Off switchboard)
- Auto/0/Man flushing valve switch FV (Auto = system operating automatically – 0 = flushing disabled – Man = flushing manually operated for maintenance)
- Auto/0/Man lubricating system switch LU (Auto = system operating automatically – 0 = lubricating system turned off – Man = lubricating system manually operated for maintenance)
- on top of the switchboard orange lamp.

4.2 – FUNCTIONING OF THE VACUUM SYSTEM

The switchboard programmable interface can regulate the desired vacuum through reading the signal of the pressure transducer and operating the booster pump electrical motor with the inverter.

The supplied setting is based on the information received from the customer and should allow a correct and useful functioning of the vacuum system. If the customer needs a different target vacuum can operate on the programmable interface. For details about the functions of the programmable interface please refer to dedicated manual: DVD2 Programmable Unit.

The booster pump sucks gas through the inlet pipe and push it to the vacuum pump inlet.

The liquid ring vacuum pump discharge goes into the separator tank.

The suction pressure transmitter (Pin) and discharge pressure transmitter (Pout) read the pressure and pass the reading to the DVD2 that decide when switch on the booster pump and run the inverter at the appropriate frequency according to correct operating parameters and desired target vacuum.

The DVD2 try to reach the desired target vacuum pushing the Booster pump electrical motor to high speed but keep under control the booster pump discharge pressure (Pout) to prevent excessive compression, heating, overload of electrical motor and possible seizing of the booster pump.

In the separator tank the mixture water-gas is separated. The water remains at the bottom of the tank and the gas can escape through the discharge flange.

The separator tank has a glass level to visually check the liquid level in the tank. The liquid in the tank is re-used by the vacuum pump. The start-up level should be about the same height of the vacuum pump shaft.

From the separator tank the service liquid flow goes through the primary circuit of the heat exchanger and to the vacuum pump. On top of the exit from the heat exchanger there is a thermometer that show the service liquid temperature. The secondary circuit of the heat exchanger is dedicated to the cooling liquid and must be connected to a source of cool liquid and set to a flow that can keep the temperature of the service liquid below 20 °C.

Usually the correct flow is about the same of the vacuum pump service liquid flow at the working pressure. The working pressure of the liquid ring pump can be read as Pout on the display and the service liquid flow came from the vacuum pump performance curve.

The anti-cavitations valve on the separator tank could be opened if the desired target vacuum keep the working pressure of the vacuum pump below the cavitations pressure, otherwise could be left closed.

ATTENTION!

POMPETRAVAINI cannot be held liable for any wrong set up of system or any mistake during installation. Inside the switchboard there are all the electrical components properly installed for a correct and safe functioning according to received information. Any unauthorized modifications of the switchboard content or parameters from the customer is under his own responsibility.

4.3 – INSTALLATION OF THE VACUUM SYSTEM

The installation of the vacuum system must be carried out according to the Operating Manual of Liquid Ring Vacuum Pumps supplied with the system.

If the user for any reason do not have this manual please contact POMPETRAVAINI.

Pay attention that all the pipe and electrical connections have been correctly executed following the instruction for the electrical appliances and the national provisions in force.

There must not be obstructions on the suction and discharge side of the system.

The air grating on the switchboard must absolutely not be obstructed and they must periodically be cleaned.

The switchboard could be opened to connect the power supply to the appropriate connections must be paid attention to not damage the internal components.

The switchboard include a signal connection for an optional separation valve to be used by the operator to close the suction pipe in front of the vacuum system.

4.4 – OPERATING OF THE VACUUM SYSTEM

4.4.1 - Start-up of the vacuum system

The steps for a correct Start-up of the vacuum system are the following:

- set the correct liquid level in the separator tank
- turn to 1 the main on-off switch
- check for any anomaly on the switchboard
- set to 1 the Booster pump switch and set to auto the vacuum pump switch
- push the start button on the switchboards
- the vacuum pump start first by the star-triangle starter
- the DVD2 will start the Booster pump according to its pressure settings
- the DVD2 push the system to reach the desired target vacuum
- regulate the correct cooling flow to the hate exchanger.

If it's the first start of the system or the separator tank has been completely emptied for shipment and the liquid needs some seconds to fill up the pump, pipes and connections. After the first start-up wait some time and re-check the liquid level in the tank.

