



ADDENDUM to

OPERATING MANUAL

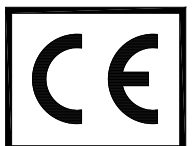
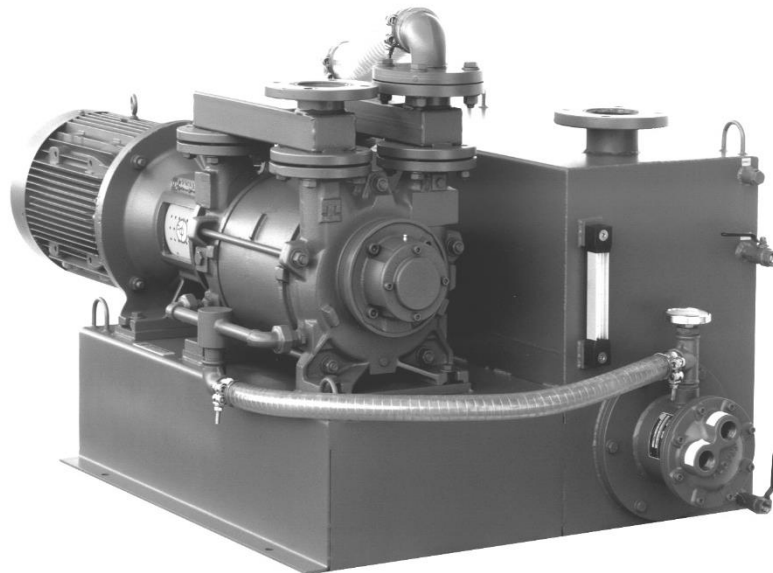
LIQUID RING

VACUUM PUMPS AND

COMPRESSORS

for Systems type

HYDROPACK



INTRODUCTION

These instructions are for the installers and maintenance personnel for installation, maintenance and repair of HYDROPACK systems.

They match with and relates to 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.

However, 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 the appropriate protective apparel (helmet, glasses, gloves, shoes, etc.)
- switch off electricity
- close suction valves and feeding circuit
- disconnect the pump from the system, taking care not to damage any components
- adopt proper emergency measures in case the pump is handling dangerous liquids or gases
- empty the pumped liquid through the drain connection, if necessary flush the pump.

When requesting spare parts or technical information for the pump, always quote the pump model number and serial number which is 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 flange).

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: Numbers named ITEM (VDMA) identify all the particulars, different from each other, composing the systems.

All the given diagrams are purely schematic and non-committal.

For further information consult POMPETRAVAINI.

WARRANTY: All 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.

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REMARKS: For the missing chapters refer to the "OPERATING MANUAL FOR LIQUID RING VACUUM PUMPS AND COMPRESSORS".



The liquids and the gases handled by the pumps and also their parts could be potentially dangerous for persons and environment: provide their eventual disposal in conformity with the laws into force and a proper environment management.



The present manual is not assigned for 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 strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.

For pumps subjected to the ATEX 2014/34/EU directive it is available a dedicated integrative manual.

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 consult the “OPERATING MANUAL FOR LIQUID RING VACUUM PUMPS AND COMPRESSORS”.

5 - UNLOADING, LIFTING AND MOVING INSTRUCTIONS

For unloading, lifting and moving instructions of the systems 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 2A and 4A show the correct and incorrect methods for lifting the systems.

