

Owner's Manual

- *Installation*
- *Use*
- *Maintenance*



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1. INTRODUCTION

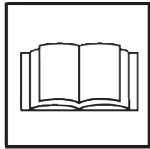
Please read this manual carefully before using your pump. It contains the necessary information for correct installation, use and maintenance as well as some practical suggestions for trouble shooting. Providing your HF high pressure plunger pump is correctly installed and maintained, it will give trouble free operation for a long time. The manufacturer declines all responsibility for damages arising from the misuse and non-observance of the instructions indicated in this manual. On receiving the pump, please check that it is complete and in good state.

Should you find anything out of order, please contact General Pump before installing and starting the pump.

2. SYMBOL DESCRIPTIONS

**Warning**

Potential Danger



Read carefully and understand the manual before operating the pump

**Danger**

Electrocution Danger

**Danger**

Wear protective mask

**Danger**

Wear goggles

**Danger**

Wear protective gloves

**Danger**

Wear protective boots

3. SAFETY

3.1 General warnings for safe operation

The misuse of a high pressure water unit and the non-observance of the pump installation and maintenance instructions may cause serious damages and/or injuries to people or properties or both.

Any Manufacturer/Operator requested to assemble/use a high pressure water unit should be competent to do so, should have the necessary knowledge on every high pressure component installed in the unit and on the precautions to be taken in order to guarantee the largest safety margins during operation. No precaution, so far as is reasonably practical, should be left out in the interest of safety, both from the Manufacturer and the Operator.

3.2 High pressure unit safety requirements

1. A safety valve should be installed in any delivery line and should be sized to discharge or by-pass the entire pump flow rate
2. High pressure unit components, with particular regard for those units working outside, should be adequately protected against rain, frost and heat.
3. Electric components and wiring should be provided with an adequate degree of protection, able to protect them against spray coming from any direction. They should also be suitable for working in a wet environment.
4. High pressure hoses and any other accessory under pressure should be sized in accordance with the maximum unit working pressure and must always work within the safety margins indicated by the hose/accessory Manufacturer.
5. High pressure hose ends should be fastened to a steady object in order to prevent them from dangerous sweeping around, should they burst or come off their end fittings.
6. Proper safety guards should be provided to adequately cover transmission joints, pulleys, belts or auxiliary drives.



3.3 Safety of operation

The access into the area when a high pressure unit is working should be strictly prohibited to unauthorized personnel. The area should be suitably enclosed and its perimeter, so far as is reasonably practical, cordoned off and proper warning notices displayed in prominent positions.

Personnel authorized to enter that area should have been previously trained to do so and informed of the risks arising from failures, misuse and any foreseeable circumstance which may occur during operation. Before starting the pump unit and bringing it up to pressure the Operator is requested to carry out the following checks:

1. Make sure that a correct water supply to the pump is provided.
2. Make sure that water inlet filters are properly clean.
3. Electrical components and wiring, with special emphasis on connections, junction boxes, switches and supply cables should be free from external damage (i.e. exposed and broken wires) and adequately protected against water.
4. High pressure hose should not show apparent external wear and the fittings at both ends should be free from signs of erosion or corrosion.
5. Make sure that all fluids (lubricating oil for pump and engine, cooling water, hydraulic fluids) are at proper levels and in good condition.
6. Make sure the safety guards are in good condition.

The work should stop immediately and the pressure must be released in the event that leakage becomes apparent or if any person becomes aware of a change in condition or any hazard existing or being introduced. Any failure must be promptly reported and then checked personnel.



3.4 General procedures for high pressure gun/lance operation

1. The Operator should take reasonable care for the safety of himself and of other persons who may be affected by his acts or omission at work. His actions should always be governed by his good sense and responsibility.
2. The Operator should wear suitable waterproof protective clothing, having regard to the type of work being undertaken. The clothing set should include adequate hand protection, suitable boots able to ensure proper grip on wet floors, helmet provided with full face shield, waterproof garment providing full cover to the Operator, including his arms.
As most water jets produce noise levels in excess of

90 dB(A) suitable ear protection is advised.

NOTE: *it must be emphasized that whereas protective clothing provides adequate protection against spray and flying particles, it does not constitute complete protection against the direct impact of the water jet. Additional protections in the form of suitable metal shields or barriers may be necessary for certain jetting operation.*

3. In most jetting operations it is an accepted practice to employ a team of Operators consisting of two members at least, in order to provide mutual assistance in case of need and to rotate their duties in case of long and heavy work. While the first Operator holds the gun, the second Operator attends the pump unit, keeping close watch on the first Operator for signs of difficulty or fatigue, and watching the surrounding area for intrusion by other persons or unsafe situations. If required, he will shut off the pressure unit until it is safe to continue.
4. The area in which the work is to proceed should be clear of loose items and debris to prevent tripping and slipping hazards.
5. The water jet should be directed only and always against the workpiece even during preliminary operating tests prior to starting work.
6. Where applicable, proper side shields should be suitable placed to safeguard personnel and equipment against contact with grit or particles removed by the water jet.
7. On no account must the Operator be distracted during operation until the jet has been stopped. Personnel having reason to enter the water jetting area should wait until the jet is stopped and his presence known.
8. Each team member must always be aware of the actions and intentions of other team members in order to prevent any dangerous misunderstanding occurring during jetting operation.
9. The pump unit should not be started and brought up to pressure unless each team member is in his designated position, the nozzle directed to the workpiece and the lance or gun securely held.

3.5 Safety of maintenance

Apart from the working pressure regulation no attempt should be made to adjust any nut, hose, fitting, etc., while that part of the system is under pressure. The pump should be stopped and any pressure in the line released prior to making any adjustments.

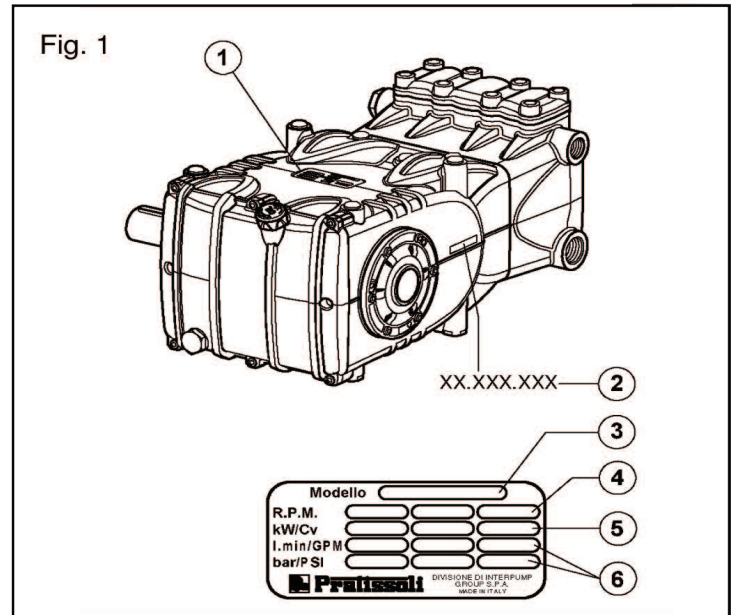
1. The high pressure water unit should be maintained in accordance with the Manufacturer's instructions.
2. The unit should be maintained only by competent personnel
3. Service and maintenance should be carried out with proper tools in order to prevent any damage on high pressure connections and fittings.
4. Use of other than original spare parts is strictly forbidden.

4. PUMP IDENTIFICATION

Each pump is fitted with a rating plate (see Fig. 1) containing the following information:

2. Serial number
3. Pump model and version
4. Max RPM
5. Power absorbed
6. Max flow rate (l/min) and pressure (bar)

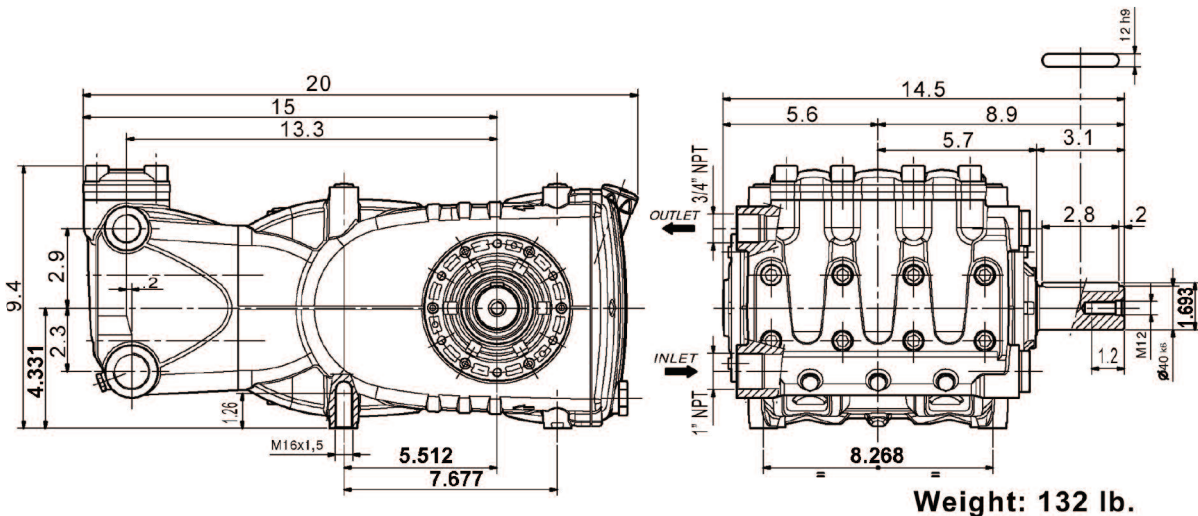
Pump model, pump version and serial number should be specified when ordering spare parts. Should the pump be modified (i.e by changing the original version) than any change should be mentioned on the rating plate for future reference.