ATTENTION!
The vacuum pump must not run without the correct liquid level inside, because it can seize. Absolutely avoid the dry running of the vacuum pump and prevent excessive liquid level in the separator tank that can cause the vacuum pump running against a back pressure.

ATTENTION!
The Booster pump must not reach a discharge temperature above 135 °C. The hottest spot usually is under the blower body close to the discharge flange. Periodically check the temperature. It's considered normal a temperature increase of 10°K every 100 mbar of compression between Pin and Pout. Check periodically the temperature with a correct instrument.

4.4.2 – Exercise of the vacuum system

When correctly connected and supplied the vacuum system is able to optimize its performances according to the operating conditions by the DVD2 control unit.
During operation the user can read the suction pressure (Pin) and the discharge pressure (Pout) on the vacuum pump side on the DVD2 display and set the target vacuum requested from the process. For the instructions for the set up of the DVD2 unit refer to the DVD2 Programmable Unit manual.
The vacuum pump must not work under cavitations conditions or under condition different from that on the order confirmation.
For a better description of the vacuum pump functioning and regulation refer to the Operating Manual of Liquid Ring Vacuum Pumps. The permanence of cavitations will cause a quick wear of the pump components and a decreasing of performance. The phenomenon of cavitations is a direct consequence of the type and the temperature of service liquid, of the pressure at the pump's intake and other minor factors. If the operating conditions compel the pump to run close to the event of this phenomenon, it is advisable to check frequently the operating conditions, in order to act before a longer exposure to cavitations can damage the pump. During checking there must be no heavy vibrations on the pump or the typical noise (rattle) which indicates the presence of cavitations.
On the system there is an anti cavitations valve that open a pipe to recover a small flow of gas from the separator tank and convey it to the second stage of the vacuum pump. This valve can be left open to reduce the phenomenon of cavitations but must not be considered a permanent solution.
The user must avoid the suction of foreign bodies into the vacuum system, if necessary a filter has to be installed to prevent damage of the Booster pump with a filtering grade <= 0,005 mm.
The vacuum process can generate condensate vapour to accumulate in the separator tank or evaporation of service liquid from the separator tank. The user must periodically check the service liquid level and refill the service liquid if missing or drain the excessive liquid though the overflow level valve.

4.4.3 – Stop of the vacuum system

The steps for a correct Stop of the vacuum system are the following:

- lower the vacuum level if possible
- push the system stop button on the switchboard
- the Booster pump stop first
- the air flushing valve open (if switch on Auto) and the optional valve connection switch phase and the orange lamp on top start blinking
- if supplied the lubricating valve open for a short time (optional)
- after a first time interval the system stop the vacuum pump
- after a second time interval the system stop the flushing valve to allow re-establish atmospheric pressure
- in case of prolonged stop turn to 0 the on-off switch.

The booster pump needs an air flushing and freely rotating time for cooling down and drying of vapours to prevent seizing. The selector switch of the flushing valve must be set on Auto and it is important not to shorten this time without asking to Pompetravaini. The Man selection on the switch is reserved to authorized personnel and maintenance.

The pumps need few seconds to come to a complete stop. Wait for it before operating on the vacuum system or re-start the system.

In an Emergency Stop the system will cut power to both pumps immediately but pumps will continue to rotate for few seconds before a complete stop.

ATTENTION!
The emergency stop is not the correct way to stop the vacuum system and can cause damage to the pumps.

4.4.4 – Lubricating System (optional)

The lubricating system allow the suction of a small quantity of protective oil mist and air before the complete pump stop, so it will cover the internal rotors of the booster pump protecting them from humidity and oxidation.

This function is useful when a long term stop of the system has been scheduled. It isn't necessary for short term stop of few hours but under particular conditions.

On the front of the switchboard there is a switch that allow for a turning off of the lubricating system (0) or an automatic functioning at any shut down of the vacuum system (Auto) or a manual activation of the lubricating system (Man).

The suggested selection is Auto for long lasting intervals between working cycles, while for short and frequent working cycles the suggested selection if off (0) to reduce oil consumption and turn it on only sometimes.

The Manual selection is reserved to maintenance personnel and allow the operator to select the operating of the lubricating system.

The operator must periodically check the oil level in the tank (a minimum level sensor is optional).

