Pratissoli

VS series

Instruction Manual

INDEX

1. INTRODUCTION

Pratissoli VS high pressure water plunger pumps have been designed for long life industrial duties and provided they are correctly installed and mantained will give long time 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 suggestions for trouble shooting.

When receiving your pump make sure of the good state of the supply and that no items are missing.
Any missing item or damage should be reported before installing and starting the pump.

2. SYMBOLS DESCRIPTION

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 safety boots

3. SAFETY

3.1 General warnings for safe operation

The misuse of an 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 an 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 practicable, 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 wirings 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 max 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 body 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, auxiliary drives.

3.3 Safety of operation

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

Personnel authorised to enter that area should have been previously trained to do so and informed on the risks arising from failures, misuse and any unforaseeable 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 wirings, with special emphasis on connections, junction boxes, switches and supply cables should be free from external damages (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 level and in good condition.
6. make sure the safety guards are in good conditions.

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

3.4 General procedures for high pressure guns/lances operation.

1. the Operator should take reasonable care of the safety of himself and of other persons who may be affected by his acts or omission at work. His actions should be always governed by his good sense and responsability.
2. The Operator should wear suitable waterproof protective clothings, having regard to the type of work being undertaken. The clothing set should include adequate hand protections, 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 of water jets produce noise levels in excess of 90 dB(A) suitable ear protection is advised.

Note: it must be emphasised 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 operations.

3. in most jetting operations it is an accepted practise 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 difficulties or fatigues, and watching the sorrounding area for intrusion by other persons or unsafe situations. If required, he will shut off the pressure 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 preliminar operating tests prior to starting work.
6. where applicable, proper side shields should be suitably 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 occuring 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, ect, while that part of the system is under pressure. The pump should be stopped and any pressure in the line released prior to make any adjustment.

1. the high pressure water unit should be mantained 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 1 Fig.1 containing the following information:

2. pump model and version.
3. serial number.
4. max r.p.m.
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) then any change should be mentioned on the rating plate for future reference.

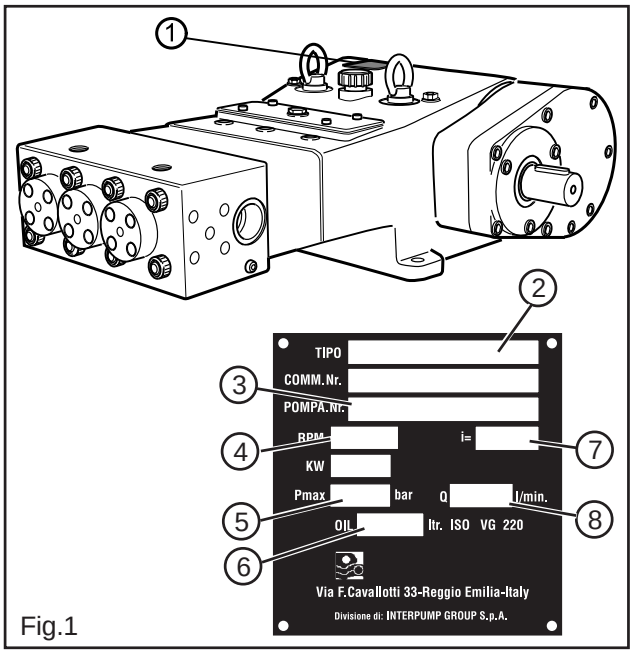


Fig.1

5. TECHNICAL FEATURES

Model	Flow rate	Gear box A 2200 rpm R=1:3,04	Gear box B 1800 rpm R=1:2,417	Gear box C 1500 rpm R=1:2,037	Pressure		Power	Power A 2200 rpm	Power B 1800 rpm	Power C 1500 rpm
VS 16	l/m	26	27	27	bar	1500	HP	101	105	105
	gpm	6,9	7,1	7,1	psi	21750	kW	74,3	77,2	77,2
VS 18	l/m	33	34	34	bar	1200	HP	103	106	106
	gpm	8,7	9,0	9,0	psi	17400	kW	75,6	77,9	77,9
VS 20	l/m	41	42	42	bar	900	HP	96	99	99
	gpm	10,8	11,1	11,1	psi	13050	kW	70,6	72,8	72,8
VS 22	l/m	49	51	50	bar	750	HP	96	100	100
	gpm	12,9	13,5	13,2	psi	10800	kW	70,6	73,5	73,5
VS 24	l/m	59	61	60	bar	600	HP	92	95	94
	gpm	15,6	16,1	15,8	psi	8700	kW	67,6	69,9	69,1

Crankshaft speedi: A= 723 rpm B= 745rpm C= 736 rpm

6. DIMENSIONS AND WEIGHT

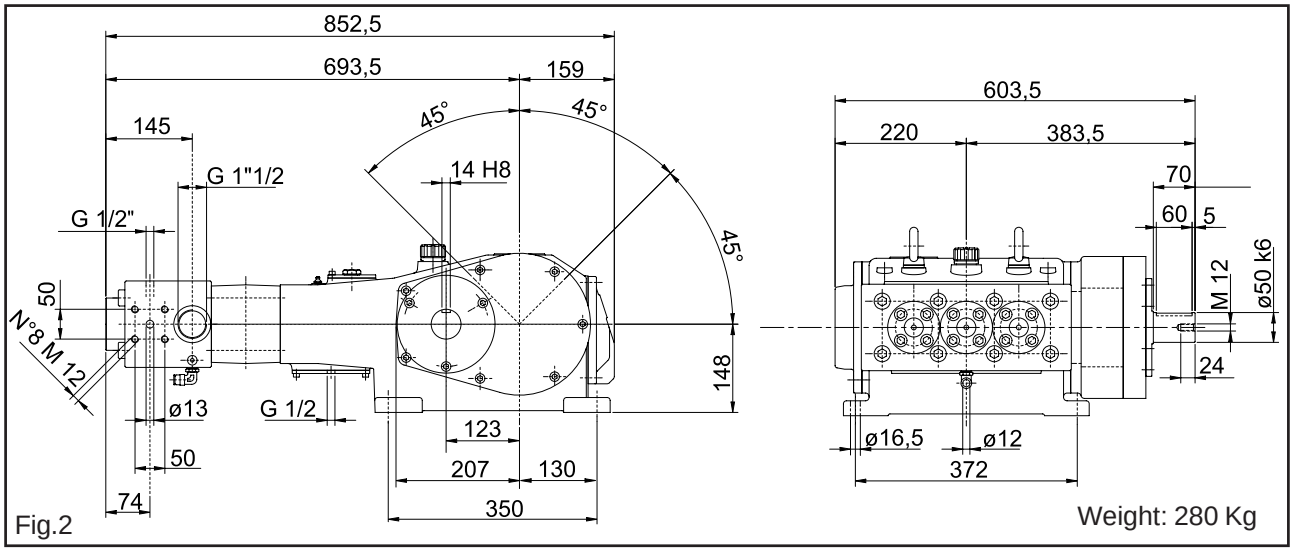


Fig.2

Weight: 280 Kg

7. GENERAL INFORMATION ABOUT THE PUMP USE

The VS pump has been designed to pump fresh and filtered water at room temperature.

7.1 Water temperature

The max admitted water temperature is 30°C.

7.2 Max flow and pressure ratings

The performance data indicated in the catalogue and in 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 VS's (all versions) is 400 rpm.

