

# *HF Series*



## **User and Maintenance Manual**

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16. EXPLODED VIEW AND PART LIST

## 1. INTRODUCTION

This manual describes the use and maintenance instructions of the HF pump, and should be carefully read and understood before pump operation.

Correct use and adequate maintenance will guarantee the pump's trouble-free operation for a long time.

The Interpump Group declines any responsibility for damage caused by misuse or the non-observance of the instructions indicated in this manual.

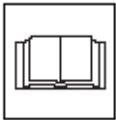
Upon receiving the pump, check that it is complete and in perfect conditions.

Should anything be found out of order, please contact us before installing and starting the pump.

## 2. SYMBOL DESCRIPTION



**Warning Signal**



Carefully read the indications in this manual before operating the pump.



**Danger Signal**  
Electrocution danger



**Danger Signal**  
Use a face guard



**Danger Signal**  
Use protective glasses



**Danger Signal**  
Use adequate hand protection before operating the pump



**Danger Signal**  
Use appropriate boots

## 3. SAFETY

### 3.1 General safety indications

The misuse of pumps and high pressure units, and the non-observance of installation and maintenance instructions may cause severe injury to people and/or damage to property. Anyone requested to assemble or use high pressure units must possess the necessary competence to do so, should be aware of the characteristics of the components assembled/used, and must adopt all the necessary precautions in order to guarantee maximum safety in any operating condition. In the interest of safety, no precaution that is reasonably feasible must be neglected, both by the Installer and the Operator.

### 3.2 High pressure unit safety requirements

1. The pressure line must always be equipped with a safety valve.
2. High pressure unit components, in particular for those units working outside, must be adequately protected against rain, frost and heat.
3. The unit's electrical parts must be adequately protected from water spray, and must comply with the specific norms in force.
4. High pressure pipes must be correctly sized for the unit's maximum operating pressure, and must only be used within the pressure range indicated by the pipe Manufacturer.

The same conditions apply for all other unit accessories where high pressure is involved.

5. The extremities of high pressure pipes must be sheathed and fastened to a steady structure in order to avoid dangerous whiplashes should they burst or should their connections break.
6. Appropriate safety guards must be provided for the pump transmission systems (joints, pulleys and belts, auxiliary drives).



### 3.3 Safety during operation

The working area of a high pressure system must be clearly signalled. Access must be prohibited to non-authorized personnel and, if possible, the area must be fenced in.

The personnel authorized to access this area must be previously trained, and informed about the risks that may arise from failures or malfunctions of the high pressure unit.

Before starting the unit, the Operator must check:

1. That the high pressure unit is correctly fed (see Chapter 9, paragraph 9.5).
2. That pump intake filters are perfectly clean; we advise to use a device that indicates the filter's clogging level.
3. That electrical parts are adequately protected and in perfect conditions.
4. That high pressure pipes do not show apparent signs of abrasion, and that fittings are in perfect shape.

Any anomaly or reasonable doubt that may arise before or during operation must be promptly reported, and verified by competent personnel. In these cases, pressure must be immediately released and the high pressure unit stopped.



### 3.4 General procedures for using nozzles

1. The Operator must always place his own and other worker's safety before any other interest; his actions should always be governed by good sense and responsibility.
2. The Operator must always wear a helmet with a protective visor, waterproof clothing, and appropriate boots capable of guaranteeing grip on wet pavements.

*Note: appropriate clothing will effectively protect against water spray, but it may not offer adequate protection against the direct impact of water jets or sprays from a close distance. Some circumstances may require further protection.*

3. We advise to employ a team of at least two Operators, able to provide mutual and immediate assistance if needed, and rotate their duties in case of long and heavy work.

4. Access to the work area that is within the water jet's range must be absolutely forbidden; the area must be free of objects that may be unintentionally hit by the pressurised jet, causing damage or dangerous situations.
5. The water jet must only and always be directed towards the work area, even during testing or preliminary inspections.
6. The Operator must always pay attention to the trajectory of the debris removed by the water jet. If necessary, adequate side guards must be provided by the Operator in order to protect anything that may be accidentally exposed.
7. For no reason must the Operator be distracted during operation. The personnel that needs to access the working area must wait for the Operator to suspend his work, and then immediately make his presence known.
8. For safety reasons, it is important that each member of the team is perfectly aware of the intentions and actions of other team members in order to avoid dangerous misunderstandings.
9. The high pressure unit must not be started and brought up to pressure unless each member of the team is in his designated position, and the Operator has already directed the nozzle towards the work area.

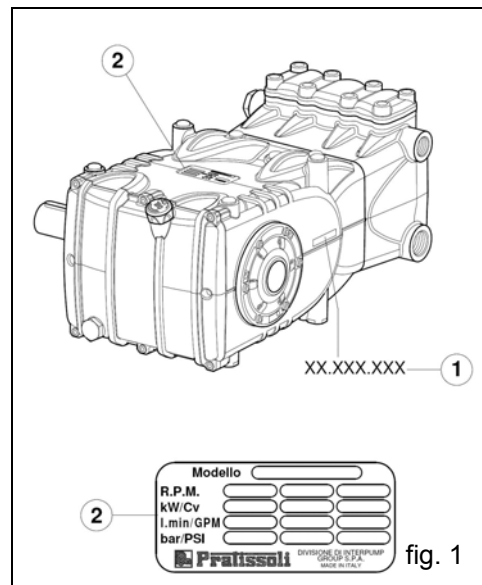
### 3.5 Safety during unit maintenance

1. The maintenance of the high pressure unit must be done within the time intervals indicated by the Manufacturer, who is responsible for the entire unit's compliance with the norms in force.
2. Maintenance must always be carried out by specialised and authorised personnel.
3. Assembly and disassembly of the pump and its various components must be performed exclusively by authorised personnel, using appropriate tools in order to avoid damage to components and connections.
4. To guarantee total reliability and safety, always use original spare parts.

## 4. PUMP IDENTIFICATION

Each pump (fig. 1) has its own serial number XX.XXX.XXX (see point ①) and a rating plate (see point ②) that indicates:

- Pump model and version
- Maximum rpm
- Power absorbed Hp - kW
- Flow rate l/min - G.P.M.



Modello	Model
R.P.M.	R.P.M.
Kw/Cv	Kw/Cv
l.min/GPM	l.min/GPM
Bar/PSI	Bar/PSI



**Pump model, version and serial number must always be specified when ordering spare parts.**

## 5. TECHNICAL DATA

Versions HF 22-25

Model	RPM	Flow rate		Pressure		Power	
		l/min	Gpm	bar	psi	kW	Hp
HF 22	800	45	12.05	400	5800	35.3	48
HF 25	1000	74	19.44	280	4060	39	53

Versions HF 18

Model	RPM	Flow rate		Pressure		Power	
		l/min	Gpm	bar	psi	kW	Hp
HF 18	1000	38	10.08	500	7250	36.8	50
HF 18	800	30	8.06	600	8700	35.3	48

## 6. DIMENSIONS AND WEIGHT

For dimensions and weight of Standard Version pumps, please refer to fig. 2;

For dimensions and weight of pumps with a type "A" Flange, please refer to fig. 2/a.

