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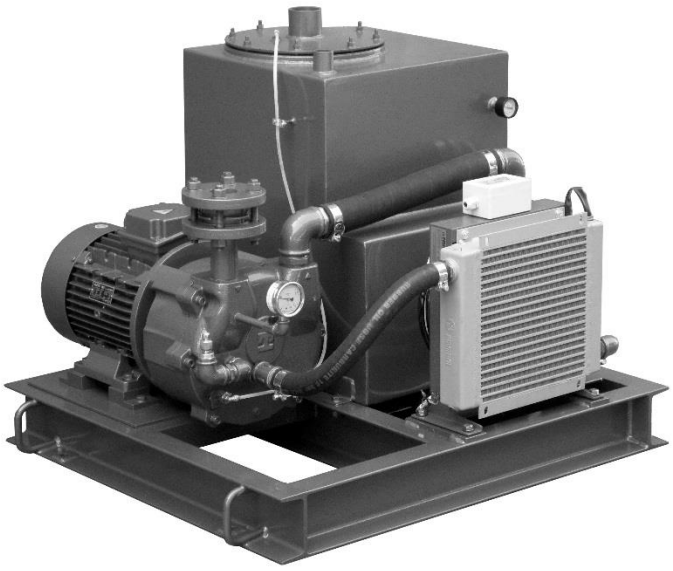
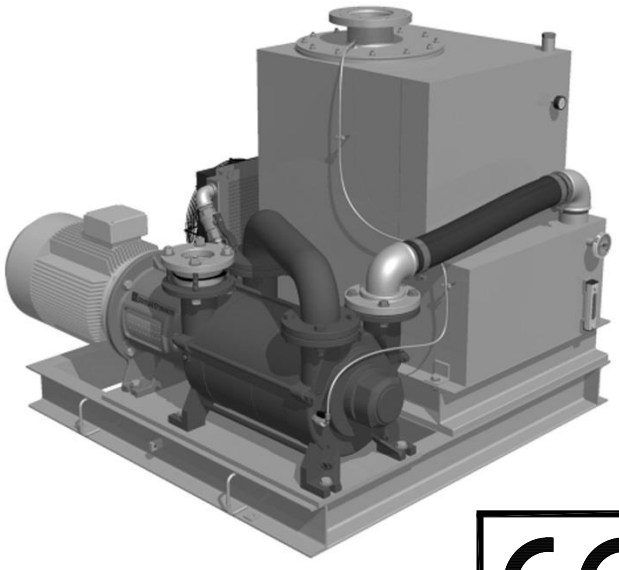
ADDENDUM to

OPERATING MANUAL LIQUID RING VACUUM PUMPS AND COMPRESSORS

For Systems type

OILPACK





INTRODUCTION

These instructions are for the installation, maintenance and repair of OILPACK systems.
These instructions are to be used along with the "OPERATING MANUAL FOR LIQUID RING VACUUM PUMPS AND COMPRESSORS" and "ASSEMBLING AND DISASSEMBLING INSTRUCTIONS FOR LIQUID RING VACUUM PUMPS", which are a reference for safe installation, operation, maintenance and repair.
Caution, before start working on the pump or system, it is very important to follow safety procedures mentioned in chapters 2 and 15 of the "Operating Manual", and important to:

- wear appropriate protective apparel (helmet, glasses, gloves, shoes, etc.)
- turn off electrical power supply
- close suction valves and feeding circuit
- disconnect the pump from the system, taking care not to damage any components
- use proper emergency measures when pump is handling dangerous liquids or gases
- empty the pumped liquid through the drain connection and if necessary, flush the pump.

When requesting spare parts or technical information for the pump, always provide pump model number and serial number which are printed on the pump nameplate: therefore, it is recommended not to remove the pump nameplate or, in case this action will be necessary, write the serial number on the pump (for example on the casing).
Should additional information be required, please do not hesitate to contact POMPETRAVAINI or the closest representative. Should there be any difficulties in repairing the pump, it is recommended to send the pump for repair to POMPETRAVAINI or the local authorised representative. Any pump repairs and/or system work carried out by others will not be guaranteed by POMPETRAVAINI.

