USER MANUAL

INSTALLATION, OPERATION, MAINTENANCE INSTRUCTION FOR

LIQUID RING VACUUM PUMPS



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LIQUID RING VACUUM PUMPS | AL

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LIQUID RING VACUUM PUMPS | AL

1) GENERAL INSTRUCTION

Dear customer, thank you for purchasing an I.VA.CO. product.
I.VA.CO. liquid ring vacuum pumps are high quality machines and each pump is thoroughly tested before it leaves our warehouse. For obtaining a trouble-free operation it is necessary to carefully study these instructions when installing the pump in the plant and before first starting.

This manual should be kept in a safe place and always be available to the qualified operating and maintenance personnel responsible for the safe operation and maintenance of the pump.

Qualified personnel should be experienced and knowledgeable of the safety standards.

To avoid faulty operation and malfunctioning of pumps the instructions in this manual should be carefully studied and followed at all stages of the pump installation and operating life.

The pump should be used only in the operating conditions given on the order for which the pump and materials of the construction have been selected.

I.VA.CO. refuses to assume any responsibility if the pump is used for different applications without prior written permission.

I.VA.CO. does not guarantee repairs or alterations done by user or other unauthorized personnel.

2) SAFETY INSTRUCTION

During operation of the pump:

- Do not insert hands or fingers in pump holes.
- A void approaching the pump with large clothes and accessories like neckties, bracelets, necklaces etc.
- Do not touch the components with electrical connections.
- Do not disconnect the connections of the pump.
- Be careful when approaching the pump connections.
- Do not disconnect safety systems.
- Keep flammable materials away from the pump.

3) PUMP CHARACTERISTICS

a) Construction and working principle:

Liquid ring vacuum pumps belong to the class of positive displacement pumps. Using the expansion and reduction principle in the cell of impeller blade, they vacuum the gases with a liquid ring. If the appropriate liquid is selected (generally water) all the gases and vapours are moved.

A sealing ring of liquid rotates within the casing eccentrically relative to the shaft and impeller assembly. The service liquid, which is normally water, must be admitted continuously to the pump while it is working so that the heat resulting from the near compression of the gas can be

eliminated by the liquid ring. This make-up service liquid supply compensates for the liquid which is discharge from the pump with the compressed gas.

b) Nameplate:

The nameplate which is installed on the pump shows the following data:

1. Pump type
2. Production year
3. Serial number
4. Suction capacity (m3/h); this data is referred to MAX vacuum
5. Suction pressure (mbar), intended as mbar abs
6. Electrical motor power (kW)
7. Speed (rpm)

For any problem or questions about the pump and also for purchasing spare parts, you will need the following data:

c) Pump designation:

ALM : Closed coupled (with motor)

ALD : Two stage (bare shaft)

ALA : Single Stage (bare shaft)

Standard versions:

GI : Casing and housing in cast iron, impeller AISI 316

GB : Cast iron and impeller in Bronze

II : Casing, housing and impeller in AISI 316

d) Operation limits:

- Max. gas intake temperature 1OO °C
- Max. service liquid temperature 70 °C
- Max. service liquid viscosity 8 cst
- Max. suction pressure 1O bar

The pump minimum suction pressure is 33 mbar and it discharges to the atmospheric pressure.

Service liquid temperature affects the pump suction pressure. A temperature higher than 15 °C also decreases the pump suction capacity.

Higher pressure at the discharge may damage the pump.

Do not work pump long time under cavitation conditions. This may damage the pump.

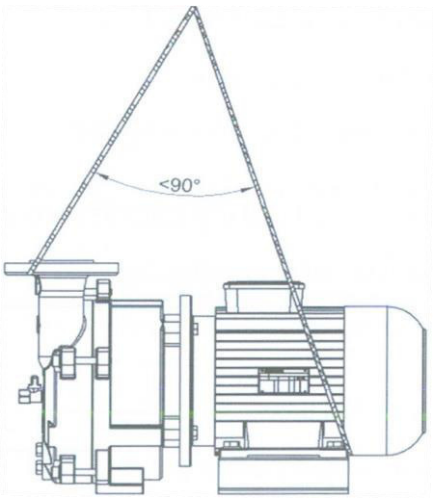
Higher liquid flow inside the pump from the suction or service liquid connection may damage the pump.

4) TRANSPORT AND STORAGE

a) Transport:

- Existing regulations for the prevention of accidents must be followed.
- Wearing of gloves, hard hats and hard-toed boots is obligatory for all transport works
- The load-bearing capacity must be proper to the weight of the pump.
- The pump must always be transported in horizontal position.
- It is absolutely forbidden to stand beneath a raised load.
- Lift the pump assembly using the lifting slings or ropes as shown.

Do not use the eyebolt of the electrical motor to lift the complete unit



b) Storage:

If the pump ran before stocking,

- Empty the pump service liquid by unscrewing the drain plugs and clean the pump
- Fili half of the pump with protective oil and rotate the shaft enough to lubricate all the internal parts.
- Close all the pump openings.
- Store the pump in a cool, closed and dry environment.
- Preserve pump from vibrations.
- Renew the protective oil every 3 months.