5. TECHNICAL FEATURES

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		GPM	l/min	PSI	Bar	Hp	kW
HF18A	1000	10.08	38	7250	500	50	37.0
HF18A	800	8.06	30	8700	600	48	35.3
HF20A	1000	12.4	47	5800	400	50	37.0
HF22A	800	12.05	45	5800	400	50	37.0
HF22A	1000	15.0	57	5000	350	50	37.0
HF25A	1000	19.44	74	4060	280	53	39

6. DIMENSIONS AND WEIGHT



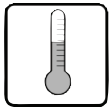
7. GENERAL INFORMATION ABOUT PUMP USE



The HF pump has been designed to pump fresh filtered (360 micron max) water at room temperature (40⁰ C max).

7.1 Water temperature

Water temperature is critical for the pump life, the higher it is, the more likely it is to create cavitation, resulting in premature seal and valve failures.



For such conditions, use HT series pumps.

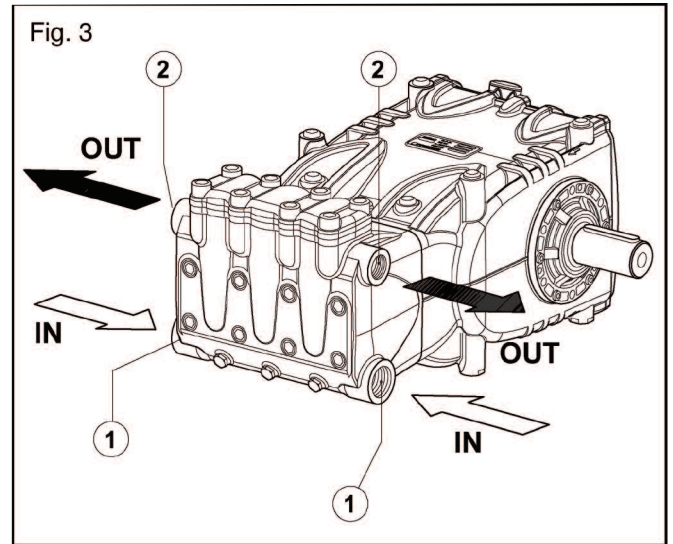
7.2 Pump performances

The performance data indicated in the catalog and on the rating plate refer to the maximum performance of the pump. The use of the pump below the rated performances does not allow the drop in power absorbed to be balanced by altering the pressure or volume of the pump **above** its maximum value unless especially authorized by our technical department.

7.3 Lowest operating RPM

The lowest operating speed for all HF's (all versions) is 500 RPM (on crankshaft).

8. CONNECTIONS AND PLUGS



HF pumps are provided with (Fig. 3):

1 - 2 inlet ports IN Ø 1" NPT

Either inlet port can be used; the one not used must be hermetically plugged.

2 - 2 outlet ports OUT Ø 3/4" NPT

9. PUMP INSTALLATION

9.1 Positioning

The pump must be installed on a rigid and perfectly flat and horizontal base by means of the proper four M16 x 1.5 threaded feet. The base should be rigid enough to avoid any misalignment or flexing on the pump/transmission coupling axis due to the torque involved during operation. The unit should not be rigidly fixed on the floor but be installed upon vibration dampeners. For special applications contact our technical department.

An eye-bolt is provided on top of the crankcase for easy handling of the pump (see picture below).



The eye bolt can be replaced with a plastic cap (see below), in order to protect the thread in the crankcase. The plastic cap is provided with the pump.



The oil plug must absolutely be replaced by the oil stick and the oil level checked. Make sure that you can easily reach the oil stick even after the unit has been assembled.

Never use rigid coupling on the shaft.

The following transmission types are suggested:

- Hydraulic by means of a flange
- Pulleys
- Cardan joint (within the max working angles indicated by the manufacturer).

9.2 Direction of rotation

An arrow situated on the crankcase near the shaft indicates the correct direction of rotation. Fig. 4 shows the direction of rotation looking at the pump from the fluid end side.

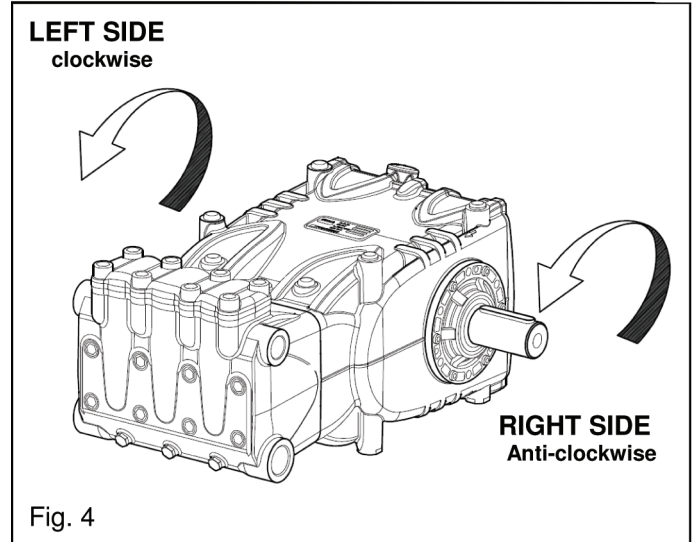


Fig. 4

9.3 Water connections

In order to isolate the high pressure equipment from the pump vibrations it is suggested, where applicable, to use flexible hoses for both suction and delivery lines at least for the first length. The flexible suction hose must be rigid enough to prevent it from collapsing during the suction stroke, when a partial vacuum may occur.

9.4 Suction line

The pump life is considerably influenced by the effectiveness of the suction line which must have the following characteristics:

1. The internal diameter of the suction line should be at least 30 mm (see the diagram on point 9.7) in any point, possibly larger depending on the drop in pressure due to the length and shape of the line.
2. It should be as straight as possible minimizing changes in size and direction and positioned in such a way to allow air pockets and bubbles to escape.
3. It should be perfectly airtight.
4. It should be completely free from 90° elbows, diameter reductions, counter slopes, "T" connections and should not be connected with other pipelines.
5. It must be positioned in such a way to prevent the pipe emptying after the pump stops.
6. Do not use high pressure hydraulic fittings like 90° elbows, high pressure adaptors, high pressure 3 or 4 way nipples, and so on.
7. Do not install any kind of detergent infector along the suction line.
8. Do not install standing valves, check valves or other

kind of one-way valves.

9. In the case of a feed tank, make sure that dimensions of the tank and the water minimum level do not give rise to turbulence at the tank outlet port, which, in turn might create cavitation in the pump.
10. Do not connect the by-pass line from the valve directly to the pump suction line.
11. Connect the bypass line from the valve directly to the feed tank and make sure that both the bypass and tank feeding flows could not give rise to turbulence at the tank outlet port, which in turn, might create cavitation at the pump. Proper baffle plates should be provided inside the tank.
12. Before connecting the suction line to the pump inlet port make sure the pipe is perfectly clean.