8. CONNECTIONS AND PLUGS

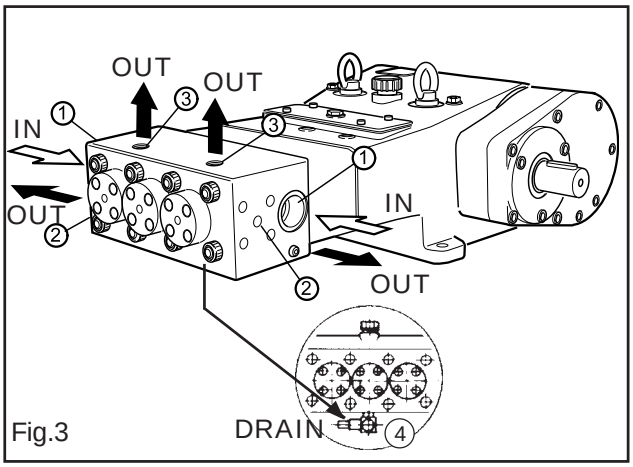


Fig.3

VS pumps are provided with (Fig.3):

1 - N°2 inlet ports IN G 1"1/2.
Suction line connection to either inlet port is acceptable, the port not being used should be hermetically sealed with the correct plug.

2 - N°2 outlet ports OUT Ø 13 mm.

3 - N°2 outlet ports OUT G1/2" (designed for pressure gauge and safety valve only).

4 - N°1 DRAIN port provided with quick coupling for connection with Rilsan air hose Ø 10 mm., it collects the water drainage from the cooling system and should be connected back to the suction line BEFORE the feed pump.

The VS pump is supplied with 4 conical seals (Fig.4) made of stainless steel and designed to provide total sealing of the outlet connections. They must be used in either the outlet ports of the head or in the outlet ports of the optional outlet mounting flanges.
The conical seals should be replaced at any disassembling and not re-used.

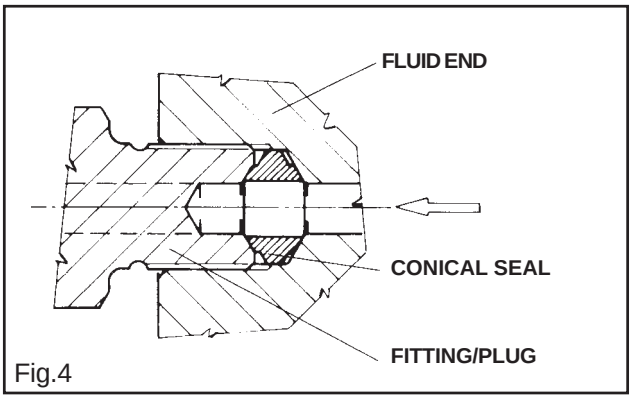


Fig.4

9. INSTALLAZIONE POMPA

9. PUMP INSTALLATION

9.1 Positioning

The pump should be installed flat on a rigid base by means of the four feet Ø 16,5 mm..
The base should be rigid enough to avoid any misalignment of flexing of the pump/transmission coupling axis due to the torque involved during operation.

9.2 Direction of rotation

The fig. 5 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.

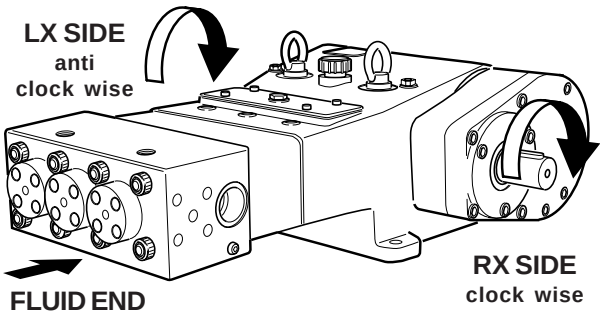


Fig.5

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.

9.4 Pump feeding

VS pumps require an inlet pressure at the suction port of at least 3 bar (44 psi) up to 5 bar (73 psi).
The feeding pump should be of a centrifugal type, supply at least twice the rated VS pump flow rate at the above required pressures in any working condition at any pump speed. The feeding pump should be operated independently from the plunger pump.
The VS pump should be started only when the inlet pressure is 3 bar (44 psi) at least.
A pressure switch to control the correct inlet pressure should be always installed in the suction line after the filters.

9.5 Suction line

For the correct pump operation make sure that the suction line meet with the following specifications:

1. Internal diameter should be at least 38 mm. in any point, possibly larger, depending of 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 adaptors, high pressure 3 or 4 ways nipples and so on.
8. do not install any kind of detergent injetor 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 feeding 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 and the cooling system should be directed back in the tank. Make sure that the by-pass and tank feeding flows do not give rise to turbulence at the tank outlet port, which, in turn, might create cavitation at the feeding 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.

9.6 Filtration

VS pumps require 10 to 20 microns water filtration degree. For a correct filtration system three individual filter units should be provided and positioned as shown by Fig 6.

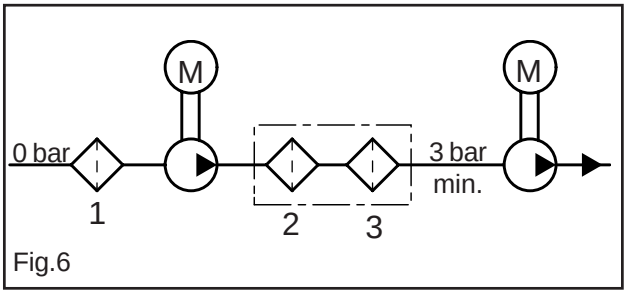


Fig.6

The filters should be installed as close as possible to the pump, allow easy inspection and have the following specifications:

a. capacity of each filter should be at least three times the rated pump flow rate.
b. filter port diameters should not be smaller than the pump inlet ports.
c. Filtration degree of each filter should be as follows:
   Filter n°1: 250 microns
   Filter n°2: 70 - 100 microns
   Filter n°3: 10 - 20 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.**

9.7 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 glycerin filled pressure gauges, being 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.

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 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 trasmission Manufacturer.
7. make sure of the correct oil level.

Note: in case the pump has not run for a long period check the suction and delivery valves for scaling

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. make sure the pump starts only when the correct inlet pressure is provided.

3. when starting the pump up for the first time or after every wiring re-connection check for the proper direction of rotation.

4. check that the rotating speed does not exceed the rated value.

5. before putting the pump under pressure let it run for some time until the oil flows freely.

6. 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).

10.3 Water cooling system

During operation the cooling water is drained out of the pump through the port (4, Fig.7) located underneath the pump head. The cooling water line should be connected to the inlet line **BEFORE the feed pump as shown below.**

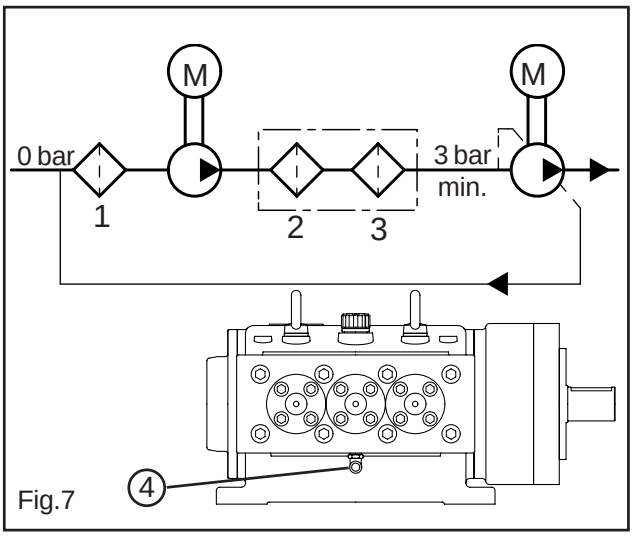


Fig.7

11. MAINTENANCE INSTRUCTIONS

11.1 Crank mechanism maintenance.

Check oil level on a weekly basis by means of the two oil dipsticks (1, Fig.8) provided with notches for min and max level.

