

# Owner's Manual

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



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## 1. INTRODUCTION

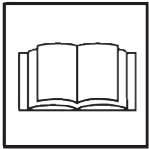
HE high pressure water plunger pumps have been designed for long life industrial applications and provided they are correctly installed and maintained will give long trouble-free operation. Read and understand this manual before using your pump; it contains the necessary information for the correct installation, use and maintenance as well as some practical suggestion for trouble shooting.

Upon receipt of your pump, inspect for overall good condition and that no items are missing. Any missing item or damage should be reported before installing and starting the pump.

## 2. SYMBOL DESCRIPTIONS

**Warning**

Potential Danger



Read carefully and understand the manual before operating the pump

**Danger**

High Voltage

**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. pump model and version
3. serial number
4. max RPM
5. max operating pressure (bar)
6. oil capacity (ltr) and oil specification
7. gear box ratio
8. max flow rate (l/min)

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.

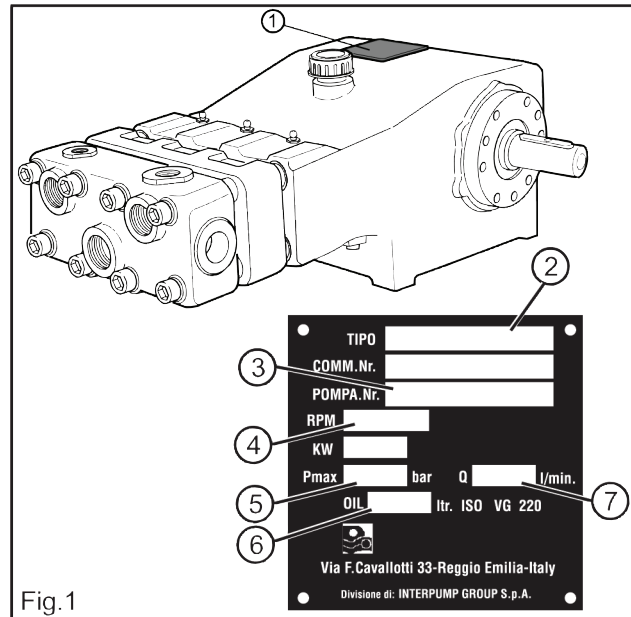


Fig.1

## 5. TECHNICAL FEATURES

| MODEL | RPM  | FLOW RATE |       | PRESSURE |     | POWER |      |
|-------|------|-----------|-------|----------|-----|-------|------|
|       |      | GPM       | l/min | PSI      | Bar | Hp    | kW   |
| HE18  | 1000 | 7.9       | 30.5  | 7250     | 500 | 39.6  | 29.1 |
| HE20  | 1000 | 9.8       | 37.7  | 5800     | 400 | 39.4  | 29   |
| HE22  | 1000 | 11.9      | 45.6  | 4650     | 320 | 38.1  | 28.1 |
| HE25  | 1000 | 15.6      | 58.9  | 3600     | 250 | 38.5  | 28.3 |
| HE30  | 750  | 16.5      | 62.4  | 2600     | 180 | 29.4  | 21.6 |

## 6. DIMENSIONS AND WEIGHT

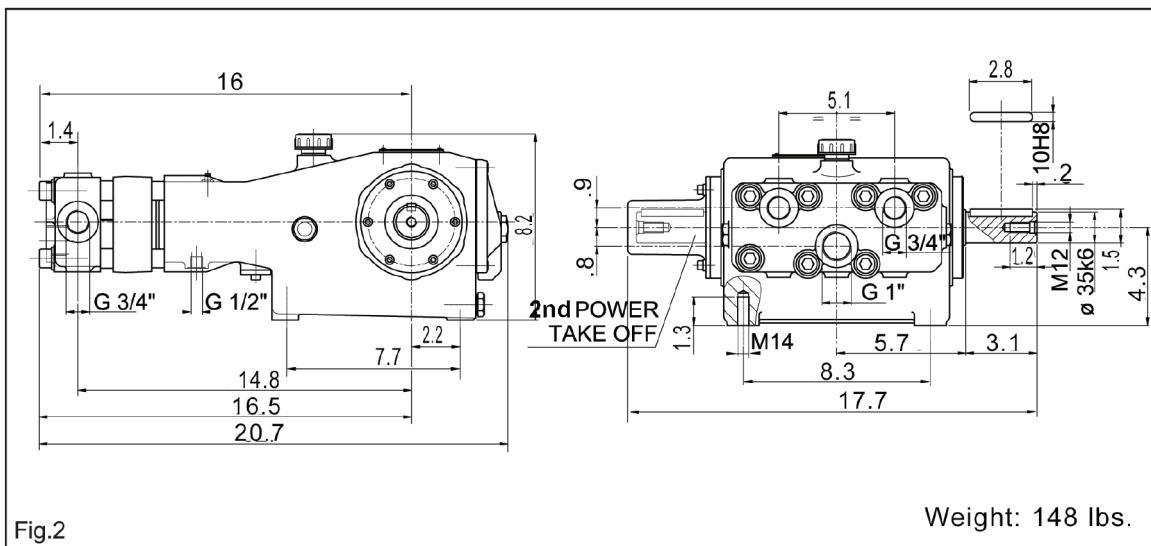


Fig.2

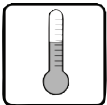
## 7. GENERAL INFORMATION ABOUT PUMP USE



The HE pump has been designed to pump fresh filtered water at room temperature. HE-N special stainless steel versions are also available for critical fluids.

### 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.



Below is the temperature chart and relevant limitations:

|                               |   |
|-------------------------------|---|
| <104°F/40°C                   | Water is considered to be at room temperature.  |
| from 104°F/40°C to 140°F/60°C | <p>feed the plunger pump with a centrifugal pump supplying at least twice the plunger pump volume at 30 to 45 PSI</p> <p>reduce pump rated RPM by 30% to 50%</p> <p>Make sure the crankshaft turns as indicated by the arrows located neat the drive shaft projection</p> |
| >140°F/60°C                   | standard pump not suitable, contact our Customer service Department   |

### 7.2 Max flow and pressure ratings

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.

### 7.3 Lowest operating RPM

The lowest operating speed for all HE's (all versions) is 500 RPM

## 8. CONNECTIONS AND PLUGS

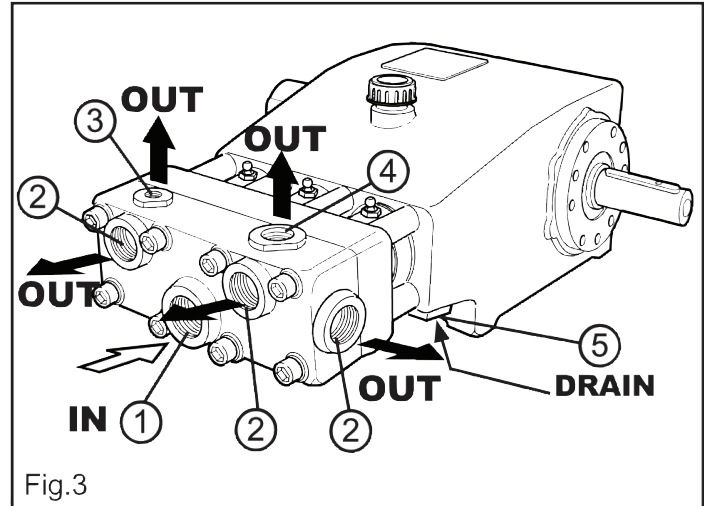


Fig.3

HE pumps are provided with (Fig. 3):