9.5 Filtration

All pumps require a suitable filter. The filter should be installed as close as possible to the pump, should allow easy inspection and have the following characteristics:

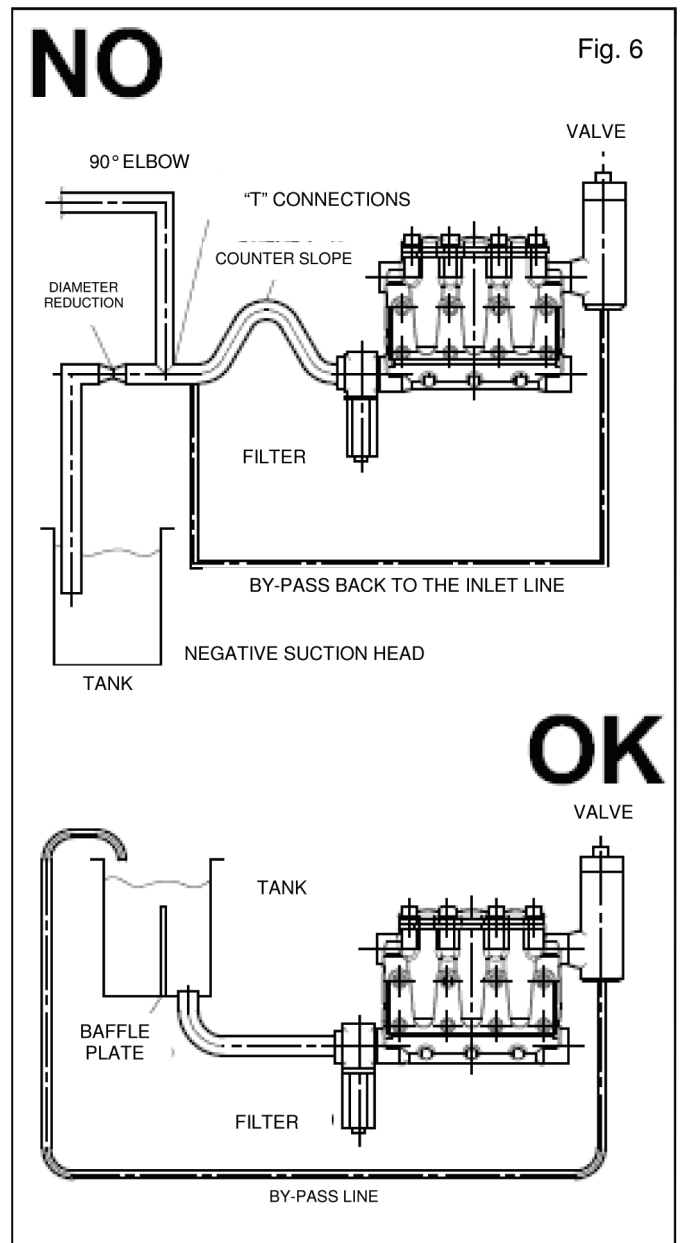
1. The filter capacity should be at least three times the rated pump volume.
2. Filter port diameters should not be smaller than the pump inlet ports.
3. Filtration degree in between 50 and 80 mesh (360 to 200 microns).

IMPORTANT NOTE: In order to properly safeguard the pump it is very important to plan cleaning of the filter with a frequency depending on the water quality, filtration degree and number of hours of each application. It is recommended to use filters with a clogging signaling device.

9.6 Delivery line

For a correct delivery line comply with the following instructions:

1. The first length of delivery hose should be flexible in order to isolate the pump vibrations from the rest of the system.
2. Use only high pressure hoses and fittings able to guarantee the largest possible safety margins in any working conditions.
3. A suitable relief valve should be installed in the delivery line.
4. Use glycerine filled pressure gauges, as the most suitable for pulsating loads.
5. When designing the delivery line, take into proper account the unavoidable drop in pressure, due to its length and size.
6. If necessary, the effects of the pump pulsations can be reduced by installing a proper pulsation dampener in the pressure line.



9.7 Internal Diameter of Piping

To determine the internal diameter of the piping, follow the following diagram.

Example 1 ()

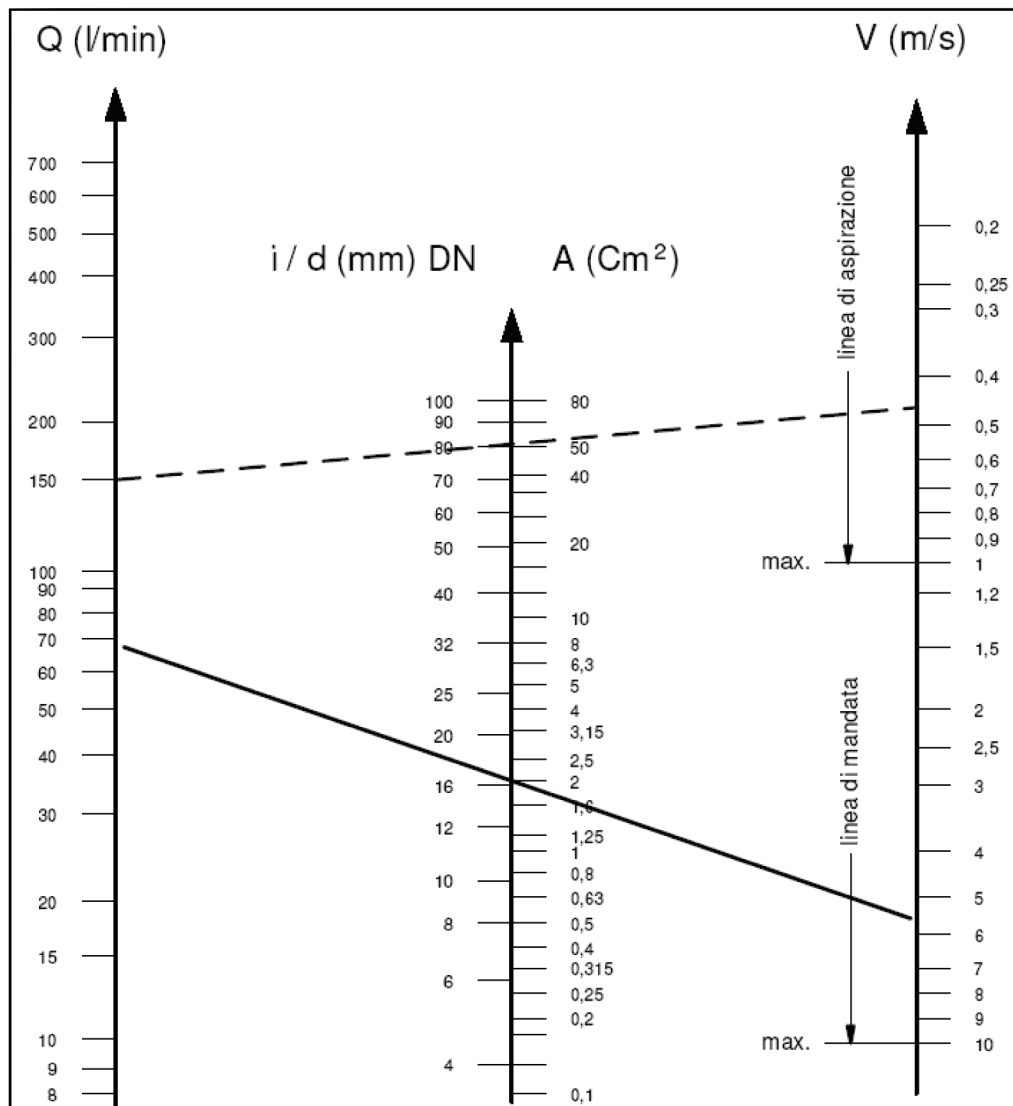
With a flow of 150 l/min and a water speed of 0.45 m/sec, the diagram line joining the 2 scales intersects the central scale, indicating the diameters, at a value of 80 mm.

Example 2 ()

With a flow of 70 l/min and a water speed 5.5 m/sec. The diagram line joining the 2 scales intersects the central scale, indicating the diameters, at a value of 16 mm.

Optimal speeds:

- suction: 0.5 m/sec.
- delivery: 5 m/sec.



The diagram does not take into consideration the pipe and valve resistance, drop in pressure due to the pipe length the viscosity of the pumped fluid, its temperature, etc.

If necessary, contact our technical department.

10. START UP AND RUNNING PROCEDURES

10.1 Before start up

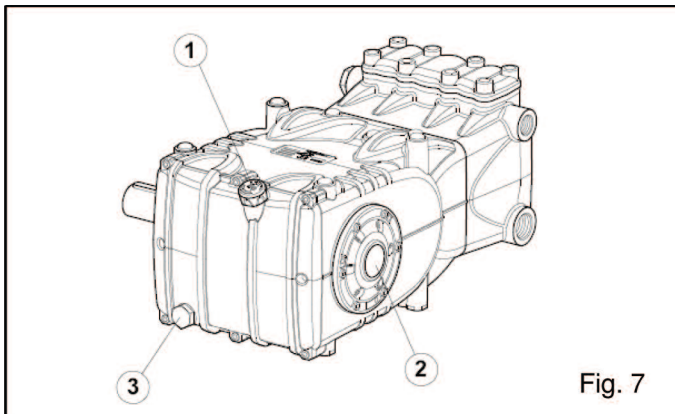
Before start up make sure that the following conditions have been complied with:

1. Suction line should be connected: **the pump must never run dry.**
2. Suction line must be perfectly air-tight.
3. Any ON-OFF valve in between the pump and water source should be open and make sure the water gets into the pump freely.
4. Set the pressure line in dump mode in order to let the air in the pump get out easily thus facilitating the pump priming.
5. Make sure all suction/delivery line connections are fully tightened.
6. Joint alignment, belt tightening and PTO shaft inclination tolerances should remain within the values indicated by the transmission Manufacturer.
7. Make sure the oil level is correct using the dipstick (position 1, Fig. 7) and the oil sight glass (position 2, figure 7).

