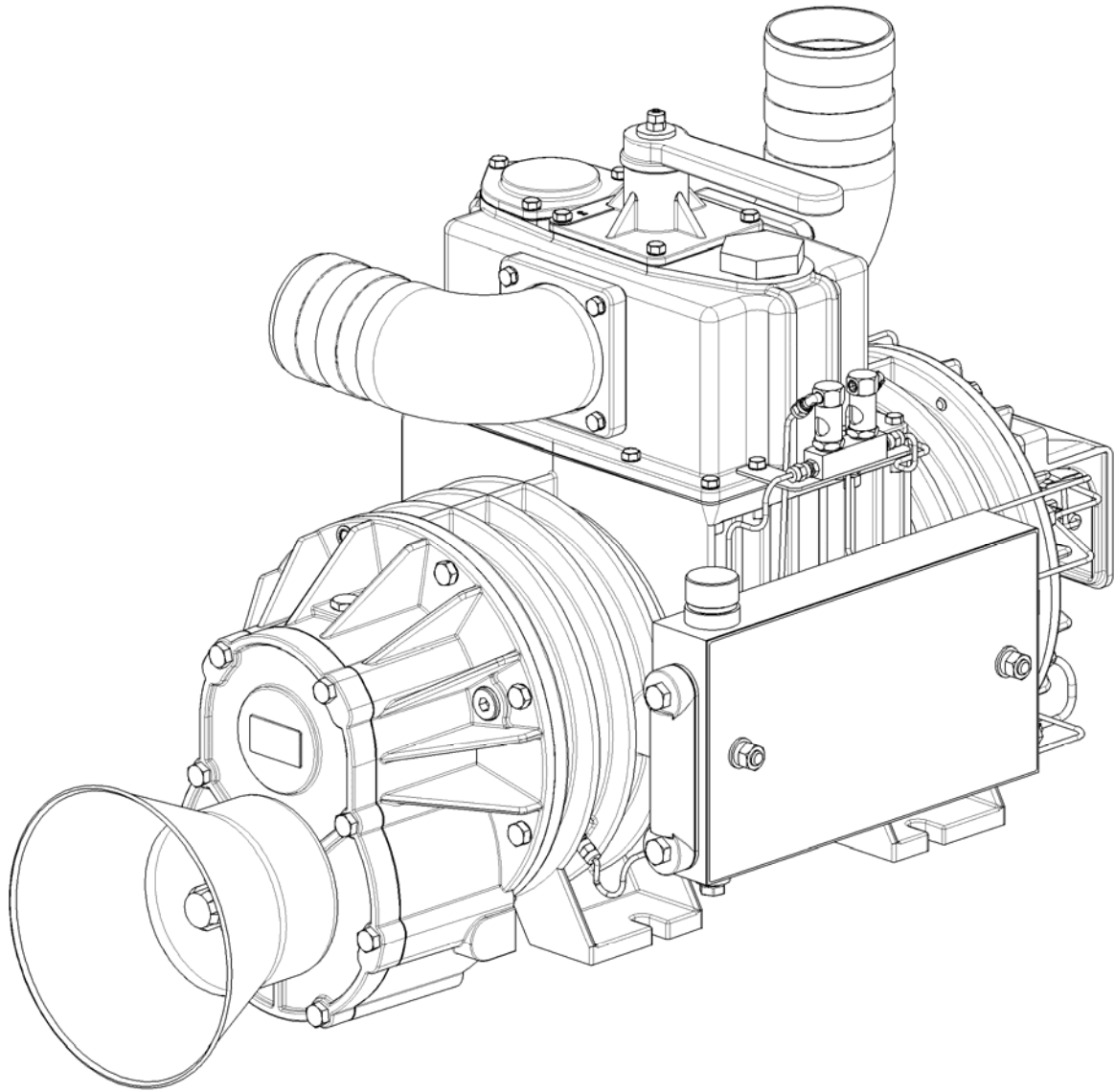


# PN 155 PN 155 R

## OPERATING AND MAINTENANCE INSTRUCTIONS



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## 1. INTRODUCTION

This booklet contains the necessary instructions for a correct installation, starting-up, running, and maintenance of the vacuum pump as well as some practical basic rules for a safe operating.

The knowledge of the following contents will grant a long and trouble-free operation of the pump. The observance of these operating and maintaining instructions is absolutely necessary to have the guarantee for defective parts acknowledged.

The manufacturer shall not be deemed responsible for any damages resulting from an improper, incorrect or unreasonable use of the pump.

It is therefore strictly recommended:

- the operators be acquainted with these instructions;
- the booklet be kept in a place at hand known by all users.

In these instructions, some graphic symbols are used to draw the attention to some particular operations:



If these safety rules are not respected, operators can be injured and the pump or oilers damaged remarkably.



If these safety rules are not respected, the pump or system can be damaged.



Suggestions for an environment-friendly use of the pump.



Useful information for an easy usage and maintenance of the pump.

## 2. DIMENSIONS PN155 – PN155 R

**PN155 D left splined shaft (A350709410)**

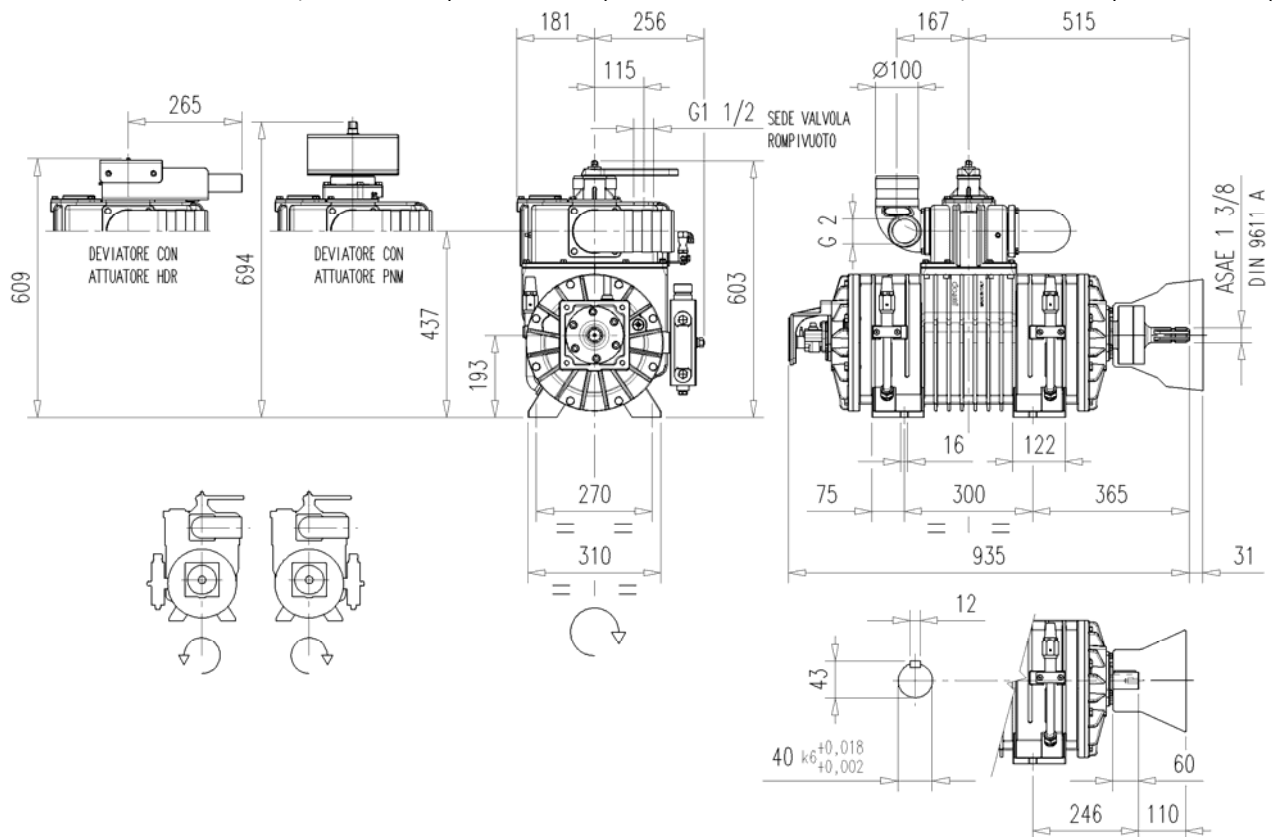
**PN155 D smooth shaft, L rotation (A350909410)**

