GENERAL PUMP

VF

Serial #10127003 and Later

Owner's Manual

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

NOTE: This Manual covers VF pumps with Serial Numbers starting at 10127003

General Pump is a member of The Interpump Group

Ref 300767 Rev. B
07-16

GENERAL PUMP

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1. INTRODUCTION

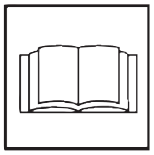
This manual describes the use and maintenance instructions of the VF pump, and should be carefully read and understood before using the pump.

Correct use and adequate maintenance will guarantee the pumps trouble-free operation for a long time. General Pump declines any responsibility for damage caused by misuse or the non-observance of the instructions indicated in this manual.

Upon receiving the pump, check that it is complete and in perfect condition.. Should anything be found out of order, please contact us 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
Use Protective Mask

Danger
Use Protective Goggles

Danger
Wear protective gloves

Danger
Wear protective boots

3. SAFETY

3.1 General Safety Indications

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

3.2 High pressure unit safety requirements

1. The pressure line must always be equipped with a safety valve.
2. High pressure unit components, in particular for those units working outside, must be adequately protected against rain, frost and heat.
3. The units electrical parts must be adequately protected from water spray, and must comply with the specific norms in force.
4. High pressure hoses must be correctly sized for the units maximum operating pressure, and must only be used within the pressure range indicated by the hose manufacturer. The same conditions apply for all other unit accessories where high pressure is involved.
5. The extremities of high pressure hoses must be sheathed and fastened to a steady structure in order to avoid dangerous whiplashes should they burst or should their connections break.
6. Appropriate safety guards must be provided for the pump transmission systems (joints, pulleys and belts, auxiliary drives).

3.3 Safety During Operation

The working area of a high pressure system must be clearly signalled. Access must be prohibited to non-authorized personnel and, if possible, the area must be fenced in. The personnel authorized to access this area must be previously trained, and informed about the risks that may arise from failures or malfunctions of the high pressure unit.

Before starting the unit, the operator must check:

1. **That the high pressure unit is correctly fed (see paragraph 9.5).**

3.3 Safety of Operation (continued)

2. That pump intake filters are perfectly clean; we advise to use a device that indicates the filters clogging level.
3. That electrical parts are adequately protected and in perfect condition.
4. That high pressure hoses do not show apparent signs of abrasion, and that fittings are in perfect shape.

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

3.4 General Procedures For Using Nozzles

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

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

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

3.5 Safety During Unit Maintenance

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

4. PUMP IDENTIFICATION

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

Pump model and version
Maximum RPM
Power absorbed Hp-kW
Flow Rate l/mn - GPM
Pressure bar/PSI

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

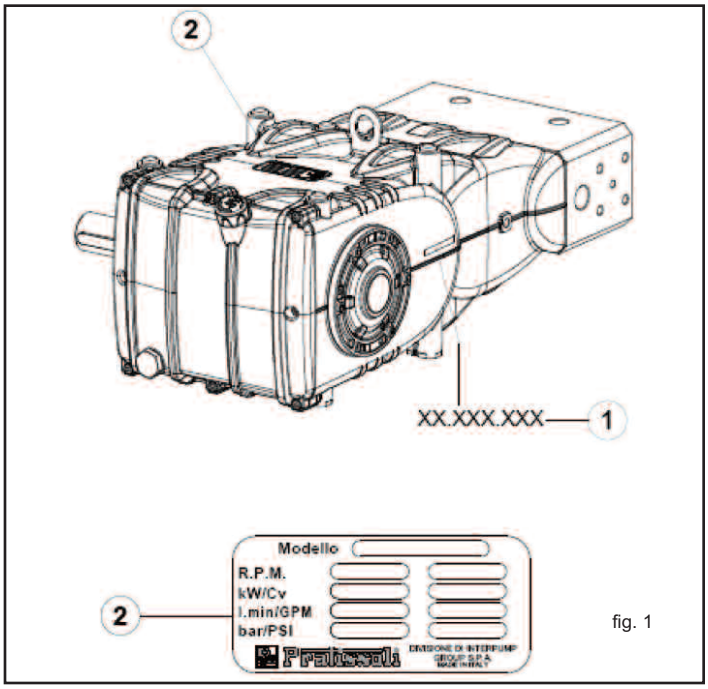


fig. 1

5. TECHNICAL CHARACTERISTICS

Model	RPM	Flow Rate		Pressure		Power	
		GPM	LPM	PSI	Bar	Hp	Kw
VF12	750	3.3	12.5	21,750	1500	50	36.8
	900	4	15	17,500	1200	50	36.8
VF14	750	4.5	17	16,000	1100	50	36.8
	1000	6	23	11,600	800	50	36.8

4. DIMENSIONS AND WEIGHT

For dimensions and weight of Standard Version pumps, please refer to fig. 2; for dimensions and weight of pumps with type “A” Flange, please refer to fig 2a.