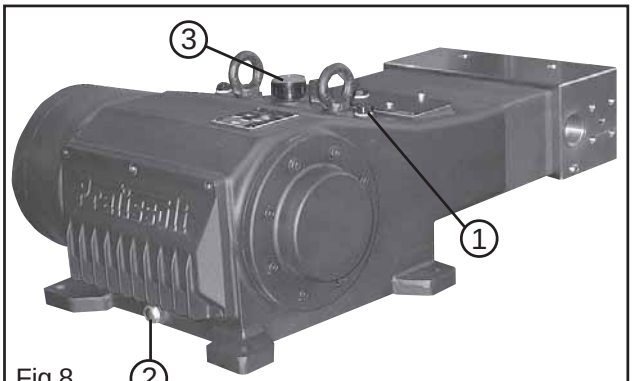


Fig.8

If necessary, top up from the oil plug 3, Fig.8.
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.8.
At every oil change clean the magnetic plug 2 Fig.8 and check the lower cover of Fig.7 for sediments or deposits.

OIL CHANGES	hours	Q.ty Lt.	Oil type
1° change	50	10	ISO 220
further 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 the valves inspection and/or replacement, when necessary.

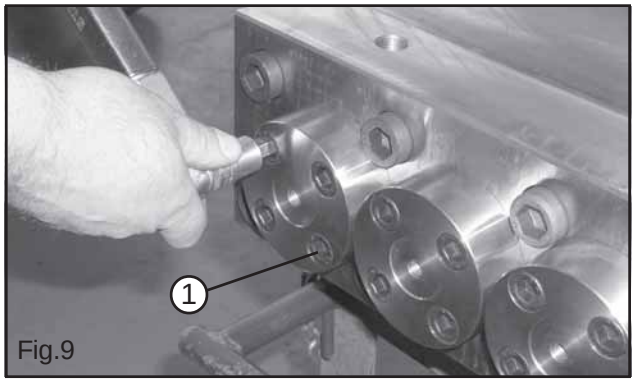


Fig.9

In order to have access to the delivery valves loose the 12 valve cover screws (1, Fig.9) and remove the valve covers.

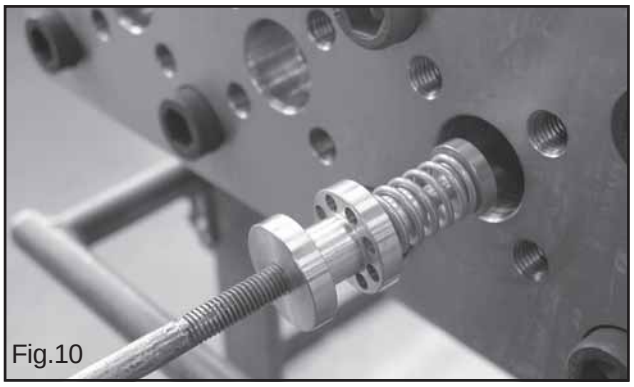


Fig.10

Once removed, take out the delivery valve guide with the spring and valve disk. An M10 threated bolt to be used as a simple extractor would help the operation (see Fig.10).

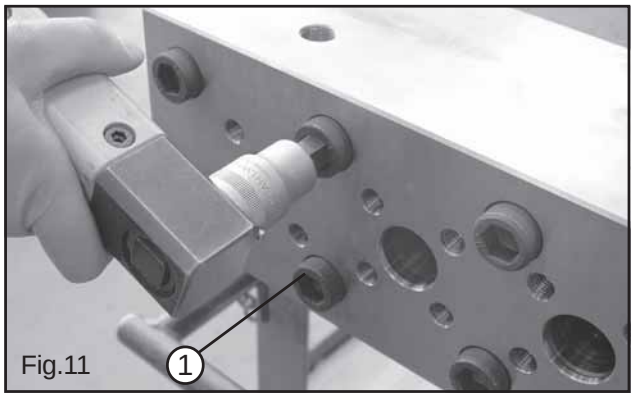


Fig.11

Loose and remove the 8 head screws (1 Fig.11).

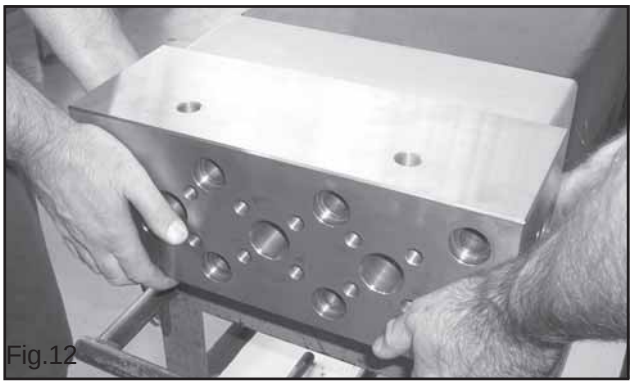


Fig.12

Remove the pump head (Fig.12).

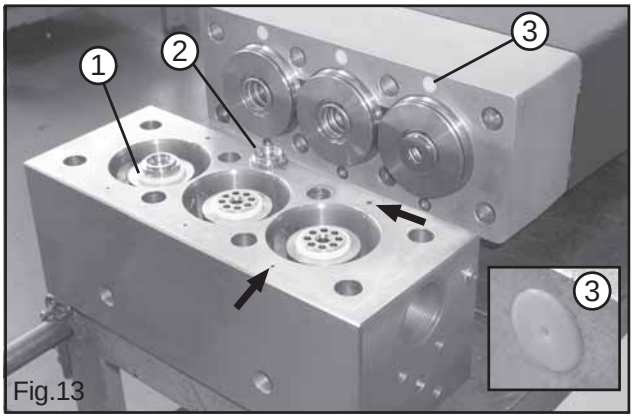


Fig.13

When removing the head from the pump pay attention to the valve seats (1, Fig.13) and the suction valve disks (2 Fig.13) which may fall off the head.
Check the cooling system orifices of the head (see arrows) and the relevant white tips (3, Fig.13) for deposits or sediments that may prevent cooling water from flowing through.

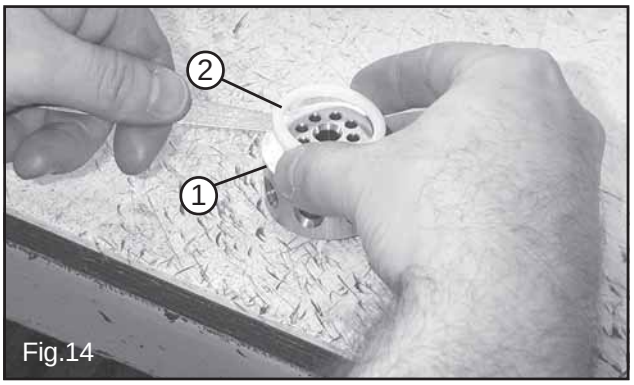


Fig.14

Remove the valve seats (1, Fig.14) from the head, check them for wear and replace if necessary.

BEFORE REPOSITIONING THE VALVE UNITS BACK IN PLACE CLEAN AND PERFECTLY DRY ALL VALVE HOUSINGS INSIDE THE HEAD.

VALVE RINGS (2, FIG.14) AND ALL O'RINGS SHOULD BE REPLACED AT EVERY INSPECTION.

Reassemble valves and head back in place by following the disassembling steps in the opposite sequence and use a torque wrench at the following settings for the valve cover screws and head screws :
-Valve cover screws: 20 kgm.
-Head screws: 47 kgm.