REMARKS: Components of the systems are identified with ITEM (VDMA) numbers, details and differences between them are defined in tables and drawing.
All diagrams provided in this document are purely schematic and non-binding.
For further information consult POMPETRAVAINI.

WARRANTY: Products manufactured by POMPETRAVAINI are guaranteed to meet the conditions listed on the general terms & conditions of sales and/or conditions listed on the order confirmations.
Failure to strictly adhere to the instructions and recommendations listed in this manual will void manufacturer's warranty.

INDEX

REMARKS: Refer to "OPERATING MANUAL FOR LIQUID RING VACUUM PUMPS AND COMPRESSORS" for any missing chapters.

The liquids and the gases handled by pumps and/or components could be potentially dangerous to persons and environment: disposal must be carried out in compliance with applicable local laws and with a proper environment management.

The present manual is not applicable to pumps subjected to the ATEX 2014/34/EU directive. In case the pump is assigned in environments subjected to the application ATEX 99/92/CE directive or in case the pump is provided with a nameplate indicating the ATEX stamp, it is strictly forbidden to proceed with its start-up but it is necessary to consult POMPETRAVAINI for clarifications.
A specific manual is available for pumps subjected to the ATEX 2014/34/EU directive.

In preparing this manual, every possible effort has been made to help the customer and operator with the proper installation and operation of the pump and/or system. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.

REMARKS!

For the missing chapters see: “OPERATING MANUAL FOR LIQUID RING VACUUM PUMPS AND COMPRESSORS”.

1 - UNLOADING, LIFTING AND MOVING INSTRUCTIONS

For unloading, lifting and moving instructions refer to the instructions listed in chapter 5 of the “OPERATING MANUAL FOR LIQUID RING VACUUM PUMPS AND COMPRESSORS”.

Lifting eyebolts fitted on single components (of the assembly pump or motor) should not be used to lift the total assembly.
Use the appropriate eyebolts fitted on the tank separator.
Figures 1 and 2 show the correct and incorrect methods for lifting the systems.
For more detailed information and additional explanation consult our Sales Office.