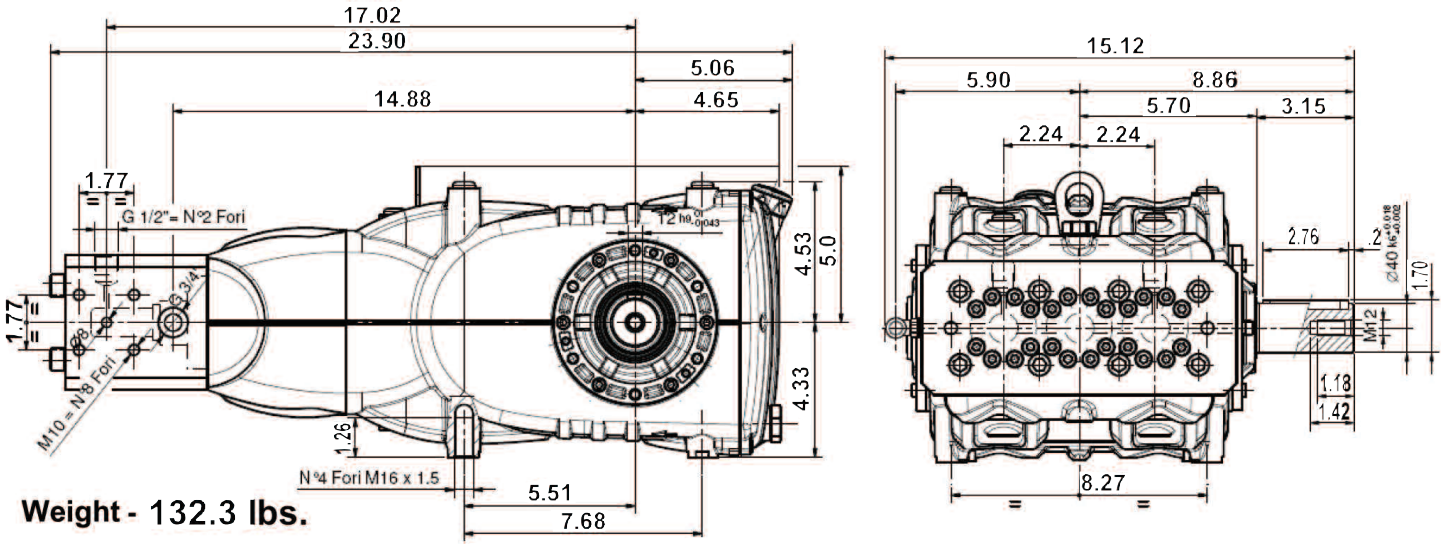


fig. 2

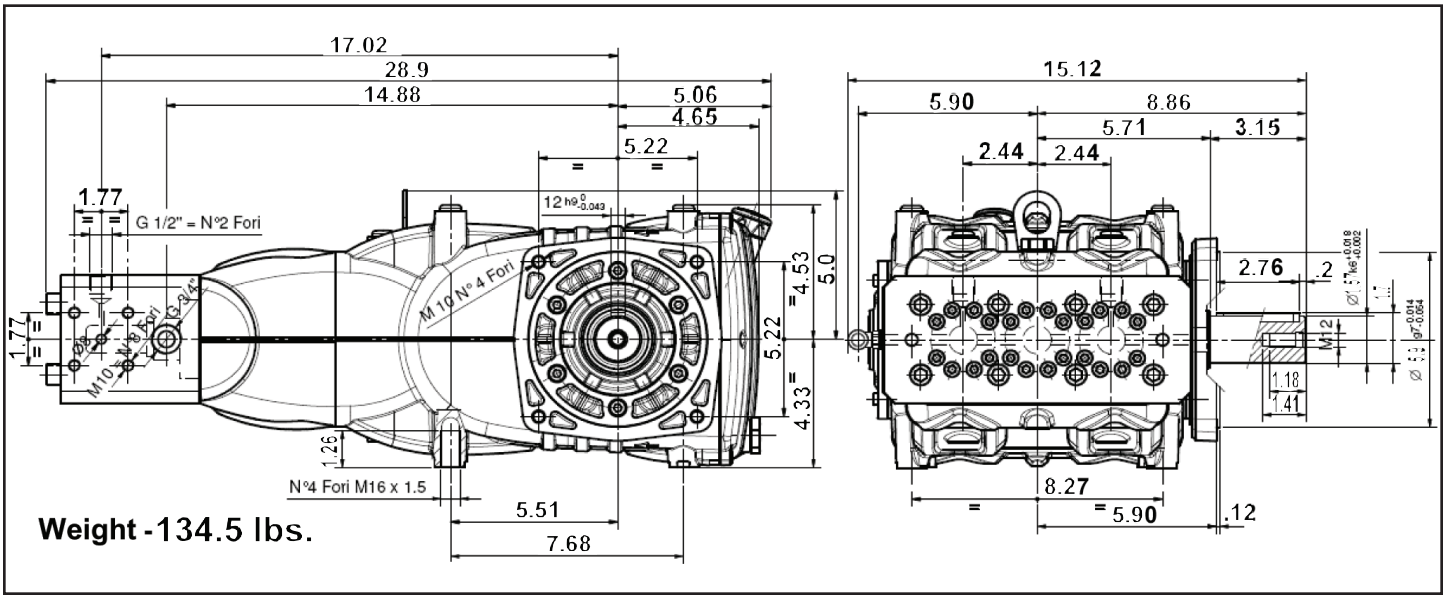


fig. 2a

7.INFORMATION ABOUT PUMP USE

The VF pump has been designed to operate with filtered water (see paragraph 9.7) and at room temperature.