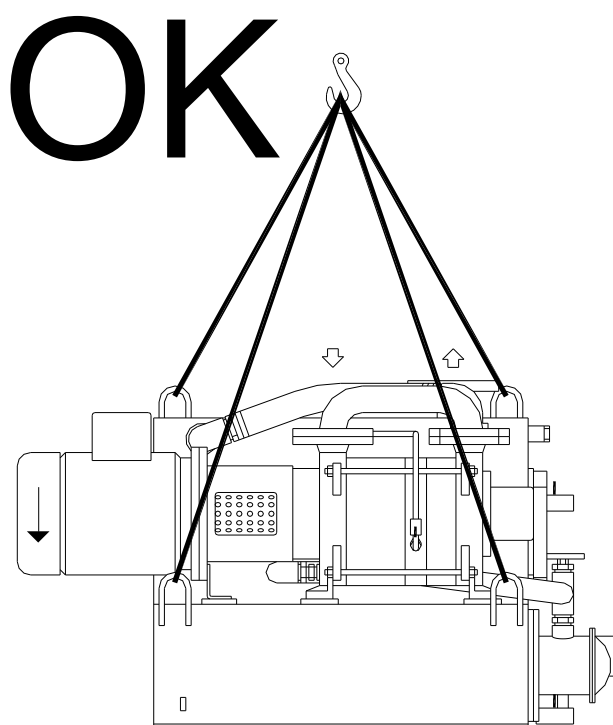


Fig. 2A

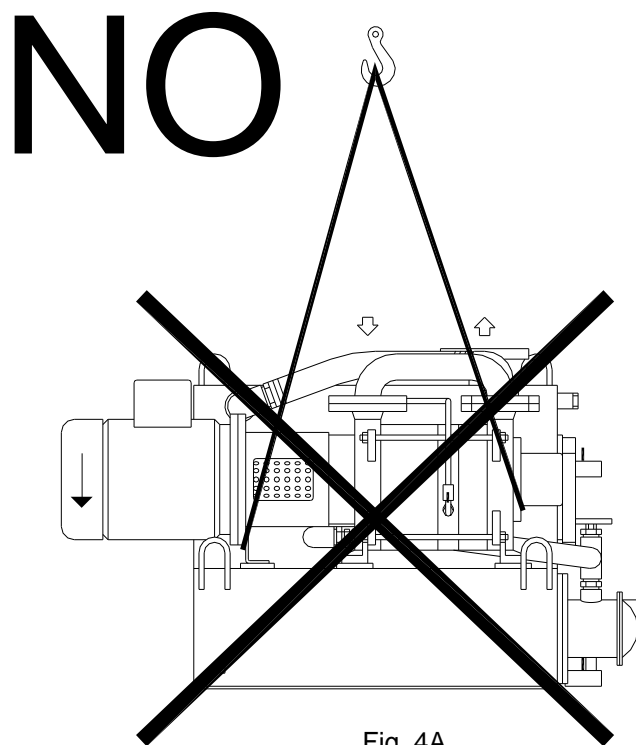


Fig. 4A

7 - INSTALLATION INSTRUCTIONS

7.5 – INSTALLATION OF “HYDROPACK” SYSTEMS

HYDROPACK systems are factory assembled, including discharge separator/reservoir, heat exchanger (air/liquid or air/air), circulating pump, interconnecting piping and all necessary accessories, mounted on a common base plate/frame. See chapter 18 for additional details.

Installation of a HYDROPACK system is similar to that of a vacuum pump or a compressor with partial or total recovery of service liquid depending upon the application (see chapter 7.3 or 7.4 of the “Operating Manual”).

It is important to properly engineer the connecting piping to the system suction and discharge, cooling lines, flushing lines, and draining lines (in correspondence with each free connection of the system, an informative label is present).

The installed heat exchanger is designed with service liquid being cooled at approximately 4 to 6°C over the available cooling media temperature. The cooling liquid flow is approximately same as the service liquid flow required by the pump during operating conditions (see chapter 7.7 of the “Operating Manual”).

Diagrams for partial and total service liquid recovery or total service liquid recovery with 2 liquid ring vacuum pumps are shown in fig. 18A, 19A e 19B.

REMARKS: The illustrated diagrams are generic. Consult our Sales Office when a specific diagram is required.