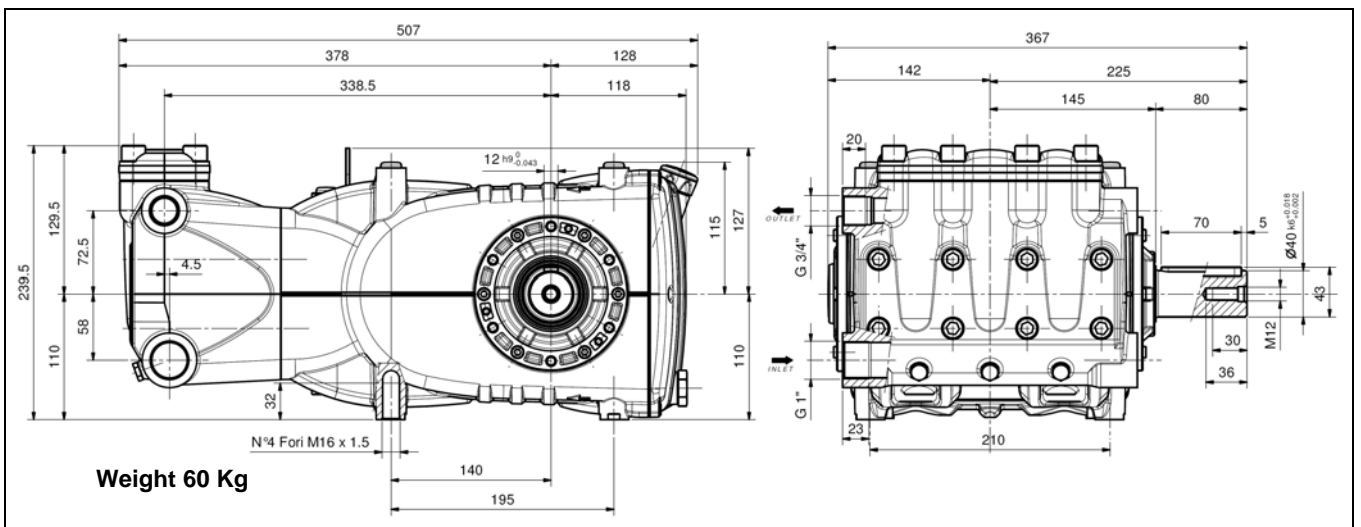
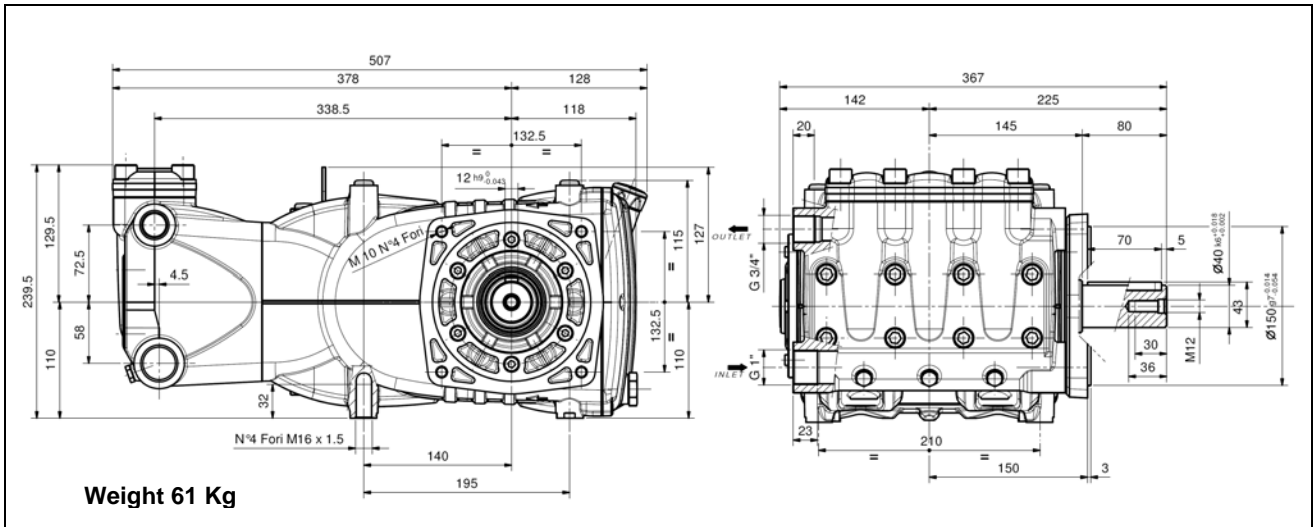


fig. 2



N°4 Fori M16 x 1,5	N°4 Holes M16x1.5
--------------------	-------------------

fig. 2/a

## 7. INFORMATION REGARDING PUMP USE



The HF pump has been designed to operate with filtered water (see paragraph 9.7) and at a maximum temperature of 40°C. Other fluids may be used only upon the approval of the **Technical Department or Customer Assistance Service**.

### 7.1 Water temperature



The maximum water temperature allowed is 40°C. Nonetheless, for short periods of time it is possible to operate the pump with water at a temperature of 60°C. In this case, we advise to contact the **Technical Department or Customer Assistance Service**.

### 7.2 Maximum flow rate and pressure values

The performance values indicated in the catalogue refer to the maximum performance of the pump. **Regardless** of the power used, pressure and maximum rpm values indicated on the plate may not be exceeded unless expressly authorised by the **Technical Department or Customer Assistance Service**.

### 7.3 Lowest rpm

Any rpm value different from what indicated in the performance table (see Chapter 5) must be expressly authorised by the **Technical Department or Customer Assistance Service**.



### 7.4 Recommended lubricant oil types and Manufactures

The pump is delivered with lubricant oil compliant with room temperatures ranging from 0°C to 30°C. Some recommended lubricant types are indicated in the table below; these lubricants are treated with additives in order to increase corrosion protection and resistance to fatigue (according to DIN 51517 part 2). As an alternative, Automotive SAE 85W-90 gearing lubricants may also be used.

Hersteller Manufacturer Producteur	Schmieröl Lubricant Lubrifiant	Hersteller Manufacturer Producteur	Schmieröl Lubricant Lubrifiant	Hersteller Manufacturer Producteur	Schmieröl Lubricant Lubrifiant
Agip	AGIP ACER 220	elf	ELF POLYTELIS 220, REDUCTELF SP 220	Shell	Shell Tellus Öl C 220
ARAL	Aral Degol BG 220	ESSO	NU TO 220, TERESSO 220	SRS	Wintershall Ersolan 220, Wintershall Wiolan CN 220
BP	BP Energol HLP 220	FINA	FINA CIRKAN 220	TEXACO	RANDO HD 220
Castrol	CASTROL HYSPIN VG 220, CASTROL MAGNA 220	FUCHS	RENOLIN 212, RENOLIN DTA 220	TOTAL	TOTAL Cortis 220
DEA	Falcon CL 220	Mobil	Mobil DTE Oil BB		

Check the oil level using the oil level dipstick pos. ① fig.3; refill if necessary.

Correct oil level inspection is done with the pump at room temperature; oil is changed with the pump at working temperature, by removing the oil dipstick pos. ①, and then the plug pos. ②, fig.3.

Oil inspection and changing is to be carried out as indicated in the table in fig.14, Chapter 11.