Other fluids may be used only upon the approval of The Customer Service Department .

7.1 Water Temperature

The max water temperature is 30^{0}C (86^{0}F)

7.2 Max Flow Rate and Pressure Values

The performance values indicated in the catalog refer to the maximum performance of the pump. **Regardless** of the power used, pressure and maximum RPM values indicated on the plate may not be exceeded unless expressly authorized by the **Customer Service Department**.

7.3 Lowest RPM

Any RPM value different from what is indicated in the performance table (see chapter 5) must be expressly authorized by the **Customer Service Department**.

7.4 Recommended Lubricant Oil Types & Manufacturers

The pump is delivered with lubricant oil, compliant with room temperatures ranging between 0^0 and 30^{0}C (32^0 and 89.6^0 F). Some recommended lubricant types are indicated in the table below; these lubricants are treated additives in order to increase corrosion protection and resistance to fatigue. As an alternative, Automotive SAE 85W-90 gearing lubricants may also be used.

BRAND	TYPE
GENERAL PUMP	SERIES 220
ARAL	Aral Degol BG220
BP	ENERGOL HLP 220
CASTROL	Hyspin VG 220, Magna 220
ELF	POLYTELIS 220
ESSO	NUTO 220
FINA	Cirkan 220
FUCHS	RENOLIN 220
MOBIL	DTE OIL BB
SHELL	TELLUS C 220
TEXACO	RANDO HD 220
TOTAL	CORTIS 220

Check the oil level by using the appropriate oil level dipstick with minimum and maximum value notches (1), fig. 3. Refill if needed. Correct oil level inspection is done with the pump at room temperature; oil is changed with the pump at working temperature, by removing the rear plug (2), fig 3. Oil is to be changed every 1000 hours of operation. The amount required is ~128.5 oz. (3.8 liters).

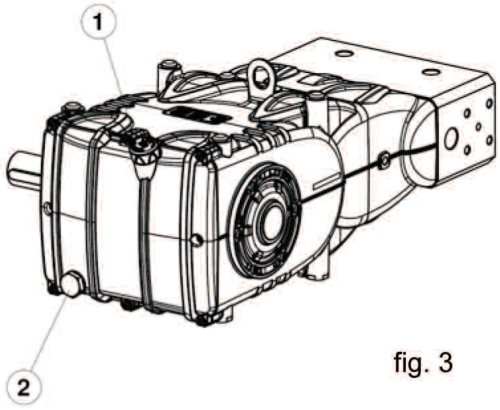
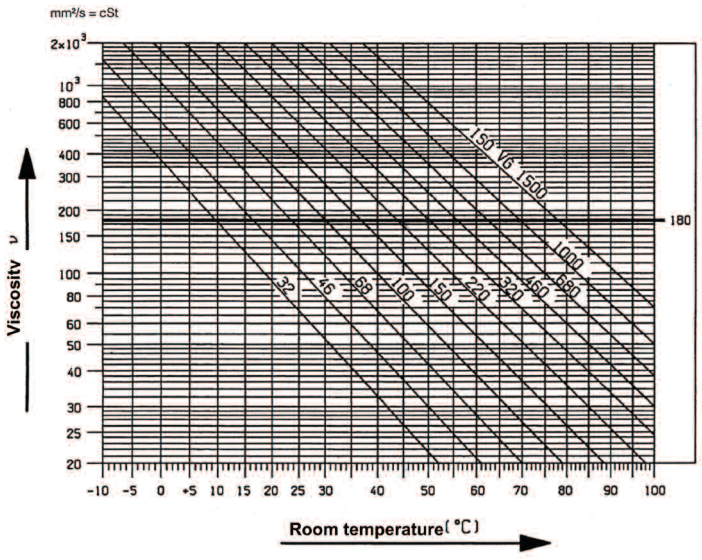


fig. 3

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

For room temperatures that differ from that mentioned earlier, follow the indications contained in the diagram below, keeping in mind that the oil must have a minimum viscosity of 180 cSt.

VISCOSITY/ROOM TEMPERATURE DIAGRAM



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

8. PORTS AND CONNECTIONS

VF Series pumps (see fig. 4) are provided with:

1. 2 inlet ports “IN”, 3/4” Gas. The line can be connected to either of the two inlet ports; the ones not being used must be hermetically sealed.
2. 2 outlet ports “OUT”, Ø 8 mm
3. 2 auxiliary ports, 1/2” gas; they can be used for the pressure gauge and the safety valve.
4. 1 drain port “DRAIN” supplied with an adjustable 90^0 rapid fitting for Ø 10 mm polyimide hoses; it is needed to recover the fluid drained from the packing cooling circuit, and must be connected to the outlet port being careful to avoid counter-pressure.