- 1 - 1 inlet port IN 1" NPT
- 2 - 3 outlet ports OUT 3/4" NPT
- 3 - 1 outlet port OUT 1/4" NPT (pressure gauge)
- 4 - 1 outlet port OUT 1/2" NPT (safety valve)
- 5 - 1 hole DRAIN provided underneath the crankcase and designed to drain out the water leakage of the pressure packings. **This hole must always be left open (see 10.3, Fig. 6, page 9).**

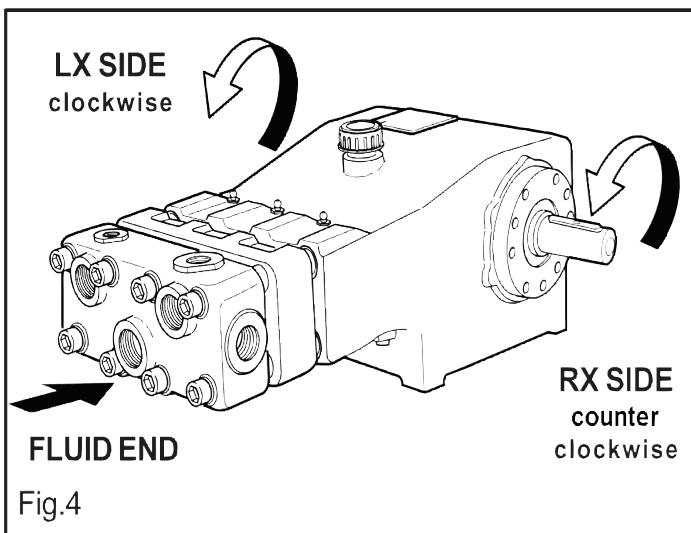
## 9. PUMP INSTALLATION

### 9.1 Positioning

The pump should be installed flat on a rigid base by means of the four M14 threaded feet. The base should be rigid enough to avoid any misalignment or flexing of the pump/transmission coupling axis due to the torque involved during operation.

### 9.2 Direction of rotation

Fig. 4 shows the correct direction of rotation looking at the pump from the fluid end side. Two arrows stamped on the crankcase nearby the crankshaft provide the information as well.



### 9.3 Water connections

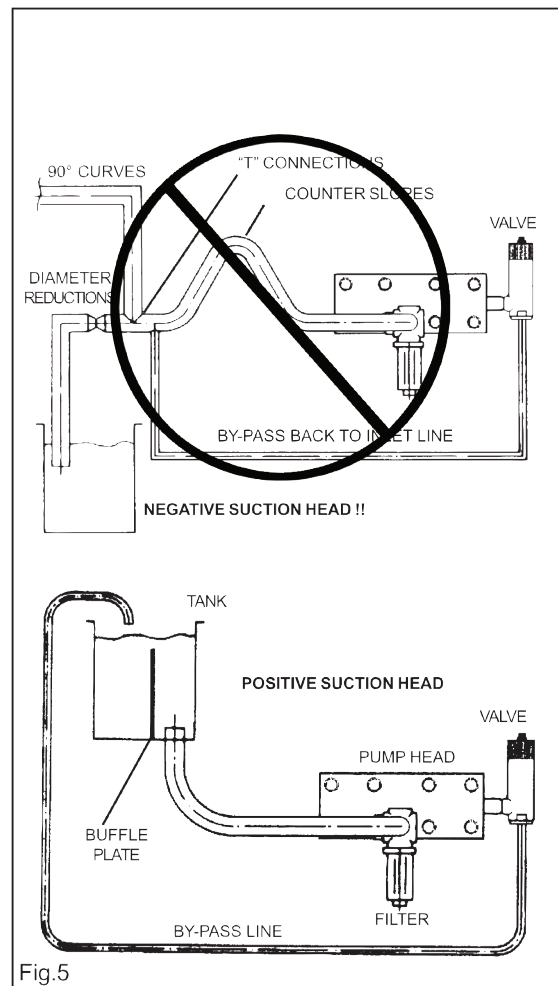
In order to isolate the high pressure equipment from the pump vibrations it is suggested, where applicable, to use flexible hoses for both suction and delivery lines at least for the first length. The flexible suction hose must be rigid enough to prevent it from collapsing during the suction stroke,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

### 9.4 Suction line

Plunger pumps are not self priming therefore a positive suction head should always be provided. Information for the correct suction line:

1. Internal diameter should be at least 3", in any point, possibly larger depending on the drop in pressure due to the length and shape of the line.
2. 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. Should be perfectly airtight.
4. Should be completely free from 90° elbows, diameter reductions, counter slopes, "T" connections and should not be connected to other pipelines.
5. Should be positioned in such a way to prevent the pipe emptying after the pump stops.

6. Do not use high pressure flexible hoses for the suction line.
7. Do not use high pressure hydraulic fittings like 90° elbows, high pressure adapters, high pressure 3 or 4 way nipples and so on.
8. Do not install any kind of detergent injector along the suction line.
9. Do not install standing valves, check valves or other kind of one-way valves.
10. Make sure that the feed tank capacity and the water minimum level do not give rise to turbulence at the tank outlet port, which, in turn, might create cavitation at the pump.
11. Do not connect the by-pass line from the valve directly to the pump suction line.
12. The water flow from the valve should be directed back in the tank. Make sure that the by-pass and tank feeding flows to 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.
13. Before connecting the suction line to the pump inlet port make sure the pipe is perfectly clean inside.



### 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.**

### 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.



## 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.

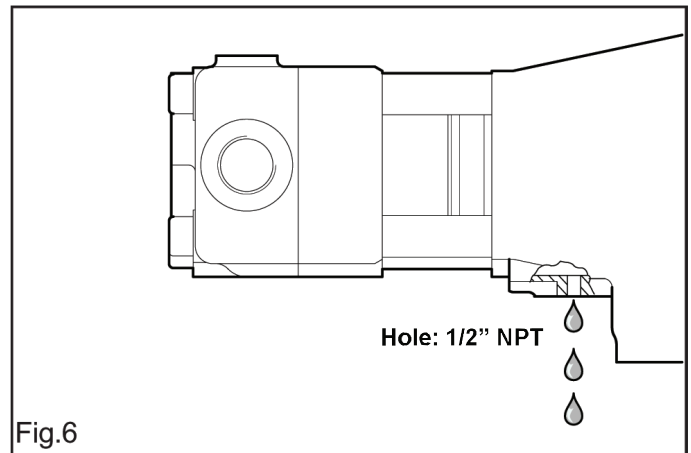
### 10.2 Starting up

1. Pump and motor/engine should start offload, set the regulating valve to zero or set the pressure line in dump mode by means of proper dumping devices.
2. When starting the pump up for the first time or after every wiring re-connection check for the proper direction of rotation.
3. Check that the rotating speed does not exceed the rated value.
4. Before putting the pump under pressure let it run for some time until the oil flows freely.
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).

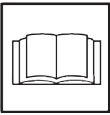
**Note:** in case of feeding by a centrifugal pump, make sure that the plunger pump starts only when the correct inlet pressure is provided.

### 10.3 Water leakage

During operation a small amount of water (a few drops a minute) is released from the pump fluid end; this leakage is designed to provide lubrication for the pressure packings. The leakage is drained out of the pump through a hole in the lower cover (Fig. 6). **This hole must always be kept open.**

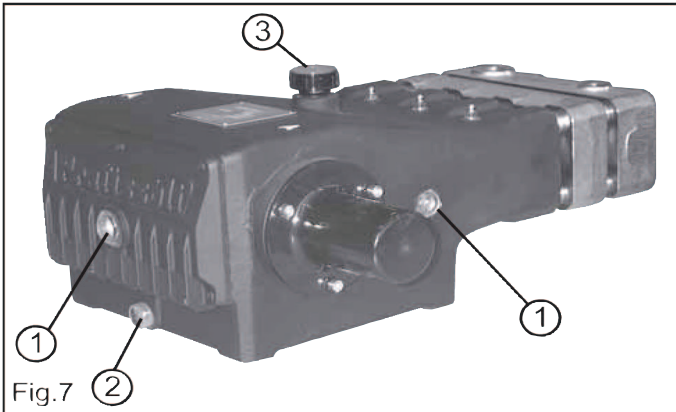


## 11. MAINTENANCE INSTRUCTIONS



### 11.1 Crank mechanism maintenance.

Check oil level through the oil level indicator 1, Fig 7 at least on a weekly basis.