The amount required is ~3.8 litres

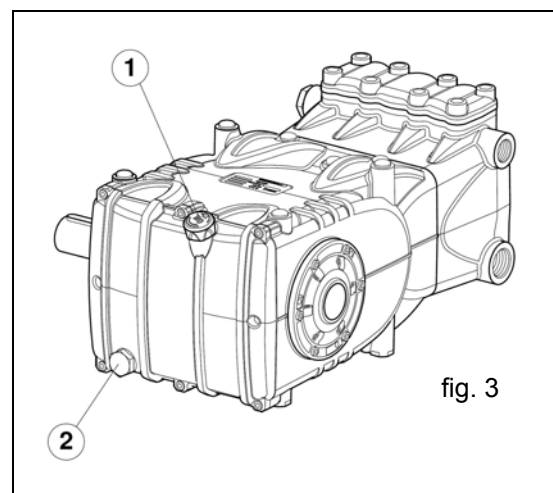


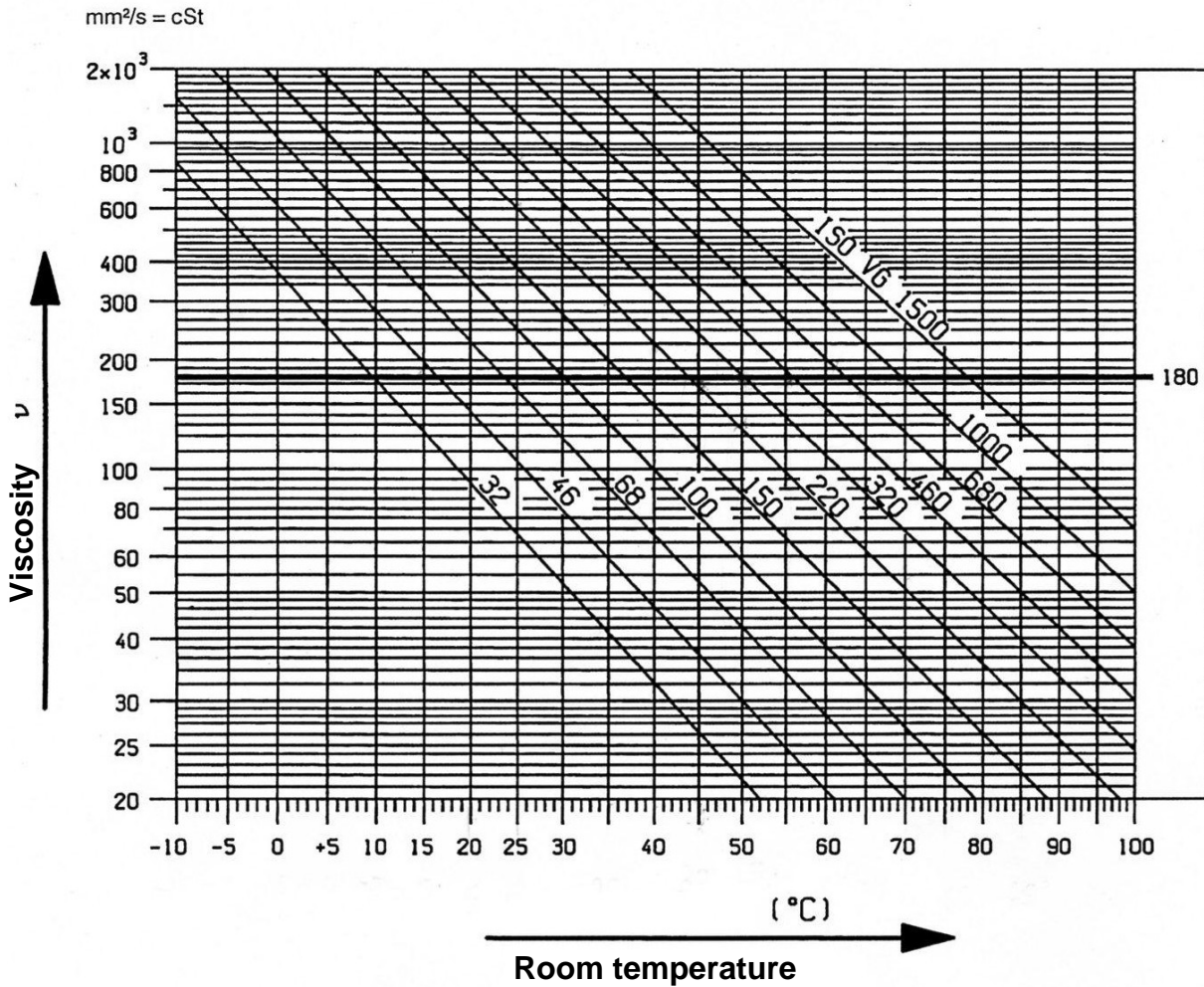
fig. 3



In any case, oil must be changed at least once a year since it may deteriorate by oxidation

For room temperatures that differ from 0°C to 30°C, follow the indications contained in the diagram below, keeping in mind that the oil must have a minimum viscosity of 180 cSt.

**Viscosity / Room Temperature Diagram**



Exhausted oil must be collected in an appropriate recipient and disposed of in apposite locations. In absolutely no case may it be dispersed in the environment.

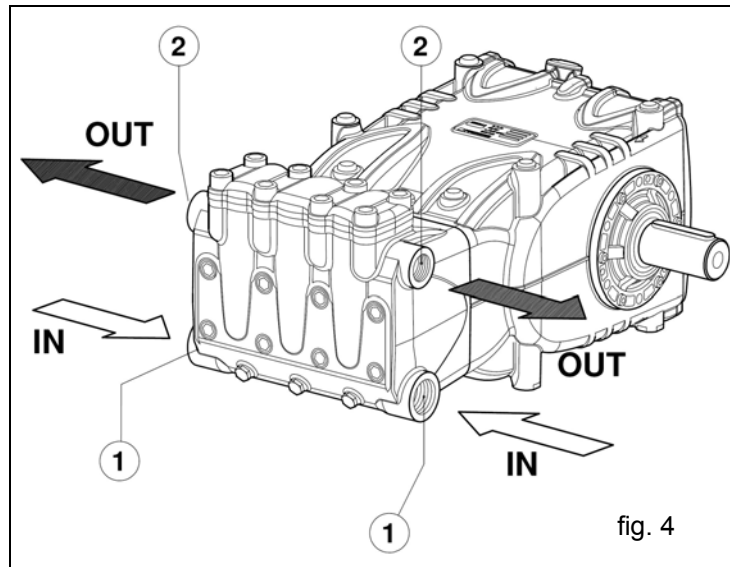
## 8. PORTS AND CONNECTIONS

HF series pumps (see figure 4) are provided with:

① N°2 inlet ports "IN", 1" Gas.

The line can be connected to either of the two inlet ports; the one not being used must be hermetically sealed.

② N°2 outlet ports "OUT", 3/4" Gas.



## 9. PUMP INSTALLATION

### 9.1 Installation

The pump must be installed in a horizontal position using the apposite threaded feet M 16x1,5; fasten the screws with a torque value of 210 Nm.

The base must be perfectly flat and sufficiently rigid in order to avoid bending and misalignments on the pump / transmission coupling axis due to the torque applied during operation.

The unit must not be rigidly fixed to the pavement, but requires the use of anti-vibration elements.

For special applications, please contact the **Technical Department or Customer Assistance Service**.

The pump is equipped with a lifting bracket to facilitate installation as shown in the following figure.



In case of disassembly, to avoid letting filth inside the front part of the crankcase, close the threaded hole with the supplied cap.



**Replace the oil cap (red), located on the rear crankcase cover, with the oil dipstick and check oil level.**

The oil dipstick must always be accessible, even when the unit is assembled.