5) INSTALLAZZIONE

a) Mounting:

The pump assembly will be mounted on a concrete foundation to provide a safe, noiseless and vibration free operation. The top surface of the concrete block will be flat and horizontal.

Locate the pump unit on the concrete block. Put a level on discharge flange to verify the horizontality of the pump. Tighten the foundation anchoring bolts.

b) Connecting the piping:

Nominal diameters of pipes and fittings will be same as pump openings.

Discharge pipe should never:

1) exceed 800 mm height from the shaft centerline.
2) connected to a closed tank
3) be immerged into water or any other liquid.

Discharge pipe end will be open to free air (atmosphere)

During fabrication, assembly and installation take the necessary precautions to avoid fouling of the system with all kind of foreign object penetration.

During the sudden pump shut- off, the water or liquid contained into the pump will flow back towards suction tank which may contain the process product. To prevent this undesirable situation, use a check valve (non-return valve) on inlet piping.

Suction line will be perfectly leakproof.

Install pump service liquid and seal quenching lines.

Do not reduce inlet tubing sizes.

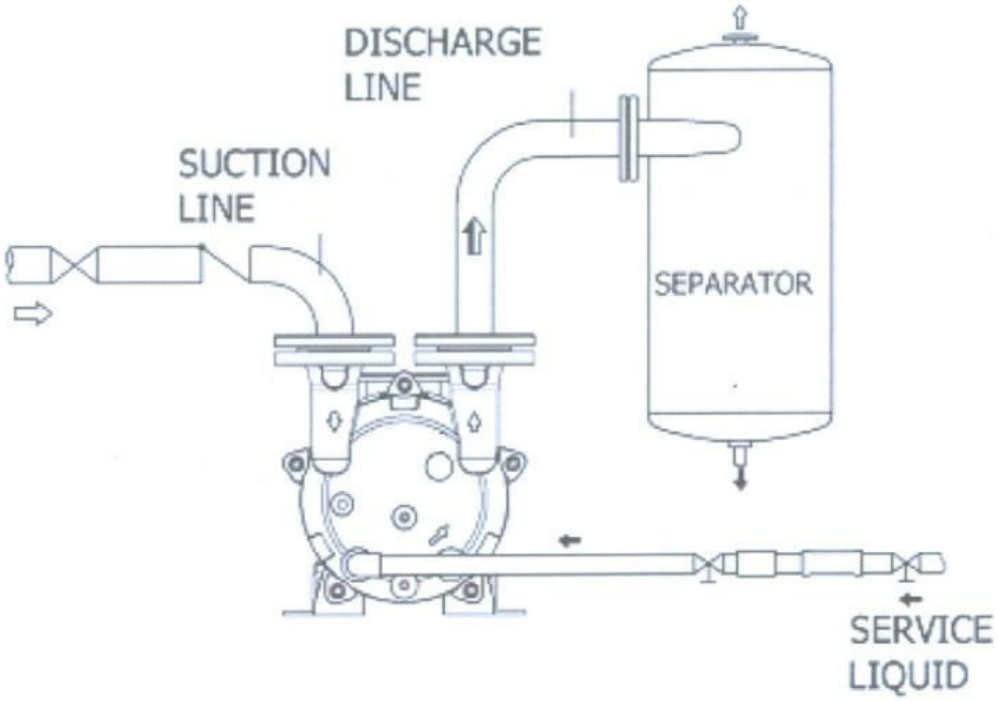
c) Installation systems:

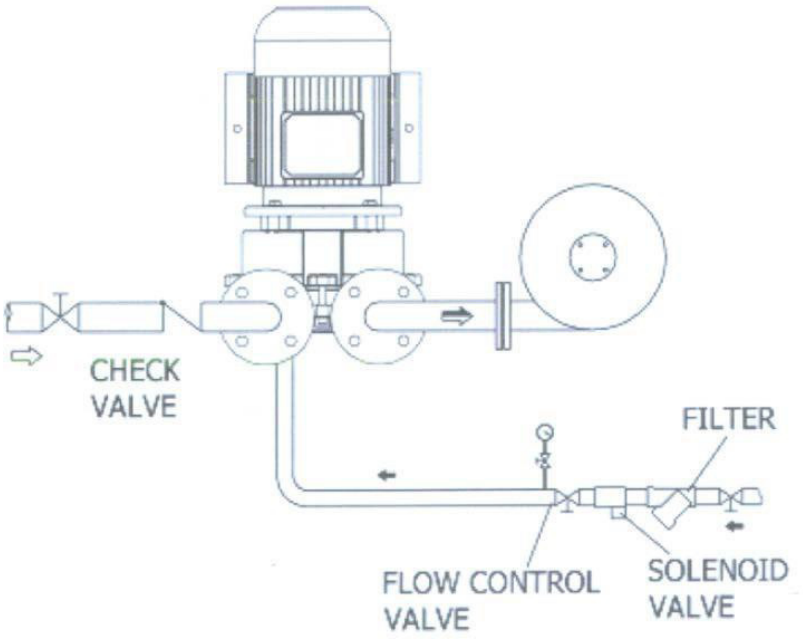
Three basic installation circuits are used on the vacuum pumps to supply enough cool service liquid without pressure.