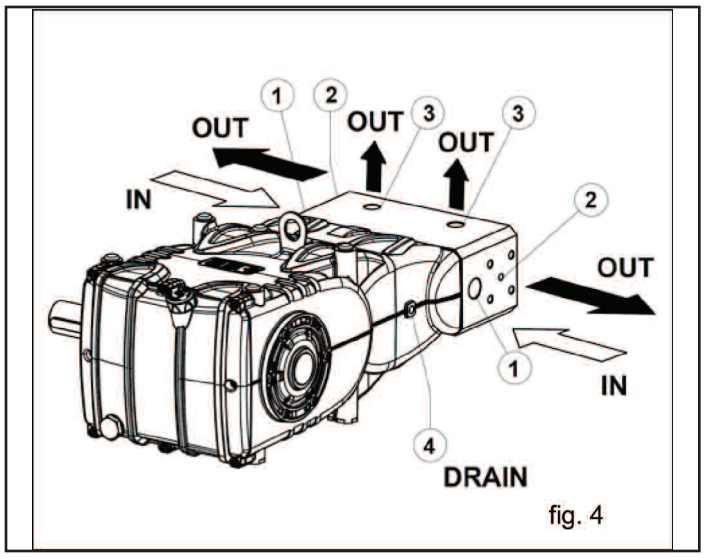


fig. 4

8.1 Conic sealing pads

The VF pumps are equipped with 4 conic steel pads to be used in correspondence of the pump’s delivery ports (fig. 5) or in the optional fitting flanges. Their function is to guarantee the sealing of the connection. The seat of the pump’s delivery port is already machined in order to hold the conic pad; if necessary, the connections for the delivery fitting or the closing plug must be correctly machined as indicated in fig. 5/a.

At each disassembly, the conic pad must be replaced.

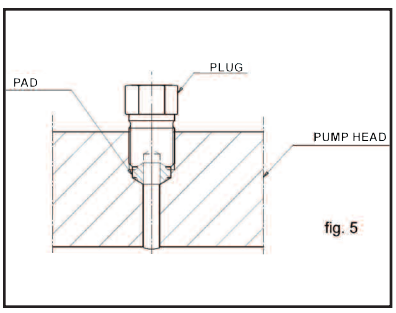


fig. 5

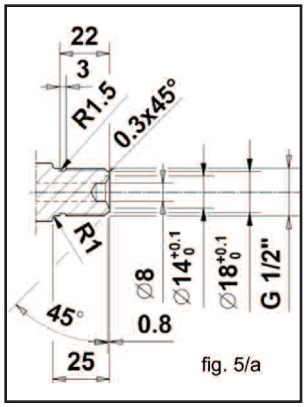


fig. 5/a

9. PUMP INSTALLATION

9.1 Installation

The pump must be installed in a horizontal position using the correct threaded feet M16 x 1.5; fasten the screws with a torque value of 155 ft. lbs. (210 Nm). The base must be perfectly flat and sufficiently rigid in order to avoid bending and misalignments on the pump/transmission coupling axis due to the torque applied during operation. The unit must not be rigidly fixed to the pavement, but requires the use of anti-vibration elements. For special applications, please contact the Customer Service Department.

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

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

Replace the crankcase cap with the oil dipstick and check oil level. The oil dipstick must always be accessible, even when the unit is assembled.

The pump’s shaft (PTO) must not be rigidly connected to the motor unit. The following transmission types are suggested:

- hydraulic by means of flange; for correct application, please contact the Customer Service Department
- Belts
- Cardan Joint (please respect the maximum working angles indicated by the manufacturer)
- Flexible joint

9.2 Direction of Rotation

An arrow situated on the crankcase near the shaft indicates the correct direction of rotation. Standing in front of the pump head, the direction of rotation must be as shown in fig. 6.

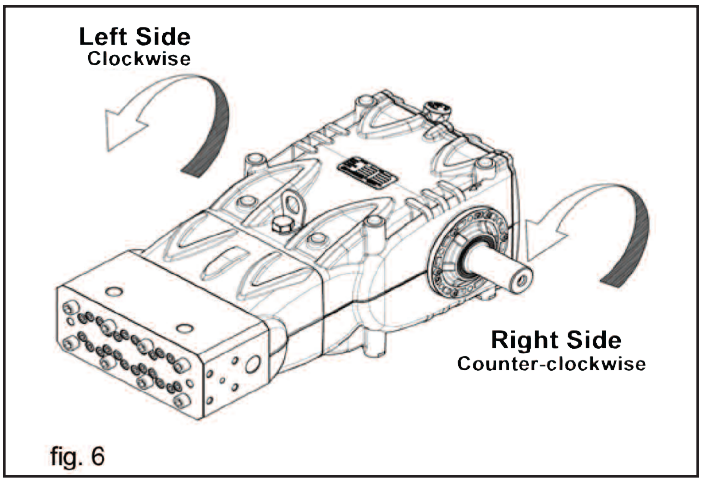


fig. 6

9.3 Version Change

A right version pump is defined when: observing the pump from the head side, the PTO shank of the pump shaft is on the right side.

A left version pump is defined when: observing the pump from the head side, the PTO shank is on the left side.

The version may be changed only by specialized and authorized personnel by carefully following the instructions that follow:

1. Separate the hydraulic part from the mechanical part as indicated in Chapter 2, paragraph 2.2.1 of the repair manual.

2. Rotate the mechanical part by 180^0, and reposition the rear crankcase cover so that the oil dipstick is facing upwards; reposition the lifting bracket and the related closing caps in the upper part of the crankcase; finally, correctly reposition the identification plate in its appropriate seat on the crankcase.
   Be sure that the lower draining holes on the crankcase near the plungers are open, and not closed by the plastic caps that are supplied.