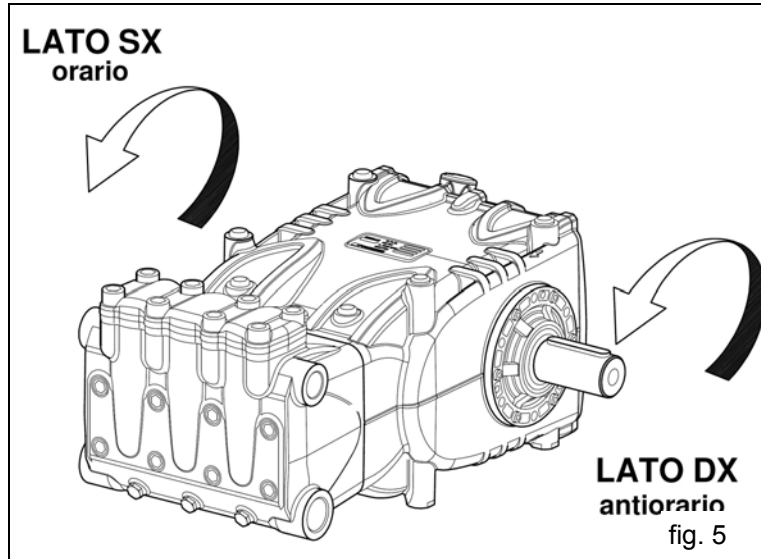
**The pump's shaft (PTO) must not be rigidly connected to the motor unit**

The following transmission types are suggested:

- hydraulic by means of a flange; for correct application, please contact the **Technical Department or Customer Assistance Service**
- V-belts
- Cardan joint (please respect the maximum working angles indicated by the manufacturers)
- Flexible joint

### 9.2 Sense of rotation

An arrow situated on the crankcase near the shaft indicates the correct sense of rotation. Standing in front of the pump head, the sense of rotation must be as shown in fig.5.



Lato Dx	Right Side
Lato Sx	Left Side
orario	clockwise
antiorario	counter-clockwise

### 9.3 Version change

A right version pump is defined when:

Observing the pump from the head side, the PTO shank of the pump shaft is on the right side.

A left version pump is defined when:

Observing the pump from the head side, the PTO shank of the pump shaft is on the left side.

**N.W.** Fig. 5 shows a right version.



**The version may be changed only by specialised and authorised personnel by carefully following the instructions that follow:**

1. Separate the hydraulic part from the mechanical part as indicated in Chapter 2, paragraph 2.2.1 of the repair manual.
2. Rotate the mechanical part by 180°, and reposition the rear crankcase cover so that the oil dipstick is facing upwards; reposition the lifting bracket and the related closing caps in the upper part of the crankcase; finally, correctly reposition the identification plate in its apposite seat on the crankcase.



**Be sure that the lower draining holes on the crankcase near the pistons are open, and not closed by the apposite plastic caps as required for the previous version.**

3. Join the hydraulic part with the mechanical part as indicated in Chapter 2, paragraph 2.2.5 of the repair manual.

#### 9.4 Hydraulic Connections

In order to isolate the system from the vibrations produced by the pump, we advise to build the first section of the duct near the pump (both for intake and delivery) with flexible tubes. The consistency of the intake section must allow to avoid deformation caused by the depressurisation produced by the pump.

#### 9.5 Pump feeding

To obtain the best volumetric efficiency, a minimum positive head of 0.20 metres is required.



**For negative head values, please contact the *Technical Department or Customer Assistance Service*.**

#### 9.6 Suction line

For the pump's correct operation, the suction line must have the following characteristics:

1. Minimum internal diameter as indicated in the diagram in paragraph 9.9, and in any case equal or greater than the pump head's value.



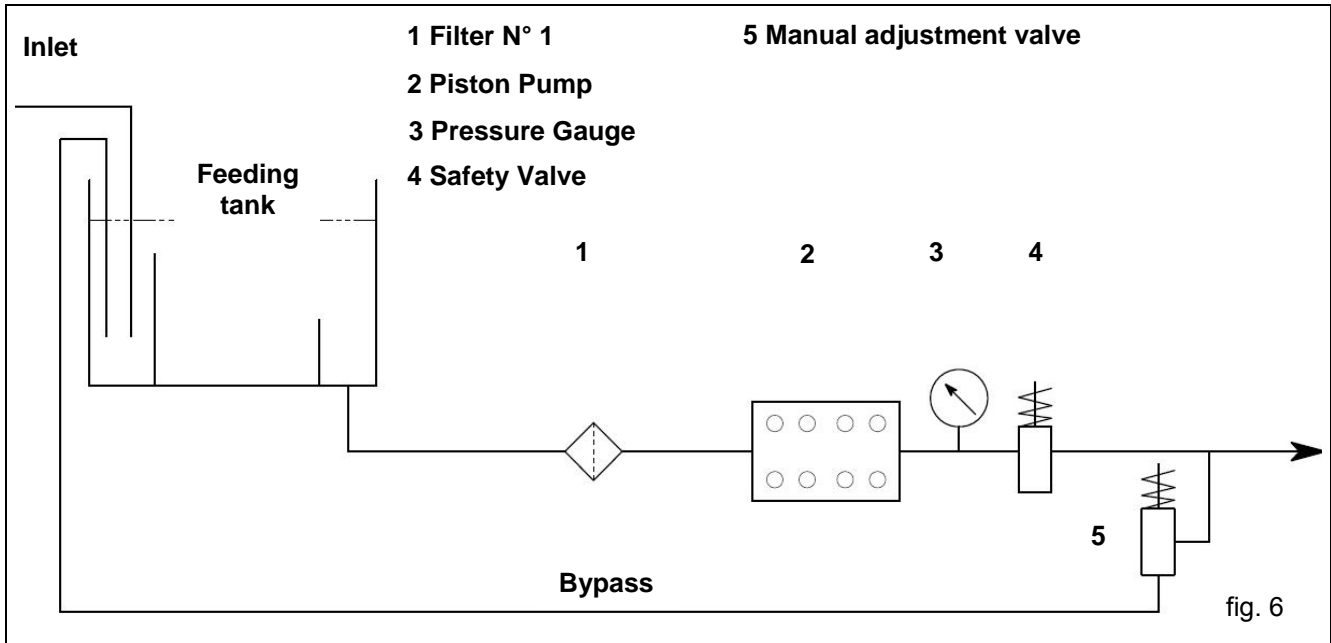
Along the duct, avoid localised diameter reductions that may cause pressure drops with subsequent cavitation. Absolutely avoid 90° elbows, connections with other pipes, bottlenecks, counter-slopes, upside-down "U" shaped curves, "T" connections.

2. The selected lay-out must allow to avoid cavitation.
3. It should be perfectly airtight, and built in a way that guarantees perfect sealing over time.
4. Avoid pump emptying when stopping (even partial emptying).
5. Do not use hydraulic-type fittings, 3 or 4 way fittings, adaptors, etc... since they may hinder the pump's performance.
6. Do not install Venturi tubes or injectors for detergent intake.
7. Avoid the use of standing valves, check valves, or any other type of one-way valves.
8. Do not connect the by-pass line from the valve directly to the pump suction line.
9. Provide appropriate baffle plates inside the tank in order to avoid that water flows coming from both the by-pass and feeding lines may create turbulence near the tank's outlet port.
10. Make sure that the suction line is perfectly clean inside before connecting it to the pump.