NOTE:
In order to facilitate reassembling operation use our tool p/n 2000.3014.0 (1, Fig.15) or equivalent, able to hold the valve seat and valve disk in place when mounting the head on the pump (see arrow Fig.16).

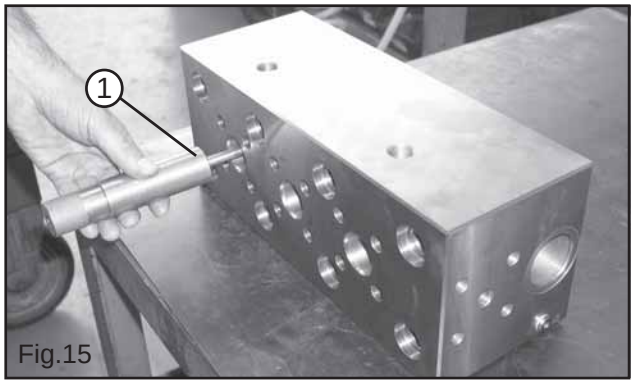


Fig.15

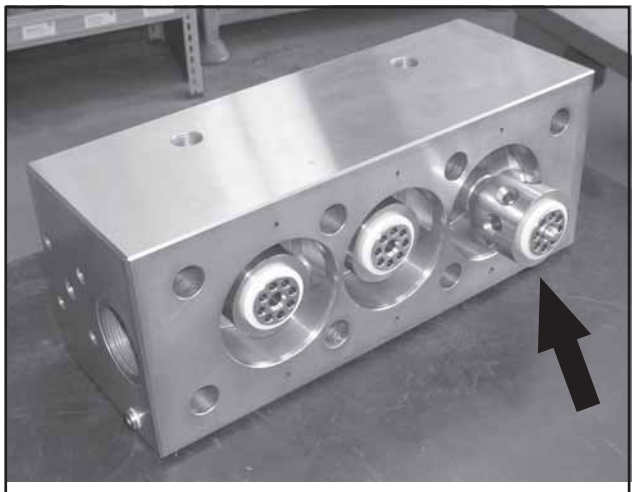
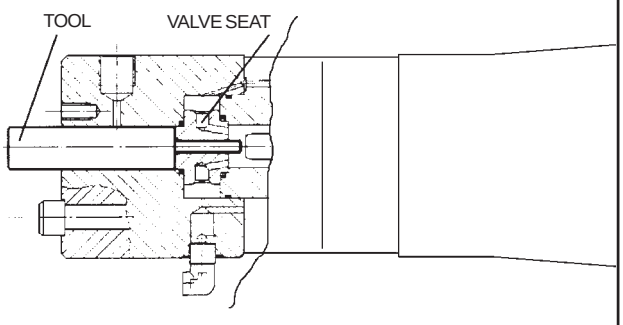



Fig.16

11.3 Pumping unit maintenance.
The only maintenance operation required for the pumping unit is the visual check of the amount of water drained out by the cooling system through the hole provided underneath the head (Fig.7, page 9). It clearly shows the pressure packing state of wear. Pressure packings should be replaced when vibration and/or drop in the operating pressure start to occur during operation.

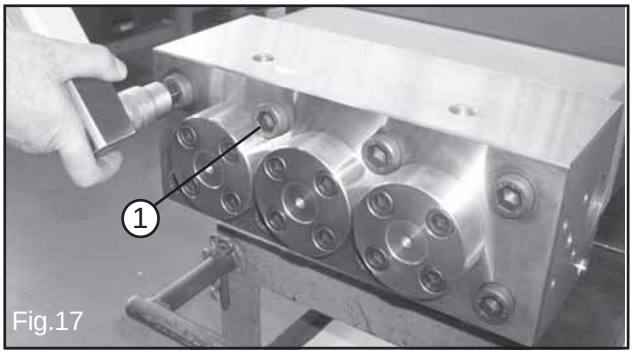


Fig.17

Remove the eight head screws (1 Fig.17).

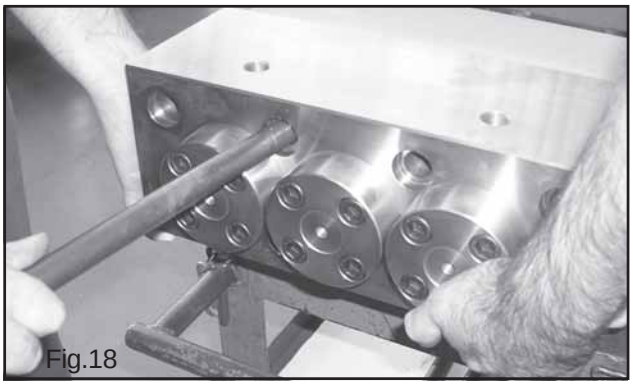


Fig.18

Remove the pump head (see chapter 11.2).

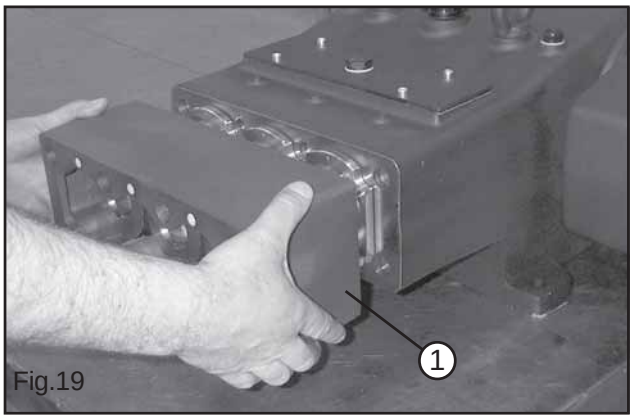


Fig.19

Take out the collector (1, Fig.19).

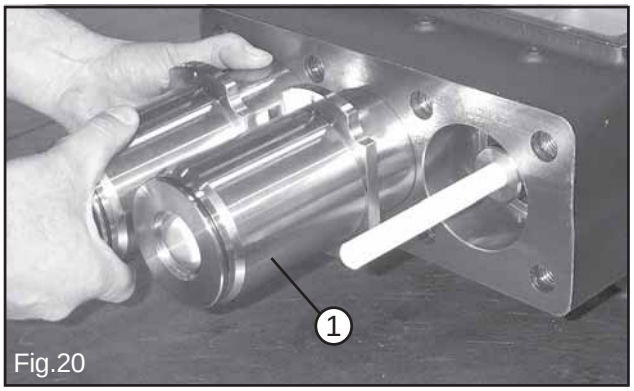


Fig.20

Once head and collector are removed the cylinders are free to be taken out of the pump body.
Beating the cylinders all around with a plastic hammer helps to loose them from possible scaling or deposit accumulated during operation. **When removing the cylinders take their weight into account and pay attention not to hit and damage the plungers.**

