YOUR VACUUM PROFESSIONALS

LIQUID RING VACUUM PUMPS

INSTALLATION USE AND MAINTENANCE MANUAL

26 - 51 - 96 - 131 - 256 - 326 - 456

Table of Contents

Dear Customer,

First of all, we would like to thank you for choosing a DVP product.

With this, we would like to invite you to carefully read our manual to ensure the correct and efficient operation of the pump for a long time.

We have tried to give as much information as possible, but we think that no manual can be completely comprehensive.

If you have any doubts or in need of clarifications regarding the installation, operation and maintenance of the pump, please contact our Sales Department that will be available to provide you with all necessary information.

Our contact:

1209 E. Ave. J
Grand Prairie, TX 75050
Ph +469-456-4917
e-mail: dallas@dvppumps.com
web site: http://www.dvppumpsus.com

1. INTRODUCTION

The purpose of this manual is to ease the installation, the operation and the routine maintenance activities of the liquid ring vacuum pumps belonging to the **FLA** range.
This manual must be completely read and understood by all operating and servicing personnel before beginning with the installation and the start-up of the pump, in order to grant the correct functioning and personnel security.
FLA pumps are to be used only for the application/duty specified in the order confirmation and for the specified construction materials which, along with the necessary tests carried out, fulfill the requirements stated in the order confirmation. The pump must not be used for different applications.
This manual must be always available at the site of operation of the machine.

Please note that the **FLA** liquid ring vacuum pumps could be potentially harmful to people and things for the following reasons:
- Rotating parts at high speed
- Deep vacuum
- Fluids and gas handled by the equipment could be hazardous and toxic
- Presence of electric power

WARNING!
The non observance of the instructions reported in this manual or the improper use of the pump by unskilled and/or unauthorized personnel may result in severe damage to things or serious injury and even death of people!

The Technical and Service Departments are available for any technical assistance or clarification you may need. Do not hesitate to contact us.

2. REVIEW OF THE SHIPPING DOCUMENTS

When receiving the goods, it is necessary to inspect and check them against the shipping documents. Make sure that no shipping damages are occurred to the equipment during transportation.

3. WARRANTY

The goods related with this instruction manual are free from defects in materials and workmanship.
The warranty period is: twelve months from the date of their initial use or eighteen months from delivery, whichever expires first (“Warranty Period”).
The warranty covers those parts of the machine that are defective in either materials, construction or workmanship.
The warranty does not cover wearing parts (e.g. bearings and lip seals), defects arising from chemical corrosion or galvanic action, from misuse or wrong interpretation of the instructions contained in this manual, or from modifications or repairs not expressly authorized in writing by the supplier.
Any claims for defects must be made in writing and the purchase entitled to withhold or delay any payments or cancel any contract as a result of those defects.
The supplier will not assume any responsibility under the terms of this warranty for equipment which has not been paid according to the agreed conditions (which are stated in the sales invoice).
Within the warranty period, the supplier will repair or replace, ex works his factory, those parts which are determined to be defective.
Within the warranty period, defective parts should be returned to the supplier, carriage paid, and any parts repaired or replaced by the supplier, will be shipped back to the purchaser, carriage forward. The supplier will not be responsible for any costs arising from the removal and reinstallation of the equipment.
In the unlikely event that the repairs under warranty will be carried out in the field, the supplier will provide the necessary skilled personnel. It is understood that such services will be charged according to the rates in force at the time. In such a case, the purchaser will provide the supplier with all facilities and assistance necessary

for the repair. The purchaser will take all the costs arising from the operations on the field. It is compulsory that all operations on the field are previously agreed in written with the supplier.
Within the warranty period, for any product repaired or replaced by others than the supplier or his representative, the warranty will become void and unenforceable and the supplier shall not be liable for any damage, to anything or anybody, that could happen after any unauthorized operation or replacement. The supplier shall not be liable for any damage directly or indirectly arising in connection with the machine non-use during the repair under guarantee. The supplier shall not be liable for any damage directly or indirectly arising in connection with the incorrect use of the machines.
In the unlikely event of a break-down due to the malfunctioning of the machine, the supplier should not be liable for any cost arising from the interruption of the plant process.

4. GENERAL NORMS FOR SAFETY

This operating and maintenance Manual has the purpose to build a reference for the installation, the operation, the maintenance and the start-up and stop procedures for a safe use of **FLA** pumps. Before pump start-up it is necessary to activate all protection devices for people and things so that any possibility of hazardous risk is avoided during operation but also during routine maintenance of the pump and of its accessories.

4.1 – General Precautions

FLA pumps shall be used exclusively for the specified duty and within the limitations stated in the technical-commercial documentation submitted at quotation stage or with the order acknowledgement.
For any use not covered by this manual, it is necessary to contact the Technical Department in order to get confirmation of the suitability to the new operating conditions in terms of performance, safety and duration.

4.2 – Precautions to be followed during Operation

- Avoid to get close to pump suction and discharge nozzles.
- In case the pump is running at high temperature due to hot gas or hot service liquid, protections against the accidental contact with external parts have to be foreseen and installed.
- When running, do not disconnect any pump auxiliary piping (service liquid supply line, etc.).
- Avoid to run the pump under cavitation for long time (it makes high and unpleasant noise).
- On routine basis, the efficiency of the monitoring and protecting devices has to be checked.
- Check that all electrical devices with protection duties are installed and activated.

If during operation any anomalies arise (gas of service liquid leakages), the electrical power supply should be immediately disconnected. In this unlikely event the plant responsible personnel must be immediately informed.

5. RESIDUAL RISKS

The wrong use of the pump may cause severe damages to both persons and things. Predominant dangers are due to:

- In suction: the pump could suck cloths or hair and harm people. The area around the pump must be duly protected.
- Hot gas and foreign particles vehiculated from the pump at high speed may unexpectedly exit from the discharge flange.
- At pump in function, some components may reach high temperatures. The machine must be protected in order to prevent burns.
- Running the pump dry or under cavitation may cause severe damages to both the machine and the plant.
- Improper vehiculation of dangerous and harming fluids (any different fluids from those listed within the order specifications) may cause damages to both people and things.

All electrical service operations must be carried out by specialized personnel only, service operations must be carried out by people utterly aware of all safety procedures relevant to the fluids in circle.

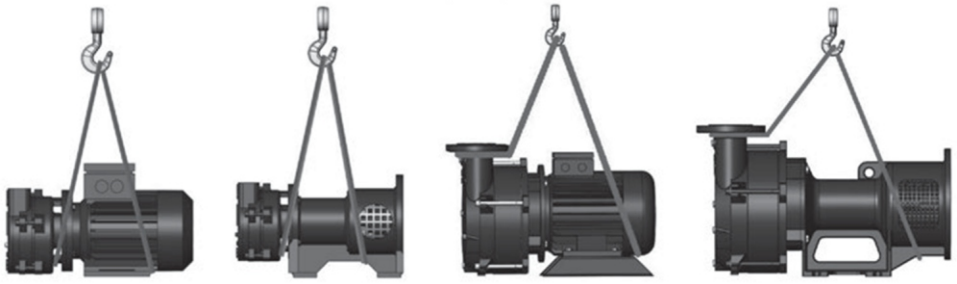
6. TRANSPORT

Before arranging the transport of the pump, the following has to be checked:

- Weight of the pump/equipment
- Overall dimensions of the pump/equipment
- Lifting points

CAUTION!
The pump must be transported by selecting adequate means of lifting and transportation suitable to the pump weight and to its packing dimensions nevertheless in compliance with the safety standards on force.
When transporting, installing and performing maintenance, it is important to grant a safe lifting of the equipment; use adequate lifting slings, installed and operated by skillful personnel (see FIG. 1).
Eye bolts and lifting points designed for single components shall not be used to lift the pump.
To lift pump units follow the figure below.

FIG.1



7. STORAGE

All **FLA** pumps are dispatched with the main connections like suction and discharge nozzles closed by plugs or adhesive disks.

- Store the pump indoor and possibly in a dry and clean area where the ambient temperature does not go below 5°C
- On a routine basis (every 30 days max.) turn the pump rotating assembly by acting on the motor cooling fan or on the coupling.
- If the pump will not be used for a long time, it is necessary:
- To discharge the liquid
- To cover the pump with a plastic sheet or PVC film and to pour condensation products
- To protect all machined parts with antioxidant products.
- To check that all connections are duly closed with plastic caps

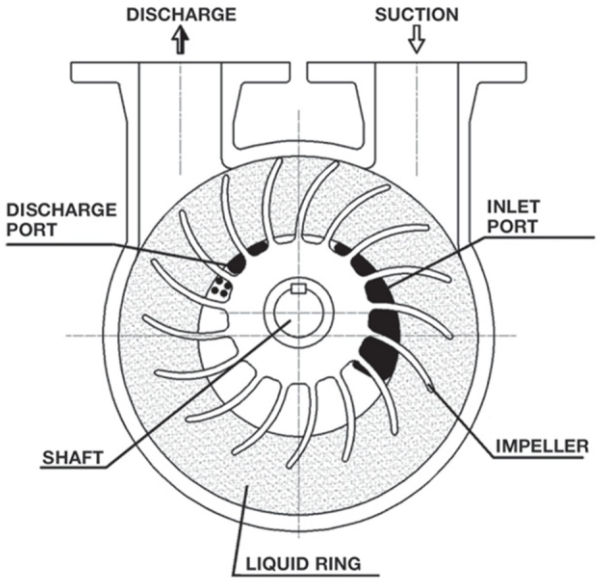
Service to the pump is suggested when not operating for more than 3 years.