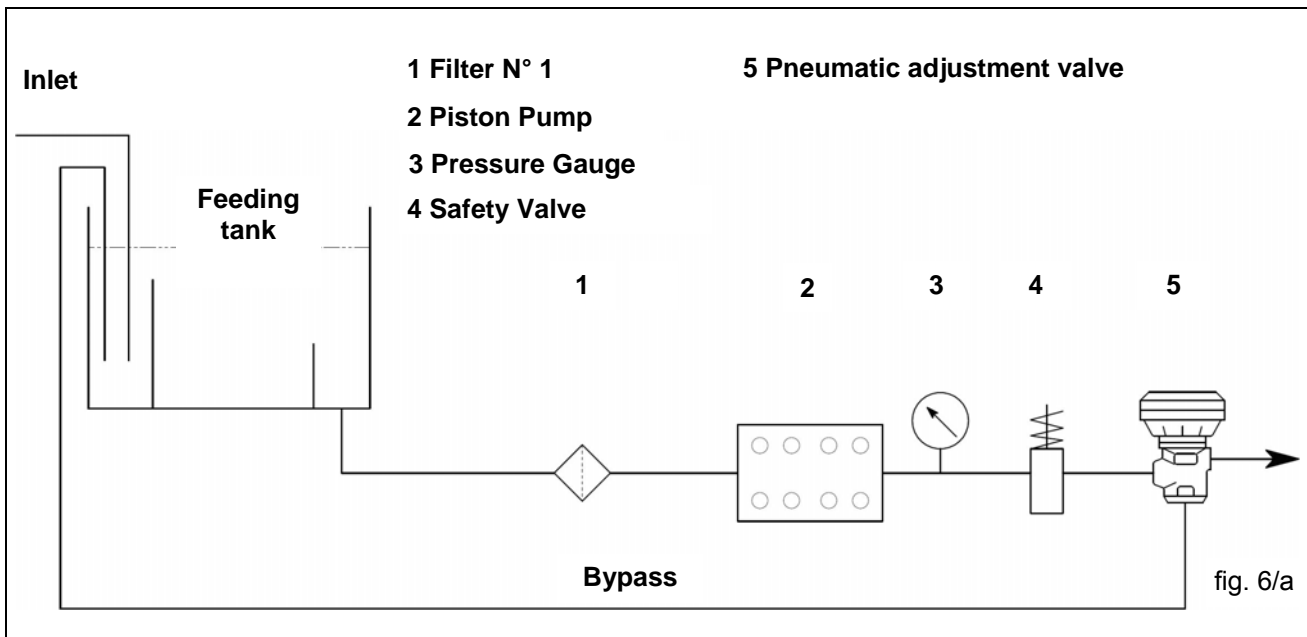
**9.7 Filtering**

On the pump suction line, install 1 filter arranged as shown in fig. 6 and fig.6/a.

**With the manual adjustment valve**



**With the pneumatic adjustment valve**



The filter must be installed as close as possible to the pump, should allow easy inspection and have the following characteristics:

1. Minimum capacity 3 times greater than the pump's rated flow value
2. Filter port diameters must not be smaller than the pump inlet ports
3. Filtration degree ranging between 200 and 360  $\mu\text{m}$



**In order to guarantee correct pump operation, it is important to plan periodical cleaning of the filter depending on actual pump usage, water quality and real clogging conditions.**

### 9.8 Delivery line

To obtain a correct delivery line, please comply with the following installation instructions:

1. The internal diameter of the pump must allow to guarantee correct fluid speed; see diagram in paragraph 9.9.
2. The first section of the pipe connected to the pump must be flexible in order to isolate pump vibrations from the rest of the system.
3. Use high pressure pipes and fittings that guarantee wide safety margins in any working condition.
4. Install a safety valve on the delivery line.
5. Use pressure switches suitable for the pulsating loads typical of piston pumps.
6. In the design phase, take into proper account the pressure drop along the line, since this causes a reduction in usage pressure with respect to the value measured at the pump
7. If the pump pulsations are harmful for particular applications, install an appropriately sized pulsation damper on the delivery line.



### 9.9 Internal diameter of the pipeline

To determine the internal diameter of the piping, please refer to the diagram below.

#### Suction pipe

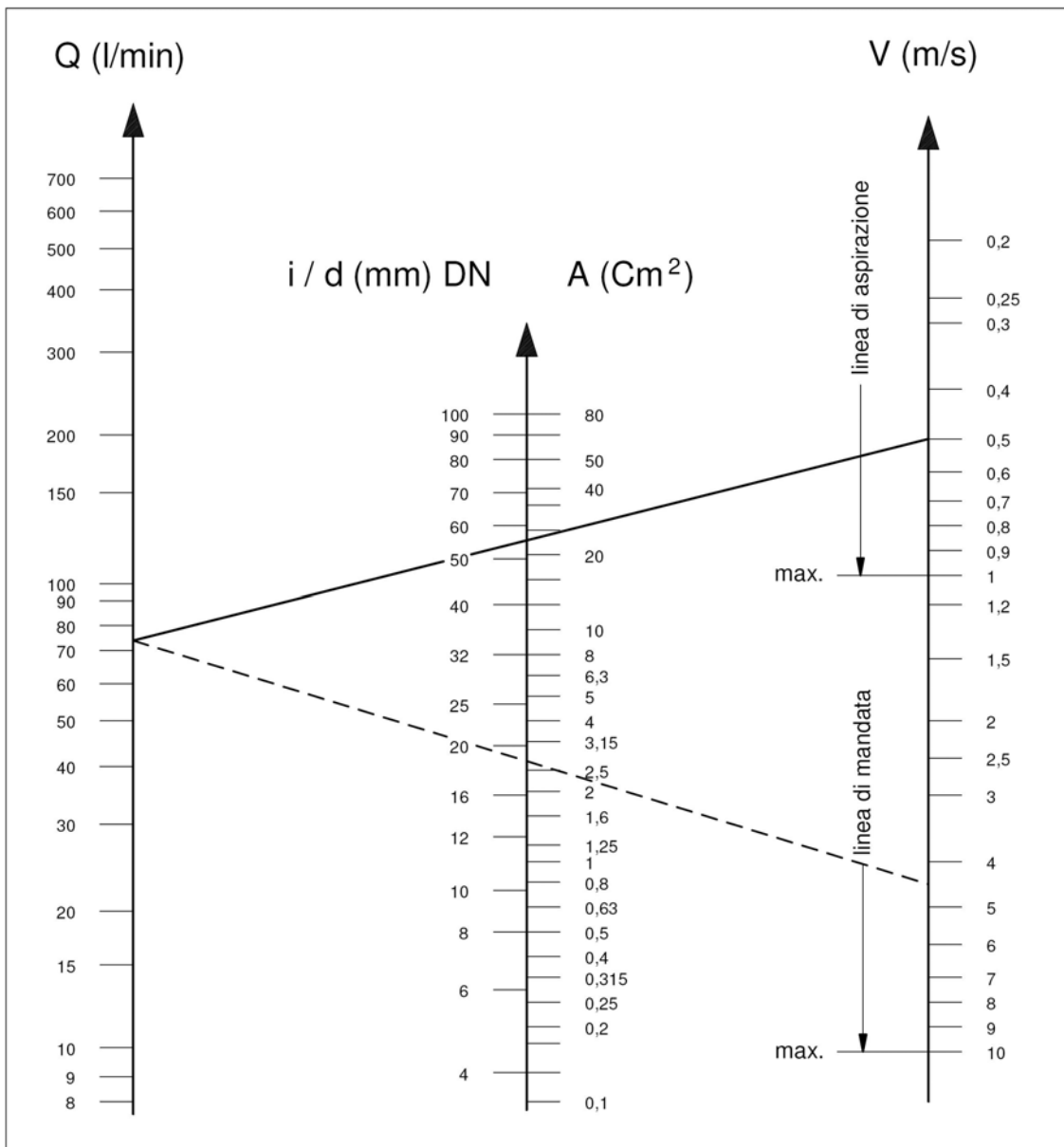
With a flow rate of ~ 74 L/min and water speed of 0.5 m/sec. The diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 55 mm.

#### Delivery pipe

With a flow rate of ~ 74 L/min and water speed of 5.5 m/sec. The diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 19 mm.

#### Optimum speed values:

- Suction:  $\leq 0.5$  m/sec.
- Delivery:  $\leq 5.5$  m/sec.



Linea di aspirazione	Suction line
Linea di mandata	Delivery line



The diagram does not take into consideration the pipe and valve resistance, the pressure drop due to the pipe length, the viscosity and the temperature of the pumped fluid.  
If necessary, contact our **Technical Department or Customer Assistance Service**.

**9.10 V-belt transmission**

The pump may be driven by a v-belt system.

For this pump model, we suggest to use N° 4 XPB belts (16.5x13 cogged); only for long durations, use the XPC profile; both the characteristics and the power transmission capacity of each belt can be verified on the diagram in fig. 7, in function of the N° of rotations normally declared by the Manufacturer.