**PN155 D smooth shaft, R rotation (A350809410)**

**PN155R D left splined shaft (A360709410)**

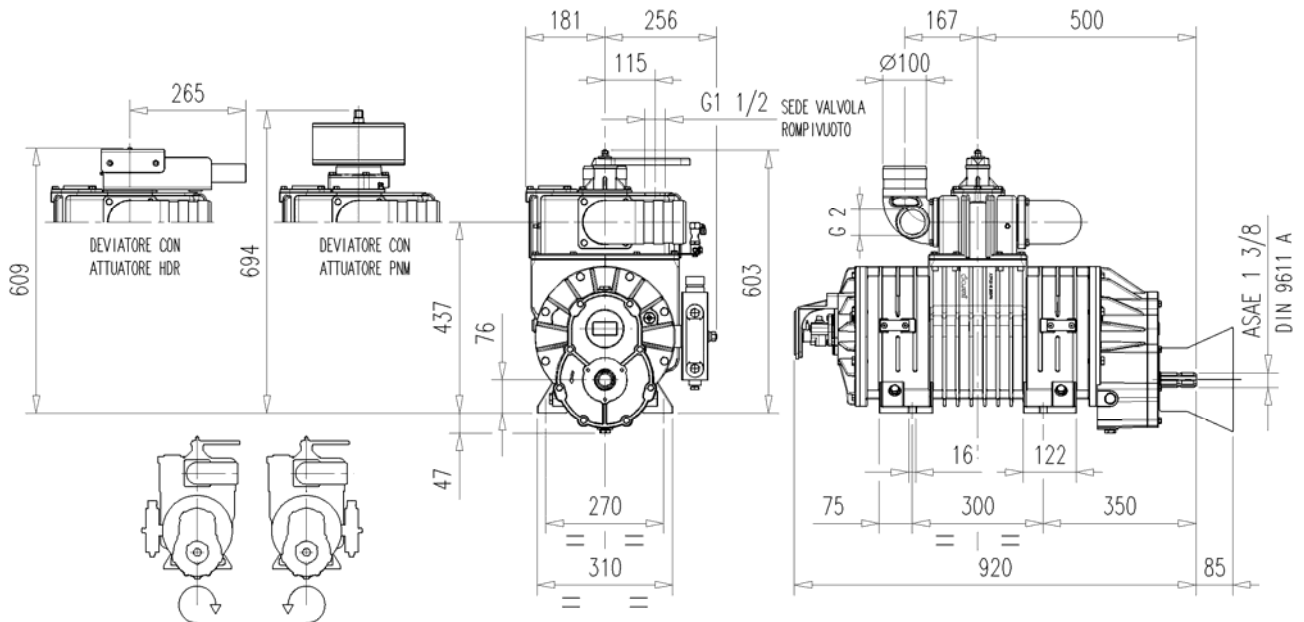
**PN155R D smooth shaft, L rotation (A360909410)**

**PN155R D smooth shaft, R rotation (A360809410)**



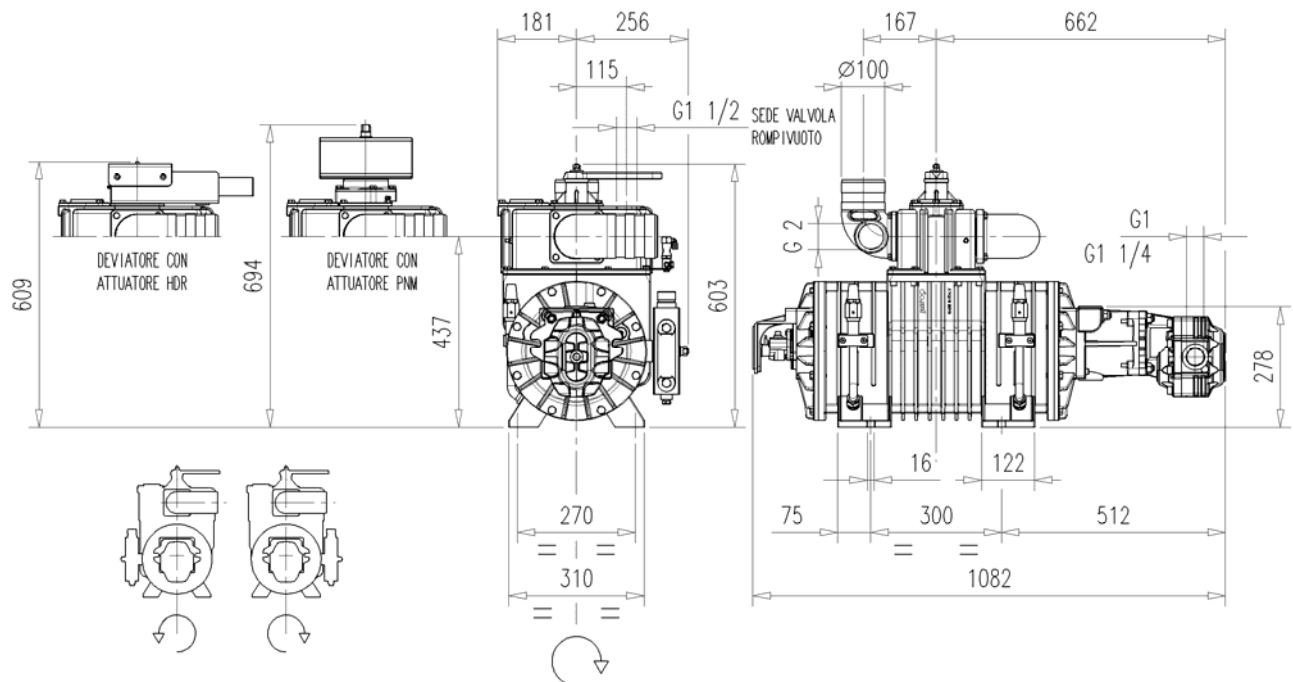
**PN155 M 540 rpm, left rotation (A353209410)**  
**PN155R M 540 rpm, left rotation (A363209410)**