3. Join the hydraulic part with the mechanical part as indicated in Chapter 2, paragraph 2.2.2 of the repair manual.

9.4 Hydraulic Connections

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

9.5 Pump Feeding

VF pumps require a minimum positive head ($NPSH_r$) ranging between 75 and 100 PSI (5 and 7 bar) measured at head intake. The booster pump must have the following characteristics: Flow rate of at least twice the value of the plunger pump's rated flow value, with a minimum pressure of 75 PSI (5 bar). These feeding conditions must be respected in all running conditions. Booster activation must be independent from that of the plunger pump.

Booster start-up must always precede plunger pump start-up. In order to protect the pump, we advise to install a pressure switch on the feeding line after the filters.

9.6 Suction Line

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

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

Along the duct, avoid localized diameter reductions that may cause pressure drops with subsequent cavitation. Absolutely avoid 90^0 elbows, connections with other hoses, bottlenecks, counter-slopes, upside down "U" shaped curves, "T" connections.

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

9.6 Suction Line (continued)

11. The pressure gauge for checking booster pressure must be installed near the plunger pump's outlet port, and always after the filters.

9.7 Filtering

The filtration degree for these pumps must be max. 20 micron; this is normally obtained by means of a series of at least three filters, positioned as indicated in fig. 7.

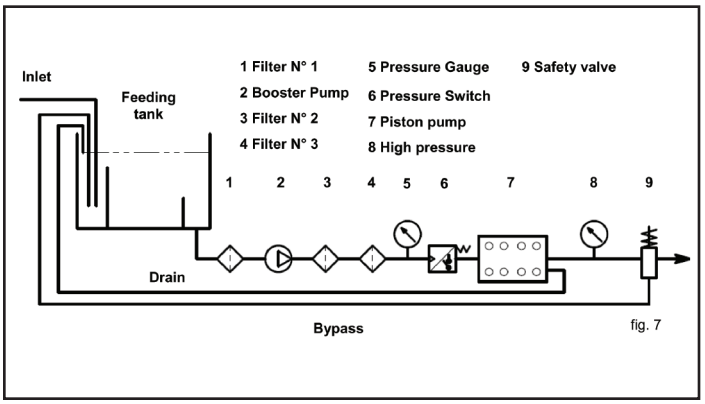


fig. 7

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

1. Minimum capacity 3 times greater than the pump's rated flow value.
2. Filter port diameters must not be smaller than the pump inlet ports.
3. Filtration degree:
   Filter No. 1: 250 micron
   Filter No. 2: 100 micron
   Filter No. 3: 20 micron.

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

In order to guarantee the required feeding pressure (see paragraph 9.5), install a pressure switch.

9.8 Delivery Line

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

1. The internal diameter of the pump must allow to guarantee correct fluid speed; see diagram in paragraph 9.9
2. The first section of the hose connected to the pump must be flexible in order to isolate pump vibrations from the rest of the system.
3. Use high pressure hoses and fittings that guarantee wide safety margins in any working condition.

9.8 Delivery Line (continued)

4. Install a safety valve on the delivery line.
5. Use pressure switches suitable for the pulsating loads typical of plunger pumps.
6. In the design phase, take into proper account the pressure drop along the line, since this causes a reduction in usage pressure with respect to the value measured at the pump.
7. If the pump pulsations are harmful for particular applications, install an appropriately sized pulsation dampener on the delivery line.

9.9 Internal Diameter of the Hose Line

To determine the internal diameter of the hose, please refer to the following diagram.

Suction Hose

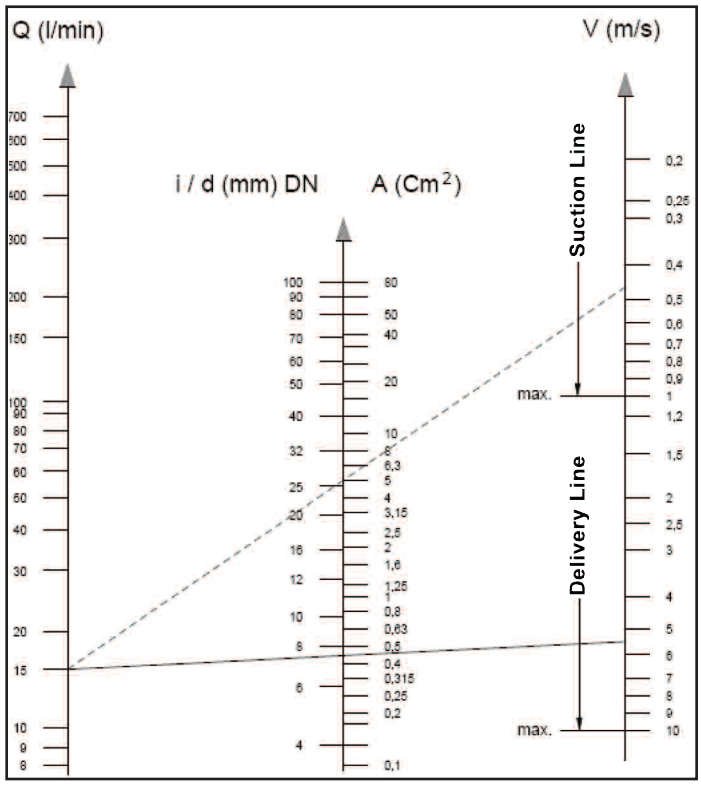
With a flow rate of ~4 GPM (15 l/mn) and water speed of 0.5 m/sec. the diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 25 mm (1 inch).