Minimum diameter of the driven pulley (on the pump shaft):  $\geq 250$  mm.

The radial load on the shaft must not be greater than 7500 N (value required for the definition of the Lay-out). The transmission is considered adequate if this load is applied at a maximum distance of **a=40 mm** from the shaft shoulder (P.T.O) as indicated in fig. 10.



For sizing that differs from what indicated above, please contact our **Technical Department or Customer Assistance Service**.

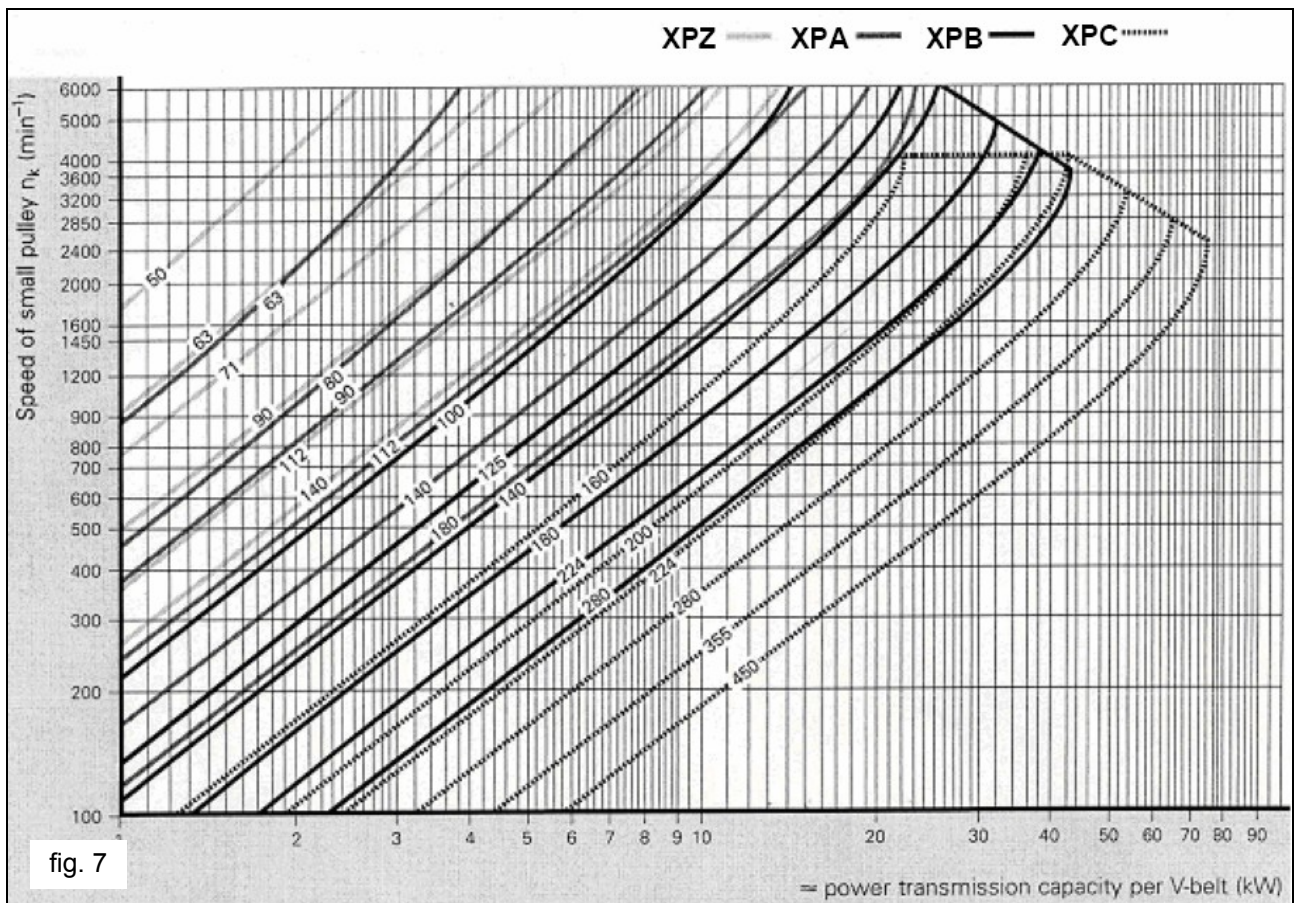


fig. 7

**9.11 Transmission definition**

To avoid abnormal radial loads on the shaft and its related bearing, please comply with the following indications:

- a) Use pulleys for v-belts with race dimensions prescribed / recommended by the belt Manufacturer. Should no indications be supplied, please see fig. 8 and the table in fig. 9.

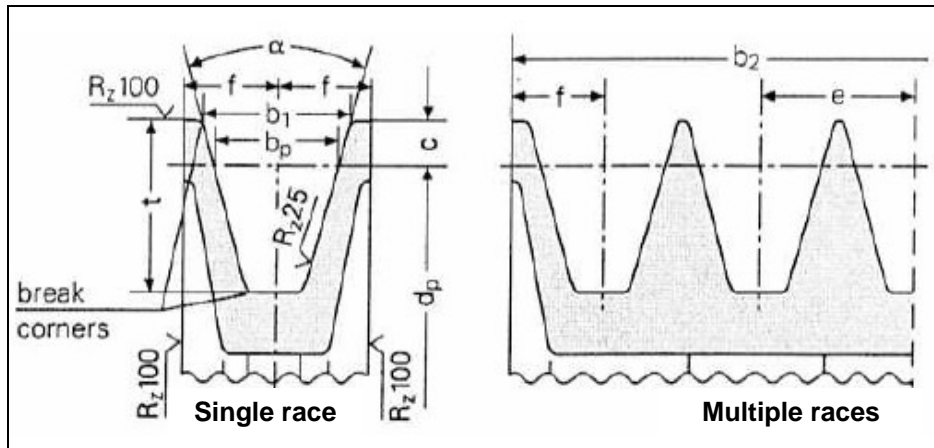


fig. 8

Dimensions (in mm)

Belt section as indicated in DIN 7753 part 1 and B.S. 3790		symbol DIN symbol B.S./ISO	XPB/SPB SPB	XPC/SPC SPC	
Belt section as indicated in DIN 2215 and B.S. 3790		symbol DIN symbol B.S./ISO	17 B	22 C	
Pitch width		$b_w$	14.0	19.0	
Increased race width $b_1 \approx$		$\alpha = 34^\circ$	18.9	26.3	
		$\alpha = 38^\circ$	19.5	27.3	
		$c$	8.0	12.0	
Distance between races		$e$	$23 \pm 0.4$	$31 \pm 0.5$	
		$f$	$14.5 \pm 0.8$	$20.0 \pm 1.0$	
Increased race depth		$t_{min}$	22.5	31.5	
$\alpha$	34°	For a primitive diameter narrow section v-belt DIN 7753 part 1	$d_w$	from 140 to 190	from 224 to 315
	38°			> 190	> 315
$\alpha$	34°	For a primitive diameter classical section v-belt DIN 2215	$d_w$	from 112 to 190	from 180 to 315
	38°			> 190	> 315
Tolerance for $\alpha = 34^\circ - 38^\circ$			$\pm 1^\circ$	$\pm 30'$	
Pulleys per $b_2$ per Number of races $z$ $b_2 = (z-1)e + 2f$			1	29	40
			2	52	71
			3	75	102
			4	98	133
			5	121	164
			6	144	195
			7	167	226
			8	190	257
			9	213	288
			10	236	319
			11	259	350
			12	282	381

The pulley's minimum diameter must be respected.  
Do not use for banded v-belts.