8. OPERATING PRINCIPLE

FLA series belong to the family of liquid ring vacuum pumps.
The pump consists of a cylindrical casing within which an impeller with radial blades turns off set in respect to the casing itself.

The impeller rotation spins by centrifugal force the service liquid around the casing thus forming a ring of liquid concentrically to the casing. Because of the off set between the casing and impeller, during the impeller revolution, chambers among the blades are formed with a progressively increasing and decreasing volume resulting in producing respectively vacuum at the inlet opening and pressure at the discharge opening of the port plate located between the pump casing and the pump suction/discharge casing. The presence of vacuum at the inlet opening area draws in gas through the pump suction nozzle which is then compressed and delivered through the discharge port towards the pump discharge nozzle.
Of course during pump operation it has to be granted the continous supply of service liquid in order to integrate the amount of liquid lost due to the internal sealing of the clearances but also remove the heat absorbed by the liquid itself due to the isothermal compression.

FIG.2



9. TECHNICAL DESCRIPTION

FLA pumps are single stage type, with horizontal axis, provided with vary port valve, designed with overhung impeller mounted on the shaft of an electric motor or of a lantern bracket; the impeller is locked by a regulating axial clearance array.

In all version with bearing housing the pump is fitted on a foot mounted lantern bracket. Connection to the electric motor is granted by a flexible coupling mounted on the pump shaft. Suitable electric motors are: UNEL-MEC standard B5 flange or, using an adaptor flange, NEMA standard.
The shaft sealing is granted by a single mechanical seal, standardized according to DIN 24960, fitted directly on the impeller hub, in order to protect the shaft from the process liquid or gas.
FLA pumps need no lubrication since the bearings of both the motor and the lantern bracket are airtight and life-pre-lubricated type.
The standardization of specific items among different pump sizes reflects the modular design in order to rationalize the construction of the whole range and reduce the amount of spare parts to be kept on stock.

10. USE

FLA pumps are mainly used for the following applications:

- Suction of gas and vapors from autoclaves and sterilizers
- Vacuum packaging, drying and impregnation
- Priming
- Process under vacuum, suction of gas and vapors in the chemical, food and wine industry
- Dryers and evaporators used in the textile, brick and soap industry

- Solvent recovery

You must ensure that the pump is suitable for your application.
If you have any doubt as to the suitability of the pump for your application, please do not hesitate to contact Asco Pompe Srl technical/commercial department.

10.1 – Use as Vacuum Pump

The whole range of **FLA** liquid ring vacuum pumps can handle any gas consistent with the material of construction and with the service liquid as well as limited quantity of liquid carry over flowing into the pump together with the process gas.
The deepest suction pressure which can be achieved by the pump is related to the vapor tension of the service liquid; any time the vapor tension comes close to the suction pressure the pump may cavitate therefore it is advisable to keep the service liquid temperature as low as possible.
Process conditions close to cavitation do require the installation of an anticavitation valve or a relief valve to protect the pump (see section 13).
In case it is requested a deepersuction pressure compared to w hat the pump can provide, it is possible to combine the pump with a gas ejector (or other type of equipment) in order to achieve even 10 mbar abs. of vacuum.

CAUTION!
The extensive use of the pump under cavitation conditions may result in heavy damages to the pump itself.

10.2 – Use as Compressor

FLA liquid ring pump range can be used also as a compressor.
Normally when the gas suction pressure is atmospheric (1013 mbar abs.), the discharge pressure must not exceed the differential pressure stated in the table below where are indicated the operating limits.

TAB.1

PUMP TYPE		FLA 26 / 51	FLA 96 / 131	FLA 256 / 326 / 456
Max. pump speed	rpm	3450		1760
Max. inlet gas temperature	°F	212		
Max. service liquid temperature	°F	158		
Max. discharge pressure (vacuum pump)	mbar	200		
Max. differential pressure (compressor)	barG	1.5	1.8	2.0

11. INSTALLATION

FLA pumps must be installed by a suitably trained technician familiar with the safety procedures related to the handled liquids and gases.
Always wear the appropriate safety clothing

FLA pumps do not require foundations or special baseplates; they shall be accommodated on a horizontal, rigid, flat and levelled surface. The fixing of the pump can be made by using anchor bolts or expansion bolts passing through the dedicated feet holes.

12. CONNECTIONS

As already stated previously, the pumps are dispatched with the main nozzle and the service liquid connection closed with protection plugs.

12.1 - Piping

Connect the machine to the piping system by flexible connectors, avoiding rigid connections that may cause mechanical strengths and cause harmful vibrations. The connection pipes must not overload the silencers.
Only remove the sealing plugs immediately before connection.

CAUTION!
Remove the protections only when the pump is ready for being connected to the plant piping. Before doing it, make sure that all piping has been checked for cleanness.

To increase the protection at start up, during the first operating hours it can be fitted an inlet screen on the pump suction with the aim to avoid that any welding shot or dirt still present in the piping may enter into the pump.
The suction and discharge nozzles can be easily identified by checking the arrows located closed to each nozzle.
Each pipe connected to the pump must have the same diameter size of the respective pump nozzle and shall be constructed so that it easily connects with the dedicated pump nozzle allowing the tightening of the bolting without any consequence to the pump casing.
The same applies to the service liquid supply pipe which shall be made available in the same size of the pump service liquid connection point.
It is extremely important to adequately support the suction and discharge piping in order to avoid loads on the nozzles which may generate problems to the smooth operation of the pump.
When constructing the piping, pay attention to the fittings and to the supporting structures in order to take into account allowance for thermal expansion.
The vertical section of the discharge line shall not exceed 1 foot in height in order to avoid the forming of backpressure inside the pump with consequent motor overload and pump flooding during pump shut down caused by the return of the discharged liquid back into the housing.
Use a suitable gasket between the pump flanges and suction/discharge pipeline.
The gasket must be made of a material which is compatible with the processed liquid and gas.

12.2 - Electrical Connections

The electrical wiring must be carried out by specialized personnel only. However, it is recommended to strictly follow the instructions provided by the electric motor manufacturers or by the manufacturers of any ancillary electrical components involved.
Check that the motor nameplate data matches with the local power supply in terms of voltage, frequency, phase and absorbed current.
In case of three phase power supply, check that the voltage of all phases is identical.
Connect the motor earthing properly.
Remove the terminal box cover by loosening the fixing screws; connect the wires as indicated in the instructions or on the inside of the cover and **then reposition the terminal box cover and fix it by tightening the dedicated screws.**
It is recommended to install a thermal circuit breaker in order to protect the motor from excessive low voltage or overload.
For its correct sizing, follow the current values reported on the motor nameplate. It is advisable to install an emergency electrical switch near the pump.
Make sure that the pump and the motor could rotate freely before making the electrical connections.
Verify that all safety devices are on and that the coupling guard has been correctly positioned.
The pump sense of rotation is clockwise from fan/motor.
To check it start the motor for 2/3 seconds.
Operation with wrong sense of rotation will damage the pump and the seals.

13. INSTALLATION DIAGRAMS

LEGEND

NOZZLE

1	SUCTION
2	DISCHARGE
3	SERVICE LIQUID MAKE UP
4	COOLING WATER INLET
5	COOLING WATER OUTLET
6	OVERFLOW
7	SEPARATOR DRAIN
8	SERVICE LIQUID INLET
9	MOTIVE AIR

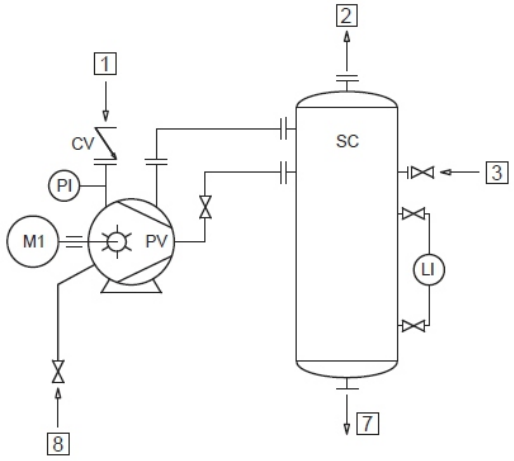
ITEMS LIST

PV	Vacuum pump
M1	Vacuum pump electric motor
SC	Separator tank
SE	Heat exchanger
PC	Recirculation pump
M2	Recirculation pump electric motor
CV	Inlet check valve
PI	Vacuum gauge
TI	Temperature gauge
J	Ejector
LI	Float switch

13.1 – Once through service liquid arrangement

The drawing shows the typical system arrangement which could be used when the consumption of fresh service liquid is not an issue but at the same time both liquid and gas present inside the pump are considered neither harmful to people nor to the environment with easy handling because not contaminated or polluted.
The mixture of gas and service liquid can be directly piped into the drain collecting system or when needed or convenient into a separator tank where gas get separated by leaving from the top while liquid from the bottom.
In order to grant the correct functioning of the pump, the service liquid supply pressure shall be 0,5 bar higher than the pump discharge pressure.