If necessary, top off oil level from the oil plug 3, Fig. 7. Check the oil when cold and change the oil when still hot (pump still at working temperature.). In order to drain the oil from the pump remove the magnetic plug 2, Fig. 7. At every oil change clean the magnetic plug 2, Fig. 7 and check the lower cover of Fig. 6 for grease sediments or deposits.

| OIL CHANGES        | Hours | Qty.          | Oil Type   |
|--------------------|-------|---------------|------------|
| First Change       | 50    | 3.1<br>quarts | ISO<br>220 |
| Subsequent Changes | 500   |               |            |

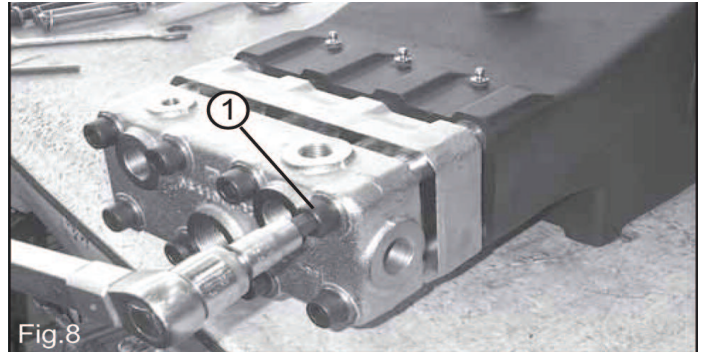
**Oil should be changed at least once a year.**

Recommended oils:

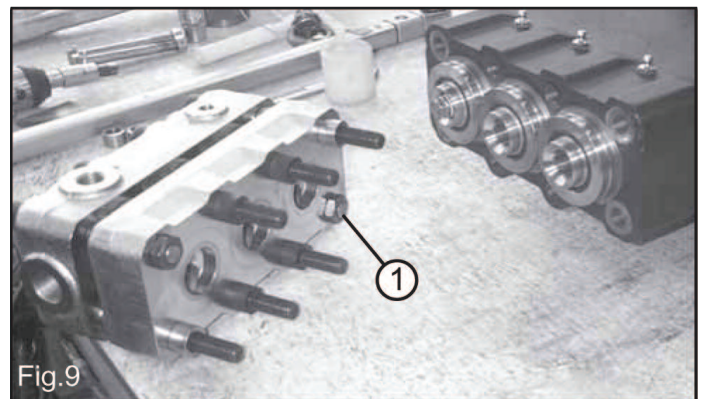
| BRAND   | TYPE           |
|---------|----------------|
| AGIP    | ACER 220       |
| ARAL    | MOTANOL HP 220 |
| AVIA    | AVILUB RSL 220 |
| BP      | ENERGOL HL 220 |
| CASTROL | ALPHA ZN 220   |
| ESSO    | NUTO 220       |
| FINA    | SOLNA 220      |
| IP      | HYDRUS 220     |
| MOBIL   | DTE OIL BB     |
| SHELL   | TELLUS C 220   |
| TEXACO  | REGOL OIL 220  |
| TOTAL   | CORTIS 220     |

### 11.2 Fluid end maintenance

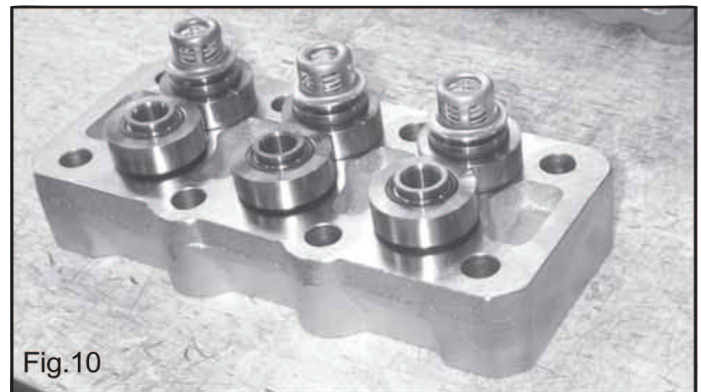
The fluid end does not require periodical maintenance. Service operations are limited to valve inspection and/or replacement, when necessary. It is recommended to remove head and collector from the pump in one piece in order to avoid possible splitting hazards of the suction/delivery valves positioned in between.



In order to do so loosen and remove only two of the head bolts, 1 Fig. 8.



Replace them with two screws with nut (1, Fig. 9) to keep head and collector packed up together and then remove the other six head bolts. Now head and collector can be easily separated from the pump and disassembled on work bench (Fig 10).

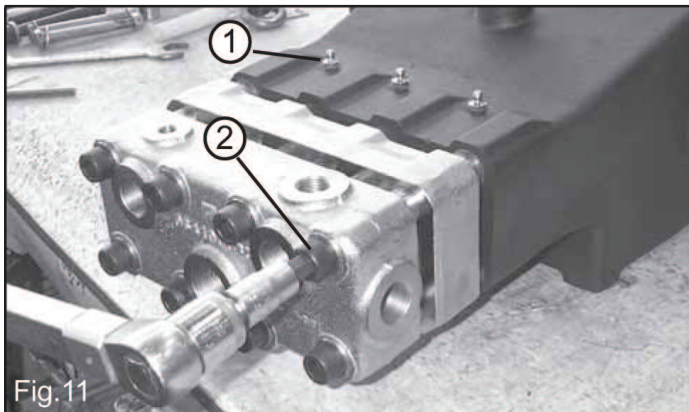


Check the valve poppets, seats and springs for wear and replace if necessary. Replace all o-rings at every inspection. Head bolts should be tightened in a uniform and alternate way using a torque wrench set for 144 ft. lbs.

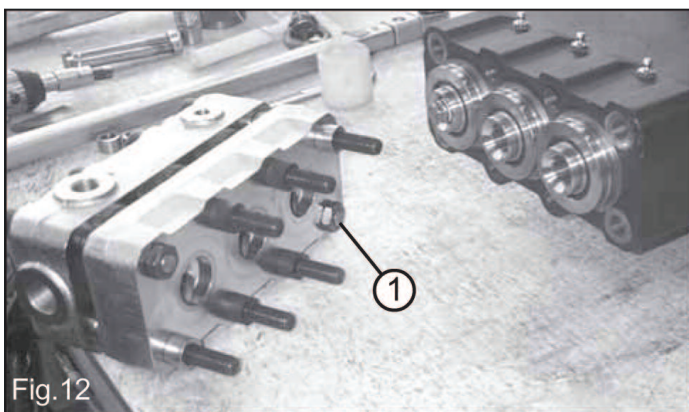
### 11.3 Pumping unit maintenance

The only maintenance operation required for the pumping unit is greasing the pressure packings through the proper greasers (1, Fig. 11) located on the packing supports. **Greasing should be carried out at even intervals at least every 100 hours** by means of a hand pump. Stop greasing when the pump trigger becomes harder to operate: that means the grease chamber is full. Use top quality silicone grease (i.e DANKELL OCILUS 250, penetration coefficient 290 or a corresponding one). Periodically check the amount of water drained out by the pump through the hole provided in the lower cover (Fig. 6). It clearly shows the pressure packing state of wear; replace them if water dripping becomes continuous and not intermittent.