7.11 – TYPICAL INSTALLATION DIAGRAM FOR “HYDROPACK” SYSTEMS

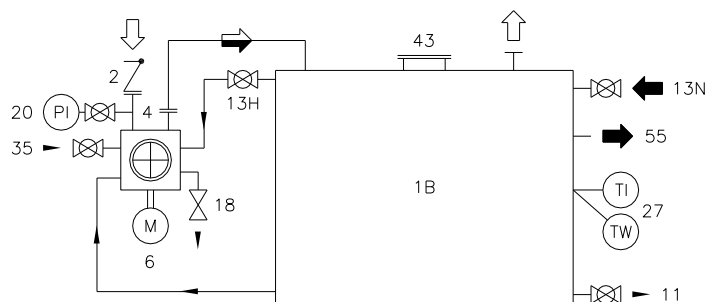


Fig. 18A – PARTIAL SERVICE LIQUID RECOVERY SYSTEM

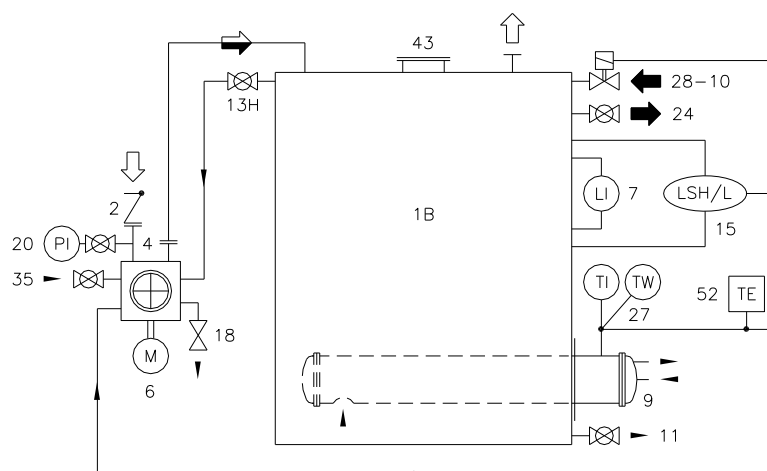


Fig. 19A - TOTAL SERVICE LIQUID RECOVERY SYSTEM

- 1B Separator/reservoir chassis
- 2 • Non return valve
- 4 Liquid ring vacuum pump
- 6 Electric motor
- 7 Level gauge glass
- 9 Heat exchanger
- 10 • Make-up solenoid valve
- 11 Drain valve
- 12 Closing valve
- 13H Anti-cavitation valve
- 13N Filling valve
- 15 • Level switch
- 18 • Automatic drain valve
- 20 • Vacuum gauge
- 24 Overflow valve
- 27 Temperature gauge
- 28 Fill-up connection
- 35 • Valve for vacuum control
- 43 • Inspection door
- 52 • Thermoelement
- 55 Connection for overflow drainage

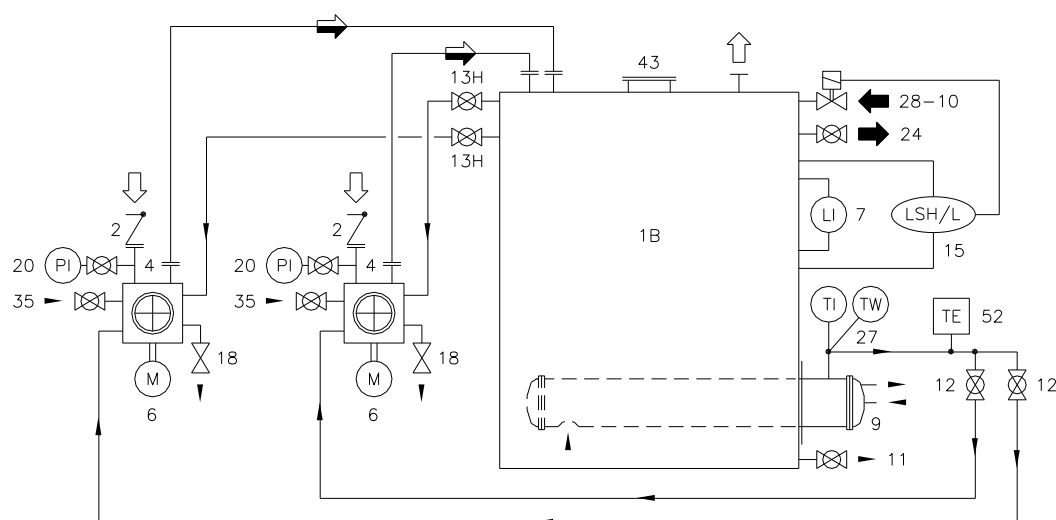


Fig. 19B
TOTAL SERVICE LIQUID
RECOVERY SYSTEM WITH
TWO LIQUID RING
VACUUM PUMPS

• = Item NOT included on standard design

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

11 - STARTING, OPERATING AND STOPPING PROCEDURES

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 monoblock style pump (without coupling) introduce a bolt (or similar tool) at the motor shaft end, which has a threaded connection, and apply the torque by hand.