Delivery Hose

With a flow rate of ~4 GPM (15 l/mn) and water speed of 5.5 m/sec. The diagram line that connects the two scales intersects the central scale, indicating the diameters at a value of ~ 8 mm (.31 inch).

Optimum speed values:

- Suction: ≤ 0.5 m/sec.
- Delivery: ≤ 5.5 m/sec.



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

9.10 V-belt Transmission

The pump may be driven by a v-belt system. For this pump model, we suggest to use 4 XPB belts (16.5 x 13 cogged); only for long durations, use the XPC profile; both the characteristics and the power transmission capacity of each belt can be verified on the diagram in fig. 8, in function of the number of rotations normally declared by the Manufacturer. Minimum diameter of the driven pulley (on the pump shaft): ≥ 250 mm. The radial load on the shaft must not be greater than 7500 N (value required for the definition of the lay-out). The transmission is considered adequate if this load is applied at a maximum distance of 40 mm from the shaft shoulder (PTO) as indicated in fig. 11.

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

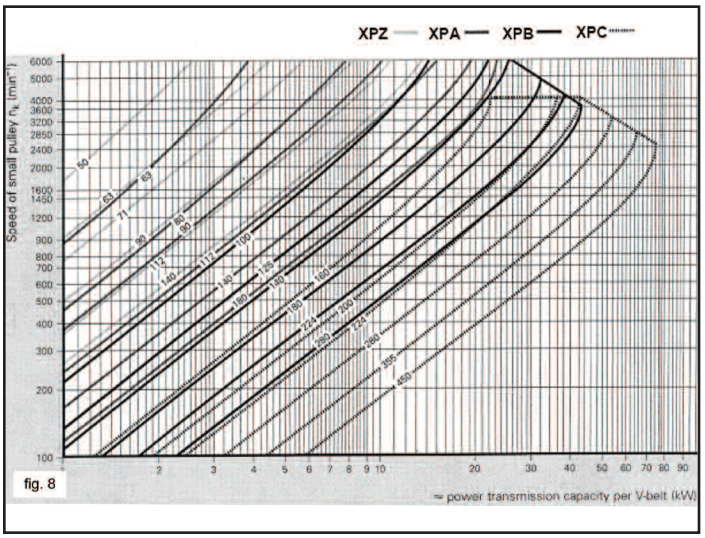


fig. 8

9.11 Transmission Definition

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

a) Use pulleys for v-belts with race dimensions prescribed/ recommended by the belt Manufacturer. Should no indications be supplied, please see fig. 9 and the table in fig. 10.

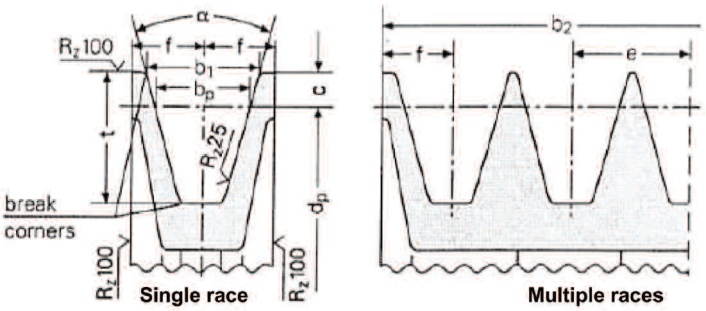


fig. 9

Dimensions (in mm)

Belt section as indicted in DIN 7753 part 1 and B.S. 3790			symbol DIN symbol B.S./ISO		XPB/SPB SPB	XPC/SPC SPC
Belt section as indicted in DIN 2215 e B.S. 3790			symbol DIN symbol B.S./ISO		17 B	22 C
Pitch width			b_w		14.0	19.0
Increased race width b_1 ≈				α = 34°	18.9	26.3
				α = 38°	19.5	27.3
			c		8.0	12.0
Distances between races			e		23 ± 0.4	31 ± 0.5
			f		14.5 ± 0.8	20.0 ± 1.0
Increased race depth			t_{min}		22.5	31.5
α	34°	For a primitive diameter narrow section v-belt DIN 7753 part 1	d_w		from 140 to 190	from 224 to 315
	38°				> 190	> 315
α	34°	For a primitive diameter classical section v-belt DIN 2215	d_w		from 112 a 190	from 180 to 315
	38°				> 190	> 315
Tolerance for α = 34°-38°					± 1°	± 30'
Pulleys per b2 per Number of races z b2 = (z-1) e + 2 f				1	29	40
				2	52	71
				3	75	102
				4	98	133
				5	121	164
				6	144	195
				7	167	226
				8	190	257
				9	213	288
				10	236	319
				11	259	350
				12	282	381

The pulley's minimum diameter must be respected.

fig. 10

2) Use high efficiency belts - for example **XPB** instead of **SPB**; this will allow to use a lower number of belts to transmit the same power, and consequently a minor distance of the resultant from the shaft shoulder (PTO) "a" in fig. 11.