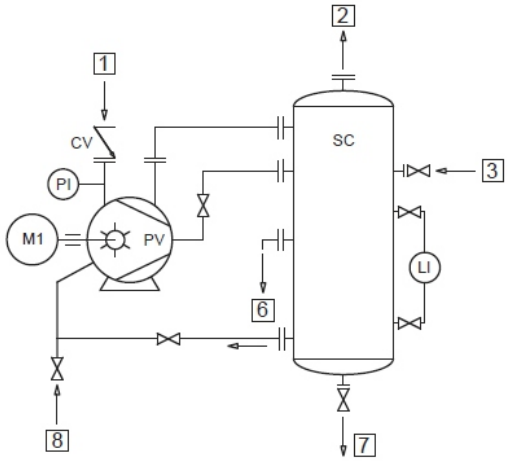
FIG.3



13.2 – Service liquid partial recirculation arrangement

The drawing shows the typical system arrangement to follow when the use of fresh liquid shall be limited but also the pump operating conditions allow to deal with a slightly higher temperature service liquid including that both liquid and gas present inside the pump are considered neither harmful to people nor to the environment with easy handling because not contaminated or polluted.
Part of the service liquid flow (usually 50%) is fresh while the rest consists of the warmer liquid recovered from the separator tank.
In order to grant the correct functioning of the pump, the service liquid supply pressure shall be 0,5 bar higher than the pump discharge pressure.
Also in this case it is recommended to make sure that the service liquid supply pressure will be 0,5 bar above the pump discharge pressure.

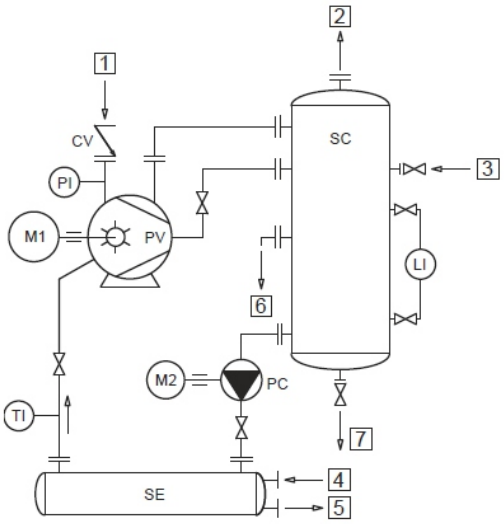
FIG.4



13.3 – Service liquid total recirculation arrangement

The drawing shows the typical system arrangement for those installations where no leakage of process gas or of any polluted liquid could take place due either to their chemical composition or to any contamination taken place between gas and liquid which does not allow any free discharge or drain but must kept within the process. The service liquid flows from the pump to the separator tank and then back to the pump through a heat exchanger that cools the liquid to the recommended temperature.
In case of high pressure drop through the equipment or any time the correct service liquid flow supply to the pump might be altered, it is advisable or even mandatory to install a recirculation pump that grants the minimum required pressure inside the system.

FIG.5

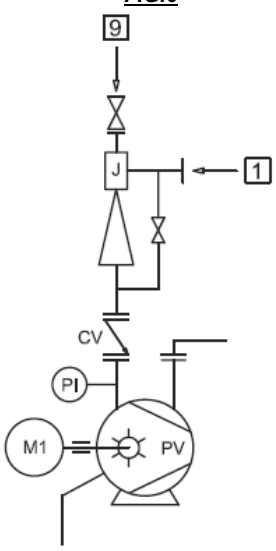


13.4 – Accessories

- Particular attention has to be paid when installing the **gaskets** between flanges which shall be placed concentrically in respect to the flange to avoid the restriction of the area dedicated to the passing of fluids.
- A **check valve** is fitted on the pump suction nozzle when it runs as a vacuum pump in order to avoid the loss of vacuum ahead of the pump; the check valve is installed on the gas discharge line when the pump runs as a compressor in order to prevent the loss of the backpressure.
- The separation of the process gases from the service liquid normally takes place in a **separator tank** which has also the duty to recover the service liquid completely or partially.
- The separator can be fitted directly on top of the pump discharge nozzle or to the side of the pump with a tangential inlet.

- Normally the separator tank is provided with an **overflow connection** (to drain the excess of liquid in case the pump sucks liquid or process vapors which do condense) and a service liquid **make up connection**.
- When the **FLA** pump runs with full recirculated service liquid, it is required to cool down the service liquid at the design inlet temperature; this can be achieved by using a **heat exchanger** located on the recirculated service liquid line back to the pump.
- The service liquid **recirculation pump** is usually installed together with a check valve fitted on its discharge line and followed downstream by a **flow adjusting valve**.
- The monitoring of the service liquid flow can be made either with a **pressure gauge**, located downstream the recirculation pump, in combination with the knowledge of the recirculation pump performance or, more accurately, by a **flow meter** or a **flow indicator**, with or without a minimum flow switch, installed on the service liquid recirculation line.
- When the pump runs close to cavitation conditions, or the process stream contains gases with high vapor tension, it is recommendable to install the **anticavitation valve** (in vertical position!) directly on the dedicated pump casing connection and normally connected to the separator.
- To avoid the flooding of the liquid ring pump during shut down time, it is required to stop the recirculation pump at the same time when the liquid ring pump is stopped.
- On complex plants or when are present toxic and hazardous gases and liquids, normally there are installed monitoring, control and self-adjusting equipment, safety devices to check levels, flow rates, pressures in all critical points like **low/high level switches, actuated valves, control valves, safety valves and any sort of extra safeties/alarms**.
- When installing a **gas ejector** on the pump suction, it can be achieved a deeper vacuum. The ejector does not have any impact on the absorbed power and usually is installed in vertical position. (It can be also installed in horizontal position without affecting the functioning).

FIG.6



CAUTION!
The driving gas of the ejector must not contain any liquid droplets.

14. OPERATING CONDITIONS

14.1 – Operating data

The nominal pump capacity and the absorbed power related to the suction pressure or differential pressure can be determined by reading the performance curve attached to the technical-commercial documentation submitted with the offer or with the order acknowledgement. A copy can be supplied upon customer's request.

14.2 – Gas and Vapors

Gases and vapors handled by the pump, as well as the service liquid, must not contain any solid particles which may damage any inner surface which has a set clearance among the rotating and static parts; are however permitted small quantity of powders, non-abrasive, in suspension.
If the inlet stream contains a consistent quantity of condensables, it is advisable to install a pre condenser ahead of the pump suction nozzle; the condensate resulting from the cooling can flow into the pump provided that the total amount shall not exceed the allowed max. quantity of liquid carry over stated in TAB 2.
In case the inlet temperature of the process gas is above 158°F, it may be necessary to increase the service liquid flow rate up to even 50% more compared to the design flow stated in TAB. 3.

14.3 – Service liquid supply

As already mentioned above, the service liquid shall not contain any solid particles therefore it is recommendable to install a strainer in the service liquid supply piping. The flow rates stated in TAB. 3 are mandatory; those values are referred to suction conditions of dry gas only.
Water at 15°C has been used for testing the pump in the ASCO POMPE Srl test lab. Pump performances will change if the service liquid is not alike. The pressure of the service liquid supply shall be adequate to overcome the pressure losses of the liquid through the piping and through the heat exchanger, if any, plus assure a positive pressure of 0,5 bar above the pump suction pressure.
The selected service liquid must be compatible with the process gases and vapors, its density shall range from 800 to 1200 Kg/m3 and its viscosity shall be below 8 cST.

Pump improper use or use not in accordance with what specified and recommended in this manual may cause malfunctioning of the equipment and serious consequences for people and things.