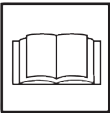
10.2 Starting up

1. When starting the pump up for the first time check check for proper direction of rotation.
2. Pump and motor/engine must start offload: set the regulating valve to "zero" or set the pressure line in dump mode by means of proper dumping devices.
3. During operation check that the rotating speed does not exceed the rated value.
4. Before putting the pump under pressure let it run for at least 3 minutes.
5. Before stopping the pump release the pressure from the system by operating the dump device or by releasing the regulating valve and reduce RPM to a minimum (diesel applications).

Note: *in case of feeding by a centrifugal pump, make sure that the plunger pump starts only when the correct inlet pressure is provided.*



11. MAINTENANCE INSTRUCTIONS



11.1 Crank mechanism maintenance.

Check oil level at least on a weekly basis (Fig. 8).

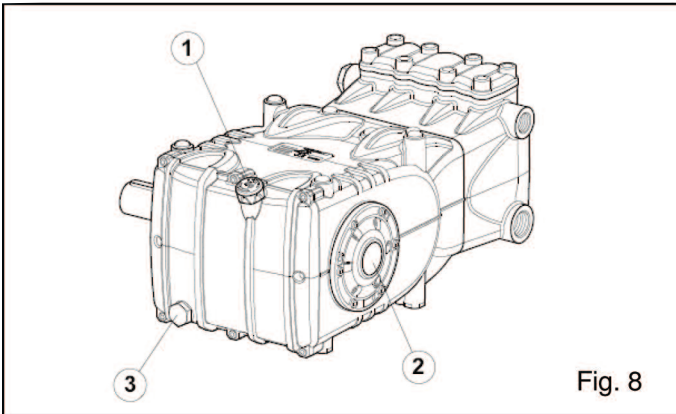


Fig. 8

If necessary, add the missing oil through the oil plug (position 1, Fig. 8). Check oil level when the pump is at room temperature. When changing the oil (removing the plug position 3, Fig. 8), the pump should be at its working temperature.

Change oil every 1000 working hours, oil pump capacity is 2 litres.

In any case the oil should be changed at least once a year, since oxidation deteriorates it.

List of recommended oils:

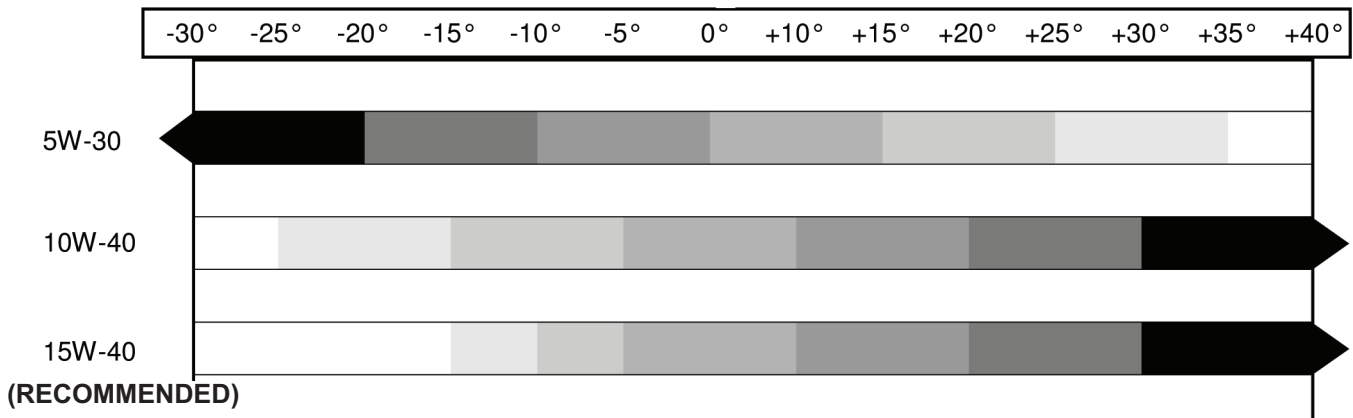
BRAND	TYPE
INTERPUMP	X99 ORIGINAL
AGIP	F1 SUPERMOTOR OIL
BP	VISCO 2000
CASTROL	CWX
ELF	SPORT ST
ESSO	UNIFLO
FIAT (FL)	VS MAX
IP	AZZURO SUPER OIL
MOBIL	SUPER
Q8	Q8 FORMULA RALLYE
ROLOIL	SUPERMULTIGRADE
SHELL	HELIX SUPER
TOTAL	QUARTZ 4000-5000

Mineral or synthetic oils can be used but they must be chosen according to the working environment temperature. Here below is a diagram indicating viscosity according to room temperature.

GENERAL PUMP RECOMMENDS USING SAE15W40

Oil grade SAE for engine oil

Recommended according to the room temperature (indicated in Celsius degrees)



11.1.1 Crank mechanism disassembling

Do as follows:

- A) Drain the oil from the pump and remove:
- shaft key
 - back cover
 - connecting rod cap
 - side covers. To do so, use 3 screws (M6 x 50) wholly threaded, putting them into the holes drilled for that purpose. See Fig. 9.



Fig. 9

- B) Push the piston guides and connecting rods forward so you can remove the pump crankshaft from the side. On the crankshaft, you will find marks (see Fig. 10) that must be turned towards the operator so the crankshaft can be easily extracted.
NOTE: to extract the piston guide, it is necessary to remove the ceramic plunger and wiper first.

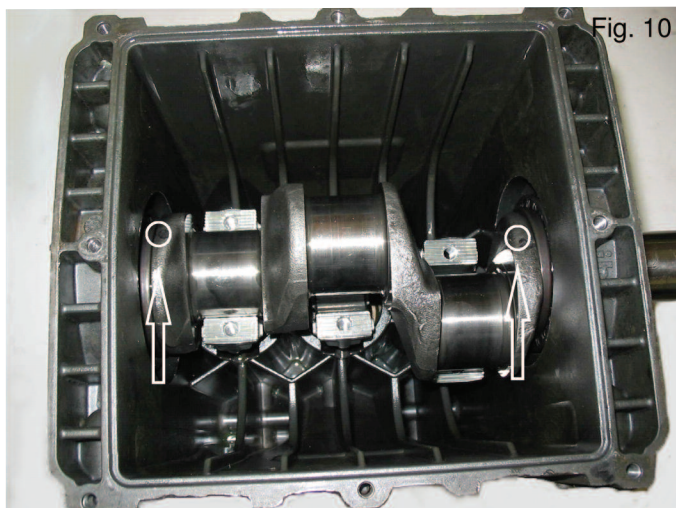


Fig. 10

- C) Disassemble the crankshaft oil seals and the piston guides using standard tools.

11.1.2 Crank mechanism reassembling

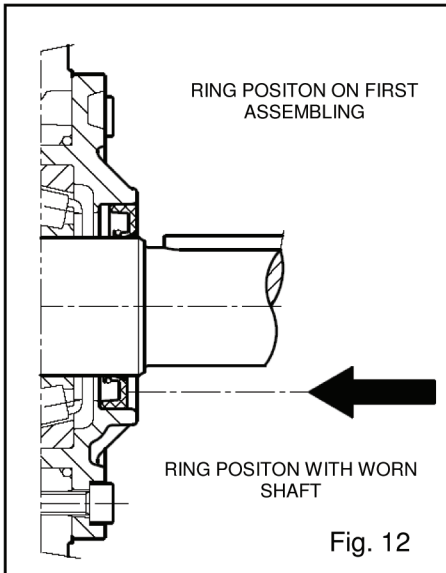
After washing the crankcase, reassemble the power end as follows:



Fig. 11

- A) Fit the piston guide seals into their seat thoroughly making sure they are correctly positioned.
- B) Introduce the unit piston guide/connecting rod into their seats. To facilitate the tightening of the connecting rod cap, position the connecting rod so you can easily read the number. To install the crankshaft, without key, it is necessary to push the unit piston guide/connecting rod backward.

- C) Before reassembling the side covers, check the seal lips for wear. If they need replacing, fit the new ring following the indications in Fig. 12.



NOTE: Should the shaft show diameter wear in the seal position, it is possible to avoid grinding it by fitting the seal further as indicated in Fig. 12. Before installing the cover, (sight glass side) check the shim rings have been placed. To help the covers fit on the crankcase, you can use 3 screws M6 x 40, and then finish screwing them with the original bolts (M16 x 18).

- D) Install the connecting rod cap taking care the numbers match and tighten the relevant bolts in 3 different stages:



1. Approach torque 6-8 Nm
2. Presetting torque 25-28 Nm
3. Tightening torque 38 Nm

NOTE: The screws must be greased on the thread and under the head.