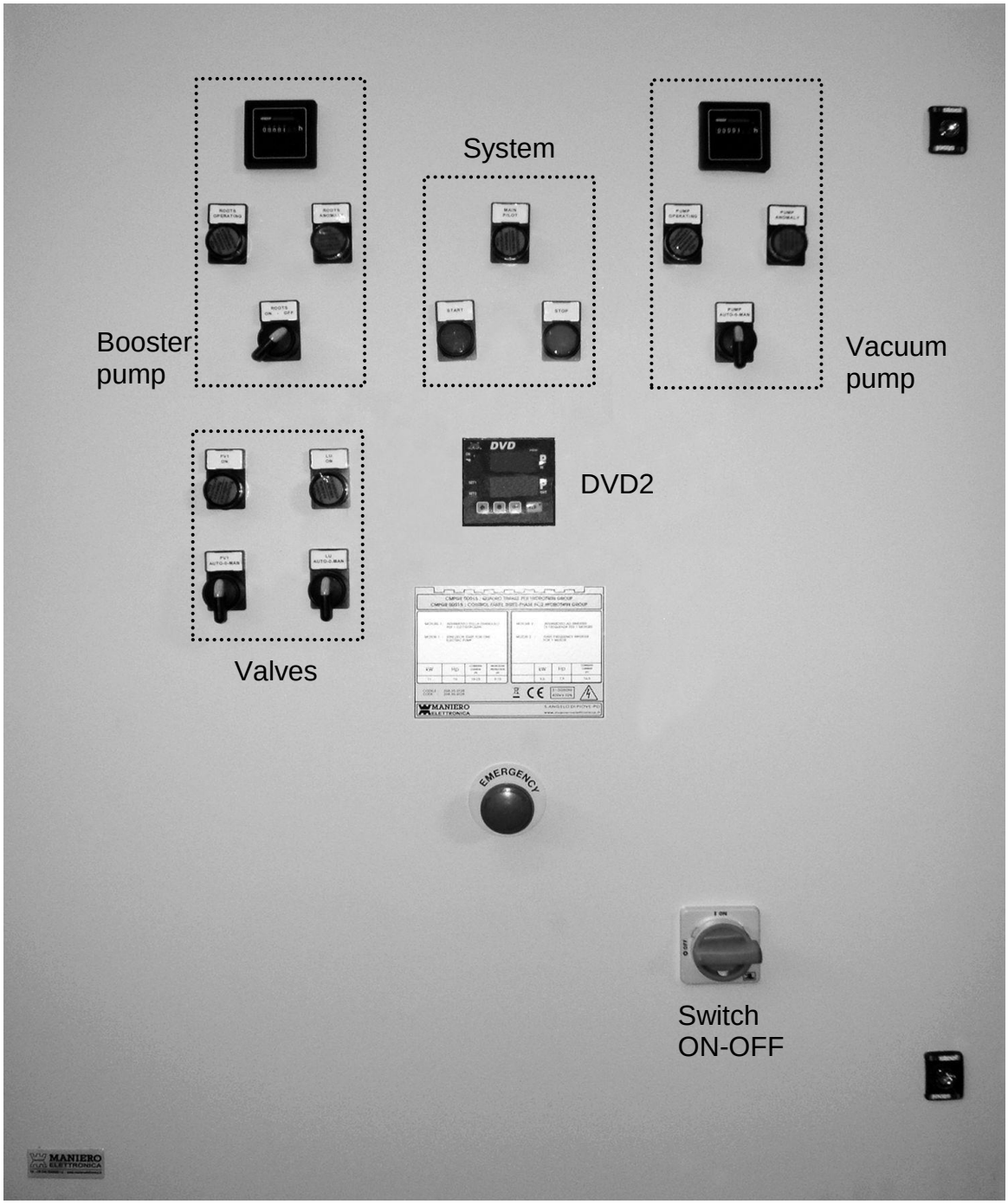
The properties of the oil for the lubricating system are:

- High water displacement performances
- Withstand 90°C of temperature
- Compatibility with seals and elastomer material
- Kinematic viscosity of max 85 mPas at 20°C
- Food grade certification when used on food plants