YES

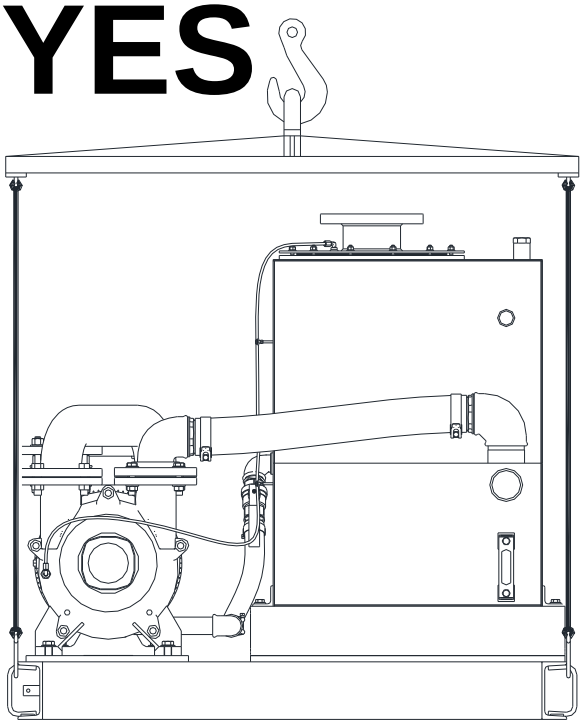


Fig. 1

NO

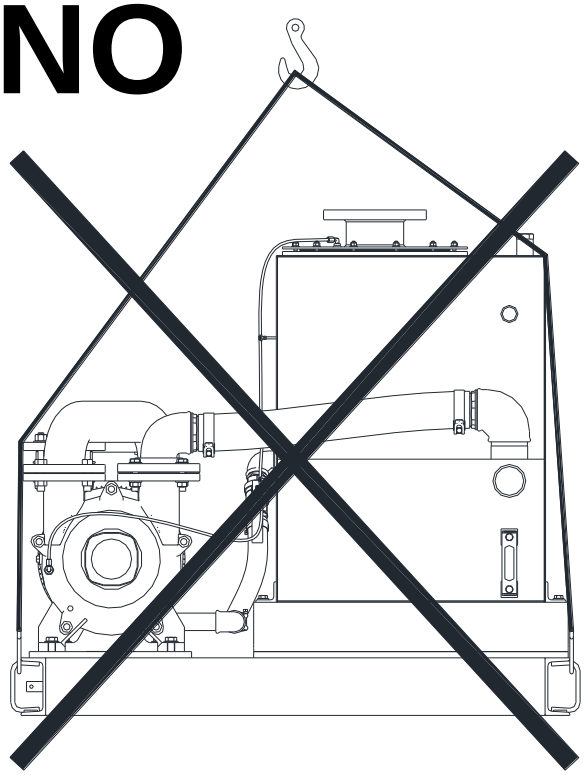


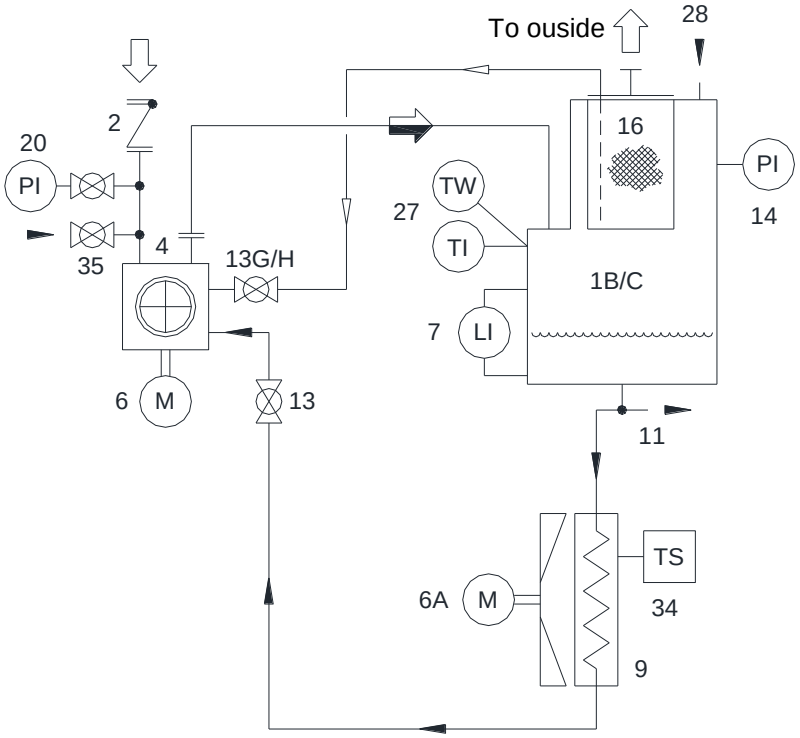
Fig. 2

2 – INSTALLATION OF “OILPACK” SYSTEMS

2.1 – INSTALLATION

OILPACK systems are supplied with air/oil separator/reservoir, air cooled heat exchanger with cooling fan and other accessories factory connected and installed on a single compact frame.
See chapter 3 of this document for a detailed description.
Installation of OILPACK system is similar to that of a vacuum pump or compressor employing total recovery service liquid (see chapters 7.3 and 7.4 of Operating Manual).
It is important to properly engineer the connecting piping to the system suction and discharge, cooling lines, flushing lines, and draining lines (an informative label is provided with each free connection of the system).
It is recommended to pipe gas venting connections to outdoor.
The heat exchanger with cooling fan is sized to provide pump service oil at operating temperatures between 60 and 80^{0}C.
An installation schematic is provided by fig. 3 and legend of this manual. Note however, the schematic per fig. 3 is of the generic type, contact our technical and commercial offices should more details be required.

2.2 – TYPICAL INSTALLATION SCHEMATICS



1B/C		Reservoir separator/ filter container
2	●	Non return valve
4		Liquid ring vacuum pump
6		Electric motor of vacuum pump
6A		Electric motor of fan heat exchanger
7		Level gauge glass
9		Fan heat exchanger
11		Drain
13		Closing valve
13G/H		Anticavitazione/ oil recovery valve
14		Manometer
16		Oil Demister Filter
20	●	Vacuum gauge
27		Thermometer
28		Fill-up connection
34	●	Thermostat
35	●	Vacuum control valve

Fig. 3

● = Item NOT included on standard design

(For special designs, not covered by these diagrams, consult our Sales Office).