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i. One through:

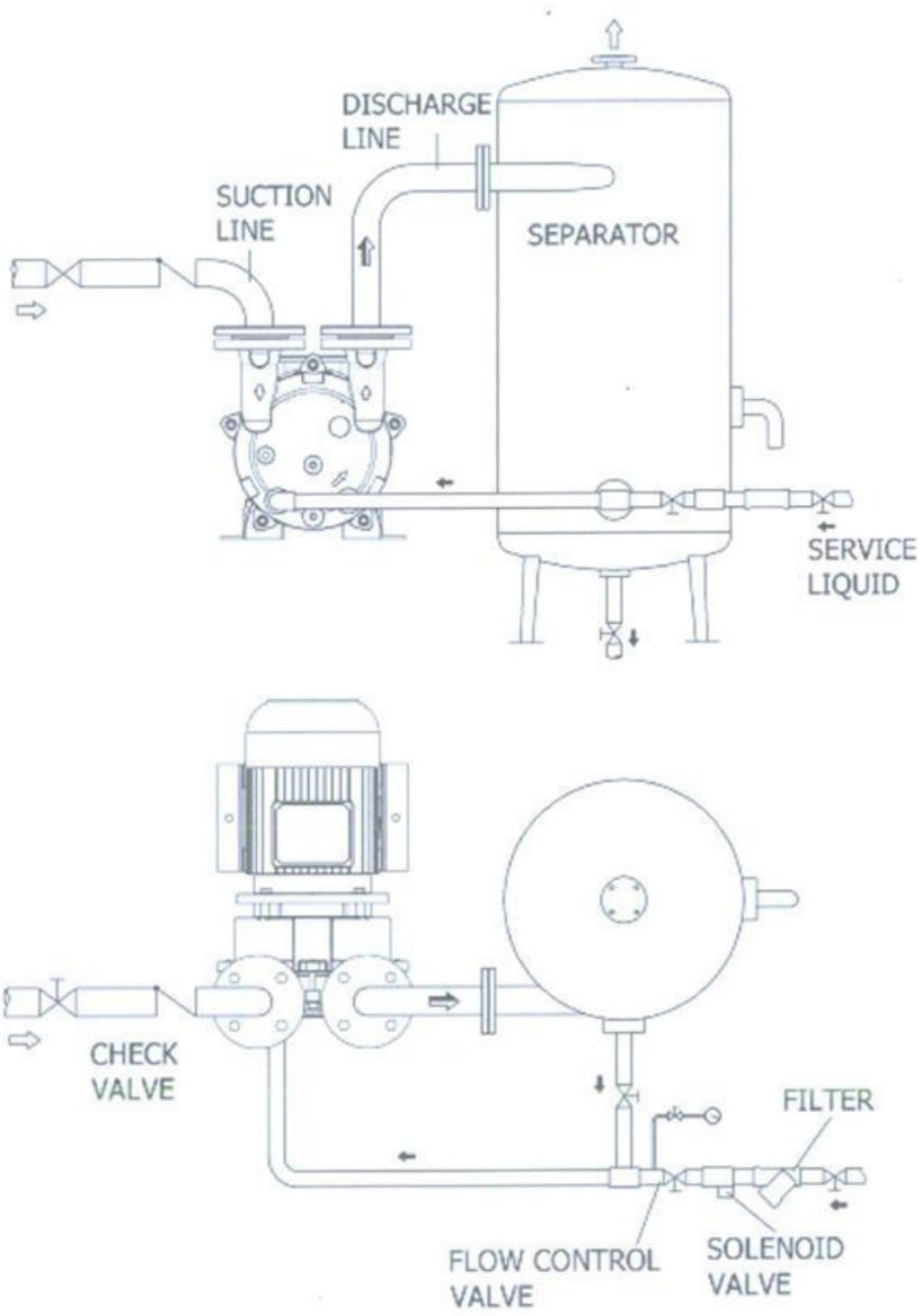
The one through plan is ideal for plants where the service liquid is freely available and has no economic value. The service liquid enters the pump where it mixes with the inlet gas. The service liquid is separated from the discharge gas and discharged directly to drain.