TAB.2

PUMP TYPE	Max. quantity of liquid carry over allowed through the suction nozzle (m3/h)	
	Continuous operation	Discontinuous operation
FLA 26	0.50	0.60
FLA 51	0.60	0.72
FLA 96	1.70	2.00
FLA 131	1.80	2.20
FLA 256	3.00	3.60
FLA 326	3.20	3.90
FLA 456	3.80	4.60

TAB.3

DESIGN SERVICE LIQUID FLOW RATE (m3/h)						
PUMP TYPE	Hz	RPM	VACUUM PUMP Suction pressure (mbar abs.)			COMPRESSOR
			40	200	600	
FLA 26	50Hz	2850	0.40	0.39	0.33	0.28
	60Hz	3450	0.40	0.39	0.33	0.28
FLA 51	50Hz	2850	0.50	0.46	0.40	0.35
	60Hz	3450	0.50	0.46	0.40	0.35
FLA 96	50Hz	2850	0.70	0.69	0.60	0.45
	60Hz	3450	0.86	0.85	0.75	0.45
FLA 131	50Hz	2850	0.70	0.69	0.63	0.55
	60Hz	3450	0.80	0.77	0.70	0.55
FLA 256	50Hz	1460	1.20	1.15	1.06	1.00
	60Hz	1760	1.25	1.22	1.15	1.00
FLA 326	50Hz	1460	1.25	1.00	0.90	0.90
	60Hz	1760	1.40	1.20	1.1	0.90
FLA 456	50Hz	1460	1.45	1.36	1.25	1.15
	60Hz	1760	1.45	1.36	1.25	1.15

14.4 – Noise

TAB.4

NOISE LEVEL		
PUMP TYPE	Sound pressure level measured at 1 m distance, when operating in vacuum at 100 mbar abs. (Noise level measured in accordance with ISO 3746) Tolerance ±3 dB(A)	
	50 Hz	60 Hz
FLA 26	67	69
FLA 51	68	70
FLA 96	71	73
FLA131	72	74
FLA 256	70	72
FLA 326	72	74
FLA 456	74	76

Data are referring to machines operating in vacuum at 100 mbar abs and piping connected to the system.
The noise level depends on several factors: the type of installed motor, the pumping characteristics, the plant and the piping features, and the characteristics of the building where the pump is installed.

15. START UP

Before shipment, pumps with cast iron casing are flushed with s oluble rust inhibitor oil. At start up flush the pump properly to clean it.

15.1 – Preparation to Start Up

When the pump is started up for the first time, the following checks shall be performed:

- Open the shut off valve located on the pump discharge line, if any.
- Prime the pump and the service liquid lines up to the pump center-line or up to the highest level allowed by the level control devices.
- Check the sense of rotation of the liquid ring pump and of the recirculation pump, if any, by starting the dedicated motor for very short time. If the sense of rotation is not correct, assuming the power supply is three phase, disconnect the power supply, open the motor terminal box and exchange the connection of two phases, **afterwards close the terminal box by fixing the cover**.

When performing this step make sure that the safety device which prevents the accidental supply of power is activated.

15.2 – Start Up

Start up the pump after having checked that all shut off valves located in the suction and discharge lines are opened and at the same time start up the recirculation pump. Just after start up, the service liquid flow adjusting valve has to be set according to the volume of the service liquid required by the pump. Block the achieved valve setting; this position shall be kept even during shut down period (for safety, it is advisable to remove the hand wheel to prevent any tampering). The exact service liquid flow required by each **FLA** model is specified in TAB. 3.
Open the cooling water supply to the heat exchanger, if any, and adjust the flow according to the value stated in the specific documentation.
Check that the current absorbed by the motor and indicated by the Amp meter located in the panel does not exceed the value reported on the motor nameplate. Check that the pump runs smoothly by turning silent and without vibration.
In case during pump operation it appears that there is something wrong with the pump, it is required to stop it immediately and to identify the reason of the malfunctioning.

During the normal operation, check on a routine basis the main parameters like the suction pressure, the discharge pressure by reading the vacuum or pressure gauge, the level in the separator, the service liquid flow and temperature and the motor absorbed current.
If required, add make up liquid inside the separator.

DO NOT RUN THE PUMP WITHOUT SERVICE LIQUID!
BEFORE STARTING UP THE PUMP,ISITNECESSARY THAT THE PLANT IS COMPLETED FROM BOTH MECHANICAL AND ELECTRICAL POINT OF VIEW, IN ACCORDANCE WITH THE LOCAL SAFETY STANDARDS ON FORCE.

15.3 – Stop

Switch off the vacuum pump motor and the recirculation pump motor, if any, stop the cooling water supply to the heat exchanger, if any, by closing the dedicated valves.
In case of pump stop and presence of vacuum ahead of the pump below 100 mbar, in order to allow the pump to start again, it is necessary to arrange the equalizing of the pressure inside the suction and discharge lines. This is not necessary when the pump has the anticavitation valve in service.

16. MAINTENANCE

CAUTION!
All maintenance activities must be carried out by authorized and specialized personnel wearing personal safety equipment.
Before starting with maintenance activities, be sure that the pump cannot start accidentally. Put the main electrical switch in OFF position and put a danger sign with the words: “PUMP UNDER MAINTENACE”

If the pump runs within the limits of the operating range specified in the previous sections and, more important, if the recirculated service liquid is clean and does not contain solid abrasive particles, **FLA** pumps will be able to operate for a long time without the need of performing any maintenance activity.
Operators responsible for plant inspection must anyway periodically check the regular pump operation.

Extreme care has to be dedicated any time there is a leak from the mechanical seal or when an unusual noise or vibration will arise. Particularly if it is associated with an increase in power consumption or irregular fluctuations of the Amp meter.
When water is used as service liquid, especially in case of recirculated service liquid arrangement, it is required to check its hardness as it might form lime deposits on the internals with consequent wear of the inner parts and increase of the absorbed power.

The most important and frequent maintenance activities are normally the following:

- Replacement of the mechanical seal
- Pump internal cleaning
- Replacement of the bearings

For any activity involving the pump disassembly and re-assembly in order to replace failed parts, please refer to section 20 – REPAIR.

17. OPERATING PROBLEMS AND TROUBLE SHOOTING

All actions to be carried out in order to recover from the malfunctioning problems reported in the next table must be performed in full safety conditions and, depending on the type of action required, in accordance with the procedures described in the dedicated section of this manual.

TAB.5

MALFUNCTIONING	POSSIBLE CAUSE	REMEDY
1.The motor is switched on but does not turn and makes no noise	1.1 At least two wires are cut off	Check the rating of the motor protection device and the wiring to the terminals of the motor box
2.The motor is switched on but does not turn and makes some buzzing noise	2.1 At least one wire is cut off	Check the wiring to the terminals of the terminal box
	2.2 The motor rotor is blocked	Disassembly and check the motor
	2.3 The pump is clogged	Disassembly and check the pump
3. The motor protection device activates just after start up	3.1 Short circuit in the motor	Check and replace the winding motor
	3.2 Motor overload	Decrease the service liquid flow
	3.3 Backpressure is too high	Decrease the backpressure
	3.4 Too much liquid goes into the pump through the suction stream	Reduce the liquid carry over
	3.5 The motor rotor is blocked	See point 2.2 and 2.3
4. Absorbed current exceeds the rated value stated on the motor nameplate	4.1 Deposits of foreign material inside the pump	Drain and clean the pump
	4.2 Backpressure is too high	See point 3.3
	4.3 Too much liquid goes into the pump through the suction stream	See point 3.4
	4.4 Motor overload	Reduce the service liquid flow
5. The pump does not make vacuum	5.1 No supply of service liquid	Check the service liquid line
	5.2 Air leak in the suction line	Check the tightness of the suction line and gaskets conditions
	5.3 Wrong sense of rotation	Exchange the connection of two phases
6. The inlet pressure provided by the pump is not deep enough	6.1 The pump is undersized	Replace the pump
	6.2 Low service liquid flow	Increase the service liquid flow
	6.3 The service liquid temperature is too high	Decrease the temperature of the service liquid or increase the flow
	6.4 Air leak in the suction line	See point 5.2
	6.5 Excessive wear of pump internals	Reconditioning of the pump is required
	6.6 Failure of the vary port valve	Replace the vary port valve
7. Unusual internal noise	7.1 Pump runs under cavitation	Install the anticavitation valve or arrange for an air bleed valve on the suction line
	7.2 Excessive service liquid flow	Reduce the service liquid flow
8. Liquid leaks between pump housing and casing	8.1 Gaskets are not granting seal	Replace the gaskets
9. Pump vibrates and is noisy	9.1 The impeller is unbalanced	Pump inspection and repair are required
	9.2 Pump bearings are worn out	Pump inspection and repair are required
	9.3 Motor bearings are worn out	Repair the motor

18. SHUT DOWN PERIOD

When a relatively long shut down period is foreseen (more than 2 months), or whenever required, it is necessary to drain the liquid ring pump, the recirculation pump and the heat exchanger, if any.
Remove the threaded drain plugs located in the lowest part of the pump casing and wait for the complete discharge of the liquid.
This procedure has to be followed also when it is required to p reserve the pumps and the heat exchanger from potential damages caused by freezing or when the service liquid may generate deposits.

If the service liquid is classified as hazardous then draining the pump it is mandatory to flush the service liquid circuit by using a suitable liquid; the flushing can be made by keeping the pump in operation.

THE END USER MUST MAKE SURE THAT THE DISPOSAL OF THE SERVICE LIQUID MAY NOT CAUSE DANGER TO PEOPLE HEALTH AND TO THINGS AND THAT THE ADOPTED DISPOSAL PROCEDURES SHALL COMPLY WITH THE LOCAL LAW AND RELEVANT STANDARDS ON FORCE.