**PN155 M 1000 rpm, left rotation (A353509410)**  
**PN155R M 1000 rpm, left rotation (A363509410)**



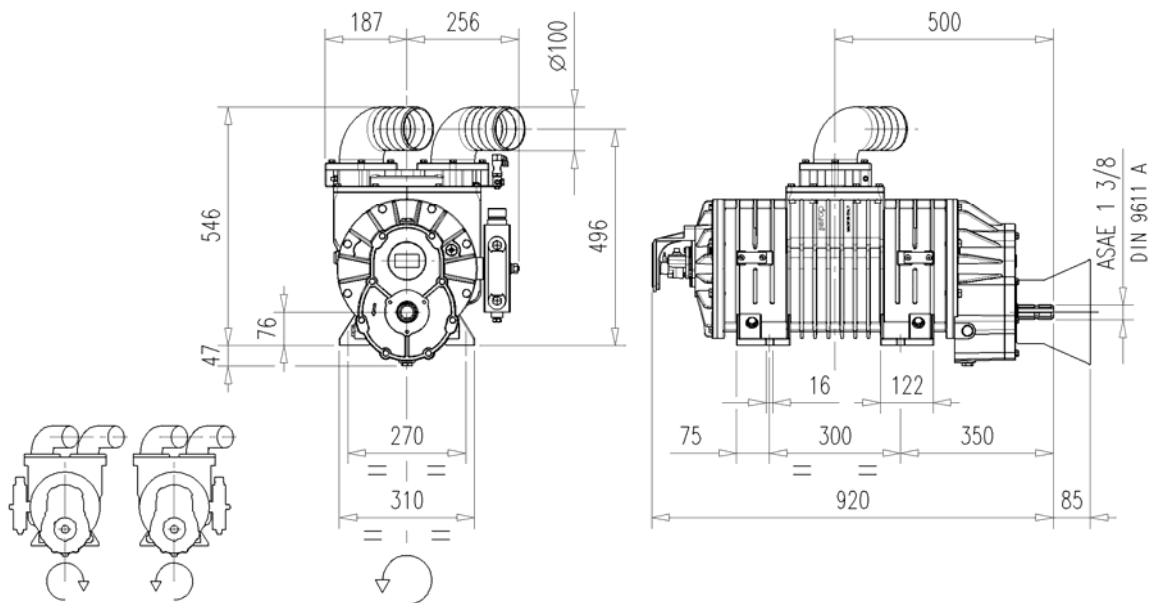
**PN155 HDR, right rotation (E3508109410)**

**PN155R HDR, right rotation (E3608109410)**



<b>HDR MOTOR FEEDING</b>		
<b>Motor Displacement</b> cc/rev.	<b>Operating Pressure</b> bar	<b>Max. Flow</b> l/min
86	140	100

**PN155 FL 540 rpm, left rotation (A353219410)**



**NOTE.** The vacuum pump PN155 may be equipped with aluminium conveyors.

Kit fixed conveyor Ø100 with valve connection: cod. 18521 035 00

Kit swivelling conveyor Ø100: cod. 18521 040 00

Kit valve connection: cod. 18521 041 00

### 3.1 FEATURES PN155

- Rotary vacuum pump with radial vanes and air cooling system.
- Automatic lubrication with volumetric pump and side mounted tank.
- Built-in vacuum-pressure change-over valve.
- Non return valve (rubber ball) inside pump manifold.
- Aluminium conveyors.
- Gear box drive (splined shaft ASAE 1 3/8) 540 rpm or 1000 rpm, left rotation.
- Direct drive with smooth shaft, right or left rotation.
- Direct drive with splined shaft ASAE 1 3/8, left rotation.

- Hydraulic drive with gear motor, right rotation.

### 3.2 FEATURES PN155R

As model PN155. In addition:

- Extra air injection cooling system.
- High resistant vanes.

#### OTHER FEATURES ON REQUEST:

- Rotation other than the standard one.
- Pneumatic or hydraulic actuator for the 4-way valve.

## 4. NORMAL USE

The vacuum pump PN155 is designed to convey filtered air into systems for the vacuum production or for the suction of powders or liquid wastes. Any other usage shall be considered improper.

Do not sack toxic substances and inflammable or explosive gasses, since the internal components of the pump may reach high temperatures.

Liquids or solids infiltrations can seriously damage the pump

Do not run the pump over its designed operating limits (see "Usage limitations"): it may break and transmission can be damaged.

## 5. USAGE LIMITATIONS

MAX. SPEED – OPERATING SPEED (RPM)			P <sub>2</sub> (bar ABS)	T <sub>2</sub> (°C)	T <sub>2</sub> - T <sub>1</sub> (°C)
PN155 – PN155R M - 540	PN155 – PN155R M - 1000	PN155 D / PN155R D PN155 HDR / PN155R HDR	Max	Max	Max
540 - 470	1000 - 900	1150 - 1000	2 *	150°C	130

P<sub>1</sub>: absolute pressure during suction  
P<sub>2</sub>: absolute pressure during delivery

T<sub>1</sub>: temperature during suction  
T<sub>2</sub>: temperature during delivery

**NOTE.** \* Belt drive only for PN155 D and PN155R D: P<sub>2</sub>= 1,5 abs bars.

## 6. PERFORMANCES

Air flow (free air condition)	l/min	15200	Vacuum at continuous duty	PN155	60 %
Air flow at 60% vac.	l/min	13500		PN155 R	70 %
Max. vacuum	%	93	Oil consumption	g/h	250
Power required at max. vacuum	kW	19	Sound pressure level **	dB (A)	79
Power required at 2 abs bars pressure	kW	23	Weight	kg	220

\*\* : only when decompressor at max. speed, 60% vacuum rate, 7 m distance in open field.

Performances referred to decompressor operating at max. speed.

### REFERENCE CONDITIONS:

Conveyed gas: air  
Reference abs. pressure: 1.013 mbar  
Vacuum functioning: free outlet

Functioning in free air.  
Reference temperature: 20°C  
Pressure functioning: free inlet

## 7. SAFETY AND ACCIDENTS PREVENTION



### CAREFULLY OBSERVE THE FOLLOWING RULES

- When transporting the pump, use proper slinging. Store the pump in stable places.
- Installation and maintenance must be operated only by qualified personnel wearing the proper clothes and the necessary tools as well as protection devices.
- Before each maintenance operation:
  - Stop the pump and restore the atmospheric pressure.
  - Disengage the drive system.
  - Only operate after the pump has cooled down.
- When the pump is running, some parts may reach very high temperatures (above 100°C). Use all necessary precautions to avoid contact.
- Operators working nearby must avoid prolonged exposure to the noise emitted by the aspirator, if not equipped with the proper ear-protection devices.
- Avoid accidental suction of solids: solids may be projected at high speed through the exhaust manifold and cause injuries.