ii. Partial recirculation

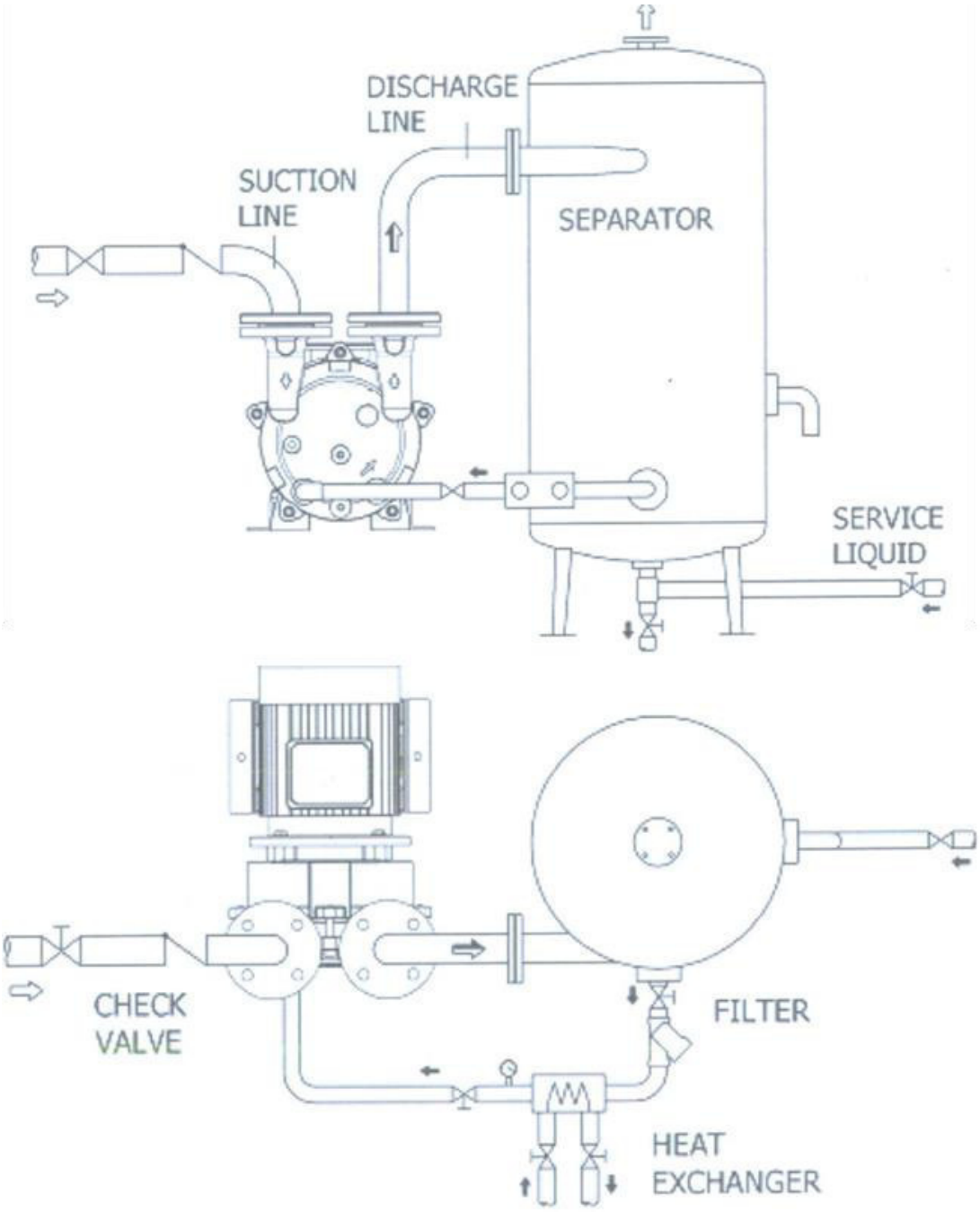
When the supply of fresh service liquid is limited, partial recirculation is recommended. In partial recirculation, a portion of service liquid mixed with re-circulated service liquid prior to re-entry into the pump. Excess service liquid is discharged to drain through an overflow connection in the separator. The supply of fresh service liquid continuously removes the heat of compression and condensation.



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iii. Total recirculation

When the pump is operated with service liquid, that cannot be discharged. full recirculation of the service liquid is required. In full recirculation, the service liquid re-circulated back to the pump. Heat of compression and condensation is removed through a heat exchanger prior to re-entry into the pump. Any loss of service liquid over time is replaced through a make-up liquid connection.



d) Electrical connections:

- The electrical motors have to be built in accordance with EN 60034-1.
- Enclosures of electrical motors and control systems on the pump unit shall as a minimum give protection in accordance with EN 60529 IP22. But in determining the degree of protection of enclosures of electrical motors and control systems on the pump unit the operating and environmental conditions must be taken into consideration.
- Electrical connection should be done by a qualified electrician. Current national regulation and motor manufacturer's instructions must be observed.
- Disconnect all power supplies prior to doing any work.
- The supply cable must be laid in such a way that it never touches the pipework, pump and motor casing.
- Check voltage, phase and frequency on motor nameplate with the mains.
- The electrical motor must be protected against overloading by means of circuit breakers and fuses. Circuit breakers and fuses must be selected in accordance with full load amperage of the motor appearing on the motor name plate.
- Make sure to ground the motor.
- The connection diagram can be found in the terminal box of the motor or in the instruction manual.