3 – ENGINEERING DATA OF "OILPACK" SYSTEMS

3.1 – OPERATING DESCRIPTION

OILPACK systems are designed with TOTAL LIQUID RECOVERY (see fig. 4 for Items with descriptions). There is no need for oil make-up from outside sources other than occasional top ups for small quantities that may have been lost due to evaporation. Air cooled heat exchangers with cooling fan are accurately sized to provide optimum oil operating temperature for the vacuum pumps or compressors, any fresh oil make up will be primarily to keep the recommended oil level.

OILPACK systems are essentially including a liquid ring pump ITEM 4 from our series **TRH**, **TRS**, **TRM**, **TRV**, a separator/reservoir tank ITEM 1B/C which acts also as frame, an air-cooled heat exchanger with cooling fan ITEM 9 and an oil demister ITEM 16. Recommended service liquid is TURBINE type mineral oil or equal (see tab. 1), it provides superior vacuum levels down to approx. 15 mbar, compared to that of water that reaches only approx. 100 mbar when the service liquid is air cooled. Gas handled by pump ITEM 4 is discharged together with a certain amount of oil into the special designed frame ITEM 1B/C which functions as air/oil separator and allows settlement of any incoming liquids or powders. As the liquid ring pump evacuates and compresses the gases it transmits the generated compression heat to the oil (the service liquid). Before being returned to the pump the oil is cooled between 60 and 80°C by the air-cooled heat exchanger ITEM 9.

Tab. 1 - SUGGESTED OILS

MANUFACTURER	TYPE
AGIP	OTE 32
ESSO	TERESSO 32
LUBRA	OLNEO 32
MOBIL	DTE LIGHT 32
SHELL	TURBO OIL 32
TOTAL	PRESLIA 32

Pump discharged gas is vented after going through the oil demister element ITEM 16 which coalesces any oil particles or 'smoke' the gas may have. The coalesced oil is then returned to the vacuum pump suction via a strategically installed scavenger line. A pressure gauge ITEM 14 is fitted on the separator ITEM 1B/C to indicate any back pressure created by oil demister element clogging (see chapter 3.2 for replacement instructions).

Contrary to rotary vane vacuum pumps, there are no moving parts that come in contact with each other, therefore there is no need for lubrication of the pump internals; OILPACK are very robust and reliable pump packages which offer extended operating life even when handling condensable gases.

See tab. 2 for materials of construction and tab. 3 for some engineering data.

EXAMPLES OF “OILPACK” SYSTEMS (General schematic drawings)