- Do not start the machine if the protection devices provided for transmissions are removed. Replace damaged parts.
- Pressure relief valve: point the air flux away from the operators.
- Do not use the aspirator over its designed limits: the machine may be damaged and the operator may be injured.

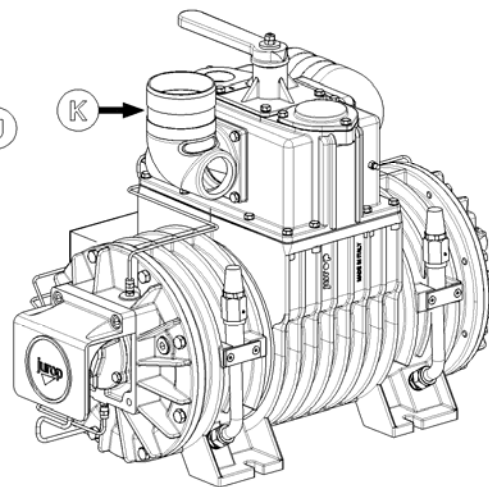
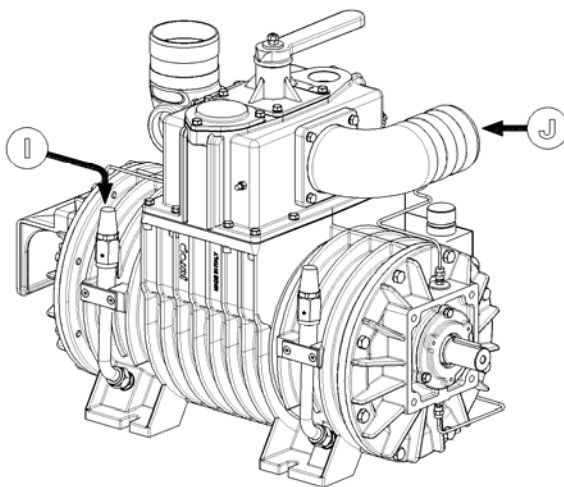
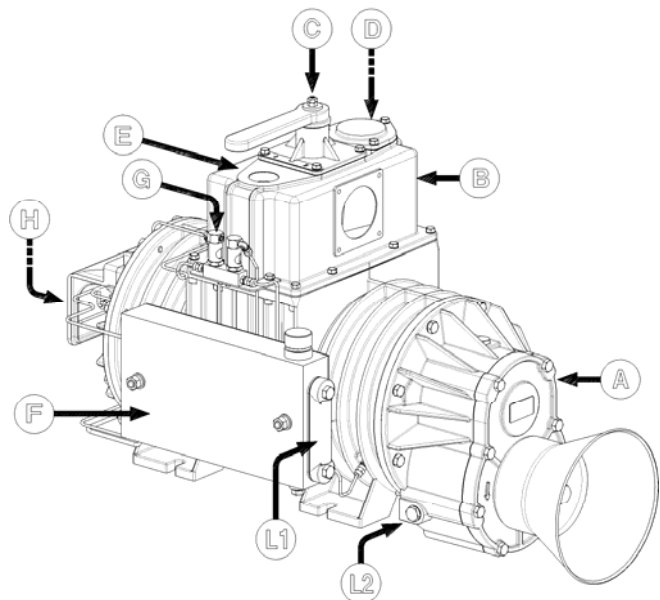


Dispose of exhausted oil (accumulated in the silencer's separator at the exhaust) and the oil used in the vacuum pump maintenance (internal wash-up or periodical replacement in the gear box) as provided by current specifications.

## 8. INSTALLATION

Legend of main components:

- A. Multiplier gear box
  - B. Manifold
  - C. Vacuum – pressure manifold
  - D. Non return valve
  - E. Vacuum relief valve connection
  - F. Oil tank
  - G. Oilers
  - H. Lubrication pump
  - I. Air injection valve
  - J. Swivelling conveyor
  - K. Conveyor with safety valve connection
- L1. Tank oil stand
  - L2. Gear box oil stand



## CHECKING UPON RECEIPT

- When the goods are delivered, make sure that all parts listed on the delivery note are in perfect condition and have suffered no damage during shipping.
- Make sure the vacuum pump has its identification plate affixed on the front cover. Pumps without such identification are to be considered anonymous and potentially dangerous: in such an event, they must not be used, otherwise the manufacturer will be deemed free from any liability whatsoever.

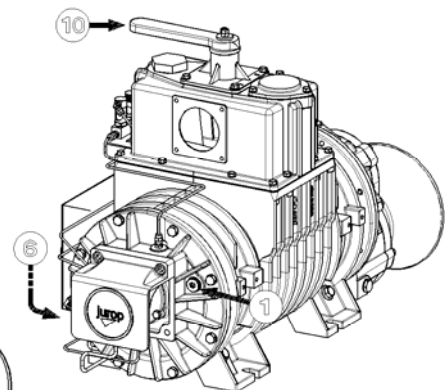
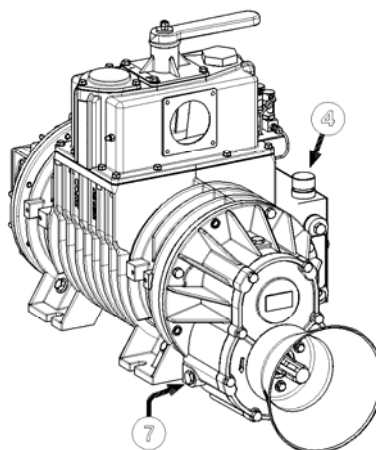
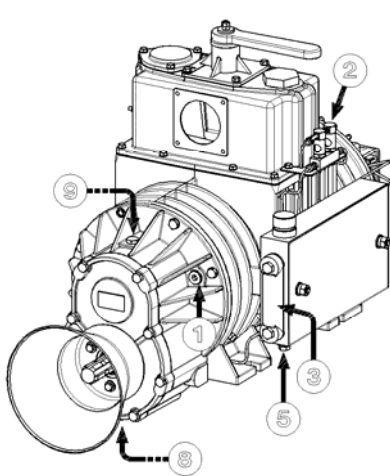


## MOUNTING

- The pump must be assembled for an easy access for maintenance operations and secured rigidly to a frame or levelled base (max. 5° slant to the horizontal plane). The base must be such as to avoid vibrations, bending or deformation.
- The oil tank is mounted on the suction side of the unit. Thus, the rotation direction determines the pump overall dimensions. See par. "Dimensions".
- Make sure there is enough room around the pump for the air for the cooling system to freely circulate and avoid exposure to dirt and debris.