fig. 9

- b) Use high efficiency belts – for example **XPB** instead of **SPB**; this will allow to use a lower number of belts to transmit the same power, and consequently a minor distance of the resultant from the shaft shoulder (P.T.O.) “a” in fig. 10

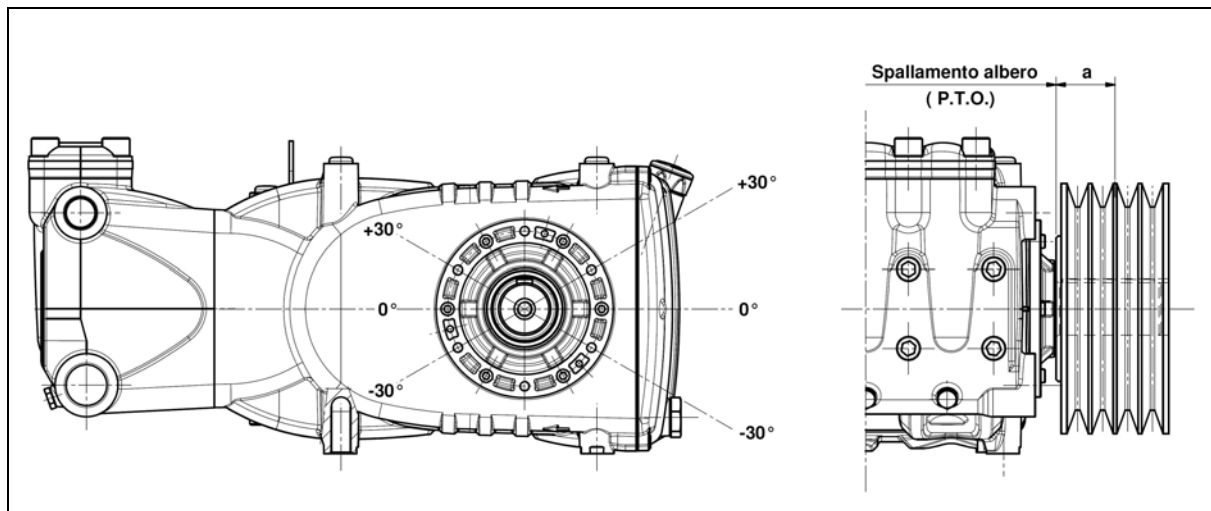


fig. 10

Spallamento albero	Shaft shoulder
--------------------	----------------

- c) Set belt tension according to the Manufacturer's prescriptions; an excessive value will abnormally stress the bearing, reduce its duration, and cause premature wear of the pulley. The tension value depends on different variables as indicated in paragraph 9.12.
- d) Belt length has a natural tolerance  $\geq \pm 0.75\%$ ; for this reason the three belts must be purchased in pairs.
- e) Follow the belt tension direction as indicated in fig. 9; for different needs, please contact **the Technical Department or Customer Assistance Service**
- f) Carefully align driver pulley and driven pulley races.

**9.12 Definition of belt static tension values**

Static tension depends on:

- a) The centre distance between the two pulleys (belt length).
- b) The load due to the belt's static tension
- c) The number of belts
- d) The angle of wrap of the smallest pulley
- e) Average speed
- f) Etc.

For belts with an XPB profile, the diagram in fig. 11 allows to obtain the values of the static tension that must be applied vs. the centre distance between pulleys.

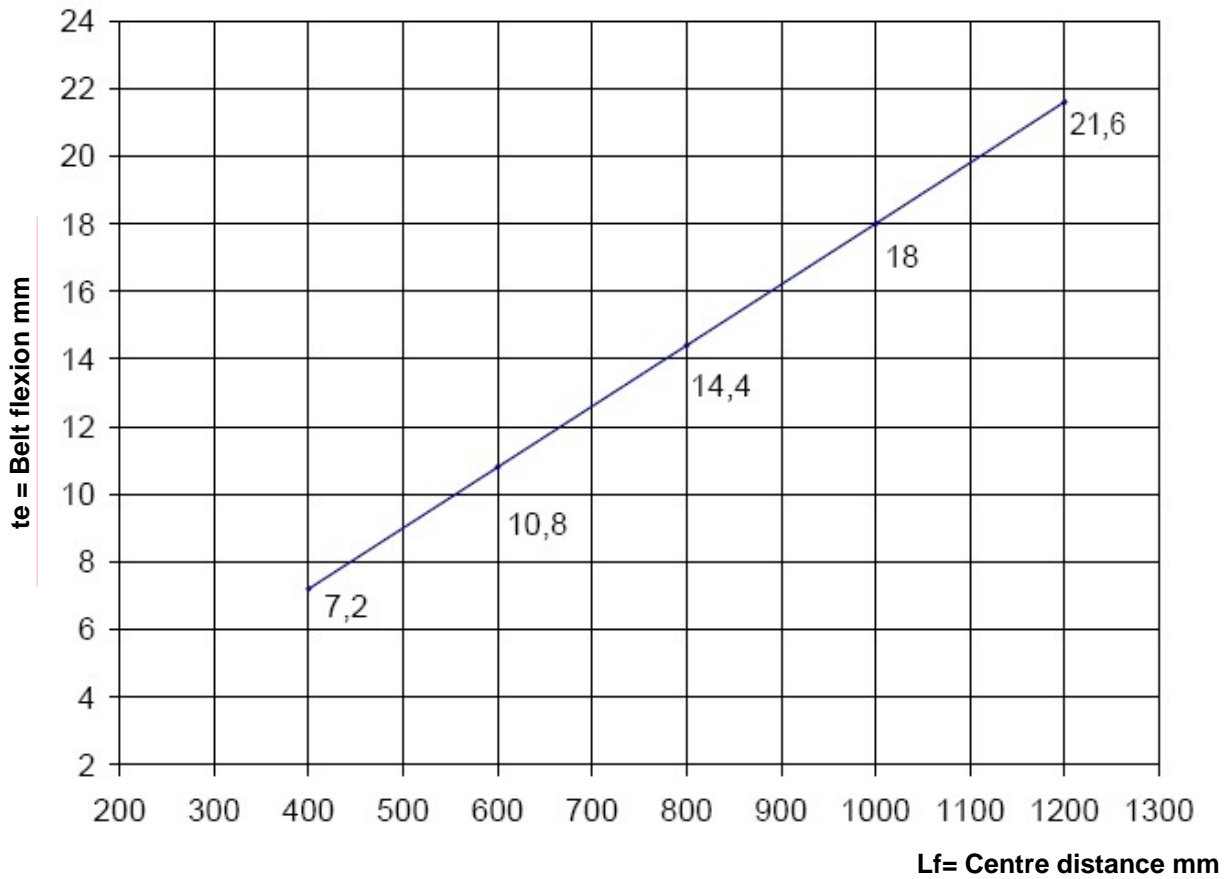
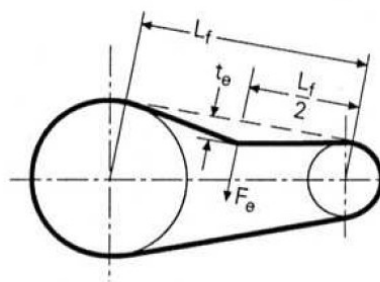
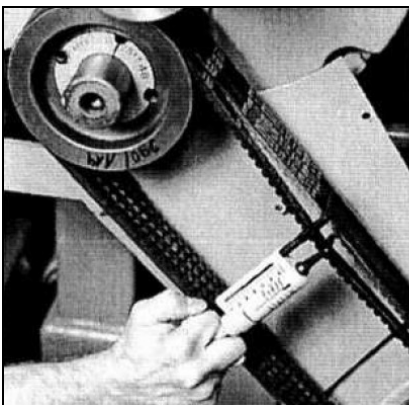


fig. 11

Conclusion: using a dynamometer, by loading the belt with 75 N as indicated in fig. 12, you will obtain a flexion value “te” of about 10.8 mm.