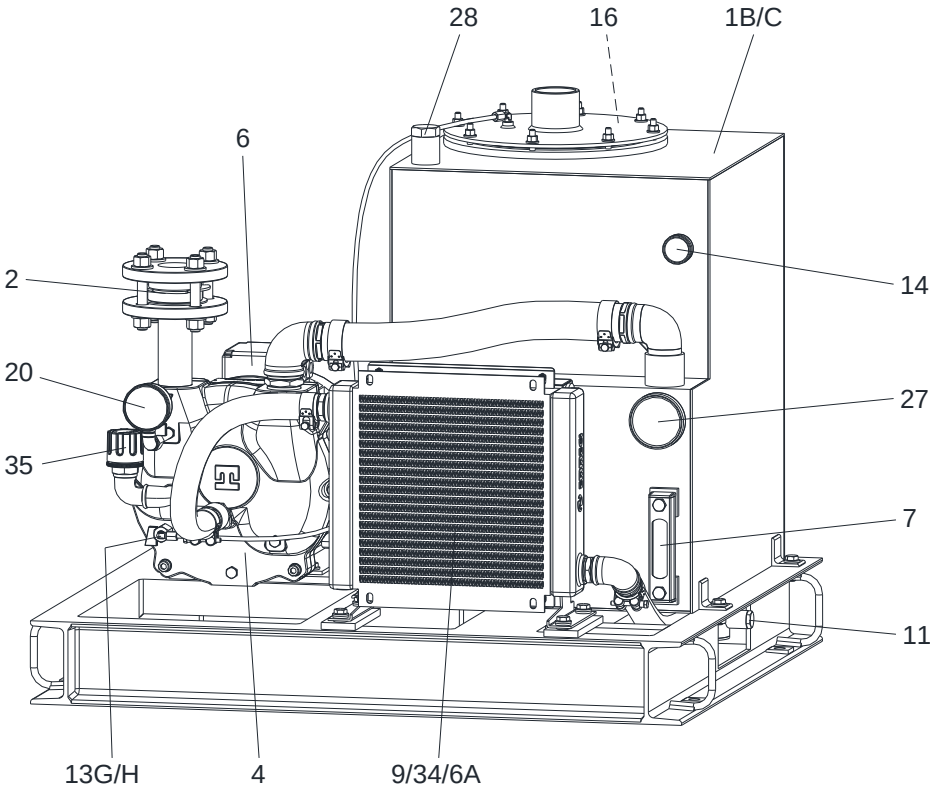


Fig. 4

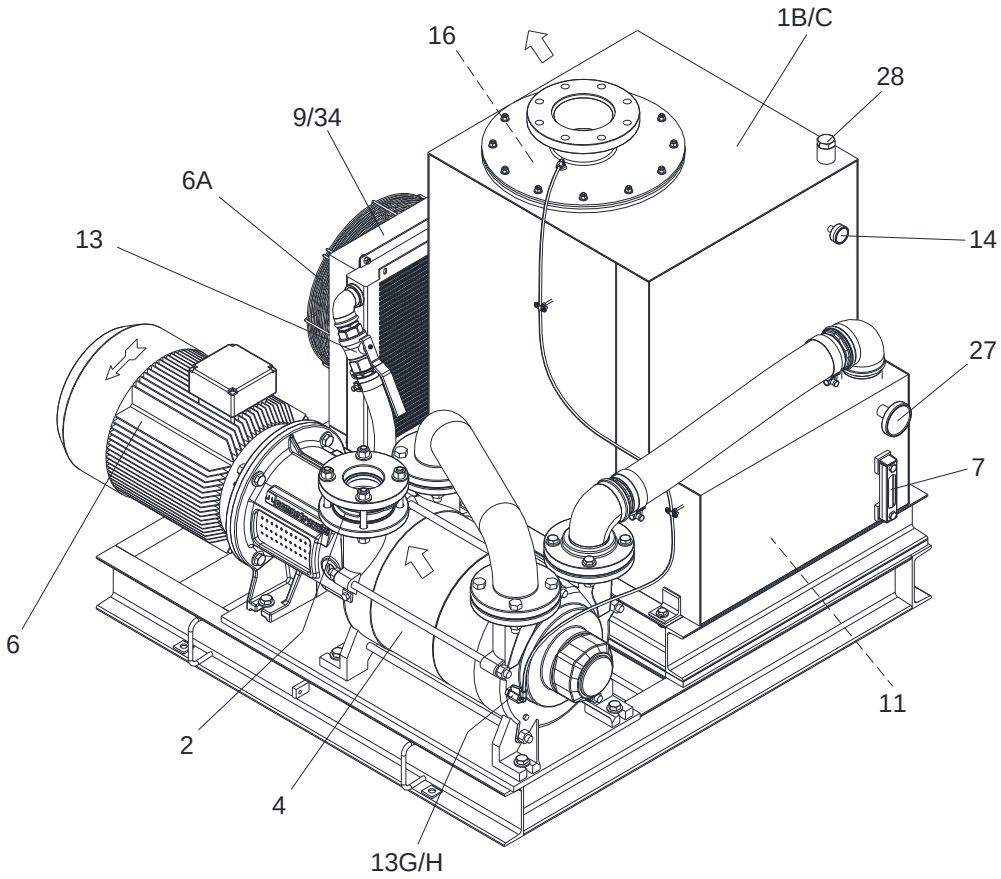


Fig 4

1B/C	Reservoir separator/ filter container	13G/H	Anticavitazione/ oil recovery valve
2	Non return valve	14	Manometer
4	Liquid ring vacuum pump	16	Oil demister filter
6	Electric motor of vacuum pump	20	Vacuum gauge
6A	Electric motor of fan heat exchanger	27	Thermometer
7	Level gauge glass	28	Fill-up connection
9	Fan heat exchanger	34	Thermostat
11	Drain	35	Vacuum control valve
13	Closing valve		

(For ITEM numbers refer to fig. 4 and relative legend).