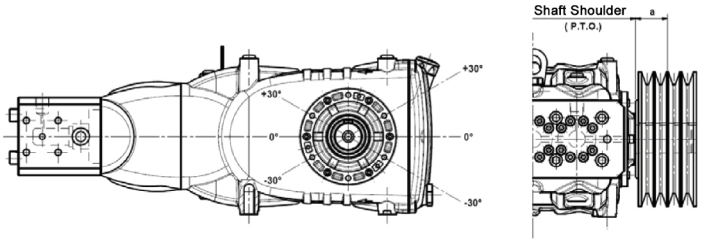


fig. 11

9.11 Transmission Definition (continued)

c) Set belt tension according to the Manufacturer's recommendations; an excessive value will abnormally stress the bearing, reduce its duration, and cause premature wear of the pulley. The tension value depends on different variables as indicated in paragraph 9.12.
d) Belt length has a natural tolerance ≥ ± 0.75%; for this reason the three belts must be purchased in pairs.
e) Follow the belt tension direction as indicated in fig. 11; for different needs, please contact the **Customer Service Department**.
f) Carefully align driver pulley and driven pulley races.

9.12 Definition of Belt Static Tension Values

Static tension depends on:

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

For belts with an XPB profile, the diagram in fig. 12 allows to obtain the values of the static tension that must be applied vs. the center distance between pulleys.

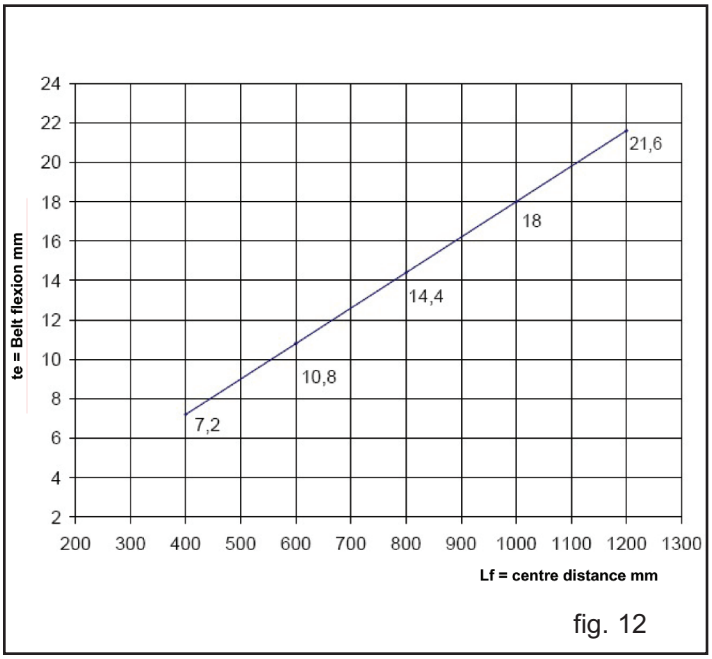


fig. 12

Conclusion: using a dynamometer, by loading the belt with 75 N as indicated in fig. 13, you will obtain a flexion value "te" of about 10.8 mm

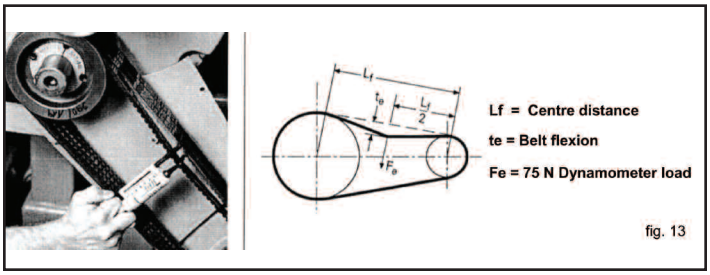


fig. 13

Note: If not differently indicated by the belt manufacturer, the inspection of the correct tension value, and the related tension adjustment if needed, is to be carried out after at least 30 minutes of operation in order to obtain belt settling. The best efficiency and maximum duration is obtained with a correct tension value.

10. START-UP AND OPERATION

10.1 Preliminary Inspections

Before Start-up Be sure that:

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

1. The suction line must be perfectly airtight.
2. All the On-Off valves between the pump and the feeding source are completely open. The delivery line must discharge freely in order to allow the air in the pump to be expulsed easily, thus facilitating pump priming.
3. All suction/delivery connections and fittings must be correctly tightened.
4. Coupling tolerances on the pump/transmission axis (half-joint misalignment, Cardan inclination, belt tightening, etc.) must remain within the limits indicated by the transmission Manufacturer.
5. The oil level in the pump must be verified using the correct dipsticks (position 1, fig 14), and especially using the oil sight glass (position 2, fig. 14).