Prepare enough room for an easy access to:

- |                          |                             |
|--------------------------|-----------------------------|
| 1. Vanes wear check port | 6. Self-lubricating pump    |
| 2. Oilers                | 7. Gear box oil level       |
| 3. Oil tank level        | 8. Gear box oil outlet plug |
| 4. Oil tank inlet plug   | 9. Gear box oil inlet plug  |
| 5. Oil tank outlet plug  | 10. 4-way valve handle      |



## 2 VACUUM – PRESSURE LINE

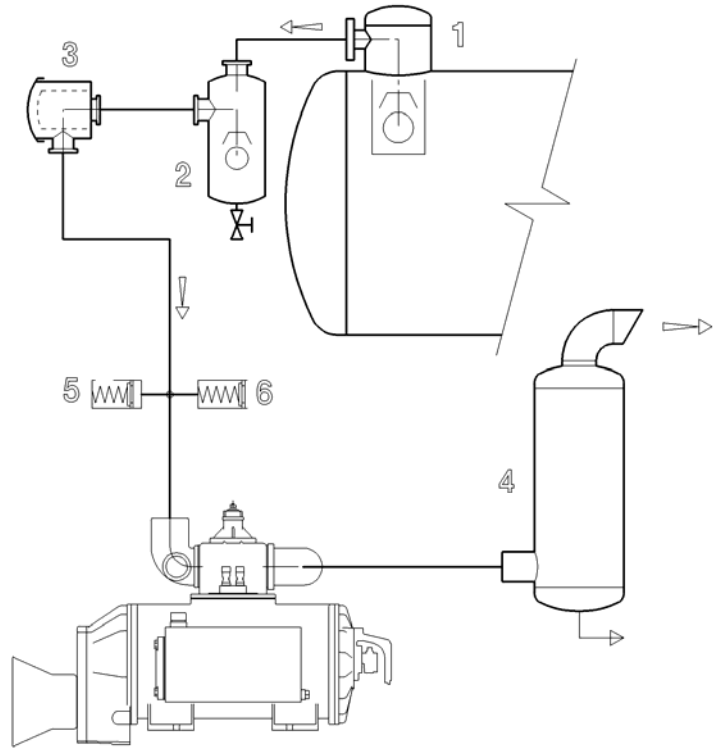
- In order to avoid accidental suction of liquids inside the pump, install a primary (pos. 1) and a secondary flow shutoffs (pos. 2). If necessary, install also a suction filter (pos. 3) to protect from solids infiltration.
- The exhaust silencer is designed to reduce the noise level and to separate the oil mist coming out from the pump outlet port. The separator must be periodically drained from oil and condensate accumulated in the separator during the normal pump functioning.
- The diameter of the vacuum/pressure line pipes must be properly dimensioned to the pump flow and, in any case, larger than the diameter of the ports (Ø100 is recommended).
- The pipes weight must not solicit the body of the pump. Use high temperature resistant rubber connections.
- Before mounting the vacuum line to the pump, remove the port protections. Pipes and all line components must be clean.
- Avoid restrictions and tight curves as much as possible if not strictly necessary.
- Exhaust pipes can reach high temperatures. Hence, they must be properly isolated.



- Max. pressure safety valve on delivery: mount it close to the pump. The valve flow must prevent the PN155 from exceeding the absolute operating pressure (see par. "Usage limitations") or, in any case, the maximum pressure allowed by the system. Do not apply gate valves on the line.
- Over-pressure safety relief valve (pos. 6): to apply if necessary to limit the vacuum rate in the system.

Pos	Description
1	Primary flow shutoff valve
2	Secondary shutoff
3	Suction filter
4	Exhaust silencer with oil separator
5 *	Over-pressure safety relief valve
6 *	Vacuum relief valve

\* : optional components



## 8. DRIVE

### CARDAN SHAFT DRIVE

Use telescopic cardan shafts. In order to achieve a uniform motion of the driven shaft, the following requirements must be met:

- Equal working angle  $\alpha$  and  $\alpha_1$  of both couplings.
- The internal fork joints must be coplanar.
- Both driven and driving shafts must be coplanar.

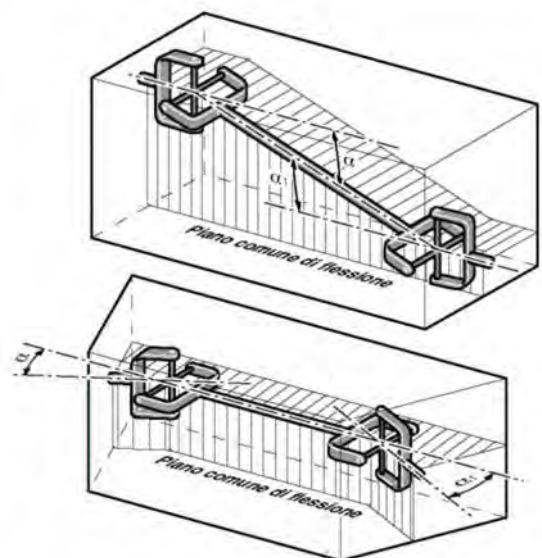
It is also recommended working with limited articulated joint angles (max. 15°) and disengaging the transmission for those operations requiring great angles (steering or lifting).



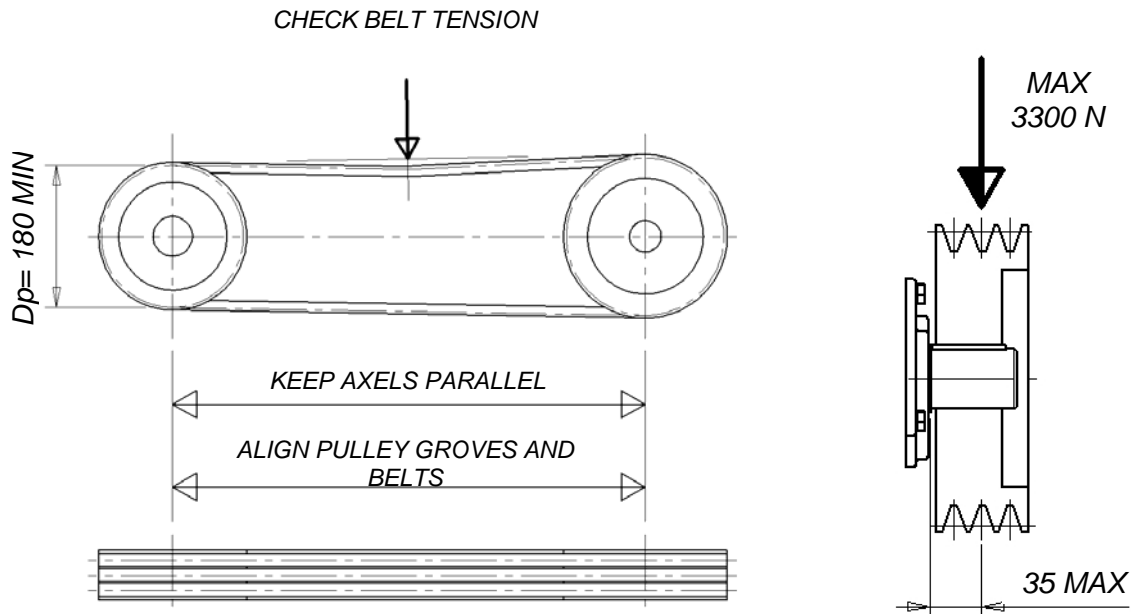
Follow the rotation direction as indicated on the front flange. Follow the instructions of the cardan shaft's manufacturer.