In order to replace the pressure packings, remove the fluid end first. It is recommended to remove head and collector from the pump in one piece in order to avoid possible splitting hazards of the suction/delivery valves positioned in between. In order to do so loosen and remove only two of the head bolts (2, Fig. 11).

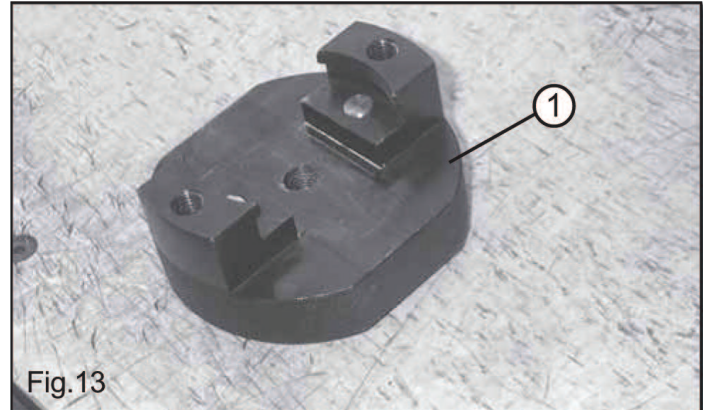


Replace them with two screws with nut (1, Fig. 12) to keep head and collector packed together and then remove the other six head bolts.

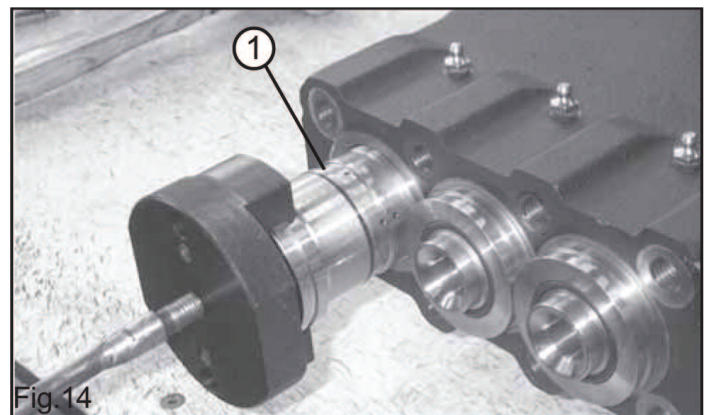


Now head and collector can be easily separated from the pump.

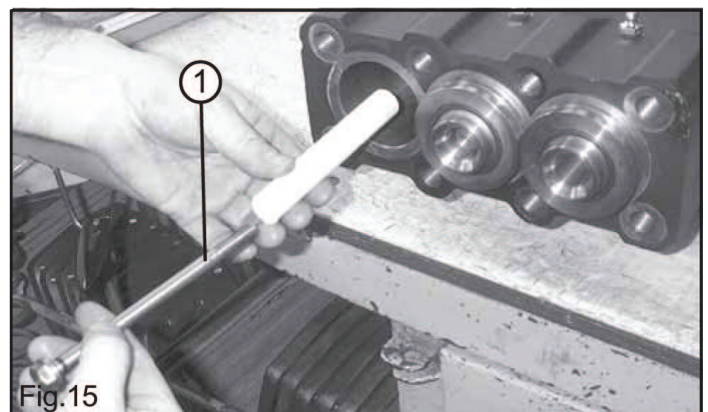
Once the fluid end is removed, cylinder and packing supports are free to slide out. Removing the cylinders is easier by using our extractor pn/ F20000020 or an equivalent tool.



Fit the extractor in place and remove the cylinders (1, Fig 14).



Check the plungers for wear and replace if necessary by loosening the plunger bolt (1, Fig. 15).



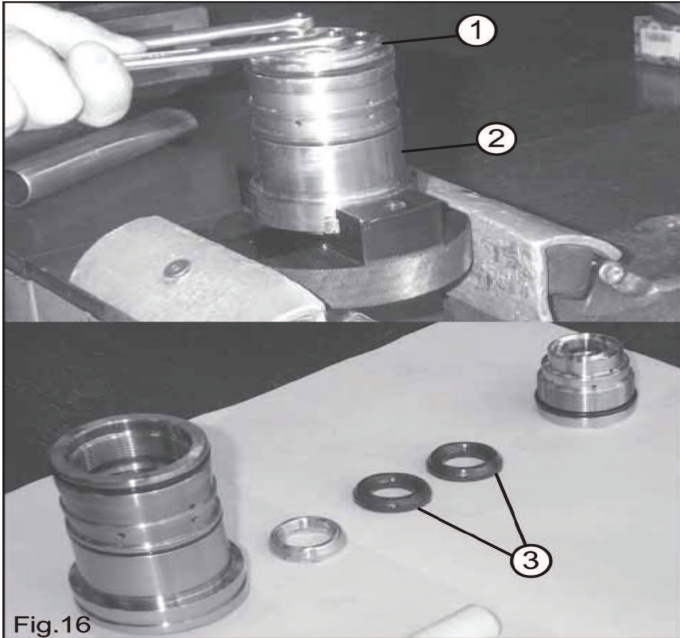


Fig.16

In order to replace the pressure packings (3, Fig. 16) loosen and remove the packing support (1, Fig 16) from the cylinder (2, Fig 16.)

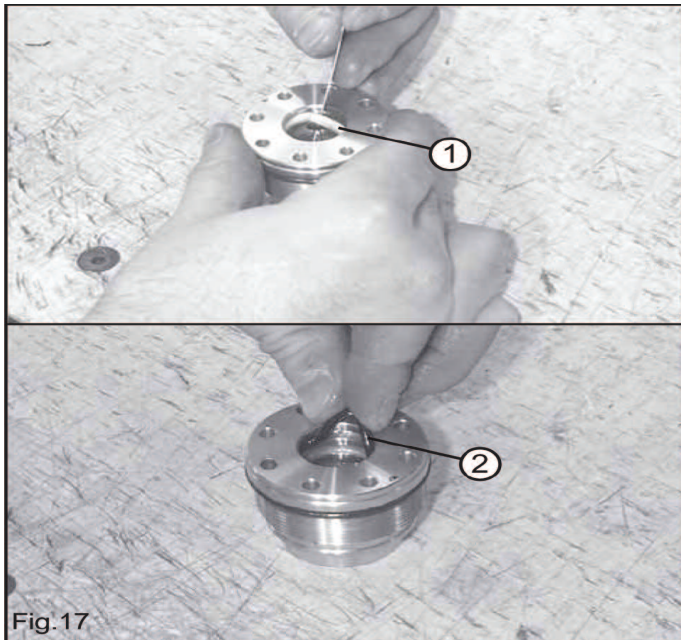


Fig.17

Remove the scraper (1, Fig. 17) and relevant o-ring (2, Fig. 17) from the packing support. **Pressure packings and o-rings should always be replaced at every disassembling of the pump.**

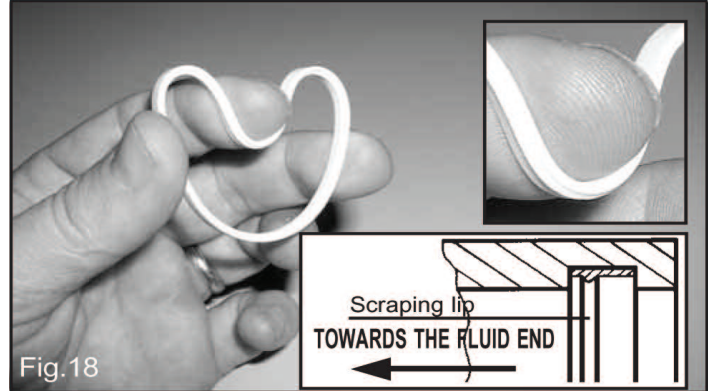


Fig.18

In order to fit the scraper in place, shape it manually as shown in Fig. 18.