19. PUMP SCRAP AND DISPOSAL

When scrapping and tearing down the pump, it is required to apply the specific disposal procedures depending on the material of each part of the pump.
It is mandatory that pump internals are cleaned and drained from any hazardous and polluting fluid which can be dangerous to people, to things and to the environment.

As already stated in other sections of this manual, the handling and disposal of fluids as well as parts or any other item shall be performed in compliance with the local law and relevant standards on force.

20. REPAIR

Due to the accuracy required in performing the disassembly and assembly activities of **FLA** pumps, they shall be carried out exclusively by trained and skilled personnel.
If required, the pump can be returned back to the DVP PUMPS, INC. for repair.

Before crating and dispatching the pump back for repair, make sure that the pump is completely drained and properly cleaned. In case of operation with toxic and/or hazardous fluids, it is mandatory to flush the pump internals for removing any process trace.
The disposal of the cleaning liquid shall comply with the local law and relevant standards on force.
Before shipping the pump put a sign with “FREE FROM POLLUTION PUMP” and write the same note on transport documents.

20.1 – Pump disassembly

In order to prevent any accidental power supply to the motor, with consequent start of the pump, make sure that all safety precautions have been applied before start disassembling the pump. All activities shall be carried out in accordance with the safety procedures and standards already described in this manual.

Before disassembly, it is necessary to close all service circuits and disconnect the plant piping connected to the pump.
Drain the pump and the service liquid lines and, in case it has operated with toxic and hazardous fluids, follow the warnings already underlined.

20.1.1 – Hydraulic part disassembly

Start by loosening bolts (16) which fix the suction/discharge casing (4) to the pump casing (1) or to the seal-motor flange (15), afterwards acting with light strokes of lead or plastic mallet, remove the suction/discharge casing (4) complete with port plate (2) from the pump casing (1).
Remove the screw (23), if present, depending on the pump model, which fixes the port plate to the suction/discharge casing, then separate the two parts.
After taking apart the port plate, dismount the vary port valve(7) by loosening the relevant fixing screws (9) and remove the valve plate (8).

To disassemble the impeller (3), loosen the impeller nut (31) and the nut (30). The impeller can be taken off from the shaft by using the two extraction holes, if present on the impeller hub, then remove the impeller key (18) from the shaft. Slide the mechanical seal rotating part (5) out from the impeller hub, then the stationary ring out from its seat located in the casing (1) on **FLA 26-51-96-131** or in the seal-motor flange (15) on **FLA 256-326-456.**

20.1.2 – Bearing housing disassembly

To replace the bearings in the bearing housing it is necessary, after the hydraulic part disassembly described above, to remove the motor and the coupling guard (34), loosen the fixing screw of the half couplig pump side, then slide the coupling from the shaft (11).
FLA 26-51-96-131: slide the V-Ring (37), the key (19), loosen the screws (25.1) and (25.2), remove the bearing covers drive end (13) and non drive end (14), the bearing circlip (36) if present, then slide the shaft towards the drive end by acting with light strokes of lead or plastic mallet; after the slide of the bearing drive end (12.1) out of the bearing housing (10), it is necessary to remove the circlip (20) inside the bearing housing, if present, in order to slide out the bearing non drive end (12.2); otherwise the non drive end bearing (12.2) remains inside the bearing housing.
Loosen the bearing nut (22) then slide the two bearings out from the shaft or from the bearing housing depending on construction.
FLA 256-326-456: slide the V-Ring (37), the key (19), loosen the screws (25.1) e (25.2) and remove the bearing covers drive end (13) and non drive end (14), loosen the bearing nut (22), then slide the shaft towards the motor side by acting with light strokes of lead or plastic mallet; then slide the bearing drive end (12.1) out from the shaft and the bearing non drive end (12.2) out from the bearing housing.

20.2 – Pump re-assembly

CAUTION!
Before starting the pump re-assembly, it is requested to carefully clean all parts by removing any trace of deposits or material build up in the internals.
During the cleaning make sure not to damage the contact surfaces, especially when using a scraper on the suction/discharge casing, port plate and casing.

To seal the contact surfaces use the relevant flat gasket (6.1) and O-Rings (63) on **FLA 256-326-456**, while on **FLA 26-51-96-131 SS** construction use the relevant flat gaskets (6.1/6.2), making sure that they are in good condition, otherwise they must be replaced with new ones.

20.2.1 – Bearing housing re-assembly

FLA 26-51-96-131: fit on the shaft (11) the bearing drive end (12.1) locking it by the relevant lock nut (22) then slide it, using a lead or plastic mallet towards the pump end side, inside the bearing housing (10), after having fitted into its seat inside it the bearing lock circlip (20), if provided.
Mount the bearing cover drive end (13) by using the dedicated screws (25.2) then, using a mallet and a mounting bush suitably sized, fit the bearing non drive end (12.2) into the bearing housing, fit into its seat on the shaft the bearing lock circlip (36) if provided, then mount the bearing cover non drive end (14) by using the dedicated screws (25.1), and finally fit on the shaft the V-Ring (37) making sure that the seal lip is in contact with the bearing cover non drive end (14).
FLA 256-326-456: fit on the shaft (11) the bearing non drive end (12.2) locking it by the relevant lock nut (22) then slide it, using a lead or plastic mallet towards the drive side, inside the bearing housing (10).
Mount the bearing cover non drive end (14) by using the dedicated screws (25.1) then, using a mallet and a mounting bush suitably sized, fit the bearing drive end (12.1) into the bearing housing, then mount the bearing cover drive end (13) by using the dedicated screws (25.2), and finally fit on the shaft the V-Ring (37) making sure that the seal lip is in contact with the bearing cover non drive end (14).

20.2.2 – Hydraulic part re-assembly

Before starting fitting the stationary ring of the mechanical seal (5) into its seat located in the casing (1) on **FLA 26-51-96-131** or in the seal-motor flange (15) on **FLA 256-326-456,** make sure that the seat itself is properly cleaned; coat the stationary ring with a lubricating medium like soap or alcohol and then install it very carefully by pushing it into the seat either by hand or with a pad in soft material in order to avoid the damaging of the ring contact surface.

To continue the re-assembly of the pump, select a horizontal surface and lay on it, in vertical position, either the bearing housing assembly with the motor mounting flange pointing downwards, in case of **FLA** version, or the motor with the fan cover pointing downwards, in case of **FLA** version.
The next step consists in fitting the casing (1), or the seal-motor flange (15), depending on construction, onto the shaft by sliding it very carefully. Pay attention to avoid any damaging of the mechanical seal stationary ring.
Fix the casing or the seal-motor flange to the bearing housing assembly (**FLA**) or to the motor (**AVM**) by using the dedicated screws (24) or (17) then, only for **FLA256-326-456**, mount the casing (1) **temporarily without the O-Rings (63)**.
Fit the key (18) into the dedicated shaft slot and then slide the impeller (3) on which it has already been fitted the rotating ring of the mechanical seal (5) in the way that the contact surface is facing down towards the housing; to ease the sliding on the hub, coat with a lubricating medium like soap or alcohol.

20.3 – Impeller clearance adjustment

Screw the stud (28) into the shaft end hole in case it was taken off at disassembly and then screw the adjusting nut (29) inside the impeller hub.
By acting on the adjusting nut (29), position the impeller in order to measure by using a depth sliding gauge or a gauge the value of the clearance between the port plate contact surface on the housing and the impeller surface; the clearance measurement shall be taken only after having tightened respectively the nut (30) and the impeller nut (31) inclusive of the O-Ring (33). The clearance shall range within the values stated in TAB.6.

CAUTION!
The measured clearance shall also take into account any axial clearance of the housing bearings or of the motor bearings; in that respect, it is advisable to fit a pad just slightly thicker compared to the distance between the working surface and the bottom shaft end of the bearing housing (**FLA**) or of the motor (**AVM**).
This assembly trick is necessary in order to prevent any internal friction especially during the operation at deep vacuum when the impeller is subject to a forward push which involves the complete rotating assembly tending to move towards the port plate.

Install the vary port valve (7) on the port plate (2) by using the dedicated valve plate (8), the fixing screws (9) and the washers (32), if provided; fix the port plate on the suction/discharge cover (4) by the dedicated screw (23), if present, depending on the pump model, taking care to seal the contact surfaces by using the relevant flat gasket (6.1).
Mount the suction/discharge cover assembly complete with port plate on the casing (1), taking care to seal the contact surfaces by using the relevant flat gasket (6.2) for **FLA 26-51-96-131**.
On **FLA 256-326-456 CS SS** construction insert the two O-Rings (63) into the dedicated seats on the casing.
Fix the casing by using the dedicated bolts (16) and make sure that the torque applied on the wrench meets the values reported in TAB. 7.

Complete the re-assembly of **FLA** pump by fitting the pump side end half coupling on the shaft and fixing it by tightening the set screw. Check that the pump shaft turns freely and that there is no friction between the impeller and the housing otherwise it is required to find out the causes and proceed with the correcting actions.
Insert the coupling guard (34) in the bearing housing (10), align half couplings to their respective shafts end, then fit the motor complete with the half coupling to the flange of the bearing housing by using the dedicated screws.
The nominal clearance between the rotating assembly and each side of the static part is stated in TAB.6 here below.