Use the cardan protection supplied with the pump. The pump installation must fulfil the current EC injury prevention specifications.



## BELT DRIVE



- Install a suitable pulley on the smooth shaft as close as possible to the pump: max 35 mm.
- Apply an adequate belt tension (see manufacturer's data). Max 3000N.
- Do not use driven or driving pulleys with a pitch diameter inferior to 180 mm. Small pulleys require a high belt tension which may cause premature wear to the bearing or transmission troubleshooting



### NOTE

If the pump PN155 is run through a belt drive, its working pressure must not exceed 1.5 abs. bars to prevent it from absorbing a power requiring an excessive belt tension. There is no limit to the operation in vacuum.

Drive min. pulley pitch diam. mm	Belts	Max. Speed rpm	Max. Pressure bar abs	Max. Vacuum %
180	XPB x 3	1150	1,5	93

## HYDRAULIC DRIVE

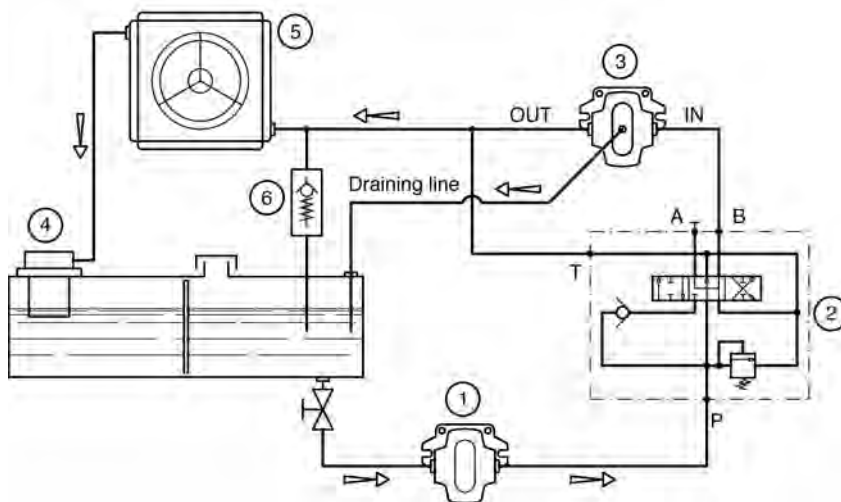
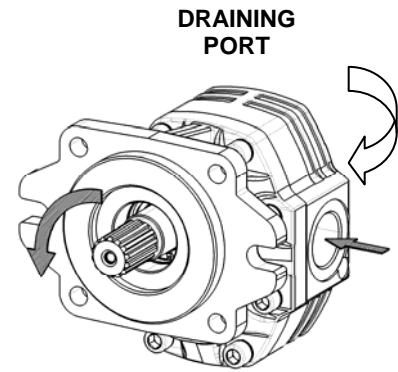
### Motor features

Displacement cc/rev	Max. operating pressure bar	Max pressure draining line bar	Max. press. motor exhaust bar
86	220	5	5

### Fluid: mineral oil for hydraulic systems in compliance with ISO/DIN

Temperature °C	Optimum viscosity cSt	Max. viscosity allowed cSt
-20 / +80	12 - 100	750

- **Filtration:** class 19/16 contamination according to ISO 4406 to be obtained with a  $\beta_{sx} = 75$  filter
- **Check circuit connections:** they must be applied in the same rotation direction as that indicated by the arrow on the pump front flange.
- **Draining:** connect directly to the tank above the maximum oil level. Operating without draining line may damage the motor.



Pos	Description
1	Hdr pump
2	Distributor
3	Hdr motor
4	Oil filter
5 *	Heat exchanger
6 *	Safety valve

\* : optional components

- **Distributor:** open-centre distributor in central idle position (vacuum pump off). It must be equipped with an adjustable overpressure safety valve.
- **Motor pipeline:** outlet pipe must not be of a smaller diameter than that of the inlet port. Inlet pipes always have a diameter smaller than outlet pipes. Choose preferably flexible pipes to avoid vibration transmission.
- **Tank:** with suction pipe and return separated by baffles. If necessary, use a heat exchanger to avoid oil heating above 70-80°C and protect it from extreme pressure with a pressure relief valve. Minimum approximate capacity: as twice as the circulation flow.
- **Starting-up:** be sure that the system is well cleaned and pour oil into the tank and into the motor housing (necessary to lubricate the internal bearings).
  - Vent the circuit and adjust the overpressure safety valve to the lowest possible value.
  - Check the oil tank level.
  - Increase pressure and rotation speed until operating values are reached.

### PRECAUTIONS WHEN STARTING THE SYSTEM

- Check oil levels in gearbox and side mounted tank.
- Check that all protection devices are correctly installed.
- Check that there are no obstacles in the vacuum line.
- Check rotation direction: open all system valves and start running slowly.



Do not rotate in the wrong direction: this may damage the vacuum pump. Follow the arrow indicated on the front flange.

Check which position of the four-way integrated valve lever allows vacuum or pressure functioning.  
Close the valve and increase vacuum rate (or operating pressure).  
Check that the lubricating pump works properly. Oil must regularly drip into the oilers. Typically 35 drops/min (at maximum speed).  
Check loading and operating speed for vibrations or unusual noises.

## WARNING



This vacuum pump is designed to work at maximum speed, but for longer operating we recommend the pump be run at working speed (see par. "Usage limitations"). Adequately prepare the transmission.

## 10. OPERATING PRECAUTIONS



- Do not make the vacuum pump overheat: maximum air temperature on exhaust (or delivery) side: 150°C.
- Do not operate the pump without lubrication: it may cause quick wear and possible breakdown of vanes.
- Do not start running the pump under load: this may damage the drive system or the hydraulic motor.
- Check the rotation speed: it must never exceed the operating limits indicated on the identification plate of the vacuum pump.
- Do not accidentally operate the pump in the wrong direction: it may break the vanes.
- Do not convey the exceeding delivery outlet towards the suction port, otherwise it will suck warm gas.
- Control the air flow by adjusting the rotation speed: do not use the pressure relief valve to discharge the exceeding flow.
- Internal wash-up is necessary after prolonged inactivity, after working in dusty environments or in case of accidental suction of liquids. Such operation must be carried out only on cooled pumps.
  - Disconnect the exhaust silencer, if possible.
  - Start running the pump at low speed.
  - Suck some water (about 1-2 litres) through the inlet port.
  - Then suck oil (about 1 litre) to complete the wash-up and lubricate internal components.