Fig. 13



- E) Fit the back cover putting the dipstick hole upward.

11.1.3 Disassembling / Reassembling of the bearings and shims

The type of bearings (conical roller) ensures there is no end float on the crankshaft; the shims are to be determined to reach that purpose. To disassemble, reassemble and if required replace them, it is absolutely necessary to do as indicated below.

Disassembling / reassembling of the crankshaft without replacing the roller bearings

After removing the side covers, as indicated on point 11.11.1, check the rollers and reces for wear; if they are in good state, accurately clean the components with suitable degreaser and grease them again evenly with oil (same as the pump oil).

The same shims can be used again, taking care to fit them under the sight glass cover.

After installing the complete unit (sight glass side flange + crankshaft + engine side flange), check that the rolling couple - **with connecting rods free** - is at least 4 Nm, max 7 Nm.

To position the two side covers on the crankcase, you can use 3 screws (M6 x 40) first, and then the original screws to fix them.

The rolling couple of the crankshaft (with connecting rods coupled) must not exceed 8 Nm.

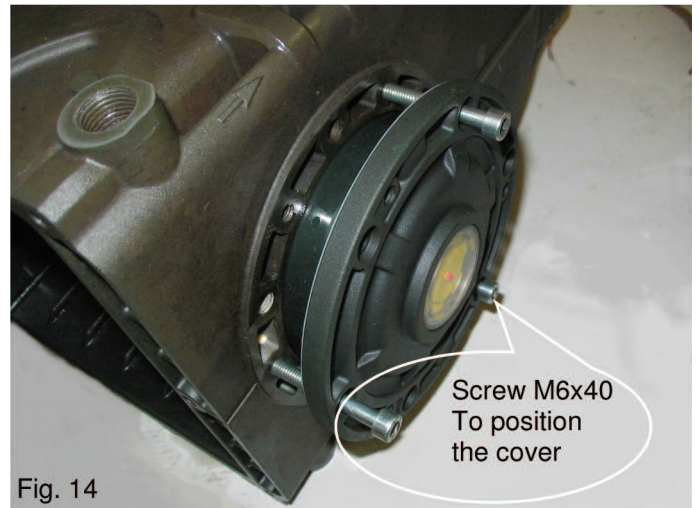


Fig. 14

Disassembling / reassembling of the crankshaft with replacement of the bearings

After disassembling the side covers, as indicated in point 11.1.1, remove the outer ring nut of the bearings from their covers and the inner ring nut, together with the remaining part of the bearing, from the 2 shaft ends by means of a standard pin extractor or similar tool. See Fig. 15-16.

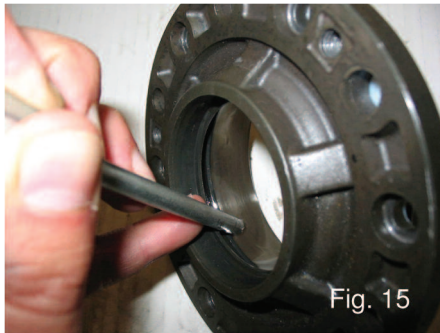


Fig. 15



Fig. 16

The new roller bearings can be mounted at room temperature with a press; it is necessary to hold them on the side surface of the ring nuts with suitable rings. The driving operation can be facilitated by heating the parts at a temperature between (250° - 300°F) making sure that the ring nuts are fitted in their seats.

NOTE: Take care not to invert the components of the 2 bearings (outer ring nut of bearing 1 instead of the one of bearing 2...).

To maintain the right axial load, the shim package has to be calculated again as follows:

- A) Install the crankshaft into the crankcase making sure that the PTO end comes out on the correct side.
- B) Fit the motor side flange on the crankcase with special attention to the seal lip as indicated on point 11.1.2.
- C) Position the sight glass side flange using the 3 screws M6 x 18 until the crankshaft cannot be turned by hand freely.
- D) By means of a thickness gauge (see Fig. 16) determine the shim package as indicated in the table below.



Fig.17

Measure	Shim Type	# Pieces
From: 0.5 to 0.10		
From: 0.11 to 0.20	0.1	1
From: 0.21 to 0.30	0.1	2
From: 0.31 to 0.35	0.25	1
From: 0.36 to 0.45	0.35	1
From: 0.46 to 0.55	0.35 0.10	1 1
From: 0.56 to 0.60	0.25	2
From: 0.61 to 0.70	0.35 0.25	1 1

- E) Fit the shims under the sight glass side cover, tightening it on the crankcase with the screws and check that the stall torque is between 4 Nm and 6Nm.



Fig.18

- F) If the torque is correct, connect the rods to the crankshaft, otherwise, calculate the shims again as per point "C".

11.2 Fluid end maintenance

11.2.1 Pump head

The pump head does not require periodic maintenance. Service operations are limited to the component inspections and/or replacement, when necessary.

Valve units:



The valve units are contained in the head and mounted in a vertical position. For proper inspection they should be taken out. Proceed as follows:

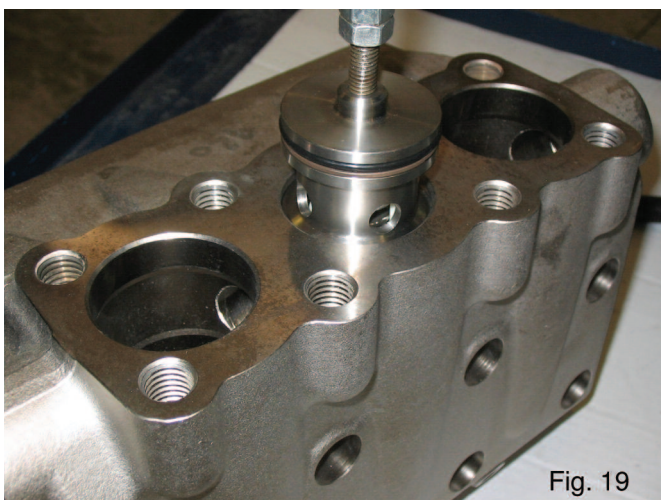


Fig. 19

- A) Loosen the valve cover screws (not shown).
- B) Extract the valve plugs with an extractor or a M8 threaded rod (see Fig. 19).
- C) Extract the valve unit with the same tool.

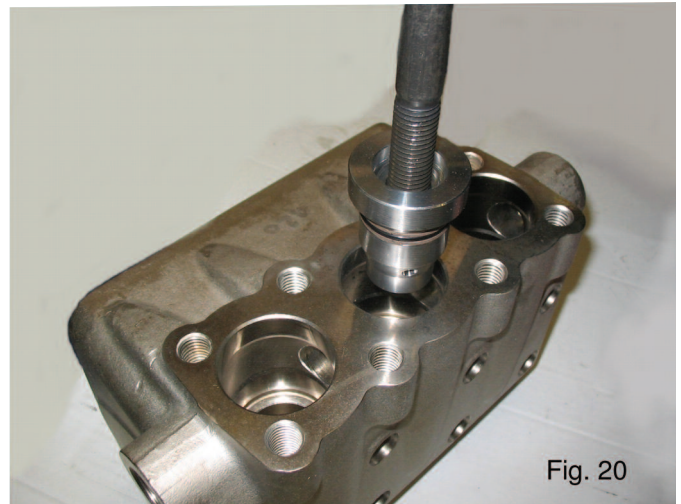


Fig. 20

- D) Extract the valve spacer using an extractor or a M16 threaded rod (see Fig. 20).
- E) Extract the suction valve unit by using an extractor or a M8 threaded rod (see Fig. 21).

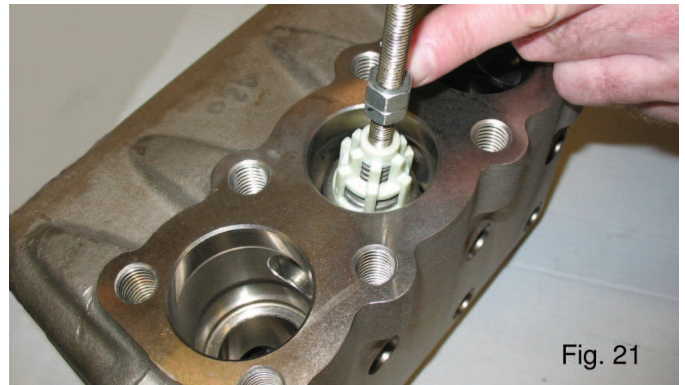


Fig. 21

Valve components of each valve are pressed together and therefore they can be easily replaced and installed back in place by means of simple tools (see Fig. 22).