**Lf = Centre distance**  
**te = Belt flexion**  
**Fe = 75 N Dynamometer load**

fig. 12

N.W<sub>1</sub>. If not differently indicated by the belt Manufacturer, the inspection of the correct tension value, and the related tension adjustment if needed, is to be carried out after at least 30 minutes of operation in order to obtain belt settling. The best efficiency and maximum duration is obtained with the correct tension value.

N.W<sub>2</sub>. If required, or during normal maintenance, never replace a single belt but the entire set.

## 10. START-UP AND OPERATION

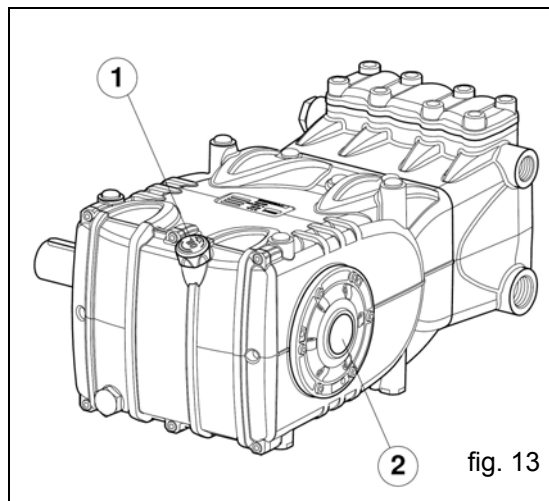
### 10.1 Preliminary inspections

Before start-up, be sure that:



**The suction line is connected and up to pressure (see paragraphs 9.4 – 9.5 – 9.6) the pump must never run dry.**

1. The suction line must be perfectly airtight.
2. All the On-Off valves between the pump and the feeding source are completely open. The delivery line must discharge freely in order to allow the air in the pump to be expelled easily, thus facilitating pump priming.
3. All suction / delivery connections and fittings must be correctly tightened.
4. Coupling tolerances on the pump / transmission axis (half-joint misalignment, Cardan inclination, belt tightening, etc.) must remain within the limits indicated by the transmission Manufacturer.
5. The oil level in the pump must be verified using the apposite dipsticks (position 1 fig. 13), and exceptionally by means of the oil sight glass (position 2 fig. 13).



**In case the pump has not run for a long period of time, verify the correct operation of the suction and delivery valves.**

### 10.2 Start-up

1. When starting the pump for the first time, check for the correct sense of rotation
2. The pump must be started off-load
3. Verify correct feeding pressure
4. During operation check that the rotating speed does not exceed the rated value
5. Before putting the pump under pressure let it run for at least 3 minutes
6. Before stopping the pump, release the pressure by acting on the adjustment valve or on any discharging device, and reduce rpm (diesel applications)

## 11. PREVENTIVE MAINTENANCE

To guarantee pump reliability and efficiency, respect the maintenance intervals as indicated in the table in fig. 14.

<b>PREVENTIVE MAINTENANCE</b>	
<b>Every 500 hours</b>	<b>Every 1000 hours</b>
Check oil level	Change oil
	Check / Replace: <ul style="list-style-type: none"><li>- Valves</li><li>- Valves seats</li><li>- Valve springs</li><li>- Valve guides</li></ul>
	Check / Replace: <ul style="list-style-type: none"><li>- H.P. packings</li><li>- L.P. packings</li></ul>

fig. 14

## 12. STOPPING THE PUMP FOR LONG PERIODS

### 12.1 Inactivity for long periods



If the pump is started up for the first time after a long period from the shipment date, before starting operation check the oil level, check the valves as indicated in Chapter 10, and therefore follow the start-up procedures described.

### 12.2 Filling the pump with an anti-corrosion emulsion or anti-freeze solution by using an external diaphragm pump as in the layout shown in paragraph 9.7, fig. 6

- a) Close the filter draining, if open.
- b) Be sure that the connecting pipe is clean and spread with grease, and connect it to the high pressure outlet port.
- c) Fit a suction hose to the membrane pump. Open the pump suction connection and fit hose between it and the membrane pump.
- d) Fill the container with the solution / emulsion.
- e) Put the free extremities of the suction pipe and the high pressure outlet pipe inside the container
- f) Start up the diaphragm pump
- g) Pump the emulsion until it comes out of the high pressure outlet pipe
- h) Continue pumping for at least another minute; if needed, the emulsion can be re-enforced by adding for example Shell Donax
- i) Stop the pump, remove the pipe from the suction connection and close it with a plug
- j) Remove the pipe from the high pressure outlet port. Clean, grease and plug both connections and the pipes.

### 12.3 Pipes

- a) Before greasing and protecting the pipes according the previously described procedure, dry the connections using compressed air
- b) Cover with polyethylene
- c) Do not wrap them too tightly; be sure there is no folding

## 13. PRECAUTIONS AGAINST FREEZING



In areas and periods of the year where there is risk of freezing, follow the instructions indicated in Chapter 12 (see paragraph 12.2).



**In the presence of ice, in no case must the pump be started until the entire circuit has been perfectly thawed out; not complying with this indication may cause serious damage to the pump.**

## 14. WARRANTY TERMS

The duration and the terms of the warranty are contained in the purchase contract.

The warranty is void if:

- a) The pump has been used for purposes that differ from what agreed.
- b) The pump has been fit with an electric or diesel engine with performance greater than what indicated in the table.
- c) The required safety devices were un-adjusted or disconnected.
- d) The pump was used with accessories or spare parts not supplied by the Interpump Group.
- e) Damage was caused by:
  - 1) improper use
  - 2) the non-observance of maintenance instructions
  - 3) use not compliant with operating instructions
  - 4) insufficient flow rate



- 5) faulty installation
- 6) incorrect positioning or sizing of the pipes
- 7) non authorised design changes
- 8) cavitation

## 15. TROUBLESHOOTING



### The pump does not produce any noise at start-up:

- The pump is not primed and is running dry
- There is no water in the inlet line
- The valves are blocked
- The delivery line is closed and does not allow the air in the pump to be discharged



### The pump pulses irregularly (knocking):

- Air suction
- Insufficient feeding
- Bends, elbows, fittings along the suction line obstruct the fluid's passage
- The inlet filter is dirty or too small
- The booster pump, where provided, supplies insufficient pressure or flow rate
- The pump is not primed due to insufficient head or the delivery line is closed during priming
- The pump is not primed due to valve seizing
- Worn valves
- Worn pressure packings
- Incorrect operation of the pressure adjustment valve
- Transmission problems



### The pump does not deliver the rated flow / is noisy:

- Insufficient feeding (see the causes listed above)
- RPM are less than the rated value
- Excessive amount of water by-passed by the pressure adjustment valve
- Worn valves



- Leakage from the pressure packings
- Cavitation due to:
  - 1) Wrong sizing of the suction pipe / undersized diameters
  - 2) Insufficient flow rate
  - 3) High water temperature



### Insufficient pump pressure:

- The nozzle is (or has become) too large
- Insufficient RPM
- Leakage from the pressure packings
- Incorrect operation of the pressure adjustment valve
- Worn valves



### Overheated pump:

- The pump is overloaded (pressure or rpm exceed the rated values)
- Oil level is too low, or the oil is not of a suitable type, indicated in Chapter 11 (see paragraph 11.1.1).
- Excessive belt tension or incorrect alignment of the joint or the pulleys
- Excessive inclination of the pump during operation



### Pipe Vibrations or Knocking:

- Air suction
- Incorrect operation of the pressure adjustment valve
- Valve malfunction
- Irregular drive transmission motion



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