Table. 1

TYPE OF SWITCH	MOTOR POWER $P_N \leq 4$ kW (3x400 V)	MOTOR POWER $P_N > 4$ kW (3x400 V)
Direct	Y – connection (4b)	Δ – connection (4a)
Y / Δ start	Impossible	Remove connecting bridges (4c)

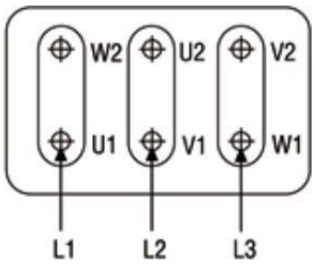


Fig.3a Δ -connection

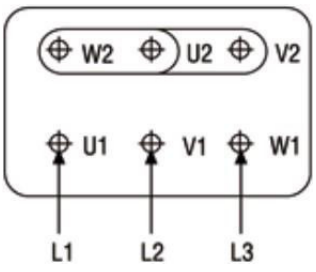


Fig.3b Y-connection

6) OPERATION

a) Before start-up:

- Check the pipes: they should be cleaned enough internally and no foreign objects inside.
- Check the connections between pump and pipes and be sure there is no leakage.
- Specify appropriate electrical starter before running the motor.
- Open the shut off valve (if installed).

b) Service liquid:

Before running the pump fill it with liquid (usually water) up to the shaft level.

Be sure that the liquid is continuously supplied during pump operation. Pump is capable of sucking the required liquid from an open tank at the same level.

Dry running or over filling of the pump with service Liquid may cause serious damages on pump.

While the pump is running, liquid supply should be maintained but when the pump is stopped the liquid supply should be cut off too. The pump cannot be operated as full of liquid since this situation may cause major damages to the shaft and impeller blades. As precaution, a use of solenoid valve at liquid inlet is hardly suggested.

The service liquid (water in this case) temperature should not exceed 15 °C. The vacuum pressure and consequently suction capacity will drop so service liquid has to be as cool as possible. If the liquid (water in this case) will exceed 40°C, the pump will deteriorate in shorter period.

Do not use hard water. The pump will be blocked with calcium and damages will be resulted. The pump should be cleaned more often.

If the pump will remain idle for more than a month, add some anti-freeze compound or empty the pump completely and fill it with machine tool cutting fluid mixture.

c) Direction of the rotation control:

Check the direction of rotation (the motor fan rotates clock-wise) by starting-up the pump for a short time.

Correct the direction, if it is not correct by turning off the electrical supply and inverting connections of the two motor conductors.

d) Sealing control:

AL closed coupled vacuum pumps are produced with mechanical seal only. There is no need to control at first operation. If you have any leakage please see the section 8.

e) Anti-cavitation valve:

During the pump run this valve has to remain shut.

Open the anti-cavitation valve slightly to let to suck air from atmosphere when the pump starts running on full vacuum (cavitation is started and knocking noise is heard)

Not connect anything the cavitation valve located on top of the pump.

7) MAINTENANCE

Before starting to work on the pump, make sure it is disconnected from the mains and cannot be switched on accidentally.

- To clean the scale inside the pump, use 10% oxalic acid solution and apply it for 30 minutes.

a) Disassembly:

- Drain the pump.
- Take the pump completely out of the plant.
- Take away the casing removing the 5 bolts.
- Take away the impeller cover removing the bolts.
- Remove the impeller.
- Take away the body removing the 4 bolts
- If you have any problem in removing the motor, please, remove the motor flange first and take away the rotor.

b) Reassembly:

- Coat the seats and screw connections with graphite, silicon or similar slippery substance before reassembly.
- Never use the old gaskets, make sure the new gaskets are the same size as the old ones.
- If removed the motor replace the bearings. Place ball bearings in their places on the shaft by slightly heating.
- Reassembly proceeds in reverse sequence to disassembly. You may find the attached sectional drawing useful.
- Make sure the gaskets are evenly placed without sliding and not damaged or not squezed at all.
- Place the pump on the baseplate, couple the motor. Connect suction, discharge and service liquid pipes.

c) Bearings:

- The bearings of I.VA.CO. liquid ring vacuum pumps are normally life time grease lubricated.
- Lifetime grease lubricated bearings are maintenance-free.
- Do not reuse the bearings following disassembly for maintenance purposes.

Table 2.

Pump type	Bearing type
AL25	6204 ZZ
AL50	6205 ZZ
AL95, AL130	6206 ZZ
AL255	6208 ZZ
AL325	6208 ZZ
AL455	6309 ZZ front 6209 ZZ back

d) Mechanical seal:

- Usually mechanical seals do not require maintenance until leakage is visible.
- Follow the instructions of mechanical seal manufacturers and NEVER RUN IT DRY.
- While starting to change mechanical seal thoroughly clean the mechanical seal plate and shaft.
- To reduce friction during assembly, wet all sliding surface for the O-rings with water or alcohol or lubricate with silicone grease. Never apply lubricant to seal faces.
- Assemble in a completely dry, dust-free and clean condition.