Check the components for wear and replace if necessary. **Replace all o-rings of the valve units and valve plugs, at each inspection.**

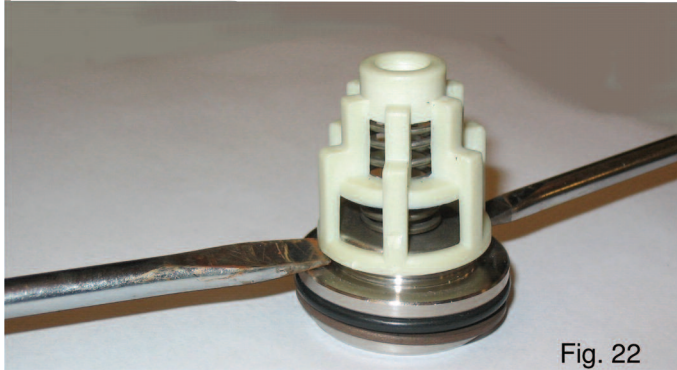


Fig. 22

IMPORTANT NOTE:
BEFORE REPOSITIONING THE VALVE UNITS AND O-RINGS, CLEAN AND PERFECTLY DRY ALL VALVE HOUSINGS INSIDE THE FLUID END (see arrows Fig. 23).

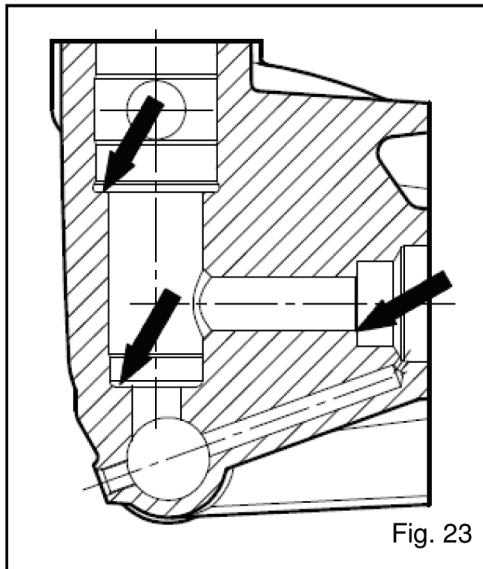


Fig. 23

D) To reassemble the valves proceed the other way around and tighten the cover screws with a torque wrench. Table on page 18 contains the screw tightening torque values and Fig. 28 indicates the sequence.



11.2.2 Seals

The replacement of the seals is necessary when water drips through the holes provided underneath the crankcase. For replacement, do as follows:

- A) Remove the fluid end by loosening the 8 bolts (see Fig. 24).

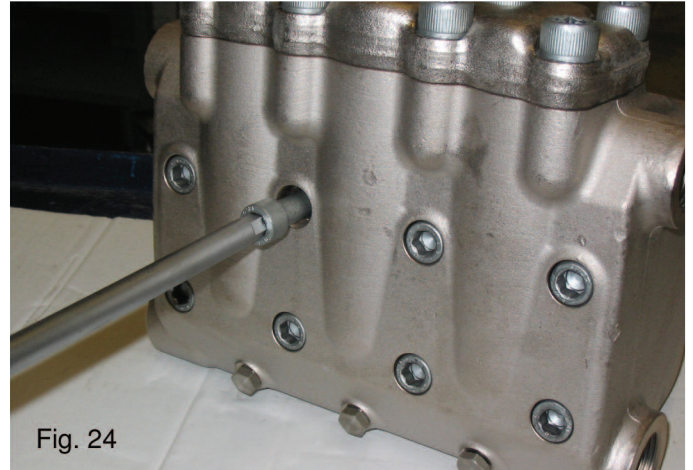


Fig. 24

- B) Remove the high pressure packings from the fluid end and the low pressure ones from their support by means of standard tools, taking great care not to damage the seats. See Fig. 25.



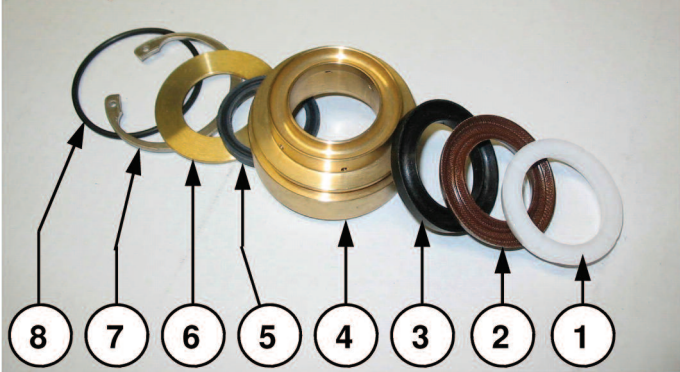
Fig. 25

Take note of the correct order of the entire package components when disassembling (Fig. 23):

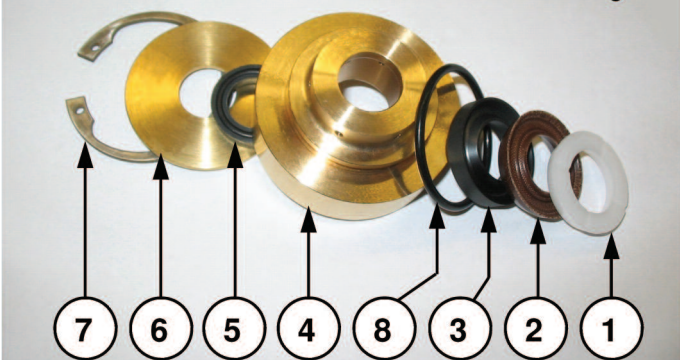
1. Head ring
2. HP packing
3. "Restop" ring
4. Middle ring
5. LP packing
6. Back packing
7. Elastic ring
8. O-ring

When reassembling, make sure of the correct order of the components.

Packing set HF 22 - 25 version Fig. 26

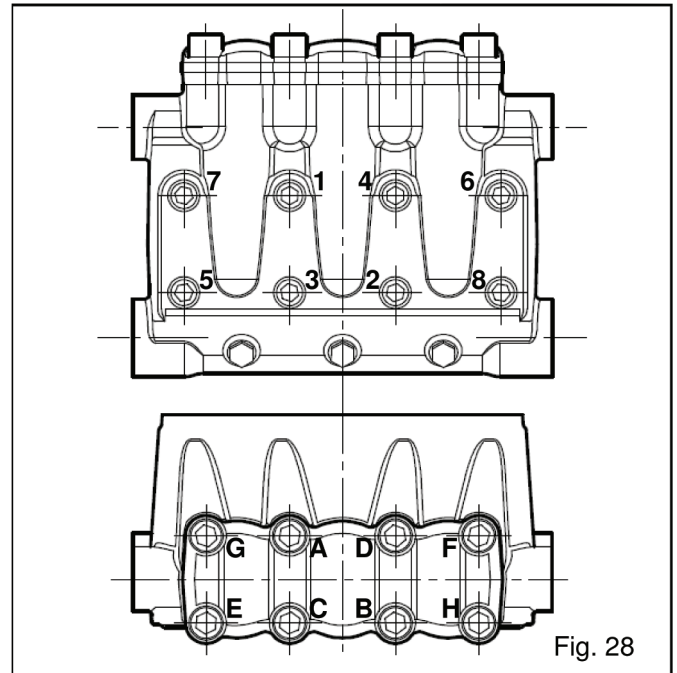


Packing set HF 18 version Fig. 27



- C) Reassembling:
In order to carry out the replacement more easily, apply a very small quantity of silicone grease on the pressure packing lips and their seats in the fluid end. This operation will also help the sealing lips settle on the plunger.

Fit the fluid end back in place and tighten the bolts with a torque wrench set for the value indicated in the table on page 18 and in the sequence indicated here below.



11.2.3 Plunger

To replace the plunger, if necessary, do as follows:

- A) Loosen and remove the plunger screws as indicated in Fig. 29



When disassembling the pumping unit, the O-rings should always be replaced.

- B) Fit back the replaced components inverting the order. Use a torque wrench set for the values indicated in the table on page 18.

11.2.4 Fluid End

In order to mount the fluid end on the pump proceed as follows:

- A) Fit the packing supports back in place in the crankcase.
- B) Fit the pressure packings back in place in the pump head.
- C) Using two stud bolts (min. length: 200 mm) and the central plunger as a guide carefully slide to head in position against the crankcase.
- D) Tighten the head bolts with a torque wrench set as indicated in the chart to the right.