In case the exhaust line cannot be disconnected, drain the liquids accumulated in the separator of the exhaust silencer.

## WARNING



### ROTATION SPEED.

Once the needed vacuum rate has been reached, we recommend reducing the vacuum pump speed to its working speed (see paragraph "Usage limitations"): this allows keeping the achieved vacuum/pressure rate constant. The pump speed can also be reduced to values lower than the working speed during the tank discharging phase (with the 4-way valve in pressure mode) without increasing the draining time. Thus, exhaust temperature is reduced, vane durability is increased and both oil consumption and power absorption are reduced.

## 11. ORDINARY MAINTENANCE



Before starting any maintenance operation, follow the safety prescriptions as described in paragraph "Safety and accidents prevention".

PUMP OPERATION CONDITION	CHECKING	FREQUENCY
OPERATING	Lubrication: dripping into oilers	D
	Rotating speed	D
	Working pressure	D
STANDSTILL	Side mounted tank oil level	D
	Clean filter and vacuum line shutoff. Drain the oil gathered in the exhaust separator.	D
	Check vanes wear	W
	Check pressure relief valve condition	M
	Gear box oil level	M
	Gear box oil change	1500 h

**Frequency:**            **D:** daily            **W:** weekly            **M:** monthly

### CHECKING THE DRIP OILERS

Check dripping into the oilers.

Be sure it is regular (app. 35 drops/min at max. speed) to grant a correct lubrication of the pump. At lower speeds, the number of drops must be directly proportional.

### CHECKING THE SIDE MOUNTED OIL TANK LEVEL

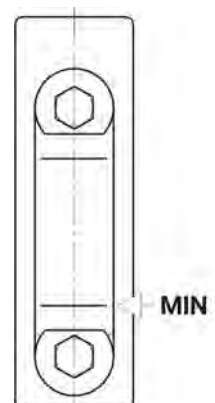
Do not run the pump with oil level under the minimum level: that may lead to dry functioning and cause serious damages. Tank capacity: 4 litres. Use pure fresh oil.



Do not re-use the exhausted oil gathered on the bottom of the exhaust silencer.

### Recommended lubricants

Room. Temp.	Viscosity	Type	AGIP	ESSO	SHELL	ELF	MOBIL	BP
Below 10°C	ISO VG 46	Mineral oil	RADULA 46	NURAY 46	VITREA 46	MOVIXA 46	RUBREX 300	ENERGOL CS 46
Above 10°C	ISO VG 150	Mineral oil	RADULA 150	NURAY 150	VITREA 150	MOVIXA 150	RUBREX 900	ENERGOL CS 150

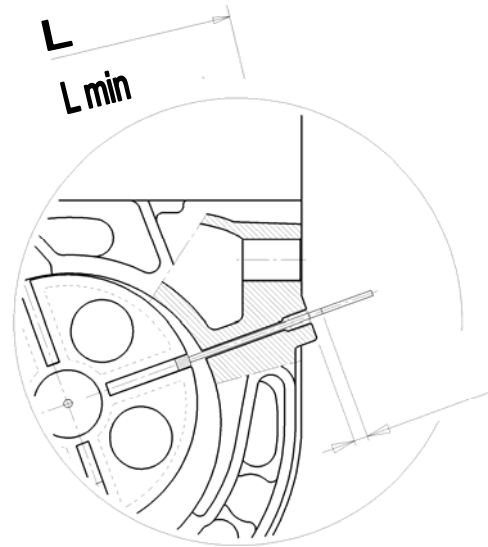
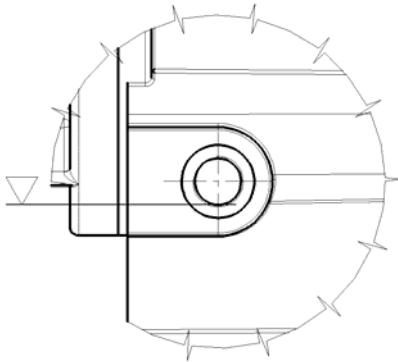


### CHECKING THE VANES WEAR

- Unscrew the vanes wear check-plug on the housing.
- Turn the shaft until you see the vane.
- The vanes should slide to the bottom of the seat due to gravity: check they really do.



Replace the vanes when their wear exceeds 10 mm ( $L - L_{min}$ ): they may break. Replace all vanes at the same time.



### CHECKING THE GEAR BOX OIL LEVEL

Check the level when the pump is cooled: it must almost reach the threaded port. Refill if necessary. For a complete replacement, 0.7 litres are required. Use mineral oil with EP additives for gears and transmissions.

### Recommended lubricants

Viscosity	Type	AGIP	ESSO	SHELL	ELF	MOBIL	BP
ISO VG 220	EP mineral oil	BLASIA 220	SPARTAN EP 220	OMALA OIL 220	REDUCTELF SP 220	MOBILGEAR 630	ENERGOL GR XP 220



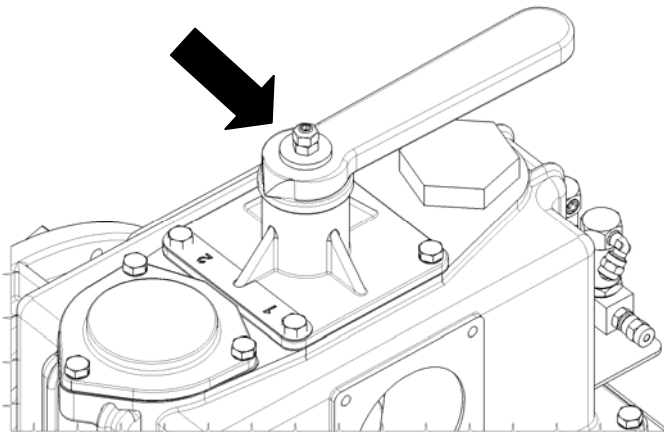
Dispose of exhausted oil as provided by current specification.

When changing the oil, also replace the outlet plug washer.

## 12. EXTRAORDINARY MAINTENANCE



Before starting any extraordinary maintenance operation, be sure the pump stands still and follow the safety prescriptions as described in paragraph "Safety and accidents prevention".



### ADJUSTING THE 4-WAY VALVE

For pumps equipped with handle for manual operation or hydraulic actuator.

Adjust the screws to avoid the valve blocking in its seat.