TAB.6

PUMP TYPE	Clearance between impeller and port plate (mm)			
	(< 122°F)		(>122 °F)	
	Min.	Max.	Min.	Max.
FLA 26-51	0.1	0.13	0.15	0.18
FLA 96-131	0.15	0.18	0.2	0.23
FLA 256-326-456	0.2	0.23	0.25	0.28

TAB.7

Fixing bolts tightening torque values (Nm)							
Size	M6	M 8	M 10	M 12	M 14	M 16	M 18
Value	6	15	30	50	80	120	170

TAB.8

Fixing bolts tightening torque values (Position 16) (Nm)			
Pump size	**26 / 51**	**96 / 131**	**256 / 326 / 456**
Value	5	9	22

21. SPARE PARTS

To order spare parts necessary to pump repair and reconditioning, the following information are mandatory:

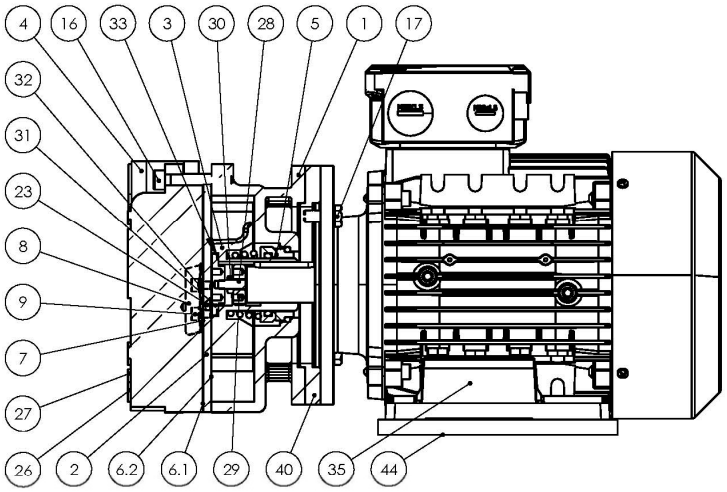
- Part description
- Item number
- Pump model
- Pump serial number

The first two data can be found on the pump section drawing attached to this manual and the remaining two on the pump identification nameplate.
Original spare parts kits are available for standard construction pumps.

Some items are buy out products and can be purchased either fro m original manufacturers or their distribution network.

FLA 26

YOUR VACUUM PROFESSIONALS	POMPA PER VUOTO / VACUUM PUMP FLA 26 DISEGNO DI SEZIONE / CROSS SECTIONAL DRAWING	ASX-A0026-01	Rev. B
		Disegnato Drawn: G.G. / Controllato Checked: A.E.	Data Date: 03/02/2021



Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
35	Motore elettrico **Electric motor**	1
1	Corpo intermedio **Intermediatre casing**	1
2	Disco distributore **Port plate**	1
3	Girante **Impeller**	1
4	Corpo aspirante/premente **Suct./disch. Casing**	1
5 ◊	Tenuta meccanica **Mechanical seal**	1
6.1 ◊	Guarnizione **Gasket**	
6.2 ◊	Guarnizione **Gasket**	1
29 ◊	Ghiera di regolazione **Adjusting nut**	1
31 ◊	Ghiera bloccaggio girante **Impeller nut**	1
7 ◊	Valvola a membrana **Membrane Valve**	1
8 ◊	Piastra valvola **Valve plate**	1

Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
33 ◊	Anello O-Ring **O-Ring**	1
44	Supporto motore (solo per 50 Hz) **Motor foot (only for 50 Hz)**	2
26	Tappo **Plug**	1
27	Tappo **Plug**	3
28 ◊	Barra filettata **Threaded rod**	1
9 ◊	Vite **screws**	2
16	Vite **screws**	5
17	Vite **screw**	4
30 ◊	Dado **nut**	1
32 ◊	Rosetta elastica **Washer**	2
23	Vite **screw**	1
40	Flangia spessoramento (solo per 60 Hz) **Spacer flange (only for 60 Hz)**	1

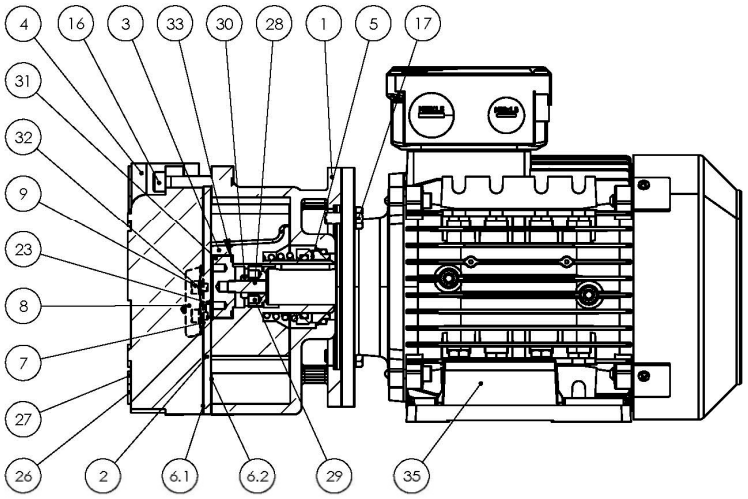
Rev.	Data-Date	Descrizione-Description	Disegnato-Drawn	Contr.-Checked
-	-	-	-	-
-	-	-	-	-
B	25/08/2021	ADDED CODE FOR KIT	G.G.	A.E.

FLA 51

YOUR VACUUM PROFESSIONALS

POMPA PER VUOTO / VACUUM PUMP
FLA 51
DISEGNO DI SEZIONE / CROSS SECTIONAL DRAWING

ASX-A0051-01		Rev. B
Disegnato Drawn	Controllato Checked	Data Date
G.G.	A.E.	03/02/2021



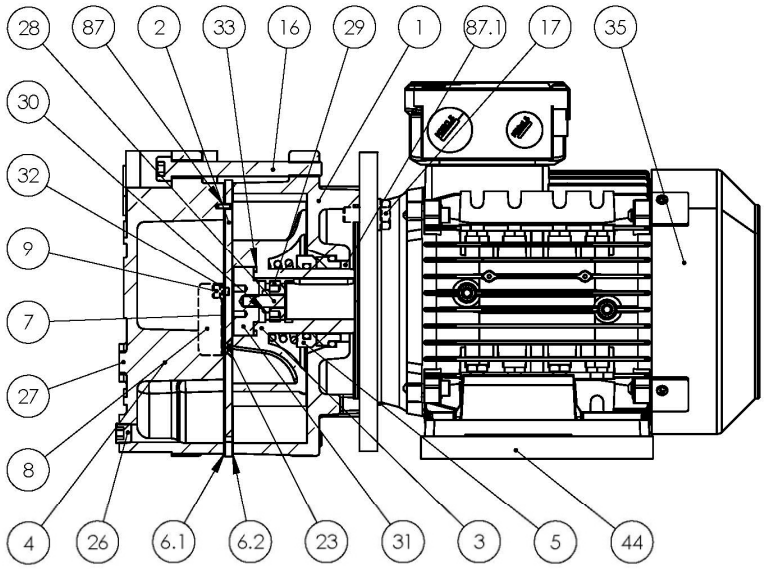
Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
35	Motore elettrico **Electric motor**	1
1	Corpo intermedio **Intermediatre casing**	1
2	Disco distributore **Port plate**	1
3	Girante **Impeller**	1
4	Corpo aspirante/premente **Suct./disch. Casing**	1
5 ◊	Tenuta meccanica **Mechanical seal**	1
6.1 ◊	Guarnizione **Gasket**	
6.2 ◊	Guarnizione **Gasket**	1
29 ◊	Ghiera di regolazione **Adjusting nut**	1
31 ◊	Ghiera bloccaggio girante **Impeller nut**	1
7 ◊	Valvola a membrana **Membrane Valve**	1

Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
8 ◊	Piastra valvola **Valve plate**	1
33 ◊	Anello O-Ring **O-Ring**	1
26	Tappo **Plug**	1
27	Tappo **Plug**	3
28 ◊	Barra filettata **Threaded rod**	1
9 ◊	Vite **screws**	2
16	Vite **screws**	5
17	Vite **screw**	4
30 ◊	Dado **nut**	1
32 ◊	Rosetta elastica **Washer**	2
23	Vite **screw**	1

Rev.	Data-Date	Descrizione-Description	Disegnato-Drawn	Contr.-Checked
-	-	-	-	-
-	-	-	-	-
B	25/08/2021	ADDED CODE FOR KIT	G.G.	A.E.