OILPACK series systems use mineral oil for service liquid. Take great care to avoid oil spills as it is pollutant and dangerous to the environment: therefore, keep high and constant care to avoid oil leaks and quickly clean any spillage in compliance with local environmental laws.

It is very important to monitor the service oil temperature; when the oil temperature exceeds 90°C there is the danger of seizing the pump and the gaskets may start leaking.
Every 100/200 working hours it is suggested to check the oil level in the frame reservoir ITEM 1B/C, make-up oil if necessary and change the oil every 4000/6000 working hours (depending upon the use and the application): make sure oil disposal is in compliance with local environment management and with local laws.
Increase oil checking frequency when handling gases with suspended particles that could alter oil quality and characteristics. Condensable vapours can be discharged through the discharge flange if they have low boiling point or through the draining connection ITEM 11, if their specific gravity is above 0.9 and with system not operating.
With service, the oil demister filter becomes impregnated with oil particles; the pressure gauge ITEM 14 installed at the housing ITEM 1B/C will provide an indication of the filter being plugged; pressure reading over 0.3 bar is an indication that the filter needs replacement.
With higher discharge pressures the discharged air quality will decrease and the vacuum pump absorbed power will increase.
Valve ITEM 13G/H connected to the pump suction should be left “open” in the minimum position. This provides vacuum to the scavenger line removing the coalesced oil from the bottom of the filter cartridge.

Tab. 2 - STANDARD MATERIALS FOR “OILPACK” SYSTEMS`

COMPONENT		MATERIAL DESIGN
Liquid ring vacuum pump		**GH - F - RA**
Reservoir separator/ filter container		Carbon steel
Fan heat exchanger	Cooler core	Aluminium
	Shroud	Carbon steel
	Fan – Guard	Carbon steel-Plastic coated
Piping		Carbon steel - Carbonite rubber
Valves – Thermometer		Brass
Level gauge		Polycarbonate

For vacuum pump materials (GH - F – RA) see chapter 4 of the “Operating Manual”.

Tab. 3 - GENERAL AND NOT BINDING ENGINEERING DETAILS FOR “OILPACK” SYSTEMS

SYSTEMS SERIES	Maximum power of motor	Dry weight without Pump and Motor kg	Quantity of oil circulating in the whole system liters
2	4 kW 2 poles / 50 Hz	100	22
4	7,5 kW 4 poles / 50 Hz	280	33
5	18,5 kW 4 poles / 50 Hz	350	58
6	30 kW 4 poles / 50 Hz	360	58

For more detailed information consult our Sales Office.

3.2 – REPLACING OIL DEMISTER FILTER

Remove oil scavenger line at pressure fitting (see fig 5), remove filter cover from separator/reservoir ITEM 1B/C, remove old oil demister filter. Apply liquid sealant to gasketing area of new filter (not required for filters that come with attached gaskets), insert new filter in tank, replace cover, be sure to evenly torque all bolts, reconnect the oil scavenger line.

Dispose the waste according to the local environmental laws.