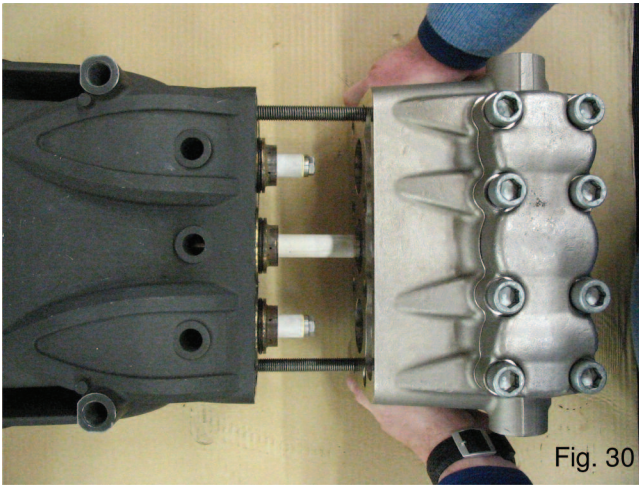


Fig. 30

12. TORQUE SPECIFICATIONS



The following table contains the screw tightening torque values, to be set by means of a torque wrench only:

DESCRIPTION	Ft. Lbs.	N-m	Kgm.
Valve cover screws	7.3	10	1
Plunger Bolts	14.7	20	2
Connecting Rod Screws	28	38*	4
Valve Plate Screws	88.5	120**	12
Fluid End Bolts	59	80***	8
Auxiliary Plug	29.5	40	4

* The conrod screws must be tightened as indicated in point D, page 13.

** The valve plate must be tightened following the sequence indicated in fig. 28.

*** The fluid end screws must be tightened in 2 stages following the sequence indicated in fig 24:
 First stage: 20 N-m
 Second Stage: 80 N-m

13. MAINTENANCE TOOLS

Standard tools are required for the pump maintenance but to facilitate the mounting and dismounting operations of some pump components, you will find the drawings to make some tools on page 23.

14. PUMP STOPPED FOR LONG TIME



Before starting the pump for the very first time after a long period from the date of shipment check for the correct oil level, check the valves as indicated in chapter 11 and then comply with the starting procedures indicated in chapter 10. When a long inactivity is scheduled drain the entire suction and delivery line and then run the pump dry **only for a few seconds** in order to drain out the water collected inside the fluid end.

15. PRECAUTIONS AGAINST FREEZING



Where and when there is a risk of freezing the following precautions should be taken:

- after use drain the entire suction and delivery lines (filter included) by means of discharging devices, provided and positioned specifically for this purpose along the lowest point of the lines.
- run the pump only for a few seconds in order to drain the water collected inside the fluid end.

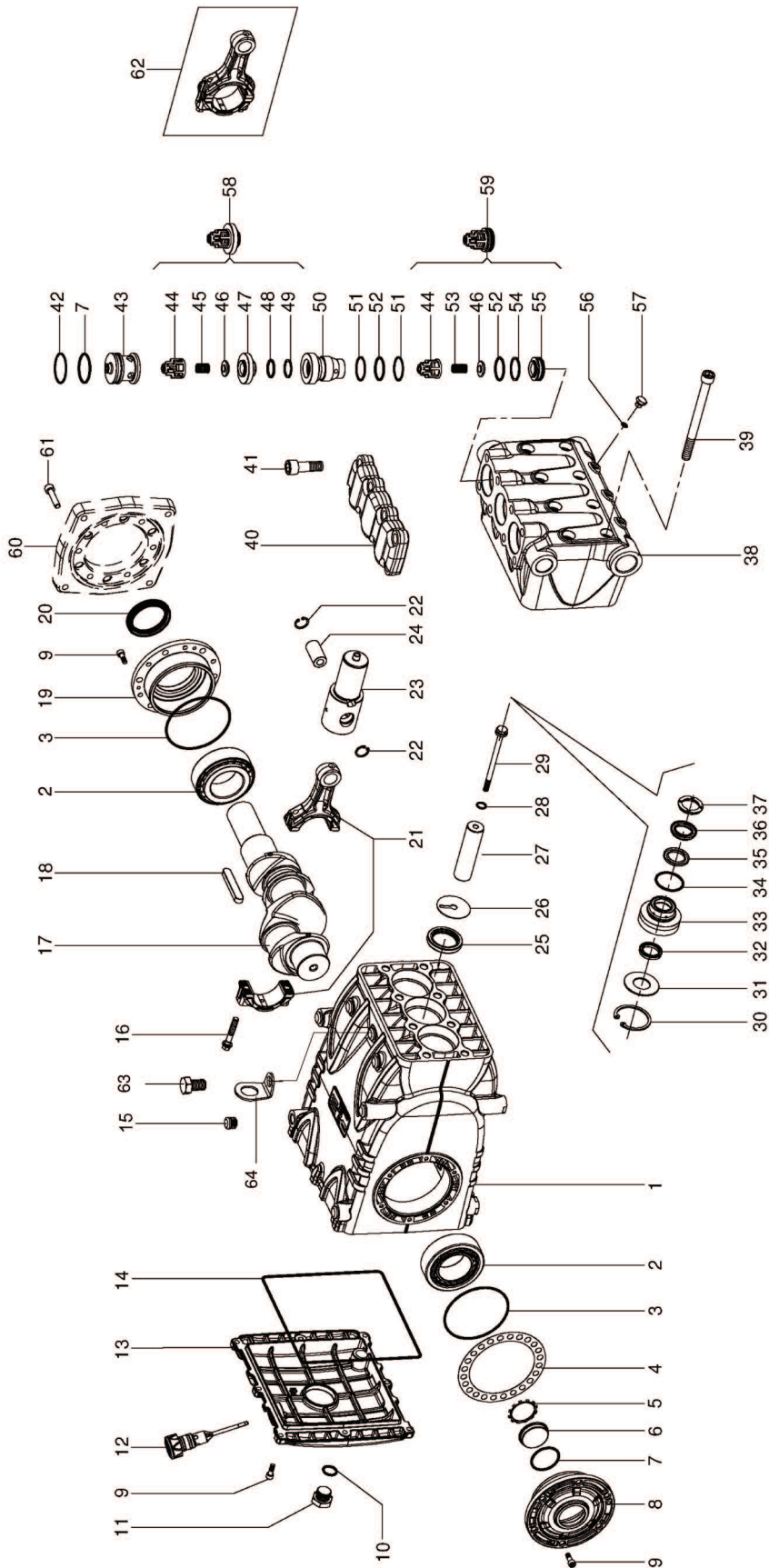
Or when applicable

- add a recommended amount of anti-freeze into the water tank and run the pump until the anti-freeze works all through the system.



If a pump is frozen or appears frozen ON NO ACCOUNT SHOULD THE PUMP BE OPERATED until the entire system has been thawed out.

17. EXPLODED VIEW AND PARTS LIST



Item	Part #	Description	QTY.
1	F71010022	Pump Crankcase	1
2	F91859000	Roller Bearing 33210/Q	2
3	F90391800	O-ring, Ø 97.92 x 2.62	2
4	F71220081	Shim, 0.1	
	F71220381	Shim, 0.25	
	F71220581	Shim, 0.35	
5	F90075600	Ring, ZJ45	1
6	F70211801	Oil Level Indicator	1
7	F90387700	O-ring, Ø 39.34 x 2.62	4
8	F71150122	Oil Level Indicator, Bearing Cover Side	1
9	F99186700	Screw, TCEI M6 x 18 UNI 5931, Zinc	20
10	F90384100	O-ring, Ø 17.19 x 2.62	1
11	F98218300	Plug, G1/2" x 13, Nickel	1
12	F98212000	Dipstick	1
13	F71160022	Crankcase Cover	1
14	F90400000	O-ring, Ø 215 x 3	1
15	F98206000	Plug for Ø 15 Port	7
16	F99313800	Connecting Rod Screw	6
17	F71020035	Crankshaft	1
18	F91500000	Crankshaft Key	1
19	F71150022	Motor Side Bearing Cover	1
20	F90170000	Oil Seal, 50 x 65 x 8, Viton	1
21	F71030043	Connecting Rod	3
22	F90060600	Ring, Ø 20 UNI 7437	6
23	F71050015	Piston Guide	3
24	F97743000	Pin, Ø 20 x 38	3
25	F90167800	Seal, 38 x 52 x 7	3
26	F96714000	Wiper	3
27	F71040009	Plunger, Ø 18	3
	F71040109	Plunger, Ø 22	3
	F71040209	Plunger, Ø 25	3
28	F90367100	O-ring, Ø 11 x 2 - 90 Sh.	3
29	F71219566	Plunger Bolt	3
30	F90079700	Ring, Ø 52 UNI7437	3
31	F71217070	Packing Ring, Ø 18	3
	F71217170	Packing Ring, Ø 22	3
	F71217470	Packing Ring, Ø 25	3
32	F90264800	Packing, Ø 18 L.P.	3
	F90271300	Packing, Ø 22 L.P.	3
	F90274600	Packing, Ø 25 L.P.	3
33	F71214070	Packing Support, Ø 18	3
	F71215170	Packing Support, Ø 22	3
	F71215270	Packing Support, Ø 25	3
34	F90389100	O-ring, Ø 52.07 x 2.62	3
35	F90268700	Restop, Ø 18	3
	F90273000	Restop, Ø 22	3
	F90274800	Restop, Ø 25	3
36	F90268600	Packing, Ø 18 H.P.	3
	F90272500	Packing, Ø 22 H.P.	3
	F90274900	Packing, Ø 25 H.P.	3
37	F71100051	Front Ring, Ø 18	3
	F70100151	Front Ring, Ø 22	3
	F71100151	Front Ring, Ø 25	3
38	F71120536	Manifold for Plunger Ø 18, G	1
	F71120136	Manifold for Plunger Ø 22, G	1
	F71120236	Manifold for Plunger Ø 25, G	1
38	F71124036	Manifold for Plunger Ø 18, NPT	1
	F71124136	Manifold for Plunger Ø 22, NPT	1
	F71124236	Manifold for Plunger Ø 25, NPT	1