FLA 96

DVP YOUR VACUUM PROFESSIONALS	POMPA PER VUOTO / VACUUM PUMP FLA 96 DISEGNO DI SEZIONE / CROSS SECTIONAL DRAWING	ASX-A0096-01	Rev. B
		Disegnato Drawn: G.G. / Controllato Checked: A.E.	Data Date: 03/02/2021



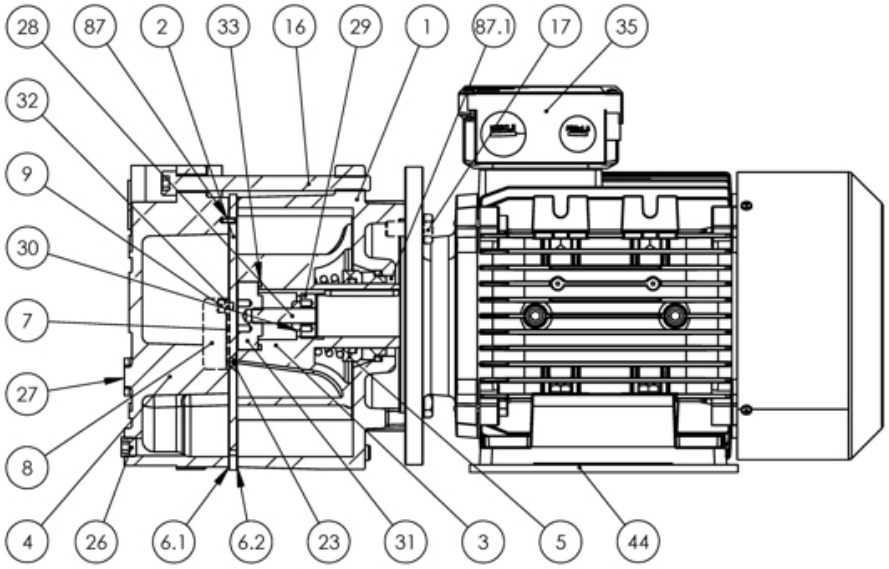
Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
35	Motore elettrico **Electric motor**	1
1	Corpo intermedio **Intermediate casing**	1
2	Disco distributore **Port plate**	1
3	Girante **Impeller**	1
4	Corpo aspirante/premente **Suction / discharge**	1
5 ◊	Tenuta meccanica **Mechanical seal**	1
6.1 ◊	Guarnizione **Gasket**	1
6.2 ◊	Guarnizione **Gasket**	1
29 ◊	Ghiera di regolazione **Adjusting nut**	1
31 ◊	Ghiera bloccaggio girante **Impeller nut**	1
7 ◊	Valvola a membrana **Valve membrane**	1
8 ◊	Piastra valvola **Valve plate**	1
33 ◊	Anello O-Ring **O-Ring**	1

Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
26	Tappo **Plug**	1
27	Tappo **Plug**	2
44	Supporto motore **Motor foot**	2
28 ◊	Barra filettata **Threaded rod**	1
9 ◊	Vite **screw**	2
16	Vite **screw**	5
23	Vite **screw**	1
17	Vite **screw**	4
30 ◊	Dado **Nut**	1
32 ◊	Rosetta elastica **Washer**	2
87	Spina elastica **Locating pin**	1
87.1	Spina elastica (solo per versione SS) **Locating pin (only for SS version)**	1

Rev.	Data-Date	Descrizione-Description	Disegnato-Drawn	Contr.-Checked
-	-	-	-	-
-	-	-	-	-
B	25/08/2021	ADDED CODE FOR KIT	G.G.	A.E.

FLA131

DVP YOUR VACUUM PROFESSIONALS	POMPA PER VUOTO / VACUUM PUMP FLA 131 DISEGNO DI SEZIONE / CROSS SECTIONAL DRAWING	ASX-A0131-01	Rev. B
		Disegnato Drawn: G.G. / Controllato Checked: A.E.	Data Date: 03/02/2021



Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
35	Motore elettrico **Electric motor**	1
1	Corpo intermedio **Intermediate casing**	1
2	Disco distributore **Port plate**	1
3	Girante **Impeller**	1
4	Corpo aspirante/premente **Suction / discharge**	1
5 ◊	Tenuta meccanica **Mechanical seal**	1
6.1 ◊	Guarnizione **Gasket**	1
6.2 ◊	Guarnizione **Gasket**	1
29 ◊	Ghiera di regolazione **Adjusting nut**	1
31 ◊	Ghiera bloccaggio girante **Impeller nut**	1
7 ◊	Valvola a membrana **Valve membrane**	1
8 ◊	Piastra valvola **Valve plate**	1
33 ◊	Anello O-Ring **O-Ring**	1

Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
26	Tappo **Plug**	1
27	Tappo **Plug**	2
44	Supporto motore **Motor foot**	2
28 ◊	Barra filettata **Threaded rod**	1
9 ◊	Vite **screw**	2
16	Vite **screw**	5
23	Vite **screw**	1
17	Vite **screw**	4
30 ◊	Dado **Nut**	1
32 ◊	Rosetta elastica **Washer**	2
87	Spina elastica **Locating pin**	1
87.1	Spina elastica (solo per versione SS) **Locating pin (only for SS version)**	1

Rev.	Data-Date	Descrizione-Description	Disegnato-Drawn	Contr.-Checked
-	-	-	-	-
-	-	-	-	-
B	25/08/2021	ADDED CODE FOR KIT	G.G.	A.E.

FLA 256

YOUR VACUUM PROFESSIONALS

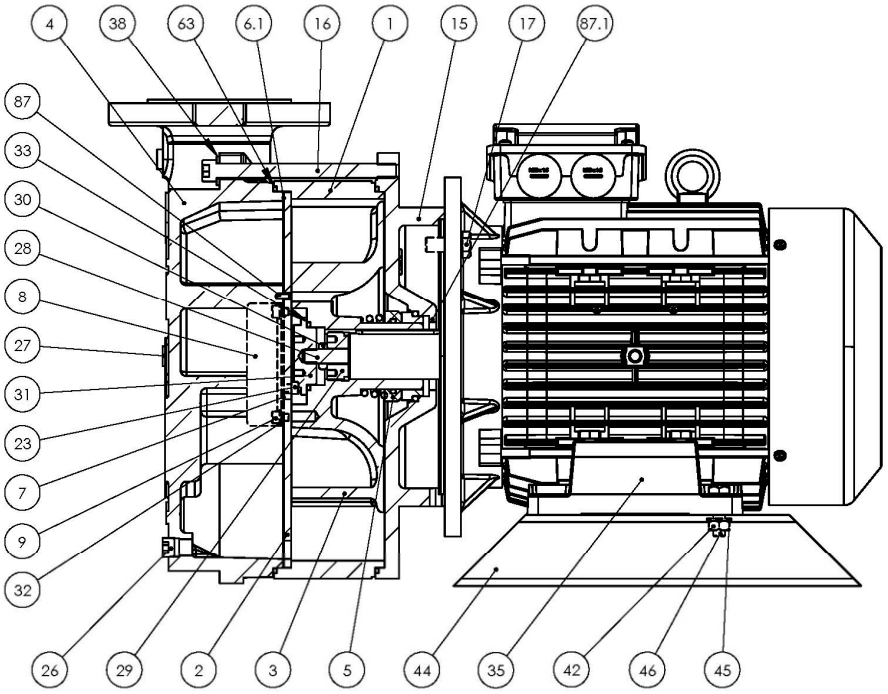
POMPA PER VUOTO / VACUUM PUMP

FLA 256

DISEGNO DI SEZIONE / CROSS SECTIONAL DRAWING

ASX-A0256-01 | Rev. B

Disegnato Drawn: G.G. | Controllato Checked: A.E. | Data Date: 03/02/2021



Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
35	Motore elettrico **Electric Motor**	1
1	Corpo intermedio **Intermediate**	1
2	Disco distributore **Port plate**	1
3	Girante **Impeller**	1
4	Corpo aspirante/premente **Suction / discharge casing**	1
15	Flangia tenuta-motore **Seal flange motor**	1
5 ◊	Tenuta meccanica **Mechanical seal**	1
6.1 ◊	Guarnizione **Gasket**	1
29 ◊	Ghiera di regolazione **Adjusting nut**	1
31 ◊	Ghiera bloccaggio girante **Impeller nut**	1
7 ◊	Valvola a membrana **Vari-port valve**	1
8 ◊	Piastra valvola **Valve plate**	1
33 ◊	Anello O-Ring **O-Ring**	1
26	Tappo **Plug**	4
27	Tappo **Plug**	1

Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
63 ◊	Anello O-Ring **O-Ring**	2
44	Supporto motore **Motor foot**	2
28 ◊	Barra filettata **Threaded rod**	1
9 ◊	Vite **screw**	2
16	Vite **screw**	5
23	Vite **screw**	1
17	Vite **screw**	4
46	Vite **screw**	4
30 ◊	Dado **nut**	1
42	Dado **nuts**	4
32 ◊	Rosetta elastica **Washer**	2
38	Rosetta piana **Plain washer**	5
45	Rosetta piana **Plain washer**	4
87	Spina elastica **Locating pin**	1
87.1	Spina elastica (solo per versione SS) **Locating pin (only for SS version)**	1

Rev.	Data-Date	Descrizione-Description	Disegnato-Drawn	Contr.-Checked
-	-	-	-	-
-	-	-	-	-
B	25/08/2021	ADDED CODE FOR KIT	G.G.	A.E.