Table 3.

Pump Type	Mechanical seal diameter
AL25, AL50	35
AL95, AL130	56
AL255	55
AL325	55
AL455	60

e) Spare parts:

I.VA.CO. guarantees the supply of spare parts for 10 years.

When ordering spare parts, please, let us know the following details that you will find on the nameplate:

- Pump type
- Production year and serial number
- Motor power and speed

8) FAULTS, CAUSES AND REMEDIES

Before searching any truble on the pump, be sure about two points:

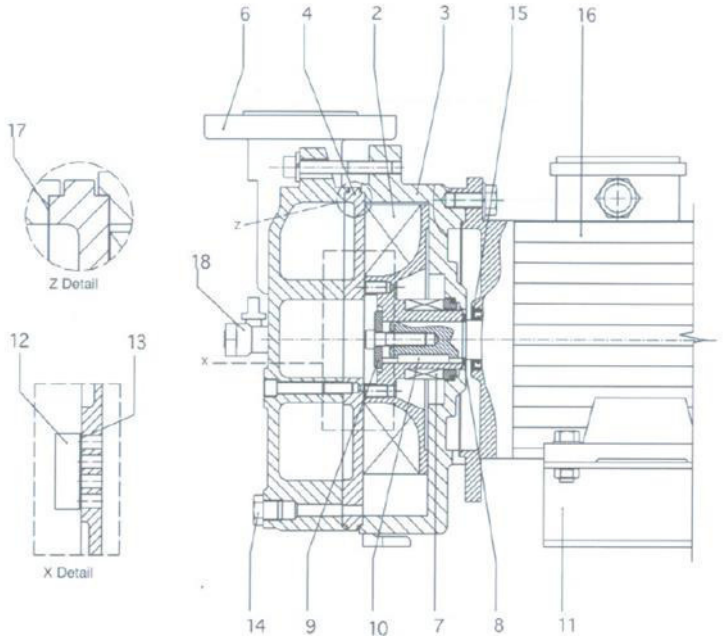
- There is no faulty on measurement instruments.
- There is no leakage in the system.
-

FAULTS	POSSIBLE CAUSES	REMEDIES
The pump works with loud and vibration	Broken shaft or impeller blades	Replace the broken parts
	Bearing failure	Replace bearing
	Motor failure	Check the motor
	Pump connections are not tighten on foundation or baseplate	Tighten the anchoring bolts
	Service liquid flow rate too high	Adjust service liquid flow rate
The pump works with different noise	Pressure come on the cavitation limit	Open the cavitation valve
	There is some particle inside the pump	Clean the pump
	Broken the impeller blades	Replace the impeller
Liquid leakage from the sealing areas	Mechanical seal failure	Replace the mechanical seal
	Corrosion the shaft	Replace the shaft
Liquid leakage from the pump body	Gaskets failure	Replace the gaskets
	There is a hole inside the pump	If it is possible close the hole otherwise replace the part
Power consumption of the motor is too high		
	Excess tightened soft packing	Loosen the nuts of the packing gland
	Discharge pipe diameter is too small	Adjust according to section 5.b
	Discharge pipe height is too high	Adjust according to section 5.b
	Service liquid flow rate is too high	Adjust service liquid flow rate
	Service liquid pressure is too high	Reduce the pressure
	Scale formed inside the pump	Clean the pump
The pump does not vacuum	Partially clogged the suction line	Clean the suction line
	Partially clogged impeller	Clean the impeller
The pump does not produce sufficient vacuum	Service liquid flow rate not enough	Adjust service liquid flow rate
	Service liquid temperature too high	Reduce the temperature
	Wrong connections of the pumps	Control the suction and discharge connection
	Wrong direction of rotation	Check motor rotation with directional arrow on name plate

	Corrosion inside the pump	Replace corroded parts
	Scale formed inside the pump	Clean the pump
	There is leakage in the system	Control the system

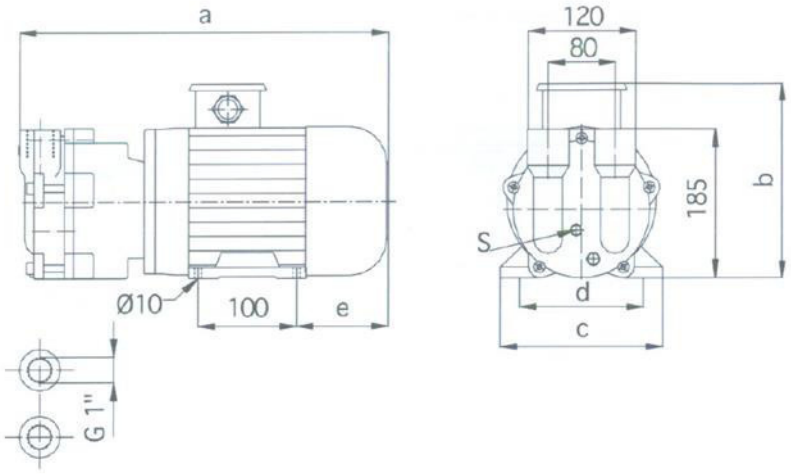
9 a) SECTIONAL DRAWING AND PART LIST (Monoblock)