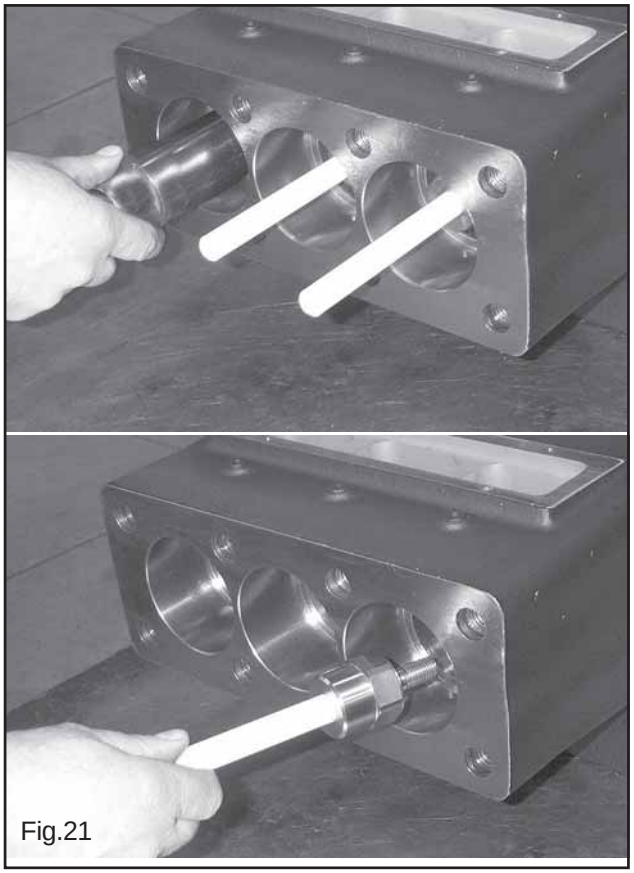


Fig.21

Once the cylinders are removed, loose the plungers and check them for wear (Fig.21).
Replace if necessary.

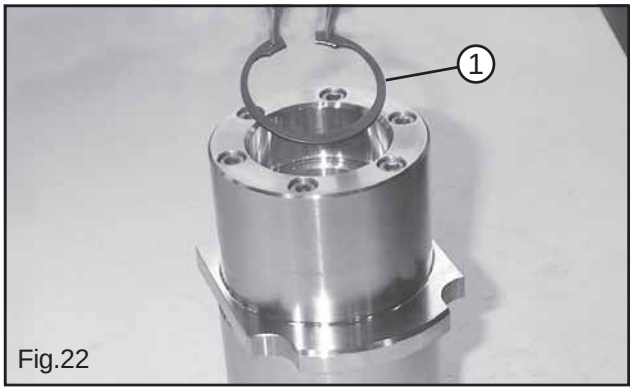


Fig.22

Remove the seeger 1, Fig.22.

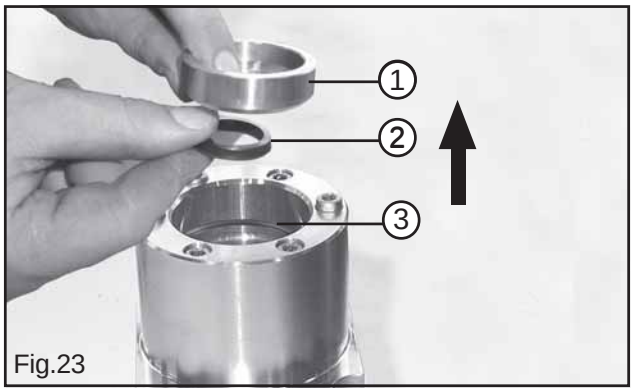


Fig.23

Remove the rear seal support 1, the rear seal 2 and the O'ring 3, Fig.23.

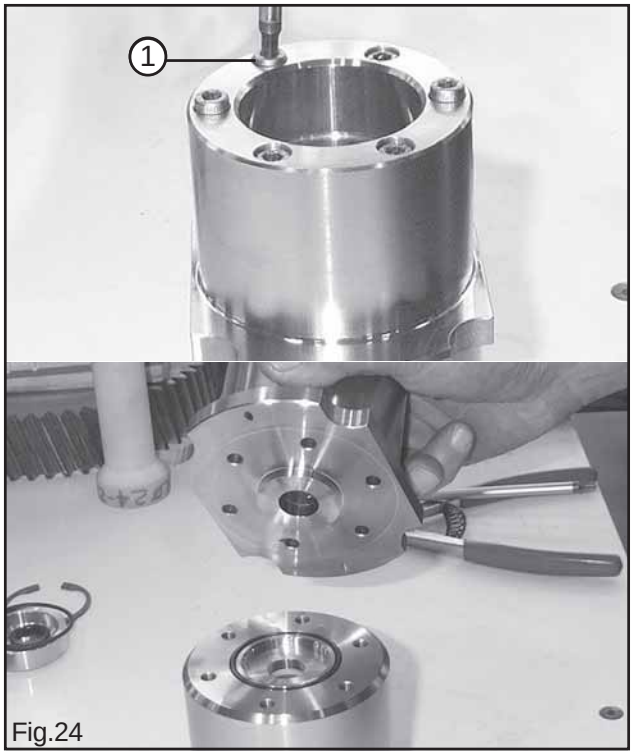


Fig.24

Remove the 6 packing support screws (1 Fig.24).

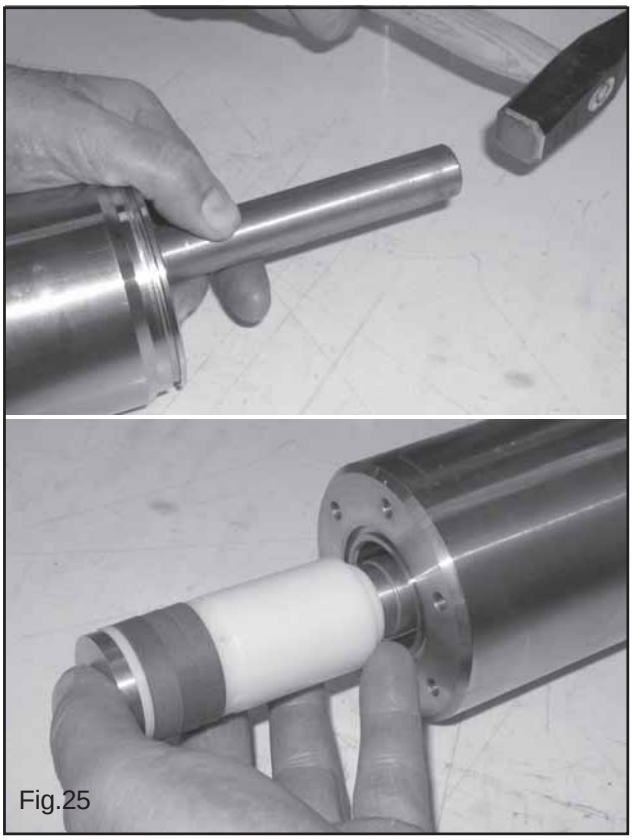


Fig.25

Insert a pin of adeguate dimensions and smartly beat till the complete pressure packing set is out (Fig.25).
Replace pressure packing set at every inspection.