In the event the pump does not become free with the above procedures, fill up the pump with a suitable solvent or lubricating liquid, let it rest for several hours to allow softening of the rust build-up inside the pump, drain the pump and apply torque to the pump shaft as described above to finally free the rotor.

REMARKS: The selected solvent or lubricating fluid must be compatible with the pump, seals and gasket materials (to avoid further damage), and it must also be compatible with the measures in effect for proper ecological waste disposal.

If the pump (coming from the warehouse) has been treated with solvent or lubricating liquid, rinse it with clean water for 15 minutes before start-up; the acquired solution must be disposed as per environmental regulations as a special liquid.



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”).

Prior to starting the pump, verify that all auxiliary components are available, ready for use, and where required, are in the operative position (i.e.: double mechanical seals are pressurized with buffer liquid, cooling liquid to the open heat exchanger, etc.) and the pump bearings are lubricated.

If the gas and/or service liquid temperatures are in the dangerous levels, it is recommended to insulate the pump, piping and separator to avoid direct contact with surfaces, freezing, thermal shock or losing heat energy.

11.1 – START-UP OF “HYDROPACK” SYSTEMS

(In the following, reference is made to certain ITEM numbers which appear on fig. 18A, 19A and 19B of chapter 9 and chapter 18).

REMARKS: Some of the ITEMS appearing in the following may not be found as they may vary depending upon the construction

Open valve at gas discharge if installed and partially open the valve at the suction side.

Drain valve ITEM 11 (situated on the bottom) of the separator/reservoir ITEM 1B must be closed, and overflow valve ITEM 24 or connection ITEM 55 must be opened.

Before start-up, fill the separator/reservoir ITEM 1B to the shaft centreline with the service liquid through the filling valve ITEM 13N or connection ITEM 28. Check all the components for leakage.

REMARKS: Connect a pipe to the overflow valve ITEM 24 or connection ITEM 55 to collect outgoing service liquid during system operation.

Start all accessories (temperature switches, level switches, pressure switches, etc.), and open the cooling and flushing lines. Start the pump and gradually open the valve (at gas suction side) until the required vacuum level is reached.

Check the system for irregular conditions (see chapters 12 and 14 of the “Operating Manual”).

REMARKS: HYDROPACK systems engineered with 2 pumps are fitted with isolating valves at suction, discharge, and service liquid lines of each pump. When a pump is not operating it is essential to isolate it by closing these valves. (i.e.: close valve ITEM 12 of the idle pump).

When the idle pump is put back into service, the mentioned valves (at suction and discharge) must be opened and reactivated in order to avoid pressure at discharge and start accessories (i.e.: temperature switches, level switches, pressure switches, etc), cooling line (i.e.: open valve ITEM 12) and flushing line.

11.2 – OPERATION OF “HYDROPACK” SYSTEM

After starting the vacuum pump check the following:

- the vacuum level is as desired or adjusts the flow regulating valves
- flow and temperature of the service liquid and/or cooling liquid are as expected (within 25% tolerance)
- motor does not draw more amperage than shown on its nameplate
- the pump-motor assembly does not have any irregular vibrations and noises such as cavitation
- the operating temperature at full load, does not exceed approximately 85°C
- there are no leaks from mechanical seals, joints and flushing or cooling liquid lines
- the liquid level in the separator is between the minimum and the maximum.



NEVER OPERATE THE PUMP DRY!

If the gas discharge is piped to other locations instead of directly open to the atmosphere, the pump discharge should be checked for backpressure that could cause higher power consumption and a loss of pump capacity.

11.3 - SHUT DOWN OF “HYDROPACK” SYSTEM

Close the cooling liquid flow (if applicable) of the heat exchanger ITEM 9.

Where possible, gradually decrease the vacuum level to 400/900 mbar in about 10 seconds max.

The discharged service liquid from the pump ITEM 4 helps produce a slow deceleration rather than a sudden stop.

Turn off the power to the motor ITEM 6 and close any accessories and flushing lines.

Make sure that the non-return valves ITEM 2, or similar, at suction and discharge lines are leak-tight.