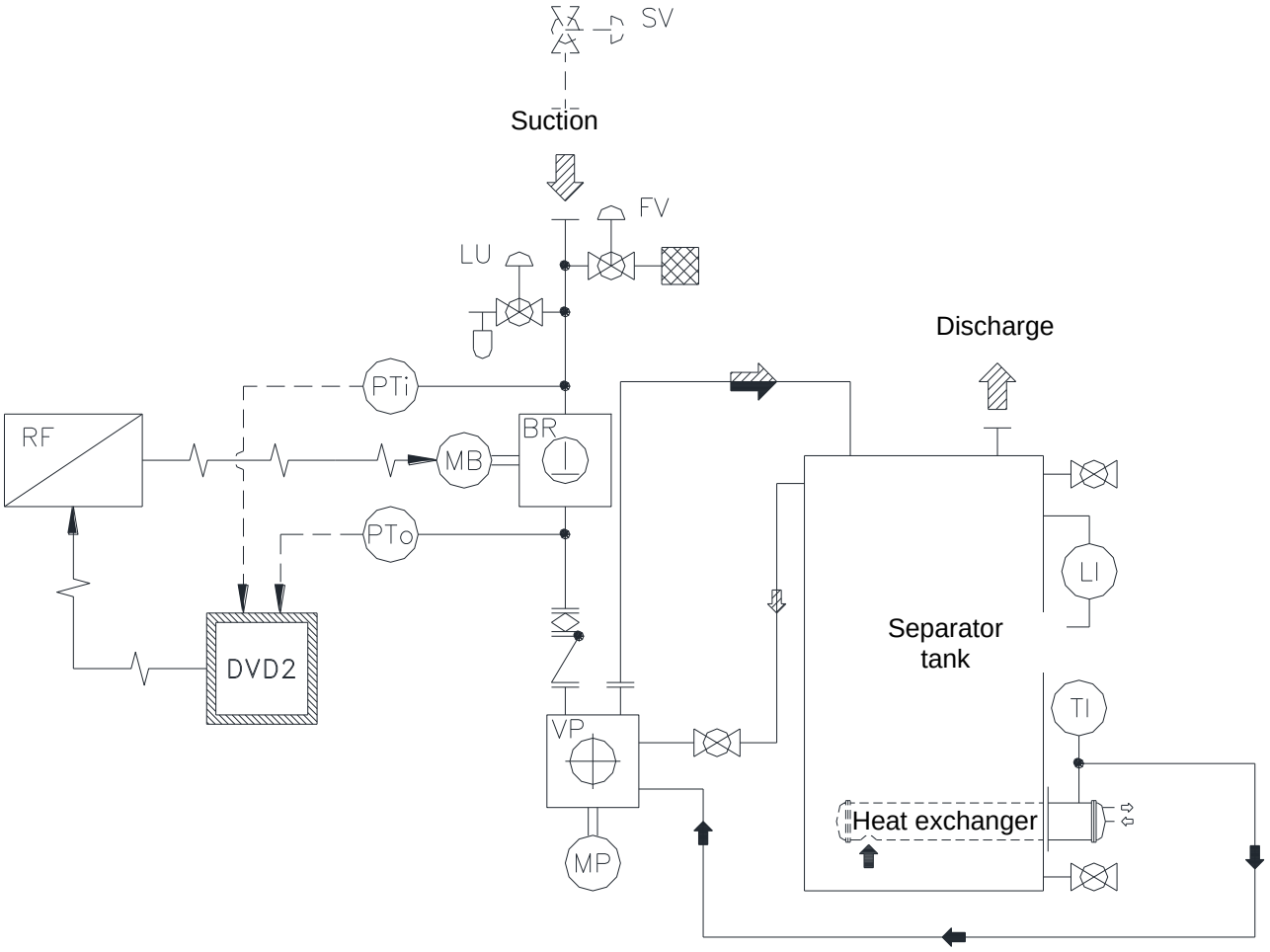
ATTENTION!
With the use of the lubricating system the service liquid in the separator tank will receive a small quantity of the lubricating oil. Dispose the service liquid according the current regulation protecting the environment.

5 – VACUUM SYSTEM SCHEME

Image of the front of the Switchboard.