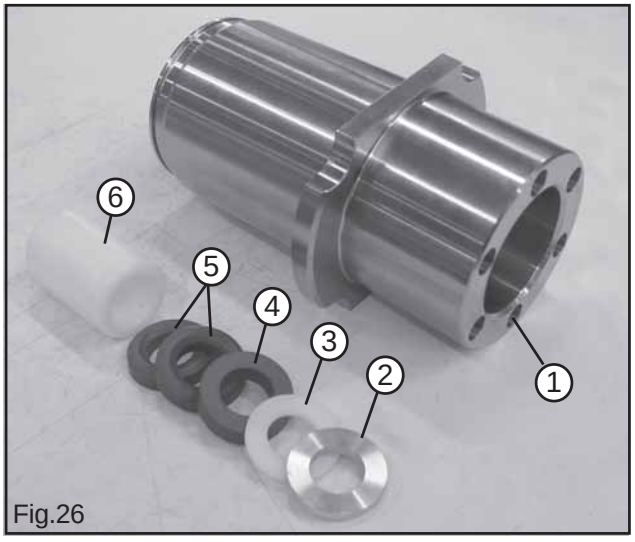


Fig.26

Reassemble packing support and cylinder. Screws 1, Fig.26 should be tighten with a torque wrench set for 1,7 Kgm.Fit each new component of the pressure packing set in the cylinder making sure of the correct order as shown in Fig.26 and Fig.27:

2 Packing bushing
3 Packing ring
4 Back packing
5 Pressure packings
6 Pressure packing retaining bush

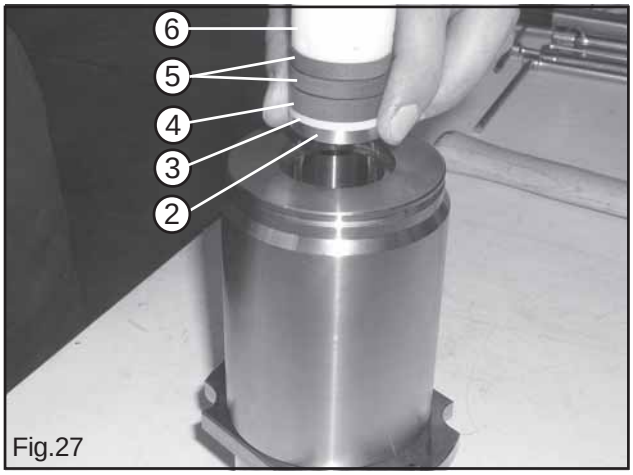


Fig.27

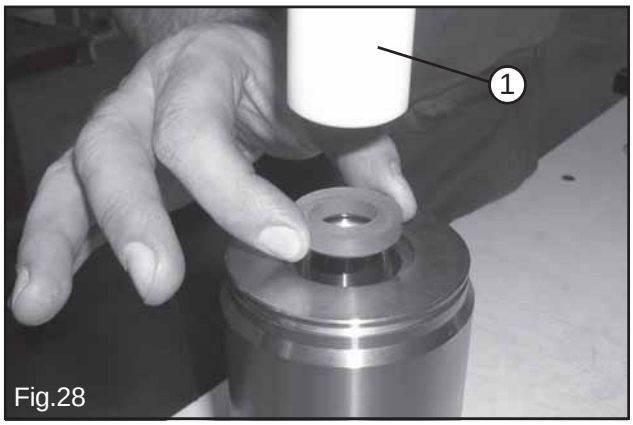


Fig.28

Each pressure packing set component should fit tight in the cylinders because of a little interference designed in the ext. diameter. A pin of adeguate dimensions (1, Fig.28) helps in guiding each component straight and alligned all the way down in the cylinder.

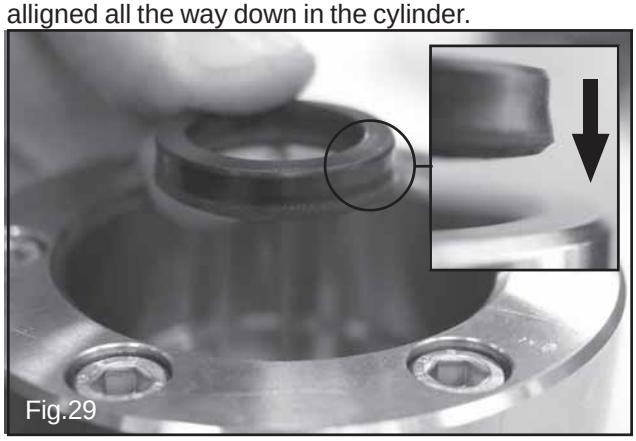


Fig.29

The new rear seal should be mounted with the larger diameter side first in, as shown in Fig.29.

Reassemble the pump following the disassembling steps in the opposite sequence and use a torque wrench for the screws listed below:

-Plunger screws: 10 kgm
-Head screws: 47 kgm
-Valve cover screws: 20 kgm.

12. SCREW CALIBRATION

Screw calibration is to be carried out by means of a torque wrench only:

DESCRIPTION	Kgm.
valve cover screws	20
head screws	47
plunger screws	10
connecting rod screws	7,5
packing support screws	1,7

13. MAINTENANCE TOOLS

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

for disassembling:
- main gear extractor cod. 2000.3002.0

for assembling:
- head/valve seats tool cod. 2000.3014.0

14. PUMP STOPPED FOR LONG TIME

Before starting the pump up 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 the chapter 11 and then comply with the starting procedures indicated in the 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.

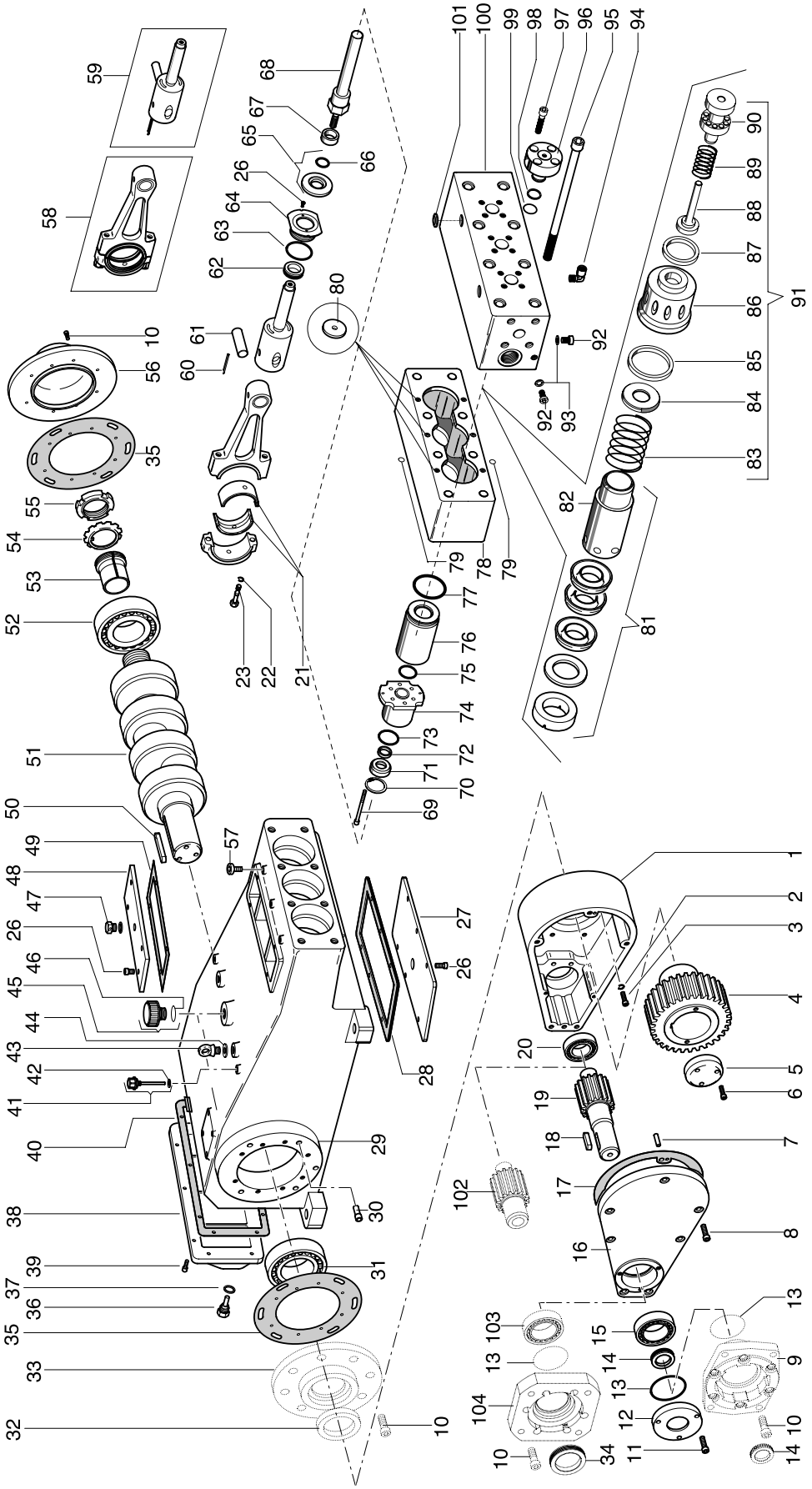
If a pump is frozen or appears frozen ON NO ACCOUNT SHOULD THE PUMP BE OPERATED until the entire system has been thawed out.