**VERY IMPORTANT!** The scraper is provided with an internal lip which performs the correct scraping effect only if oriented towards the fluid end. See window inside Fig. 18.

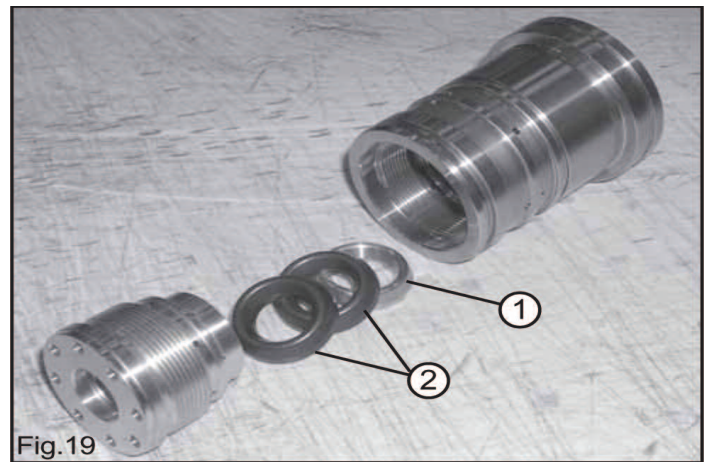


Fig.19

Before reassembling the pump unit carefully clean the pressure packing seat in the packing supports, fit in place the packing ring (1, Fig. 19) and then the pressure packings (2, Fig. 19). A little bit of grease helps when sliding the packings into the packing support.

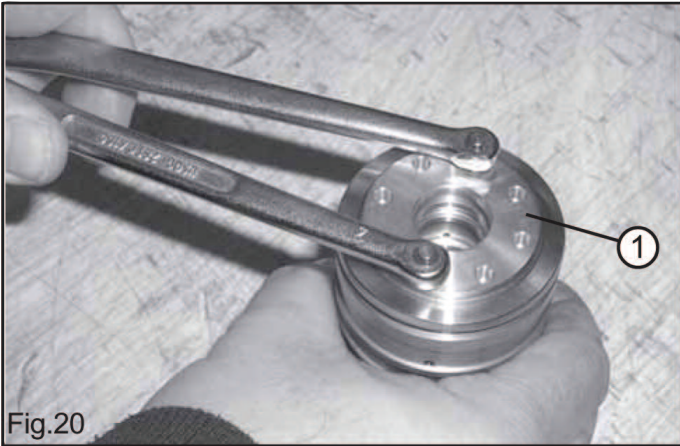


Fig.20

Set up the complete package without tightening the packing support (1, Fig. 20) but making sure that the pressure packings snap into place.

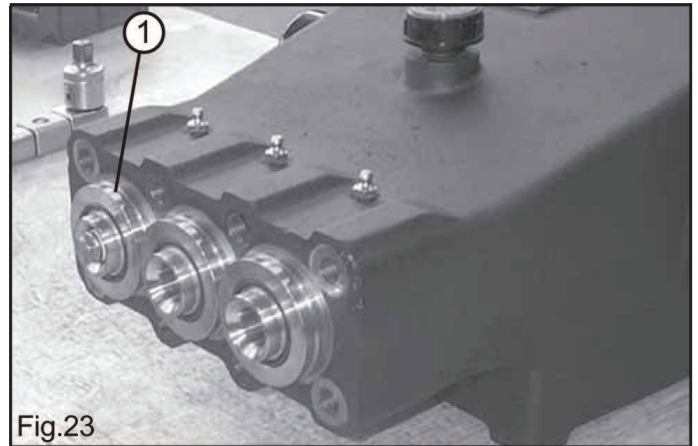


Fig.23

Fit the pumping units (1, Fig. 23) back in the pump after replacing all relevant o-rings.

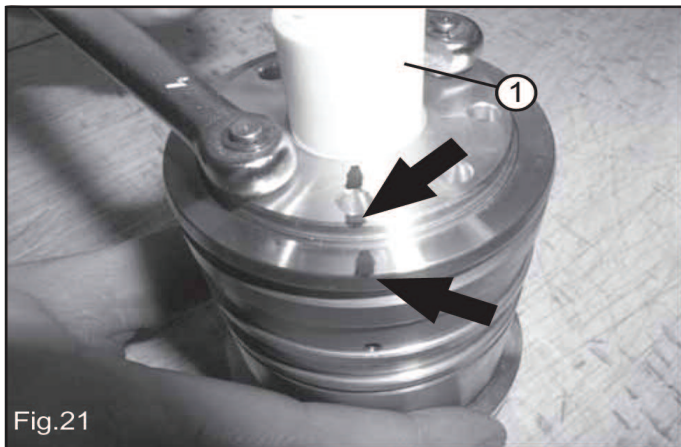


Fig.21

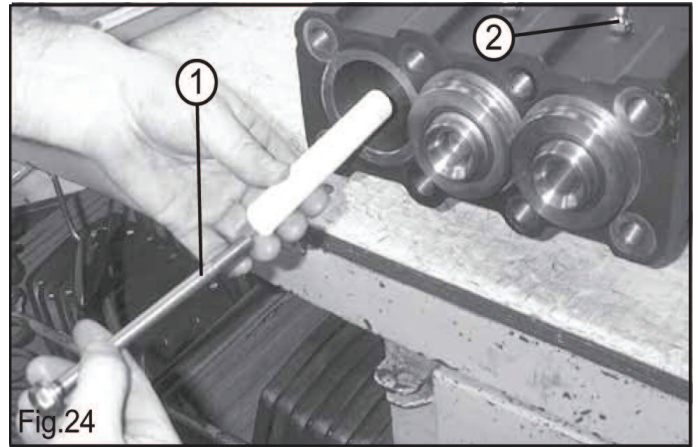


Fig.24

Fit the plunger back in place and tighten the plunger screw (1, Fig 24) with a torque wrench set for 18 ft. lbs. Grease the pressure packings through the greasers (2, Fig. 24) by means of a hand pump. Stop greasing when the pump trigger becomes hard to operate; that means the grease chamber is full.

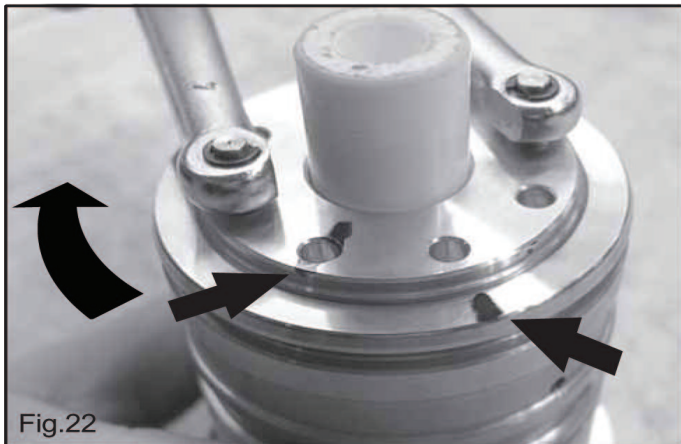


Fig.22

For the correct load of the pressure packings proceed as follows:

- Fit the plunger in the pumping unit (1, Fig. 21).
- Mark the position of any one of the 8 holes of the packing support referencing at the cylinder (see arrows Fig. 21).
- Tighten the packing support 1/8 turn



Mount the head/collector back in place and tighten the eight head bolts with a torque wrench set for 144 ft. lbs.