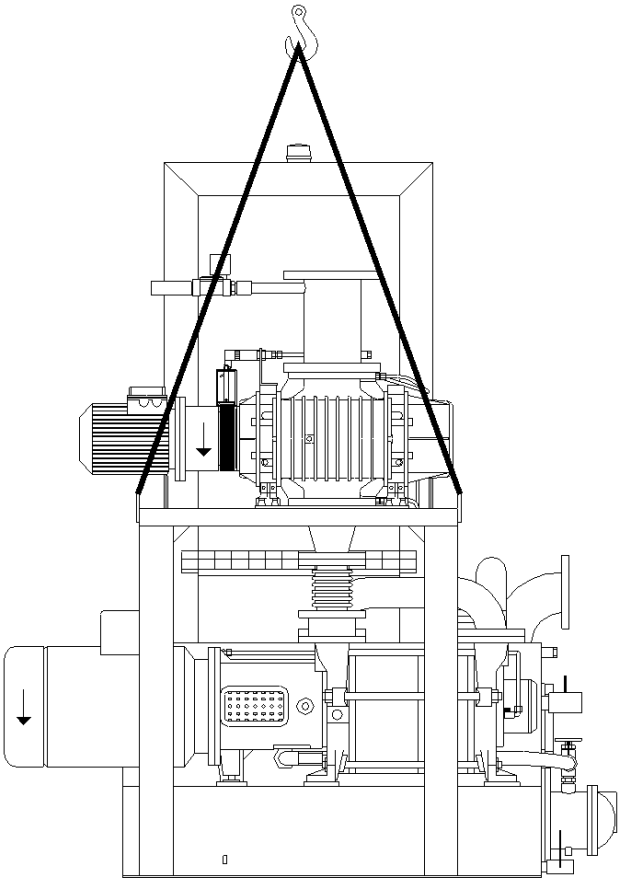
Components scheme of the Vacuum System



INDEX:

- RF: frequency regulator – inverter (inside the switchboard)
- DVD2: programmable interface (in front of switchboard)
- PTi: inlet pressure transducer (on Booster pump suction flange)
- PTo: discharge pressure transducer (on Booster pump discharge flange)
- MB: Booster pump electrical motor
- BR: Booster pump
- MP: vacuum pump electrical motor
- VP: liquid ring vacuum pump
- FV: air flushing valve with silencer (on suction pipe)
- SV: separating valve optional installed by customer
- LU: lubricating valve (optional)
- LI: liquid level indicator (on separator tank)
- TI: service liquid temperature indicator (on heat exchanger)

OK



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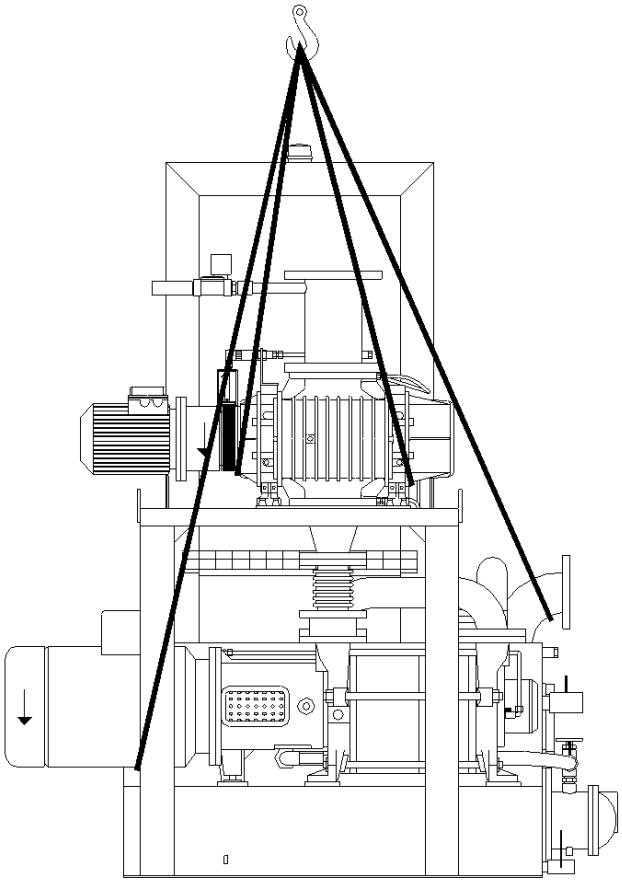