16. WARRANTY TERMS

Pratissoli products are warranted to be free from defects in workmanship and material for 12 months from the date of shipment. This warranty is limited to repairing or replacing products which Manufacturer's investigation shows were defective at the time of shipment. All products subject to this warranty shall be returned free of any freight charges to Pratissoli Pompe division of Interpump Group S.p.a., via Felice Cavallotti 33, 42100 Reggio Emilia, Italy.
The express warranty set forth herein is in lieu of all other warranties, express or implied, including without limitation any warranties of merchantability of fitness for a particular purpose and all such warranties are hereby disclaimed and excluded by the Manufacturer.
Repair or replacement of defective products as provided above is the sole and exclusive remedy provided hereunder and the Manufacturer shall not be liable for any further loss, damages or expenses, including incidental or consequential damages, directly or indirectly arising from the sale or use of this product.
For items not manufactured by Pratissoli Pompe, the warranty terms applied will be those of the original Manufacturer. The use of other than Pratissoli original spare parts automatically voids the warranty.

17. EXPLODED VIEW AND PART LIST

VS



POS	CODE	KIT	DESCRIPTION	Qt.
1	0601.0046.0		Gear box housing	1
2	8720.4700.5	C	Washer Ø 10	8
3	8711.2510.8		Screw TCEI M10 x 40	8
4	0520.0010.0		Gear 1500 rpm (Z55)	1
	0520.0012.0		Gear 1800 rpm (Z58)	1
	0520.0028.0		Gear 2200 rpm (Z67)	1
5	0300.0009.0		Gear retainer flange	1
6	8711.2510.5		Screw TCEI M10 x 25	3
7	8721.26004		Retainer pin Ø 12 x 40	2
8	8711.2511.0		Screw TCEI M10 x 50	7
9	0101.0010.0		Hydraulic motor flange	1
10	8711.2515.4		Screw TCEI M10 x 30	8-14-16
11	8711.2515.3		Screw TCEI M10 x 25	3
12	0631.0019.0		Gear box flange	1
13	8810.1013.1	C	OR Ø 113,97 x 2,62	1
14	8810.8002.6	C	Oil seal Ø 55 x 75 x 10	1
15	8111.1001.0		Bearing 21311 CC	1
16	0631.0015.0		Gear box cover	1
17	0806.0014.0	C	Gear box gasket	1
18	8720.9700.9		Pinion key	1
	8720.9701.3		Pinion key (pinion Ø 48)	1
19	0520.0011.0		Pinion 1500 rpm (Z27)	1
	0520.0013.0		Pinion 1800 rpm (Z24)	1
	0520.0018.0		Pinion 1500 rpm (Z27) Ø 48	1
	0520.0021.0		Pinion 1800 rpm (Z24) Ø 48	1
	0520.0027.0		Pinion 2200 rpm (Z22)	1
	0520.0030.0		Pinion 2200 rpm (Z22) Ø 48	1
20	8111.10002		Bearing 22208	1
21	8120.0000.1		Brass bearing	3
22	8720.4600.6	C	Washer Ø 12	6
23	0350.0007.0		Con rod screw	6
26	8711.1515.2		Screw TCEI M6 x 14	16
27	0400.0007.0		Lower cover	1
28	0806.0013.0	C	Lower cover gasket	1
29	0601.0022.0		Pump body	1
30	0340.0001.0		Pin	1
31	8111.1001.6		Bearing 21314 CC	1
32	8810.8003.2	C	Oil seal Ø 70 x 90 x 10	1
33	0634.0064.0		Bearing cover (direct drive version)	1
34	8810.8003.1	C	Oil seal Ø 65 x 90 x 10	1
35	0806.0011.0	C	Bearing cover gasket	2
36	8010.5700.2		Magnetic plug G1/2"	1
37	8720.4300.2	C	Aluminium washer Ø 1/2"	1
38	0634.0054.0		Back cover	1
39	8711.2115.2		Screw TCEI M8 x 20	6
40	0806.0010.0	C	Back cover gasket	1
41	0010.0001.0		Oil dipstick	2
42	8720.4150.1	C	Washer Ø 3/8"	2
43	8720.2600.3		Eyebolt M16	2
44	0300.0003.0		Eyebolt spacer	2-4
45	8010.5402.7		Filling plug G 1"	1
46	8810.1011.6	C	OR Ø 29,82 x 2,62	1
47	8010.5600.2		Venting plug G 1/2"	1
48	0400.0005.0		Upper cover	1
49	0806.0012.0	C	Upper cover gasket	1
50	8721.0000.5		Crankshaft key	1
51	0500.0010.0		Crankshaft	1
52	8111.1100.8		Bearing 21314 CCK	1
53	8119.2000.4		Bearing bush AH314	1
54	8720.6901.2	C	Washer MB12	1
55	8720.2001.2		Ring nut KM12	1
56	0634.0058.0		Bearing cover	1
57	8212.0405.1		Plug M10 x 1	3
58	2500.0002.0		Con rod (complete)	3
59	2500.0110.0		Piston (complete)	3
60	8721.4201.5	C	Retainer pin Ø 5 x 36	3
61	0710.0006.0		Wrist pin Ø 28	3
62	8810.8100.0	C	Oil seal Ø 32 x 45 x 6,5 Spec.	3
63	8810.1012.7	C	O'ring Ø 64,77 x 2,62	3