## 12. TORQUE SPECIFICATIONS



Bolt torquing is to be carried out by means of a torque wrench only:

| DESCRIPTION           | Ft. Lbs. | N-m  | Kgm. |
|-----------------------|----------|------|------|
| Head Bolts            | 144.6    | 196  | 20   |
| Plunger bolts         | 18       | 24.5 | 2.5  |
| Connecting Rod Screws | 28.9     | 39.2 | 4    |

## 13. MAINTENANCE TOOLS



The following tools are designed to facilitate mounting and dismounting operations of some pump components:

for disassembling:

- cylinder extractor F200000200
- piston guide F200000140
- oil seal extractor

For assembling:

- Piston guide oil seal F200000030

## 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



In the 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

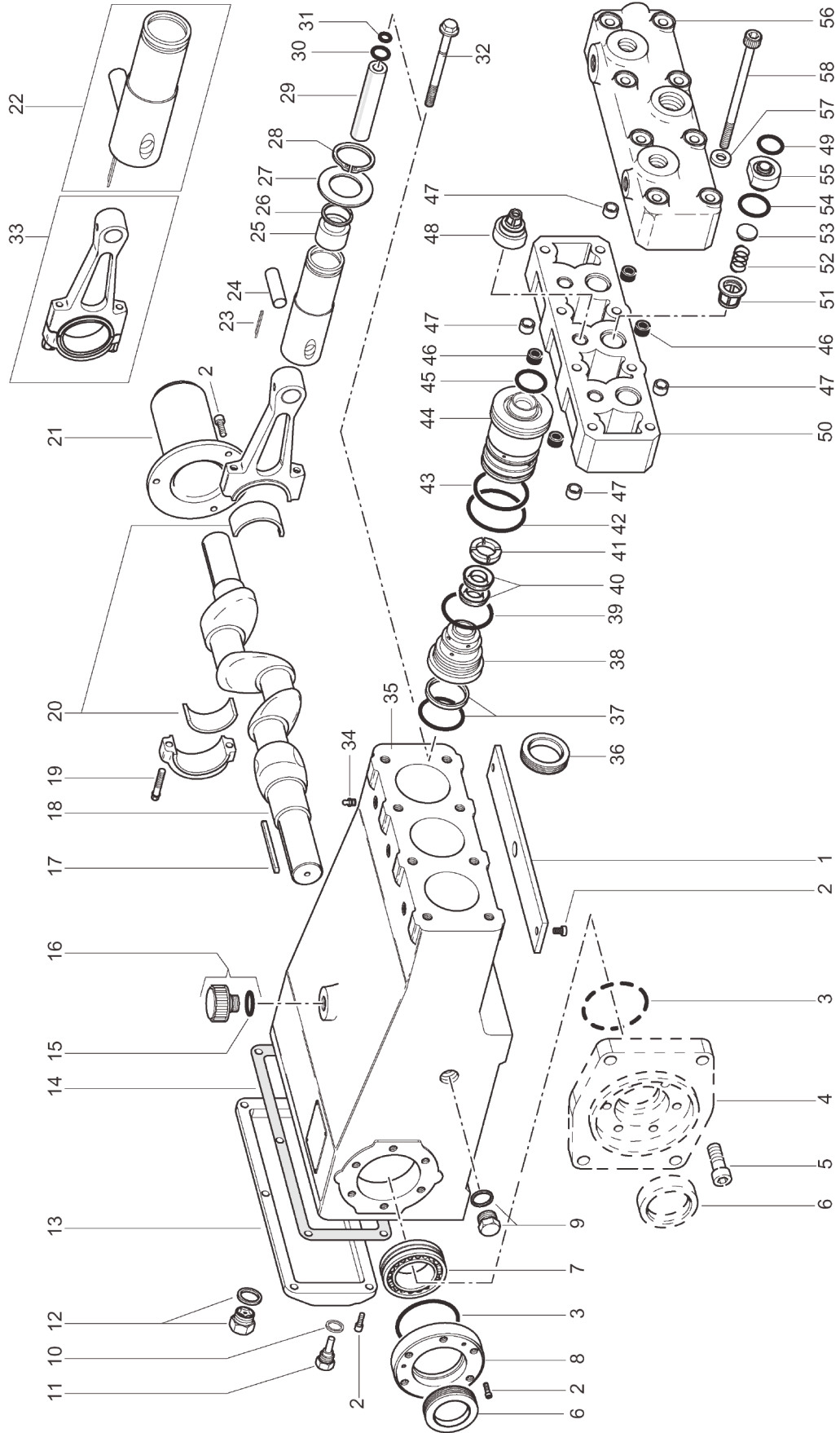
- add a recommended amount of anti-freeze into the water tank and run the pump until the anti-freeze works all through the system.



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

## 16. EXPLODED VIEW AND PARTS LIST

# HE



| Item | Part #     | Description                      | QTY.  |
|------|------------|----------------------------------|-------|
| 1    | F040000130 | Lower Cover                      | 1     |
| 2    | F871115153 | Screw, M6 x 16                   | 17-23 |
| 3    | F881013100 | O-ring, 80 x 2.5                 | 2     |
| 4    | F010100050 | Hydraulic morot flange (Type A)  | 1     |
|      | F010100040 | Hydraulic motor flange (Type B)  | 1     |
| 5    | F871125154 | Screw, M 10 x 30                 | 6     |
| 6    | F881080014 | Radial seal, Ø 40 x 60 x 10      | 2     |
| 7    | F811110002 | Bearing                          | 2     |
| 8    | F063400100 | Cover                            | 1-2   |
| 9    | F801053002 | Oil level sight glass G 1/2"     | 1     |
| 10   | F872043001 | Washer, Ø 3/8"                   | 1     |
| 11   | F801057001 | Magnetic plug G3/8"              | 1     |
| 12   | F801053003 | Oil level sight glass G 3/8"     | 1     |
| 13   | F063400120 | Rear cover                       | 1     |
| 14   | F080600000 | Gasket, rear cover               | 1     |
| 15   | F881011153 | O-ring, Ø 18 x 3                 | 1     |
| 16   | F801054002 | Vented cap G 1/2"                | 1     |
| 17   | F071000030 | Key                              | 1     |
| 18   | F050000030 | Crankshaft                       | 1     |
| 19   | F871350002 | Rod cap bolt                     | 6     |
| 20   | F812000002 | Connecting rod bearing           | 3     |
| 21   | F040400010 | Shaft cover                      | 1     |
| 22   | F250001090 | Piston guide assembly            | 3     |
| 23   | F872138010 | Wrist pin Ø 2.5 x 22             | 3     |
| 24   | F071000020 | Flinger washer Ø 20              | 3     |
| 25   | F010200170 | Plunger bushing HE18             | 3     |
|      | F010200180 | Plunger bushing HE20             | 3     |
|      | F010200190 | Plunger bushing HE22             | 3     |
|      | F010200200 | Plunger bushing HE25             | 3     |
| 26   | F031000070 | Spacer                           | 3     |
| 27   | F041500030 | Flinger washer                   | 3     |
| 28   | F031000080 | Snap ring                        | 3     |
| 29   | F024201170 | Plunger HE18                     | 3     |
|      | F024201180 | Plunger HE20                     | 3     |
|      | F024201190 | Plunger HE22                     | 3     |
|      | F024201200 | Plunger HE25                     | 3     |
|      | F024201210 | Plunger HE30                     | 3     |
| 30   | F881011060 | O-ring Ø 11 x 2                  | 3     |
| 31   | F881011001 | O-ring Ø 6 x 1.5                 | 3     |
| 32   | F035200110 | Plunger bolt                     | 3     |
| 33   | F250000050 | Connecting rod assembly          | 3     |
| 34   | F801077003 | Grease fitting M 10 x 1          | 3     |
| 35   | F060100070 | Crankcase                        | 1     |
|      | F060100080 | Crankcase, hydraulic             | 1     |
| 36   | F881081002 | Seal Ø 38 x 52 x 7 Spec.         | 3     |
| 37   | F881061006 | Scraper HE18                     | 3     |
|      | F881061007 | Scraper HE20                     | 3     |
|      | F881061008 | Scraper HE22                     | 3     |
|      | F881061009 | Scraper HE25                     | 3     |
|      | F881061030 | Scraper HE30                     | 3     |
| 38   | F022301030 | Packing support HE18             | 3     |
|      | F022301040 | Packing support HE20             | 3     |
|      | F022301050 | Packing support HE22             | 3     |
|      | F022301060 | Packing support HE25             | 3     |
|      | F022301070 | Packing support HE30             | 3     |
| 39   | F881010139 | O-ring Ø 39.34 x 2.62 HE18-20-22 | 3     |
|      | F881010120 | O-ring Ø 42.52 x 2.62 HE25-30    | 6     |
| 40   | F881020000 | Packing HE18                     | 6     |
|      | F881020001 | Packing HE20                     | 6     |
|      | F881020003 | Packing HE22                     | 6     |
|      | F881020005 | Packing HE25                     | 6     |
|      | 90277000   | Packing HE30                     | 6     |