FLA 326

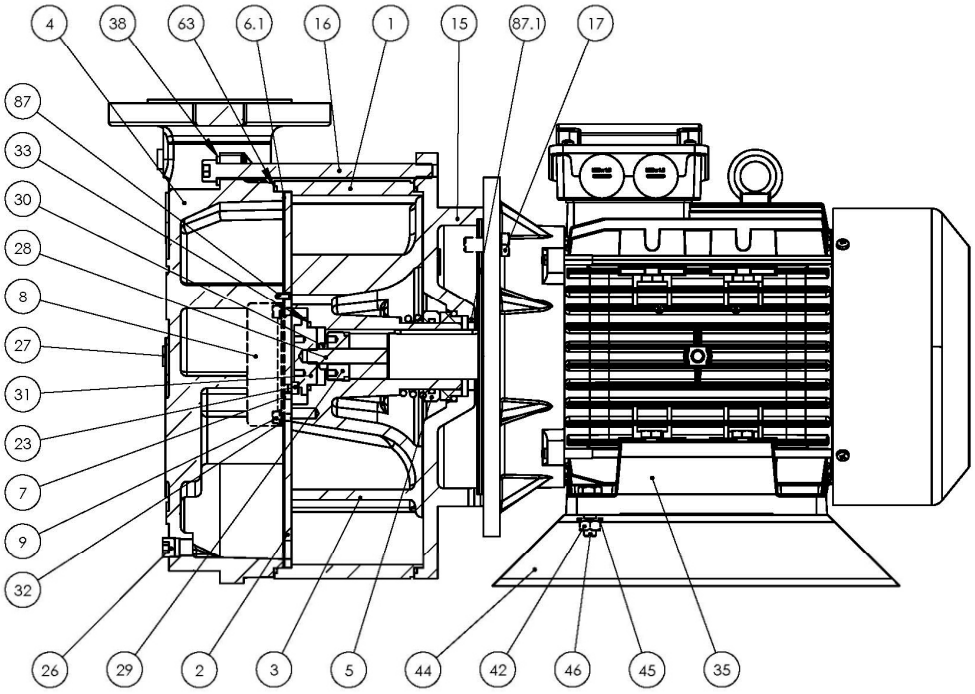
YOUR VACUUM PROFESSIONALS

POMPA PER VUOTO / VACUUM PUMP

FLA 326

DISEGNO DI SEZIONE / CROSS SECTIONAL DRAWING

ASX-A0326-01		Rev. B
Disegnato Drawn	Controllato Checked	Data Date
G.G.	A.E.	03/02/2021



Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
35	Motore elettrico **Electric Motor**	1
1	Corpo intermedio **Intermediate**	1
2	Disco distributore **Port plate**	1
3	Girante **Impeller**	1
4	Corpo aspirante/premente **Suction / discharge casing**	1
15	Flangia tenuta-motore **Seal flange motor**	1
5 ◊	Tenuta meccanica **Mechanical seal**	1
6.1 ◊	Guarnizione **Gasket**	1
29 ◊	Ghiera di regolazione **Adjusting nut**	1
31 ◊	Ghiera bloccaggio girante **Impeller nut**	1
7 ◊	Valvola a membrana **Vari-port valve**	1
8 ◊	Piastra valvola **Valve plate**	1
33 ◊	Anello O-Ring **O-Ring**	1
26	Tappo **Plug**	4
27	Tappo **Plug**	1

Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
63 ◊	Anello O-Ring **O-Ring**	2
44	Supporto motore **Motor foot**	2
28 ◊	Barra filettata **Threaded rod**	1
9 ◊	Vite **screw**	2
16	Vite **screw**	5
23	Vite **screw**	1
17	Vite **screw**	4
46	Vite **screw**	4
30 ◊	Dado **nut**	1
42	Dado **nuts**	4
32 ◊	Rosetta elastica **Washer**	2
38	Rosetta piana **Plain washer**	5
45	Rosetta piana **Plain washer**	4
87	Spina elastica **Locating pin**	1
87.1	Spina elastica (solo per versione SS) **Locating pin (only for SS version)**	1

Rev.	Data-Date	Descrizione-Description	Disegnato-Drawn	Contr.-Checked
-	-	-	-	-
-	-	-	-	-
B	25/08/2021	ADDED CODE FOR KIT	G.G.	A.E.

FLA 456

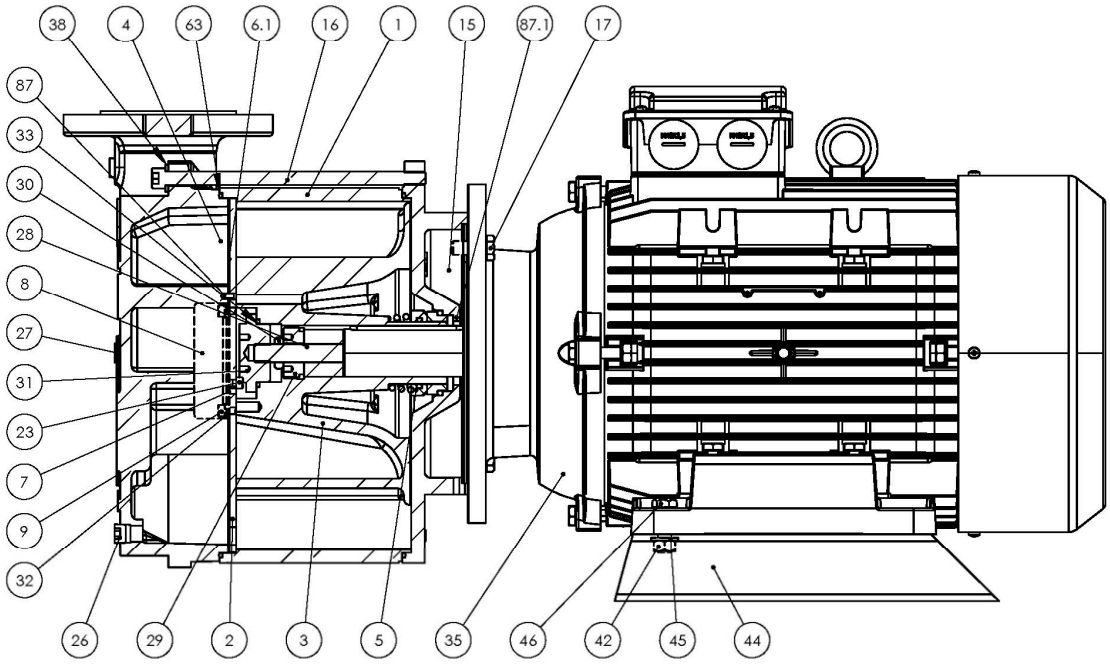
YOUR VACUUM PROFESSIONALS

POMPA PER VUOTO / VACUUM PUMP

FLA 456

DISEGNO DI SEZIONE / CROSS SECTIONAL DRAWING

ASX-A0456-01		Rev. B
Disegnato Drawn	Controllato Checked	Data Date
G.G.	A.E.	03/02/2021



Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
35	Motore elettrico **Electric Motor**	1
1	Corpo intermedio **Intermediate**	1
2	Disco distributore **Port plate**	1
3	Girante **Impeller**	1
4	Corpo aspirante/premente **Suction / discharge casing**	1
15	Flangia tenuta-motore **Seal flange motor**	1
5 ◊	Tenuta meccanica **Mechanical seal**	1
6.1 ◊	Guarnizione **Gasket**	1
29 ◊	Ghiera di regolazione **Adjusting nut**	1
31 ◊	Ghiera bloccaggio girante **Impeller nut**	1
7 ◊	Valvola a membrana **Vari-port valve**	1
8 ◊	Piastra valvola **Valve plate**	1
33 ◊	Anello O-Ring **O-Ring**	1
26	Tappo **Plug**	4
27	Tappo **Plug**	1

Item	DESCRIZIONE DESCRIPTION	QUANTITÀ QUANTITY
63 ◊	Anello O-Ring **O-Ring**	2
44	Supporto motore **Motor foot**	2
28 ◊	Barra filettata **Threaded rod**	1
9 ◊	Vite **screw**	2
16	Vite **screw**	5
23	Vite **screw**	1
17	Vite **screw**	4
46	Vite **screw**	4
30 ◊	Dado **nut**	1
42	Dado **nuts**	4
32 ◊	Rosetta elastica **Washer**	2
38	Rosetta piana **Plain washer**	5
45	Rosetta piana **Plain washer**	4
87	Spina elastica **Locating pin**	1
87.1	Spina elastica (solo per versione SS) **Locating pin (only for SS version)**	1

Rev.	Data-Date	Descrizione-Description	Disegnato-Drawn	Contr.-Checked
-	-	-	-	-
-	-	-	-	-
B	25/08/2021	ADDED CODE FOR KIT	G.G.	A.E.