Should the system be idle for an extended period of time, it is recommended to disconnect the electricity to the motor panel, and drain all liquids from the pump, separator and piping. Refer to chapter 6 of the “Operating Manual” for storage procedures.

18 - ENGINEERING DATA FOR “HYDROPACK” SYSTEMS

WORKING PRINCIPLE

The HYDROPACK package main components are: a liquid ring vacuum pump ITEM 4 from series **TRH, TRS, TRM, TRV**, an air/liquid separator reservoir ITEM 1B, and a heat exchanger (wherever required) ITEM 9.

Gas handled with a portion of the liquid ring from the pump's internal liquid ring, while functioning the vacuum pump discharges from discharge port.

This liquid must be continuously returned to the pump.

The gas/liquid mixture is separated in a cylindrical tank (separator), the gas is vented through the top mounted discharge flange of the separator, and the liquid is collected at the bottom of the separator ready to be returned to the vacuum pump. During the suction and compression cycle of the vacuum pump, all the power is transformed into heat energy, and the service liquid absorbs almost all of it. Therefore, the liquid must be cooled prior to being returned to the pump, either with a heat exchanger (total recovery system) or with the addition of a cool make-up liquid (partial recovery system).

The **TOTAL RECOVERY** system (see fig. 32A for single pump and 33B, construction with 2 pumps) does not require a significant flow of make-up liquid from an external source, rather only the necessary amount to compensate for the liquid lost, due to evaporation with the discharged gases.

The heat exchanger sizing should be based on using a minimum amount of cooling liquid (usually water), to keep the service liquid at the ideal temperature for greatest efficiency of the vacuum pump.

Remember, the higher the temperature of the service liquid, higher the losses in pump capacity and maximum vacuum, see chapter 17 of the “Operating Manual”. This system is particularly suitable where the service liquid and the condensed gases cannot be discharged into the atmosphere, either for environmental reasons or because the fluids are too valuable.

The **PARTIAL RECOVERY** system (see fig. 33A) requires a constant flow of cold make-up liquid from an external source. This liquid must be of the same nature as the service liquid being used by the pump. The mixture of the make-up and the service liquid being discharged by the pump will have a constant temperature when they enter the vacuum pump service liquid connection.

The same amount of service liquid taken from the outside source must be overflowed through the separator overflow connection ITEM 55 situated at the pump shaft centerline.

This system is utilized in many applications for conditions where there is intermittent use or low vacuum levels or no danger of pollution, and the liquid can easily be drained.

To suit customer requirements numerous accessories are available which are suitable for installation, process and maintenance.

For construction materials and some engineering data, see tab. 11A and 12A.

Tab. 11A – STANDARD MATERIALS FOR “HYDROPACK” SYSTEMS

COMPONENT		MATERIAL DESIGN	
Vacuum pump		GH - F - R...	A3
Separator reservoir		Carbon steel	AISI 316 SS
Heat Exchanger	Tubes	AISI 316 SS – ASTM-CF8M	
	Gaskets	Nitrile rubber / Viton	
Piping		Plasticized / Spiral PVC	AISI 316 SS ASTM - CF8M
Valves – Thermometer		Brass	
Level gauge		Polycarbonate	“Pirex” Glass

For vacuum pump materials (GH - F – R... - A3) see chapter 4 of the “Operating Manual”.