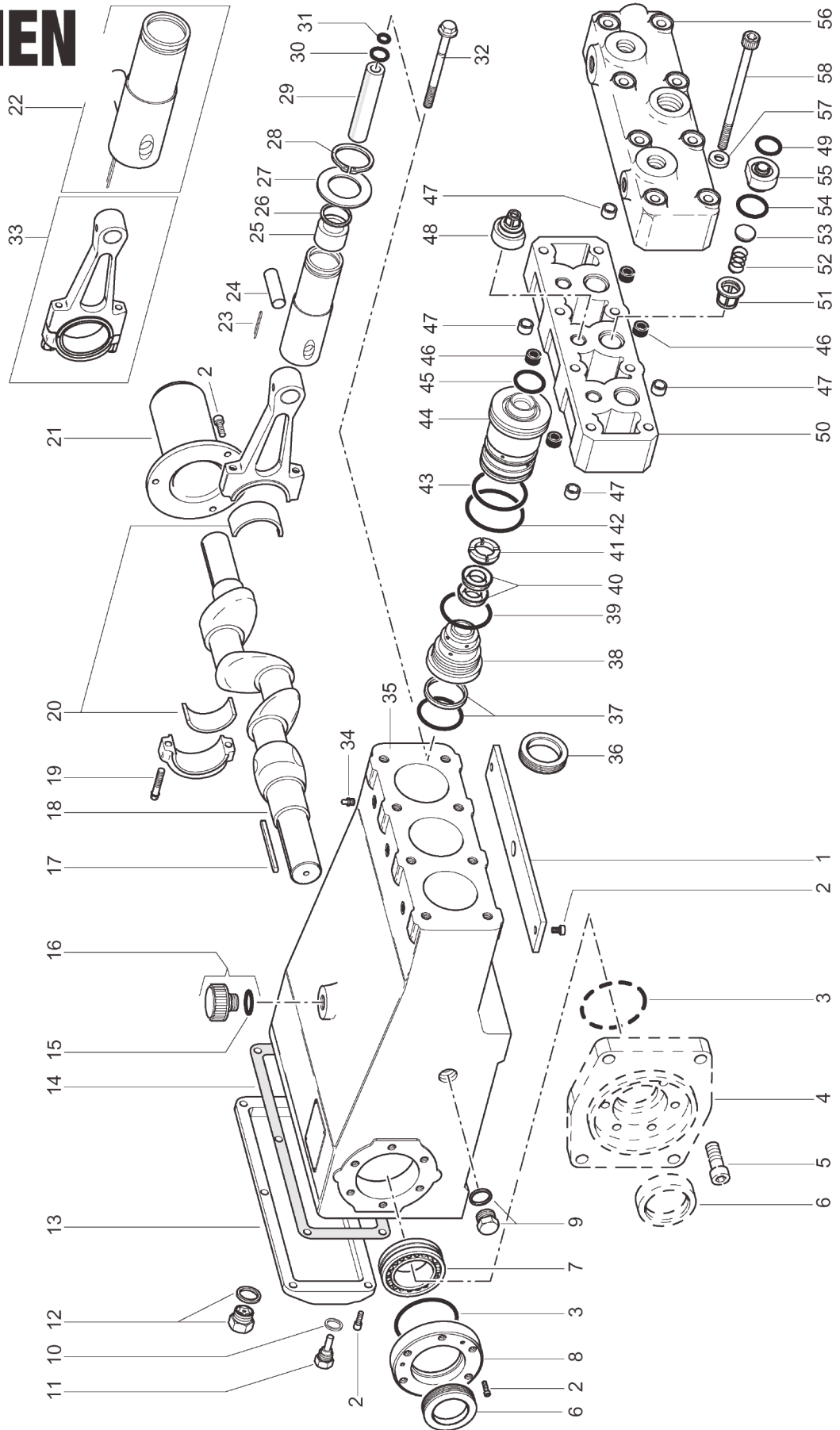
| Item | Part #     | Description                 | QTY. |
|------|------------|-----------------------------|------|
| 41   | F031200050 | Head ring HE18              | 3    |
|      | F031200040 | Head ring HE20              | 3    |
|      | F031200030 | Head ring HE22              | 3    |
|      | F031200010 | Head ring HE25              | 3    |
|      | F031200480 | Head ring HE30              | 3    |
| 42   | F881010124 | O-ring Ø 50.47 x 2.62       | 3    |
| 43   | F881010012 | O-ring Ø 50.52 x 1.78       | 3    |
| 44   | F062200610 | Cylinder HE18               | 3    |
|      | F062200620 | Cylinder HE20               | 3    |
|      | F062200630 | Cylinder HE22               | 3    |
|      | F062200640 | Cylinder HE25               | 3    |
|      | F062200650 | Cylinder HE30               | 3    |
| 45   | F881010211 | O-ring Ø 37.69 x 3.53 Spec. | 3    |
| 46   | F043500010 | Bushing                     | 8    |
| 47   | F031200060 | Manifold bushing            | 8    |
| 48   | F208007020 | Valve unit                  | 6    |
| 49   | F881011151 | O-ring Ø 22 x 3 Spec.       | 6    |
| 50   | F064100520 | Collector                   | 1    |
| 51   | F021200010 | Valve guide                 | 6    |
| 52   | F090200010 | Spring                      | 6    |
| 53   | F082200340 | Valve poppet                | 6    |
| 54   | F881011153 | O-ring Ø 26 x 3 Spec.       | 6    |
| 55   | F081200820 | Valve seat                  | 6    |
| 56   | F064100360 | Manifold                    | 1    |
| 57   | F030000000 | Manifold washer             | 8    |
| 58   | F871135320 | Manifold bolt               | 8    |

**REPAIR KITS**

| Item   | HE18    | HE20  | HE22  | HE25  | HE30  |
|--|---------|-------|-------|-------|-------|
| 30-31-37-39-40-42-43-45                                | F1266   | F1267 | F1268 | F1269 | F1270 |
| 45-49-54   | KIT1033 |       |       |       |       |
| 3-6-10-14-15-23-30-31-34-36<br>37-39-40-42-43-45-49-54 | F1271   | F1272 | F1273 | F1274 | F1275 |