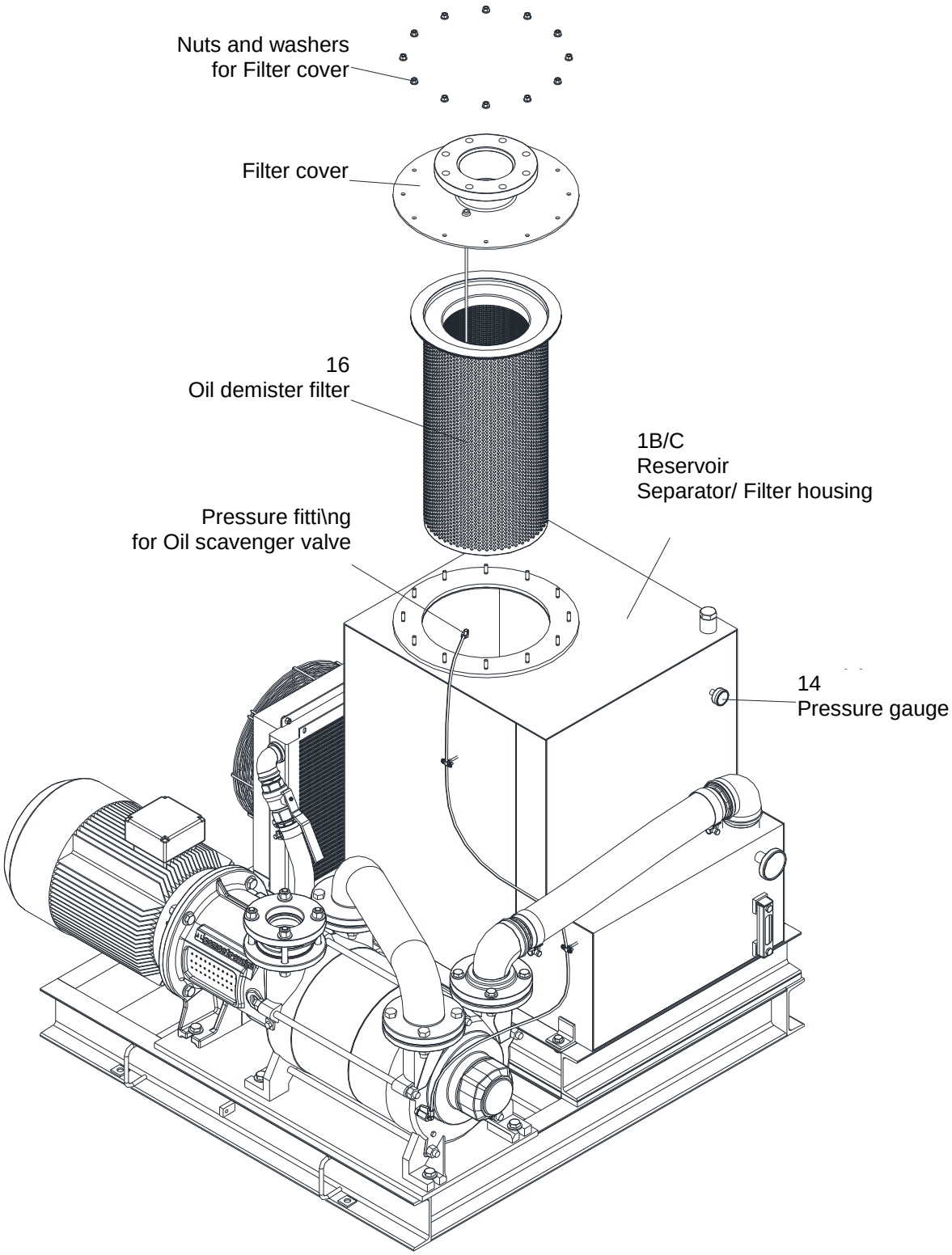


Fig. 5

4 - START-UP, OPERATING AND SHUT DOWN PROCEDURES OF “OILPACK” SYSTEMS

Upon receipt and/or completion of installation, before turning on the power to the electric motor, rotate the pump shaft by hand to make sure that the pump rotor is free. In the event the shaft does not turn, try to free it up by applying a torque to the pump coupling with a pipe wrench.
To free the rotor of a mono-block style pump (without coupling) insert a bolt (or similar tool) to threaded shaft end (fan cover side) and torque by hand with rocking motion until shaft rotates.

CHECK PUMP-MOTOR COUPLING ALIGNMENT!
This must be done prior to the first start-up, and before every start-up if the pump or motor has been removed from the installation for maintenance or other reasons (see chapter 8.2 of the “Operating Manual”).

Fill separator with recommended oil grade at filling plug ITEM 28 until proper oil level is reached as indicated at oil sight glass ITEM 7. See tab 1 and 3 for recommended oil type and quantity.
Prior to pump start-up, verify that all auxiliary installed components are ready for use and are set in the operating position (i.e.: double mechanical seals are pressurized with buffer liquid, cooling liquid is open to heat exchanger, etc.) and the pump bearings have lubricants.
If the gas and/or service liquid temperatures are at the dangerous levels (extreme hot or cold), it is recommended to insulate pump, piping and separator to prevent losses of heat energy as well contact with human skin.