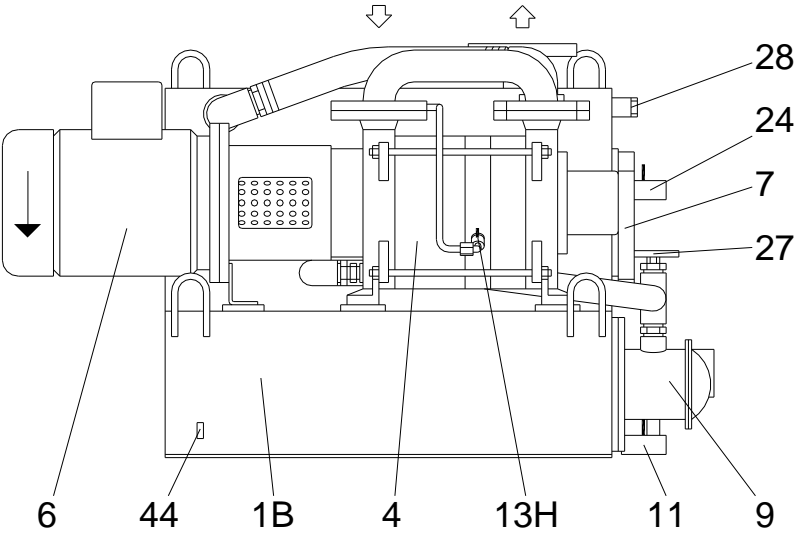


Fig. 32A – TOTAL RECOVERY system

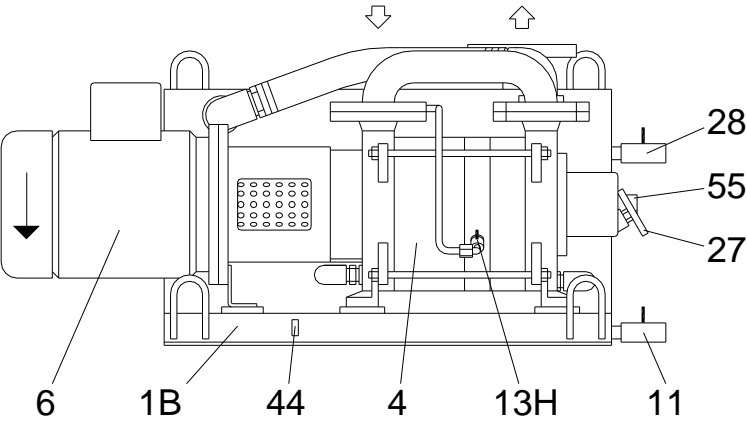


Fig. 33A - PARTIAL RECOVERY system

- 1B Separator/reservoir chassis
- 4 Liquid ring vacuum pump
- 6 Electric motor
- 7 Level gauge glass
- 9 Heat exchanger
- 11 Drain valve
- 12 Closing valve
- 13H Anti-cavitation valve
- 24 Overflow valve
- 27 Temperature gauge
- 28 Fill-up connection
- 44 Base plate
- 55 Connection for overflow drainage

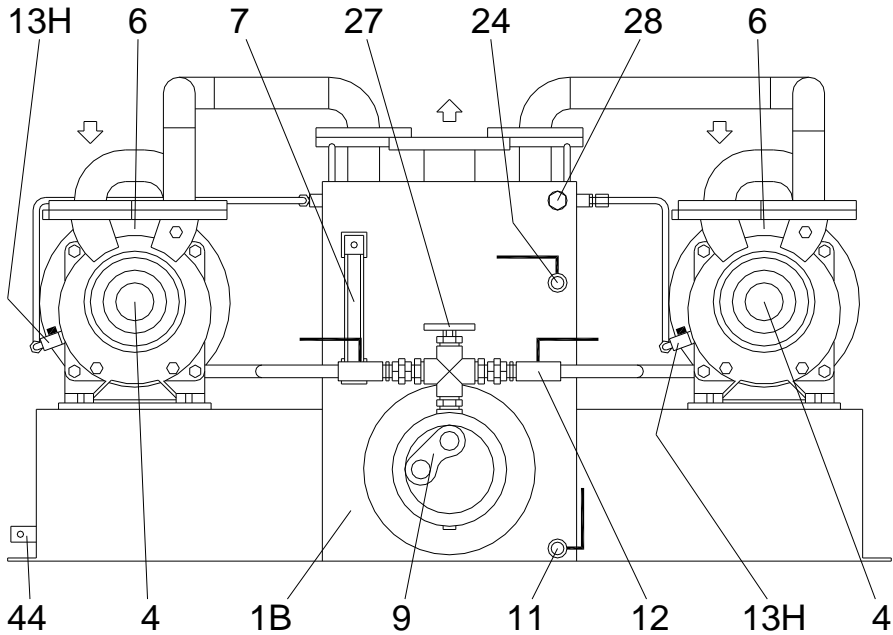


Fig. 33B
TOTAL RECOVERY system WITH 2
LIQUID RING VACUUM PUMPS

Tab. 12A – APPROXIMATED DATA FOR “HYDROPACK” SYSTEMS

SYSTEM SERIES	Motor's maximum power	Dry weight (excludes pump and motor)	Quantity of liquid circulating in the whole system
		Kg.	Litres
2	4 Kw 2 poles / 50 Hz	55	43
4	7,5 kW 4 poles / 50 Hz	95	83
5	18,5 kW 4 poles / 50 Hz	145	150
6	30 kW 4 poles / 50 Hz	320	270

For more detailed information consult our Sales Office.