## HEN



| Item | Part #     | Description                     | QTY.  |
|------|------------|---------------------------------|-------|
| 1    | F040000130 | Lower cover                     | 1     |
| 2    | F871115603 | Screw, M6 x 16 Inox             | 17-23 |
| 3    | F881013100 | O-ring, Ø 80 x 2.5              | 2     |
| 4    | F010100050 | Hydraulic motor flange (Type A) | 1     |
|      | F010100040 | Hydraulic motor flange (Type B) | 1     |
| 5    | F871125606 | Screw, 10 x 30 Inox             | 6     |
| 6    | F881080014 | Radial seal Ø 40 x 60 x 10      | 2     |
| 7    | F811110002 | Bearing                         | 2     |
| 8    | F063400680 | Side cover                      | 1-2   |
| 9    | F801053002 | Oil level sight glass G1/2"     | 1     |
| 10   | 680079     | Washer, nickel Ø 3/8"           | 1     |
| 11   | F801057011 | Magnetic plug G 3/8"            | 1     |
| 12   | F801053003 | Oil level sight glass G 3/8"    | 1     |
| 13   | F063400670 | Rear cover                      | 1     |
| 14   | F080600000 | Gasket, rear cover              | 1     |
| 15   | F881011153 | O-ring Ø 18 x 3                 | 1     |
| 16   | F801054002 | Vented cap G 1/2"               | 1     |
| 17   | F071000030 | Key                             | 1     |
| 18   | F050000030 | Crankshaft                      | 1     |
| 19   | F871350002 | Rod cap bolt                    | 6     |
| 20   | F812000002 | Connecting rod bearing          | 3     |
| 21   | F040400010 | Shaft cover                     | 1     |
| 22   | F250001090 | Plunger assembly                | 3     |
| 23   | F872138010 | Wrist pin Ø 2.5 x 22            | 3     |
| 24   | F071000020 | Flinger washer Ø 20             | 3     |
| 25   | F010200170 | Plunger bushing HEN18           | 3     |
|      | F010200180 | Plunger bushing HEN20           | 3     |
|      | F010200190 | Plunger bushinh HEN22           | 3     |
|      | F010200200 | Plunger bushing HEN25           | 3     |
| 26   | F031000070 | Spacer                          | 3     |
| 27   | F041500030 | Flinger washer                  | 3     |
| 28   | F031000080 | Snap ring                       | 3     |
| 29   | F024201170 | Plunger HEN18                   | 3     |
|      | F024201180 | Plunger HEN20                   | 3     |
|      | F024201190 | Plunger HEN22                   | 3     |
|      | F024201200 | Plunger HEN25                   | 3     |
|      | F024201210 | Plunger HEN30                   | 3     |
| 30   | F881011060 | O-ring Ø 11 x 2                 | 3     |
| 31   | F881011001 | O-ring Ø 6 x 1.5                | 3     |
| 32   | F035200110 | Plunger bolt                    | 3     |
| 33   | F250000050 | Connecting rod assembly         | 3     |
| 34   | F801077503 | Grease fitting M 10 x 1 inox    | 3     |
| 35   | F060100070 | Crankcase                       | 1     |
|      | F060100080 | Crankcase hydraulic             | 1     |
| 36   | F881081002 | Seal Ø 38 x 52 x 7 Spec.        | 3     |
| 37   | F881061006 | Scraper HEN18                   | 3     |
|      | F881061007 | Scraper HEN20                   | 3     |
|      | F881061008 | Scraper HEN22                   | 3     |
|      | F881061009 | Scraper HEN25                   | 3     |
|      | F881061030 | Scraper HEN30                   | 3     |
| 38   | F022301030 | Packing support HEN18           | 3     |
|      | F022301040 | Packing support HEN20           | 3     |
|      | F022301050 | Packing support HEN22           | 3     |
|      | F022301060 | Packing support HEN25           | 3     |
|      | F022301070 | Packing support HEN30           | 3     |
| 39   | F881010139 | O-ring Ø 39.34 x 2 HEN 18-20-22 | 3     |
|      | F881010120 | O-ring Ø 42.52 x 2 HEN 25-30    | 3     |
| 40   | F881020000 | Packing HEN18                   | 6     |
|      | F881020001 | Packing HEN20                   | 6     |
|      | F881020003 | Packing HEN22                   | 6     |
|      | F881020005 | Packing HEN25                   | 6     |
|      | 90277000   | Packing HEN30                   | 6     |

| Item | Part #     | Description                 | QTY. |
|------|------------|-----------------------------|------|
| 41   | F031200380 | Head ring, HEN18            | 3    |
|      | F031200390 | Head ring, HEN20            | 3    |
|      | F031200400 | Head ring, HEN22            | 3    |
|      | F031200410 | Head ring, HEN25            | 3    |
|      | F031200490 | Head ring, HEN30            | 3    |
| 42   | F881010124 | O-ring Ø50.47 x 2.62        | 3    |
| 43   | F881010012 | O-ring Ø 50.52 x 1.78       | 3    |
| 44   | F062200610 | Cylinder, HEN18             | 3    |
|      | F062200620 | Cylinder, HEN20             | 3    |
|      | F062200630 | Cylinder, HEN22             | 3    |
|      | F062200640 | Cylinder, HEN25             | 3    |
|      | F062200650 | Cylinder, HEN30             | 3    |
| 45   | F881010211 | O-ring Ø 37.69 x 3.53 Spec. | 3    |
| 46   | F043500010 | Bushing                     | 8    |
| 47   | F03100060  | Manifold bushing            | 8    |
| 48   | F208007020 | Valve assembly              | 6    |
| 49   | F881011151 | O-ring Ø 22 x 3 Spec.       | 6    |
| 50   | F064200050 | Collector                   | 1    |
| 51   | F021200010 | Valve guide                 | 6    |
| 52   | F090200010 | Spring                      | 6    |
| 53   | F082200340 | Valve poppet                | 6    |
| 54   | F881011153 | O-ring Ø 26 x 3 Spec.       | 6    |
| 55   | F081200820 | Valve seat                  | 6    |
| 56   | F064200070 | Manifold                    | 1    |
| 57   | F030000000 | Manifold washer             | 8    |
| 58   | F035000050 | Manifold bolt               | 8    |

**REPAIR KITS**

| Item   | HEN18 | HEN20 | HEN22 | HEN25 | HEN30 |
|--|-------|-------|-------|-------|-------|
| 30-31-37-39-40-42-43-45                                | F1266 | F1267 | F1268 | F1269 | F1270 |
| 45-49-54   | F1033 |       |       |       |       |
| 3-6-10-14-15-23-30-31-34-36<br>37-39-40-42-43-45-49-54 | F1289 | F1290 | F1291 | F1292 | F1293 |

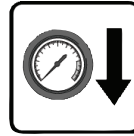


## 17. TROUBLE SHOOTING



**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.



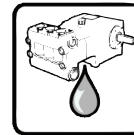
**INSUFFICIENT PUMP PRESSURE:**

- 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



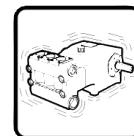
**OVERHEATED PUMP:**

- 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.

## MAINTENANCE LOG

### HOURS & DATE

|                            |  |  |  |  |  |  |  |
|----------------------------|--|--|--|--|--|--|--|
| <b>OIL CHANGE</b>          |  |  |  |  |  |  |  |
| <b>GREASE</b>              |  |  |  |  |  |  |  |
| <b>PACKING REPLACEMENT</b> |  |  |  |  |  |  |  |
| <b>PLUNGER REPLACEMENT</b> |  |  |  |  |  |  |  |
| <b>VALVE REPLACEMENT</b>   |  |  |  |  |  |  |  |



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Ref 310017 Rev.D  
05/08