Fig. 4



Pos.	Part name
2	Impeller
3	Body
4	Plate
6	Inlet & Outlet Casing
7	Mechanical Seal
8	Impeller Spacer
9	Impeller Cover
10	Key
11	Baseplate
12	Valve Cover
13	Valve
14	Plug
15	Gasket
16	Electric Motor
17	Paper gasket
18	Anti-cavitation valve

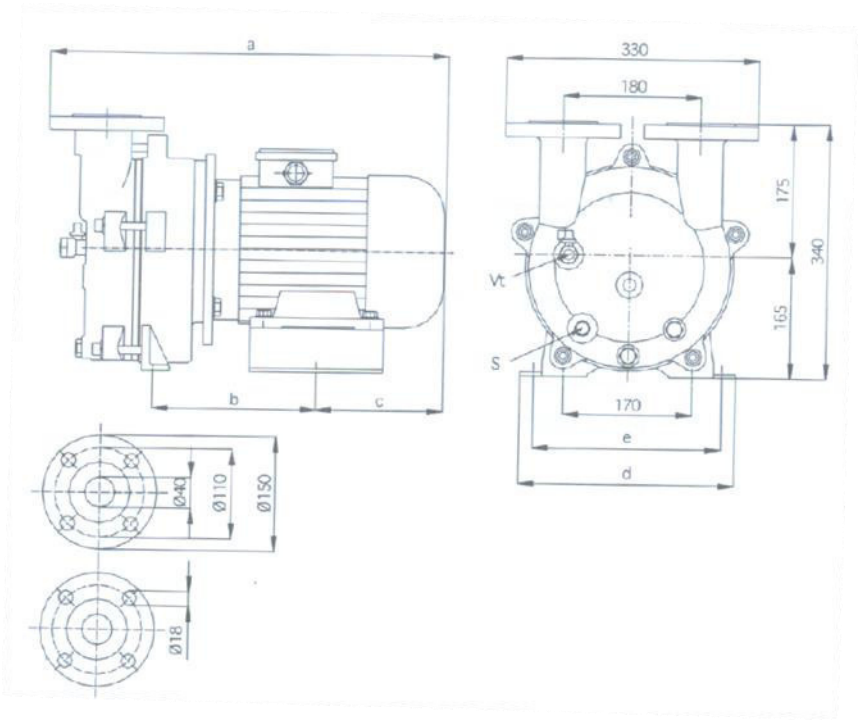
10 a) OVERALL DIMENSIONS AL25-AL50



S: Service liquid inlet G 1/4"

TYPE	a	b	c	d	e	Weight Kg
AL25	365	200	160	125	88	18
AL50	405	215	180	140	102	23

10 c) OVERALL DIMENSIONS AL95-AL130

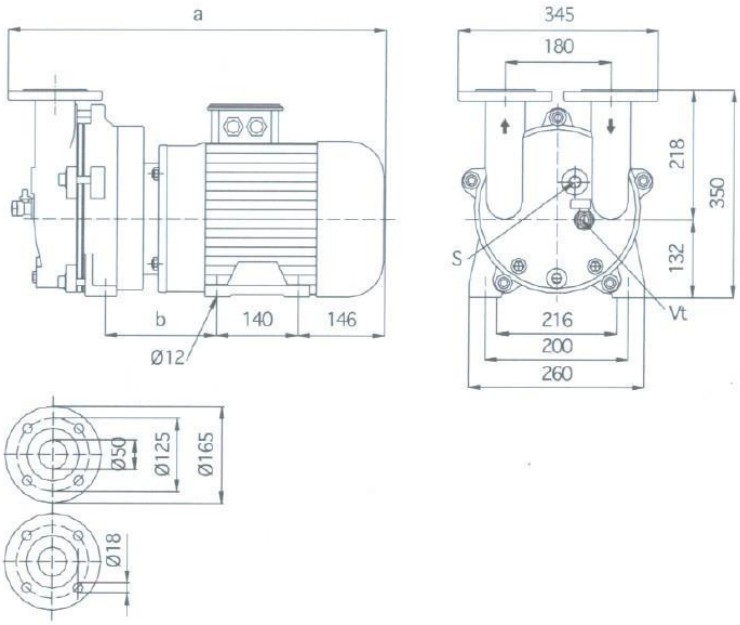


S: Service liquid inlet G1/2"

Vt: Anti-cavitation valve G 1/4"

TYPE	a	b	c	d	e	Weight Kg
AL95	520	165	185	285	255	56
AL130	570	200	190	310	280	73