4.1 – START-UP

CAUTION!
Possible contact with hot fluids and/or hot surfaces. Operate only with safety protective devices.

Refer to above chapter 3 and fig. 4 for ITEM numbers.
NOTE: Depending upon the system type and configuration some ITEMS may not be shown in the list.
Open all valves at gas discharge side and partially close those in the gas suction side.
Draining plug ITEM 11 at bottom of separator ITEM 1B/C must be left closed.
Start all instrumentations such as thermostats, level sensors, pressure sensors and circuits for cooling and flushing.
Fully open isolating valve ITEM 13 and partially open anti-cavitation/ oil scavenger valve ITEM 13G/H.
Start the vacuum pump ITEM 4.
Gradually open the installation flow regulating valve until the desired vacuum level is reached.
Check for abnormal operating symptoms (refer to chapters 12 and 14 of “Operating Manual”).

4.2 - OPERATING

After starting the vacuum pump check the following:
- the vacuum level is as desired or adjust the flow regulating valve to the required vacuum
- the oil temperature is between 60 and 80°C. If required, adjust the thermostat on the fan heat exchanger
- motor does not draw more amperage than shown on its nameplate
- the pump-motor assembly does not have abnormal vibrations or noises such as cavitation (i.e.: if there is cavitation, open the anti-cavitation/oil scavenger valve ITEM 13G/H)
- the frame temperature at full load, does not exceed approximately 85°C
- that there are no leaks from mechanical seals, joints, flushing or cooling liquid lines
- liquid level in separator and frame is between the minimum and the maximum
- the pressure gauge of the oil demister separator does not read more than 0,3 bar. When this value is exceeded it will be required to change the oil demister filter (see chapter 3.2).

If the gas discharge is not open to the immediate atmosphere but it is piped to other locations, the pump discharge should be checked for back-pressures that could cause higher power consumption and loss of pump capacity.

4.3 – SHUT DOWN

Where possible, gradually decrease the vacuum level to 400/900 mbar in about 10 seconds max. The discharged service liquid from pump ITEM 4 helps producing a slow deceleration rather than sadden stop.
Turn off motor ITEM 6 and any accessories and flushing circuitry.
Make sure the non-return valve ITEM 2, or similar, at suction and discharge lines are leak tight.
Disconnect electric power supply unless a restart is expected in the very immediate future.

5 – MAINTENANCE OF FAN HEAT EXCHANGER

(See fig. 4 for identification letters and numbers of components).

5.1 - DISASSEMBLY

Prior to starting work on the unit it is important to check the unit is not running, electrical power is off, the hydraulic circuit has been isolated upstream and downstream of the heat exchanger.
Loosen the hose clamps at heat exchanger inlet and outlet, remove hoses from their hose barbs, remove bolts from heat exchanger feet and the heat exchanger itself, drain any oil out of the heat exchanger.

5.2 – CLEANING METHODS

Cleaning method will vary depending on the type of deposits, varnishes, and accumulation of solids; it must be chosen between those that do not harm the structure and materials of the heat exchanger. Consult with suppliers of suitable cleaning materials. Depending on the instructions from the suppliers there may be commercially available chemical liquid products suitable to remove heavy deposits in their pure state or mixed with water. Cleaning with pressurized liquid must be done with pressures not exceeding 1.5 bar.
If the deposits are too difficult to be removed by means of chemical solutions it is possible to attempt their removal with mechanical tools (such as metal scalps with rounded end) but use extreme caution not to damage the metal surfaces.

5.3 - ASSEMBLY

Hydrotest the heat exchanger to about 0,5 bar to verify its integrity.
Install unit using steps reverse of those for removal; it is recommended to replace all old gaskets with new gaskets.

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NOTES

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

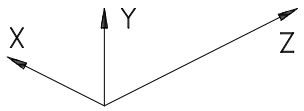
GAS handled	Capacity	Suction Pressure	Discharge Press.	Temperature
.....	.....m^3/h	.....mbar	.....mbar	.....°C

☐ 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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ISO 9001

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