19 – MAINTENANCE SHELL AND TUBE HEAT EXCHANGERS

(See Fig. 34 for parts identification numbers)

19.1 – DISASSEMBLY

Before starting any operation, ensure that system is not running, electrical power supply is off, inlet/outlet valves closed, heat exchanger water has been drained.

Make sure there is no liquid inside the tank, by acting on the draining valve no. 672.

Extract tube-bundle heat exchanger from the tank per following steps:

- drain heat exchanger Shell by removing plug no. 34 located at bottom side
- remove pipe no.14 from vacuum pump by acting on clamp no. 15 at side of “tee” fitting no. 45, then remove thermometer no. 25
- remove locking nuts no. 920
- extract and remove (by means of appropriate tools) the whole heat exchanger assembly

Disassembly is now complete.

19.2 – CLEANING TUBE-BUNDLE HEAT EXCHANGER

The most appropriate cleaning method will depend on the nature of the material build-up or deposits created upon the pipes: make sure not to damage materials and structure of the heat exchanger while carrying out cleaning. Please consult with specialized suppliers to find the best cleaning product.

Removal of major scale build-up from the tubes can be done with appropriate anti-scale product (pure or diluted), following supplier's operating procedures.

Cleaning of tubes inside diameter can be done by connecting a pre-selected cleaning product to ports A and B. Circulate such product in accordance to supplier's instructions. Pressurized cleaning must be carried out at pressure within [not more than] 1,5 Bar higher than operating pressure.

If deposits cannot be chemically removed, it is possible to act on the tubes inside diameter by appropriate tools (such as round pipe-cleaner). Removal of bolts no. 36 and heat exchanger head is required for this process.

Outside diameter of tubes on Fixed tube-bundle heat Exchangers cannot be cleaned with tools, therefore it is necessary to circulate water (or chemical products depending on the type of deposits) through the heat exchanger via connection on “tee” fitting no. 45 already provided (C side inlet with outlet at D side).

Cleaning procedure for the outside surface of tubes on Removable tube-bundle heat Exchangers: a better cleaning can be achieved using mechanical tools after the above illustrated washing process has been carried out; remove screws no.36 and extract tube-bundle paying attention not to damage gaskets and contact surfaces. Act very carefully on the outside surface of the tubes using appropriate tools (as for example rounded pipe-cleaner)

19.3 – ASSEMBLY

Reverse above mentioned disassembly steps for assembly. It's highly recommended to replace all the gaskets.

Perform pressure test on tube-bundle side: testing pressure must be 0,5 bar higher than operating pressure.