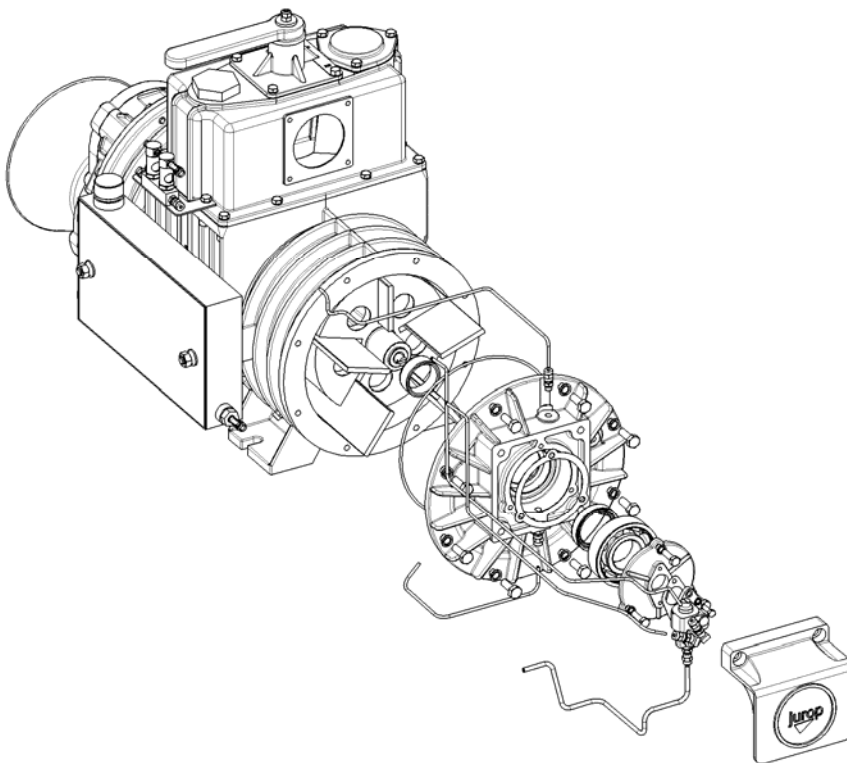


Do not exceed with the adjustment: possible vacuum loss.

For pumps equipped with changeover valve with hydraulic actuator: see the integrated part at the end of these instructions.

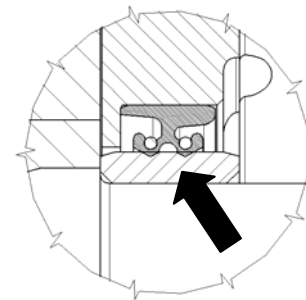
## REPLACING THE VANES

- Remove the vacuum pump from its bearing frame and wash it before disassembling.
- Disconnect the lubricating piping. Remove the screws fixing the rear flange and use the two threaded holes to remove the flange – bearing – seal housing. If necessary, hold the rotor by inserting a wooden block, protecting the internal bearings from damage.
- Remove the bearing from the rear flange and replace the seal if damaged.
- Lubricate with oil the new vanes before inserting them inside each groove of the rotor.
- Reinstall all components in the following order: rear flange, seal ring (non), bearing, compensation ring, gasket and flange with lubricating pump (we recommend the pivot-key be correctly fitted onto the shaft groove).



### WARNING

Do not damage components during assembly by forcing them exceedingly. Do not flip the seal ring during rotation of the shaft. Do not leave foreign objects inside the pump.



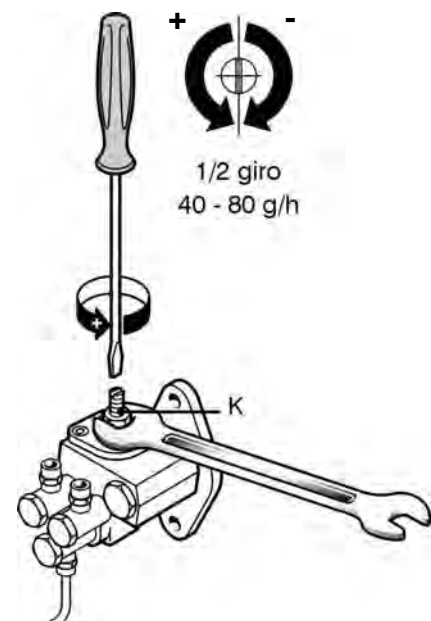
## ADJUSTING THE SELF-LUBRICATING PUMP

The automatic lubricating pump is adjusted by the manufacturer before the shipping. If consumption noticeably differs from the indicated value, adjust it as follows:

- Remove the upper protection cover.
- Using a screwdriver and a 10 mm wrench, adjust the adjusting screw (K). Close the nut and remount the upper protection cover. It is advisable to turn the screw of  $\frac{1}{4}$  of turn and verify the actual consumption.
- We recommend turning the adjusting screw by a  $\frac{1}{4}$  turn and then check the actual vacuum pump consumption.



Do not reduce oil consumption below the value indicated in par. "Performances" (for functioning at speeds different from the maximum, flow is proportionate to rotating speed).  $\frac{1}{2}$  turn of the adjusting screw causes a variation in the flow of appr. 40 - 80 g/h, depending on using conditions.



## 13. TROUBLESHOOTING

The vacuum pump overheats	
Insufficient or absent lubrication	Verify oil and rings. Check oil pump efficiency
Low tank oil level	Fill tank with oil
Excessive rotation speed	Reduce rpm to the prescribed working speed
Prolonged functioning at max vacuum rate	Reduce vacuum rate
Vacuum and/or exhaust line of insufficient diameter	Check dimensioning

The vacuum pump does not rotate	
Broken vanes:	Clean inner chambers, replace vanes
- due to infiltrated solids	Check the secondary shutoff and filters of the suction line
- due to insufficient lubrication	Check the oil pump
Power transmission breakdown	Check and replace the damaged parts
Ice inside the pump (during the cold season)	Remove ice and slowly start running it. Avoid suction of water.

Reduced performances	
Four way changeover valve in idle position	Move the lever to vacuum or pressure mode end stroke.
Four way changeover valve not correctly registered	Adjust the functioning play and lubricate
Worn vanes	Replace vanes
The non-return valve leaks	Clean or replace if necessary
Worn seal rings	Replace
Tank gate valves or gaskets leak	Replace damaged or worn parts
Tank connection pipes leak or are obstructed	Replace damaged pipes
Obstructed primary shutoff or suction filter	Remove and clean
Encrusted exhaust port	Remove and clean
Vacuum line components are too small dimensioned	Verify dimensions for pump maximum performances
Obstructed rubber couplings	Replace

Unusual oil consumption	
Insufficient or absent lubrication	Check and adjust the lubricating pump



## 14. SCRAPPING

Before dismantling, the following components must be properly disassembled and divided:

- Lubricating oil
- Rubber and plastic parts
- Cast iron, steel and aluminium parts



Do not leave in the environment. Do not use dismantled parts as spare parts

## 15. SPARES PARTS

### REQUESTING SPARE PARTS

To order spare parts, give the following information

*Find in the parts list:*

- code
- name
- quantity

(Ex. : cod. 1601606200 ; Vane; 4 pz

*Find on the suction plate:*

- model
- serial number

(Es. : LC 420 ; H60013