10 d) OVERALL DIMENSIONS AL255

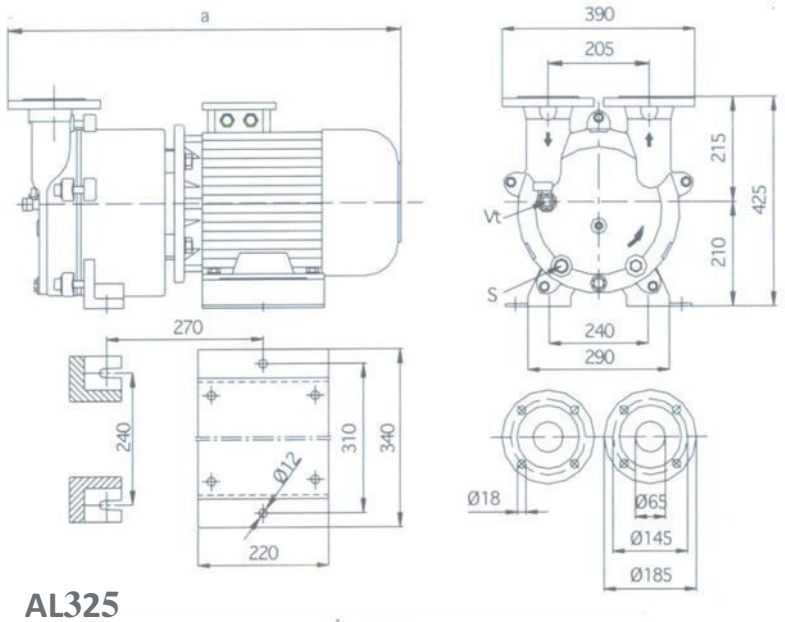


S : Service liquid inlet G1/2"

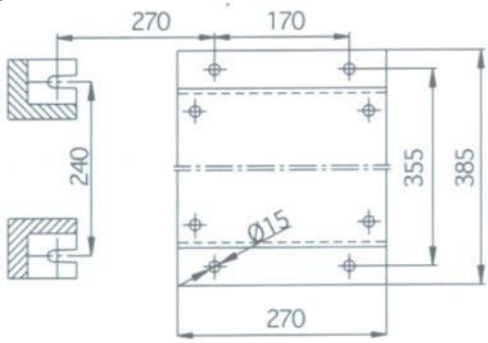
Vt: Anti-cavitation valve G 1/4"

Type	A	B	Weight Kg
AL255	680	215	100

10 e) OVERALL DIMENSIONS AL325-AL455



AL325



AL455

S: Service liquid inlet G3/4"

Vt: Anti-cavitation valve G 1/2"

Type	A	Weight kg
Al325	720	132
Al455	840	205

11) ENERGY SAVING:

- High efficiency (IE2 and IE3) electrical motors should be preferred to supply energy savings in the industry.
- Vacuum pumps shouldn't be selected larger than required. To selection of a pump larger than required increase power consumption.
- Leakages at vacuum system should be prevented.
- Entrance of water with higher pressure or more than required int the vacuum pump increase energy consumption and can damage the pump's parts.
- Being narrow and high of discharge pjpe diameter of pump, increase power consumption. That's why discharge pipe diameter should be designed suitable as the given data.

12) ECONOMICAL LIFE:

The economical life of I.VA.CO. Vacuum pumps is 10 years.

The pump should be operated following the conditions stated in the user manual. The following operations will shorten the economical like of the pumps: wrong material selection, usage of wasted and limy water, wrong floor connections, not using filters and valves required for system, operated the pumps under cavitation.

13) EXPECTED NOISE VALUES

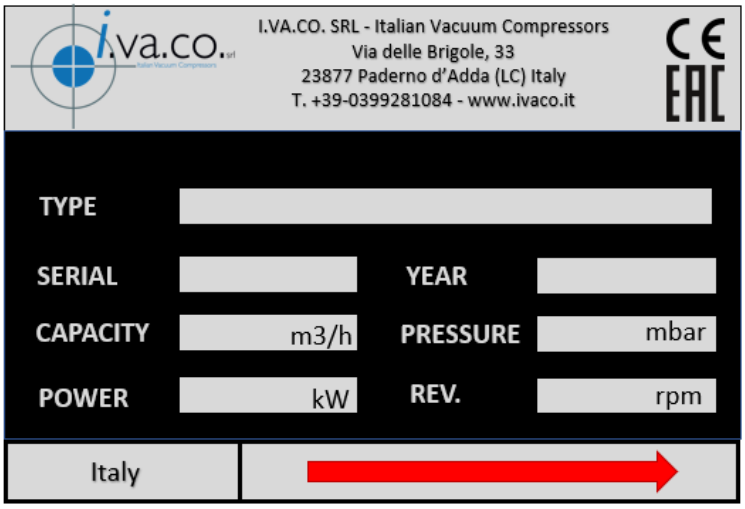
Table.5

Pump type	Sound pressure level (dBA)
AL25, AL50	68
AL95, AL130	65
AL255	68
AL325, AL455	72

Sound pressure levels are valid at 80 mbar suction pressure.

Without protective sound hood, measured at a distance of 1 meter directly above the driven pump, in a free space above a sound reflecting surface.

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