7 – TROUBLE SHOOTING

PROBLEMS	LIST OF POSSIBLE CAUSES
Vain or scarce performance, insufficient outlet pressure.	1, 2, 4, 5, 6, 7, 8, 13, 14, 15, 16, 18, 19, 24, 42,43,44,45,46,47,48,49,50,51,52,53,55,58,59
Excessive performance, outlet pressure higher than expected.	7, 20, 21,53
High power absorption.	4, 5, 7, 14, 15, 20, 21, 22, 23, 26, 27,58
Raised noise and high vibrations.	8, 9, 10, 20, 21, 27, 28, 29, 30, 31, 32,51,52,59
Overheating.	1, 2, 4, 8, 9, 10, 13, 20, 21, 22, 23, 24, 25, 27,59
Nonfunctional seal system.	22, 33, 34, 35, 36, 38, 39,61
System general malfunction	42,43,44,45,46,47,48,49,54,55,56,57,58,59,60

	CAUSES	REMEDY	PERSONNEL
1	Too small diameter of pipes.	Replace piping with larger diameter ones.	Qualified technician
2	Obstructed piping.	Remove the obstructions.	Operator
4	No airtight machinery.	Look for the leaks and remove them.	Qualified technician
5	Intake filter clogged.	Clean or replace the filter (see 7.2.9).	Qualified technician
6	Speed of rotation lower than expected.	Check the correct reading of sensors PIN and POUT, check communication between DVD2 and inverter	Qualified technician
7	Inappropriate Blower/booster sizing.	Check the machine selection and correct it.	Qualified technician
8	Insufficient primary vacuum. (LRVP)	Check the machine selection and correct it.	Qualified technician
9	No starting up delay.	Check primary pump starts correctly in advance before the booster pump. Correct, if necessary.	Operator
10	Vacuum sensor defective	Check the measuring instrument readings using another one. Replace the instrument if necessary.	Qualified technician
13	Insufficient primary vacuum. (LRVP)	Check the machine selection and correct it.	Qualified technician
14	Electric motor improperly connected.	Check the electric connection and the direction of rotation. If it is wrong, correct.	Qualified technician
15	Wrong supply voltage.	Check the electric motor supply. If it is wrong, correct.	Qualified technician
16	Damaged motor.	Check the motor operation. Replace, if it is damaged.	Qualified technician
18	Unconnected transmission coupling.	Check if transmission coupling is consumed or it has lost its place. Reset the place or replace it.	Qualified technician
19	Speed of motor rotation is not sufficient.	Check direction and speed of rotation. Check the electrical connection and correct it, if necessary.	Qualified technician
20	Speed of rotation is higher than the target.	Check the correct reading of sensors PIN and POUT, check communication between DVD2 and inverter	Qualified technician
21	Speed of motor rotation is excessive.	Check the rotation speed. Check the electrical connection and correct it, if necessary.	Qualified technician
22	Exceeding quantity of lubricant in the casing	Drain any excess lubricant, restoring the correct level.	Qualified technician

23	Deformation caused by foot tightening.	Check the uniformity of the supporting surface of feet machinery (within 2 mm). If necessary, use some shims to correct it.	Qualified technician
24	Intake gas temperature too high.	Check that the suction conditions are within the established parameters (see 3,1,2). Correct, if necessary.	Qualified technician
25	Too high machine-room temperature.	Machine-room has to be appropriately ventilated to dissipate the produced heat. If ventilation is deficient, correct it.	Operator
27	Frictions inside the blower/booster.	Stop the machine and rotate slowly by hand. If there is friction or contact between the parties, call assistance.	Assistance
28	Rotors out of phase after seizure.	Stop the machine and rotate slowly by hand. If there is friction or contact between the parties, call assistance.	Assistance
29	The contact of rotors is caused by fouling.	Stop the machine and rotate slowly by hand. If there is friction or contact between the parties, call assistance.	Assistance
30	The contact of rotors is caused by oxidation.	Stop the machine and rotate slowly by hand. If there is friction or contact between the parties, call assistance.	Assistance
31	Bearings or gears deterioration is caused by lack of lubricant.	Stop the machine and rotate slowly by hand. If there is friction or contact between the parties, call assistance.	Assistance
32	Blower/booster damage is caused by seizure.	Stop the machine and rotate slowly by hand. If there is friction or contact between the parties, call assistance.	Assistance
33	OR seal damaged.	Check the O ring integrity and replace it, if necessary.	Qualified technician
34	Damaged lip-seal on shaft.	Check the leak is on shaft and, if necessary, replace the radial shaft seal with an efficient one.	Qualified technician
35	Insufficient preloading of mechanical seal.	Check the seal preloading and reset it, if necessary. Call assistance if the leaks remain.	Qualified technician
36	Damaged mechanical seal.	Check if mechanical seal is damaged. Call assistance, if necessary.	Assistance
38	No airtight plugs or seals.	Pick out the damaged external tightness elements and replace them.	Qualified technician
39	Damaged internal tightness organs.	Stop the machine and call assistance.	Qualified technician
40	Clogged vent plugs.	Clean or replace vent plugs.	Qualified technician
41	Degraded silencers.	Replace the degraded silencer components.	Qualified technician
43	DVD2 error	Check communication with PIN and POUT sensors, correct it	Qualified technician
44	DVD2 error	Check power supply, correct it	Qualified technician
45	DVD2 error	Check inverter communication, correct it	Qualified technician
46	Booster pump doesn’t start	Check connection between DVD2, inverter and electrical motor, correct it	Qualified technician
47	Booster pump doesn’t start	Check DVD2 and inverter parameters, correct it	Qualified technician
48	Booster pump doesn’t start	Check DVD2 and inverter parameters	Assistance
49	Insufficient primary vacuum. (LRVP)	Check status of primary pump, correct it	Qualified technician
50	Fault of drying step at shut down	Check functioning of solenoid valve, check manually, correct it or replace	Qualified technician
51	Insufficient primary vacuum. (LRVP) or cavitation	Check correct functioning and efficiency of heat exchanger, correct it	Qualified technician
52	Insufficient primary vacuum. (LRVP) or cavitation	Check POUT pressure, correct it	Qualified technician