Item	Part #	Description	QTY.
39	F99448000	Screw TCEI M12 x 150 UNI 5931	8
40	F71210036	Valve Cover	1
41	F99485000	Screw TCEI M14 x 40 UNI5931	8
42	F90522000	Back-up Ring, OR Ø 40.9 x 45 x 5	3
43	F71211070	Valve Plug	3
44	F36204051	Suction/Delivery Valve Guide	6
45	F9740100	Valve Spring, Delivery Kit	3
46	F36205066	HF18A Suction/Delivery Valve Plate	6
	F36203966	HF22A-25A Suction/Delivery Valve Plate	6
47	F36204366	Valve Seat, Delivery	3
48	F90385100	O-ring, Ø 21.89 x 2.62	3
49	F90514500	Back-up Ring, Ø 22.9 x 27 x 1.5	3
50	F71211566	Valve Spacer	3
51	F90517900	Back-up ring, Ø 31.4 x 35.5 x 1.5	6
52	F90386600	O-ring, Ø 29.82 x 2.62	3-6
	F90385600	O-ring, Ø 23.47 x 2.62 (HF18A)	3
53	F94739700	Valve Spring, Suction	3
54	F90515500	HF18A Back-up ring, Ø23.9 x 28 x 2	3
	F90517700	HF22A-25A Back-up Ring, Ø30 x 34 x 1.5	3
55	F36204966	HF18A Valve Seat, Suction	3
	F36204266	HF22A-25A Valve Seat, Suction	3
56	F90357600	O-ring, Ø 6.75 x 1.78	3
57	F98197200	Plug, G 1/8" x 8	3
58	F36713901	Valve Assembly, Delivery	3
59	F36714401	HF18A Valve Assembly, Suction	3
	F36713801	HF22A-25A Valve Assembly, Suction	3
60	F10067720	Hydraulic Motor Flange	1
61	F99309900	Screw TCEI M8 x 35 UNI 5931	6
62	F71030001	Connecting Rod	3
63	F99512000	Screw, TE M16 x 1.5 UNI 5470	1
64	F71223074	Lifting Eyebolt	1

REPAIR KITS

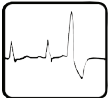
Kit Number	F2022 (HF22A & HF25A)	F2023 (HF18A, 22A & 25A)	F2031(HF18A)	F2024 (HF18A)	F2026 (HF22A)	F2028 (HF25A)
Items Included in Kit	44-46, 53-54, 56-65, (59)	44-45, 46-47, 48-49 (58)	44-46, 53-54, 55-65 (59)	32-34, 35-36	32, 33, 34 35, 36	32, 33, 34 35, 36
Number of Assemblies	3	3	3	3	3	3

18. TROUBLE SHOOTING**THE PUMP DOES NOT PRODUCE ANY NOISE:**

- The pump is not primed and is running dry!
- No water in the inlet line
- The valves are blocked
- The pressure line is closed and does not allow the air to get out the fluid end.

**INSUFFICIENT PUMP PRESSURE:**

- The nozzle is (or has become) too large.
- RPM are less than rated
- Excessive leakage from pressure packings
- Excessive amount of water by-passed by the pressure regulating valve or faulty valve operation.
- Worn out valves.

**THE PUMP KNOCKS:**

- Air suction.
- Insufficient feeding:
 - bends, elbows and fittings along the suction line throttle the amount of water which passed through.
 - too small inlet filter.
 - dirty inlet filter.
 - the feeding pump, where provided is not of the suitable type or provides insufficient pressure or volume.
- The pump is not primed due to insufficient feeding or the delivery line is closed during start up.
- The pump is not primed because some valves are stuck (i.e pump inactivity for long time).
- Jammed or worn out valves.
- Worn out pressure packings.
- The pressure regulating valve does not work properly.
- Clearance in the drive system.
- RPM are higher than rated.

**EXCESSIVE WATER LEAKAGE FROM THE PUMP:**

- Pressure packing are excessively worn out (due to normal wear or excessive cavitation).
- Worn out plungers

**OVERHEATED PUMP:**

- The direction of rotation is not correct.
- Pump is overloaded (pressure or RPM over the rated values).
- The oil level is too low or the oil is not of a suitable type or fully used
- Water in the oil
- Excessive belt tension or incorrect alignment of the joint (where provided).
- Excessive inclination of the pump during operation.

**THE PUMP DOES NOT DELIVER THE RATED VOLUME:**

- Insufficient feeding (due to the cause listed above).
- RPM are less than rated.
- Excessive amount of water by-passed by the pressure regulating valve.
- Worn out valves
- Excessive leakage from pressure packings

**PIPE VIBRATIONS OR KNOCKING:**

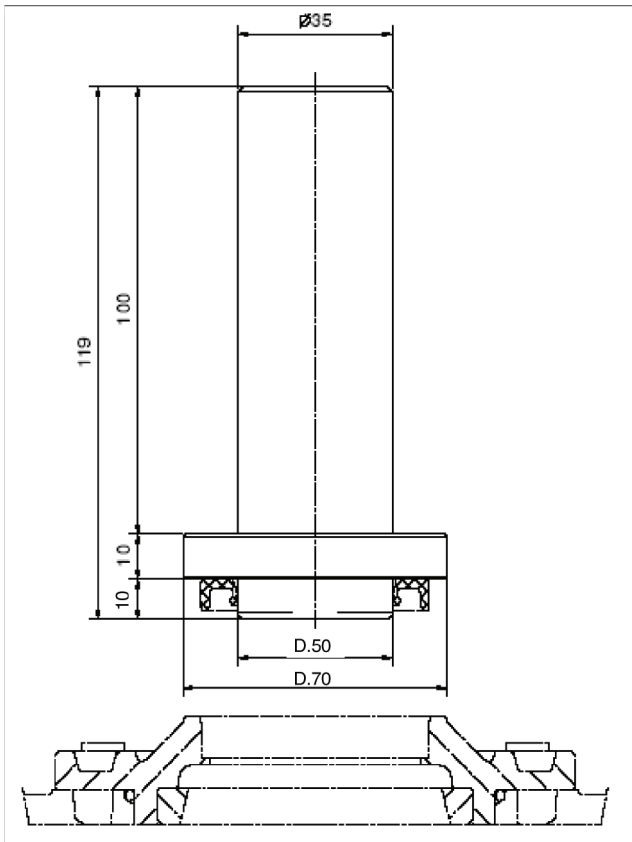
- Air suction.
- The pressure regulating valve does not work properly.
- The by-pass line is undersized.
- Jammed up valves.
- Drive transmission motion is irregular.

19. MAINTENANCE TOOLS

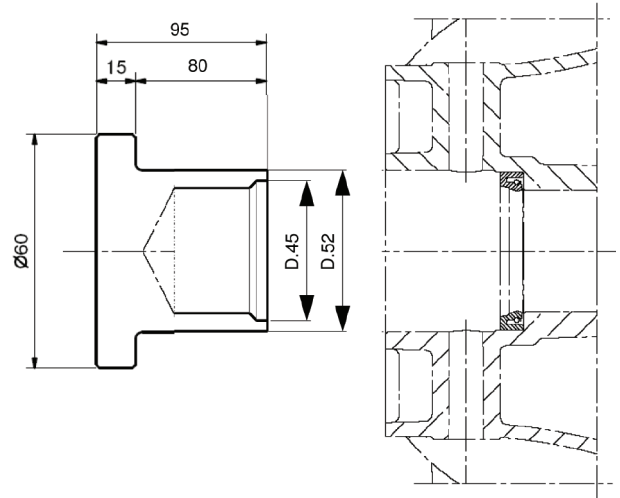
The pump maintenance can be carried out with simple tools for mounting and dismounting, but tools can be made to facilitate these operations.

The drawings here below will help the operator make tool if he wants to.

19.1 Assembling crankshaft oil seal



19.2 Piston guide oil seal assembling



MAINTENANCE LOG

HOURS & DATE

OIL CHANGE							
GREASE							
PACKING REPLACEMENT							
PLUNGER REPLACEMENT							
VALVE REPLACEMENT							



GP Companies, Inc.
1174 Northland Drive
Mendota Heights, MN 55120
Phone: 651.686.2199 Fax: 800.535.1745
www.generalpump.com email: sales@gpcompanies.com

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