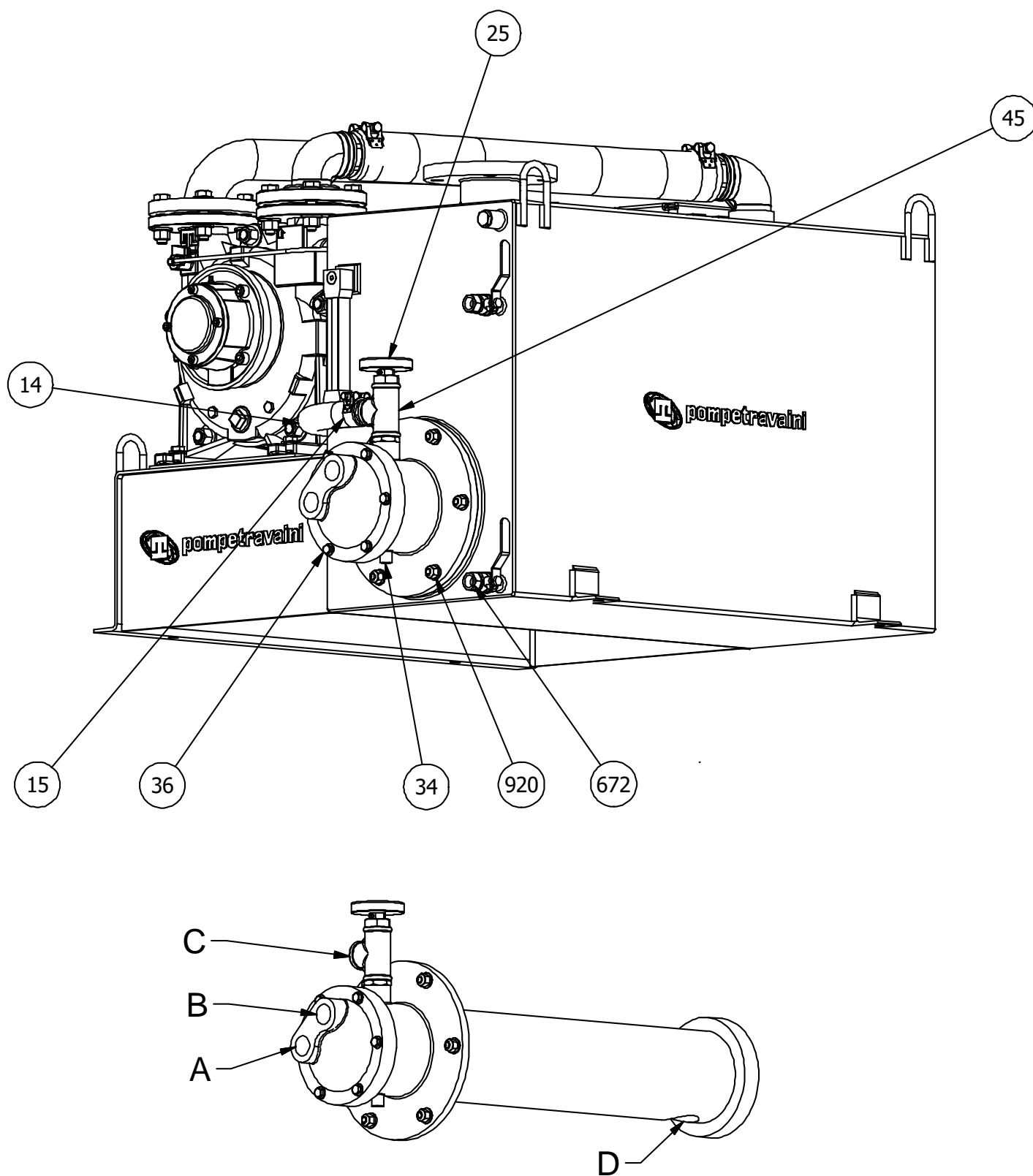


Fig. 34

NOTES

GAS handled	Capacity	Suction Pressure	Discharge Press.	Temperature
.....m ³ /hmbarmbar°C
<input type="checkbox"/> Lethal <input type="checkbox"/> Toxic <input type="checkbox"/> Noxious <input type="checkbox"/> Corrosive <input type="checkbox"/> Malodorous <input type="checkbox"/>				

TOTAL WEIGHT
.....KGS.

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

SERVICE	
<input type="checkbox"/> Continuous	<input type="checkbox"/> Intermittent
<input type="checkbox"/>	

COMMENTS

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MONOSTAGE CENTRIFUGAL PUMPS

**MAGNETIC DRIVE
MONOSTAGE CENTRIFUGAL PUMPS**

SELF-PRIMING CENTRIFUGAL PUMPS

**MAGNETIC DRIVE
SELF-PRIMING CENTRIFUGAL PUMPS**

MULTISTAGE CENTRIFUGAL PUMPS

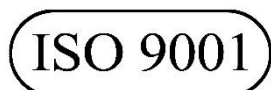
LIQUID RING VACUUM PUMPS

LIQUID RING COMPRESSORS

**PACKAGE VACUUM UNITS WITH PARTIAL OR TOTAL
SERVICE LIQUID RECIRCULATION**

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Continuing research of POMPETRAVAINI results in product improvements: therefore any specifications may be subject to change without notice.



 **pompetravaini**
20022 CASTANO PRIMO (Milano) ITALY
Via per Turbigo, 44
Tel. +39 0331 889000
www.pompetravaini.com