53	Stuck or clogged check valve	Check functioning of check valve, correct it or replace	Qualified technician
54	Red bulb inverter anomaly on	Check inverter connection and settings, correct it. Turn off the system for 10 seconds.	Qualified technician
55	Red bulb inverter anomaly on	Call assistance	Assistance
56	Red bulb primary pump anomaly on	Check cable connection and star-delta starter, correct it	Qualified technician
57	Red bulb primary pump anomaly on	Call assistance	Assistance
58	Liquid accumulating inside separator tank	Check the process if condensation occurs, drain the tank to correct level	Qualified technician
59	Liquid evaporating from separator tank	Check the process if evaporation occurs, refill the tank to correct level	Qualified technician
60	Insufficient primary vacuum. (LRVP)	Check for pH of service liquid that may have damaged the primary pump, correct it	Qualified technician
61	Losses from primary pump mechanical seal	Check and correct it	Qualified technician

NOTES

PUMP model	Serial Number	Computer Number	Year of manuf.
.....	.....	.....	.....

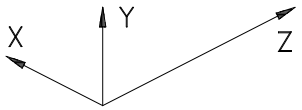
GAS handled	Capacity	Suction Pressure	Discharge Press.	Temperature
.....	.....m^3/h	.....mbar	.....mbar	.....°C

☐ Lethal ☐ Toxic ☐ Noxious ☐ Corrosive ☐ Malodorous ☐ .....

Service LIQUID	Capacity	Temperature
.....	.....m^3/h	.....°C

TOTAL WEIGHT
.....KGS.

MAXIMUM DIMENSIONS



X =.....cm
Y =.....cm
Z =.....cm

NOISE (measured at 1 m)
Pressure =.....dB(A)
Power =.....dB(A)

INSTALLATION	
☐ Inside	☐ Outside
☐ Explosive area	☐ .....

SERVICE	
☐ Continuous	☐ Intermittent
☐	

MOTOR type / Frame	No Poles	No Revolutions	Absorbed power	Installed power
.....	.....	.....RPM	.....Amp	.....kW / .....HP
Frequency	**Supply**	**Enclosure**	**Insulation class**	**Absorbed power**
.....Hz	.....Volt	IP.....	.....	.....kW / .....HP

COMMENTS

MONOSTAGE CENTRIFUGAL PUMPS

MAGNETIC DRIVE MONOSTAGE CENTRIFUGAL PUMPS

SELF-PRIMING CENTRIFUGAL PUMPS

MAGNETIC DRIVE SELF-PRIMING CENTRIFUGAL PUMPS

MULTISTAGE CENTRIFUGAL PUMPS

LIQUID RING VACUUM PUMPS

LIQUID RING COMPRESSORS

PACKAGE VACUUM UNITS WITH PARTIAL OR TOTAL SERVICE LIQUID RECIRCULATION

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