POS	CODE	KIT	DESCRIPTION	Qt.
64	0634.0056.0		Piston oil seal cover	3
65	2060.0000.0		Wiper	3
66	8810.1211.5	AC	OR Ø 26,65 x 2,62	3
67	0312.0047.0		Wiper spacer	3
68	1242.0055.0		Plunger VS16	3
	1242.0056.0		Plunger VS18	3
	1242.0057.0		Plunger VS20	3
	1242.0058.0		Plunger VS22	3
	1242.0059.0		Plunger VS24	3
69	0350.0020.0		Packing support screw	18
70	8720.7153.0		Seeger Ø 52 inox	3
71	0313.0024.0		Scraper ring VS16	3
	0313.0023.0		Scraper ring VS18	3
	0313.0017.0		Scraper ring VS20	3
	0313.0018.0		Scraper ring VS22	3
	0313.0022.0		Scraper ring VS24	3
72	8810.3000.7	AC	Seal ring VS16	3
	8810.3000.8	AC	Seal ring VS18	3
	8810.3000.9	AC	Seal ring VS20	3
	8810.3001.0	AC	Seal ring VS22	3
	8810.3004.0	AC	Seal ring VS24	3
73	8810.1012.2	AC	OR Ø 47,30 x 2,62	3
74	0222.0014.0		Packing support VS16	3
	0222.0015.0		Packing support VS18	3
	0222.0016.0		Packing support VS20	3
	0222.0017.0		Packing support VS22	3
	0222.0018.0		Packing support VS24	3
75	8810.1800.1	AC	OR Ø 45,52 x 2,62 Spec.	3
76	0622.0054.0		Cylinder	3
77	8810.1014.2	AC	OR Ø 75,87 x 2,62	3
78	0644.0004.0		Collector	1
79	8810.1010.9	AC	OR Ø 5,32 x 2,62	9
80	0835.0004.0	AC	Cooling system tip	3
81	2050.0013.0	AC	Pressure packing kit VS16	3
	2050.0014.0	AC	Pressure packing kit VS18	3
	2050.0015.0	AC	Pressure packing kit VS20	3
	2050.0016.0	AC	Pressure packing kit VS22	3
	2050.0017.0	AC	Pressure packing kit VS24	3
82	0315.0025.0		Pressure packing retaining bush VS16	3
	0315.0026.0		Pressure packing retaining bush VS18	3
	0315.0027.0		Pressure packing retaining bush VS20	3
	0315.0028.0		Pressure packing retaining bush VS22	3
	0315.0029.0		Pressure packing retaining bush VS24	3
83	0902.0026.0		Suction valve spring	3
84	0822.0023.0		Suction valve disk	3
85	0805.0017.0	BC	Valve seat ring (suction side)	3
86	0812.0057.0		Valve seat	3
87	0805.0016.0	BC	Valve seat ring (delivery side)	3
88	0822.0022.0		Delivery valve disk	3
89	0902.0017.0		Delivery valve spring	3
90	0213.0039.0		Delivery valve guide	3
91	2080.0700.0		Valve assembly	3
92	8212.0310.0		Plug G 1/8"	4
93	8720.4200.0	C	Aluminium washer Ø 10	4
94	8012.0303.0		Quick coupling G 3/8"	1
95	8711.4597.3		Screw TCEI M18 x 300 Spec.	8
96	0632.0019.0		Valve cover	3
97	8711.3530.2		Screw TCEI M14 x 40 Spec.	12
98	0105.0005.0	ABC	Antiextrusion ring	3
99	8810.1020.7	ABC	OR Ø 28,17 x 3,53 Spec.	3
100	0642.0033.0		Manifold	1
101	0832.0021.0		Conical seal G 1/2"	2
102	0520.0029.0		Pinion 1800 rpm (Z24) ANSI B92.1	1
	0520.0032.0		Pinion 1500 rpm (Z27) ANSI B92.1	1
103	8111.1001.4		Bearing 22213	1
104	0631.0021.0		Hydraulic motor flange SAE J744	1

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 of the fluid end.

THE PUMP KNOCKS:
- air suction.
- insufficient feeding.
- bends, elbows and fittings along the suction line throttle the amount of water which passes 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 valves do not work properly.
- clearance in the drive system.
- r.p.m. are higher than rated.

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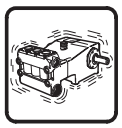
THE PUMP DOES NOT DELIVER THE RATED VOLUME:
- insufficient feeding (due to the cause listed above).
- r.p.m. are less than rated.
- excesive amount of water by-passed by the pressure regulating valve.
- worn out valves.
- excessive leakage from pressure packings.

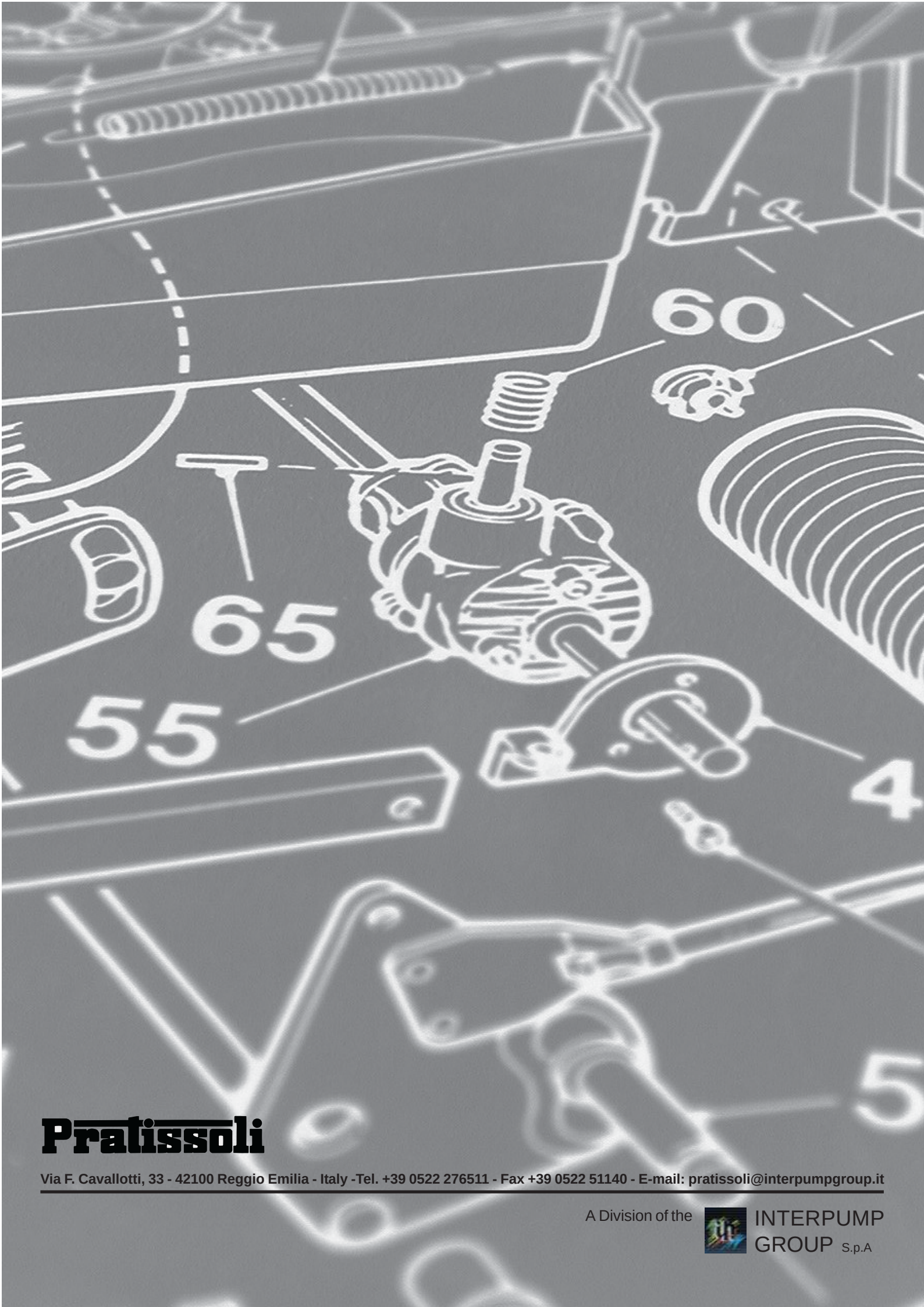
INSUFFICIENT PUMP PRESSURE:
- the nozzle is (or has become) too large.
- r.p.m. are less than rated.
- excessive leakage from pressure packings.
- excessive amount of water by-passed by the pressure regulating valve or faulty valve operation.
- worn out valves.

EXCESSIVE WATER LEAKAGE FROM THE PUMP:
- pressure packings 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.



PIPE VIBRATIONS OR KNOCKINGS:
- air suction.
- the pressure regulating valve does not work properly.
- the by-pass line is undersized.
- jammed up valves.
- drive transmission motion is irregular.



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