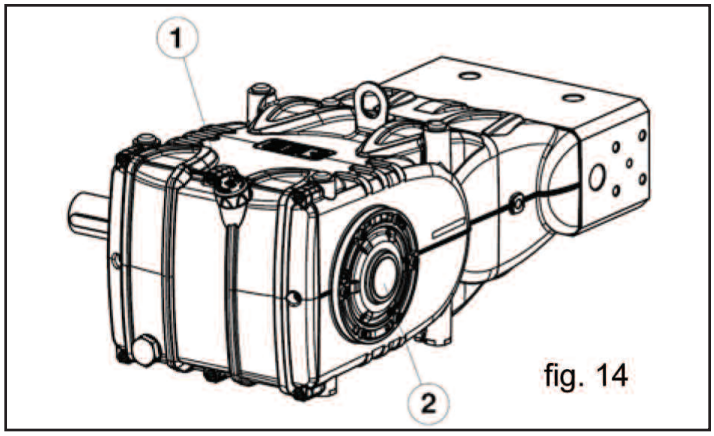


fig. 14

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

10.2 Start-up

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

10.3 Seal Packing Cooling Circuit

During operation, a certain amount of water coming from the seal packing cooling circuit is discharged from orifice 4 (see fig. 15). The draining of this circuit must be sent back to the suction line before the booster pump (fig. 15), or in an appropriate tank.

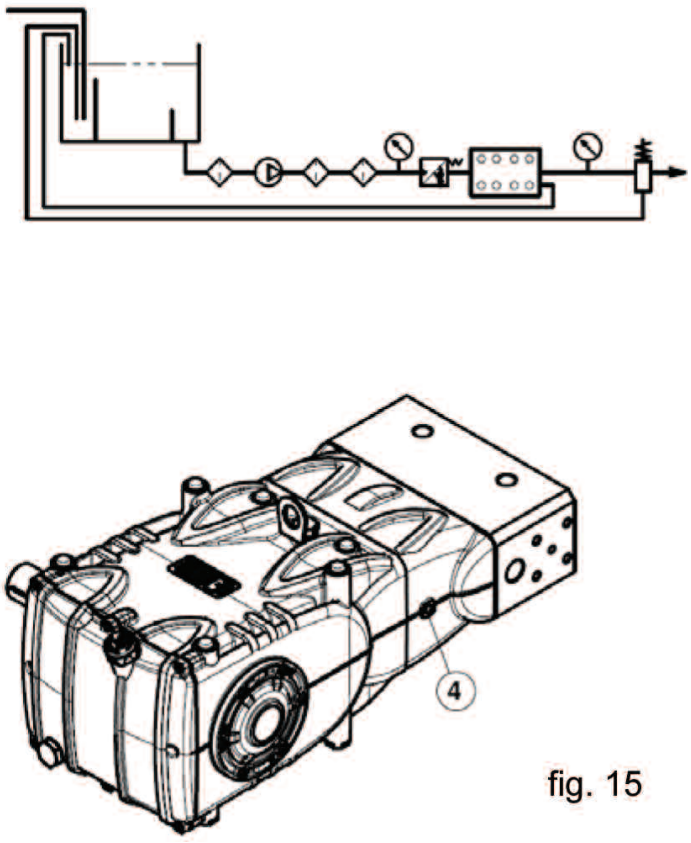


fig. 15

11. PREVENTIVE MAINTENANCE

To guarantee pump reliability and efficiency, respect the maintenance intervals as indicated in the table in fig. 16.

PREVENTIVE MAINTENANCE	
EVERY 500 HOURS	**EVERY 1000 HOURS**
Check oil level	Change oil
	Check / Replace: • Valves • Valve seats • Valve springs
	Check / Replace: • H.P packings • L.P. packings

12. STOPPING THE PUMP FOR LONG PERIODS

12.1 Inactivity for Long Periods

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

12.2 Filling the Pump With an Anti-Corrosion Emulsion or Anti-freeze Solution by Using an External Diaphragm Pump as in the Layout Shown in Paragraph 9.6, fig. 6

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

12.3 Hoses

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

13. PRECAUTIONS AGAINST FREEZING

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

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

14. WARRANTY TERMS

The duration and the terms of the warranty are contained in the purchase contract. The warranty is void if:

a) The pump has been used for purposes that differ from that agreed.
b) The pump has been fit with an electric or diesel engine with performance greater than that indicated in the table.
c) The required safety devices were maladjusted or disconnected.
d) The pump was used with accessories or spare parts not supplied by General Pump.
e) Damage was caused by:
   1) improper use
   2) the non-observance of maintenance instructions
   3) use not compliant with operating instructions
   4) insufficient flow rate
   5) faulty installation
   6) incorrect positioning or sizing of the hoses
   7) non-authorized design changes
   8) cavitation

15. TROUBLESHOOTING

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

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

The pump pulses irregularly (knocking):

- Air suction
- Insufficient feeding
- Bends, elbows, fittings along the suction line obstruct the fluid's passage
- The inlet filter is dirty or too small
- The booster pump, where provided, supplies insufficient pressure or flow rate
- The pump is not primed due to insufficient head or the delivery line is closed during priming

The pump pulses irregularly (knocking):(cont)

- The pump is not primed due to valve seizing
- Worn valves
- Worn pressure packings
- Incorrect operation of the pressure adjust ment valve
- Transmission problems

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

- Insufficient feeding (see the causes listed above)
- RPM are less than the rated flow
- Excessive amount of water by-passed by the pressure adjustment valve
- Worn valves
- Leakage from the pressure packings
- Cavitation due to:
  1) Wrong sizing of the suction hose/ undersized diameters
  2) Insufficient flow rate
  3) High water temperature

Insufficient pump pressure:

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

Overheated pump:

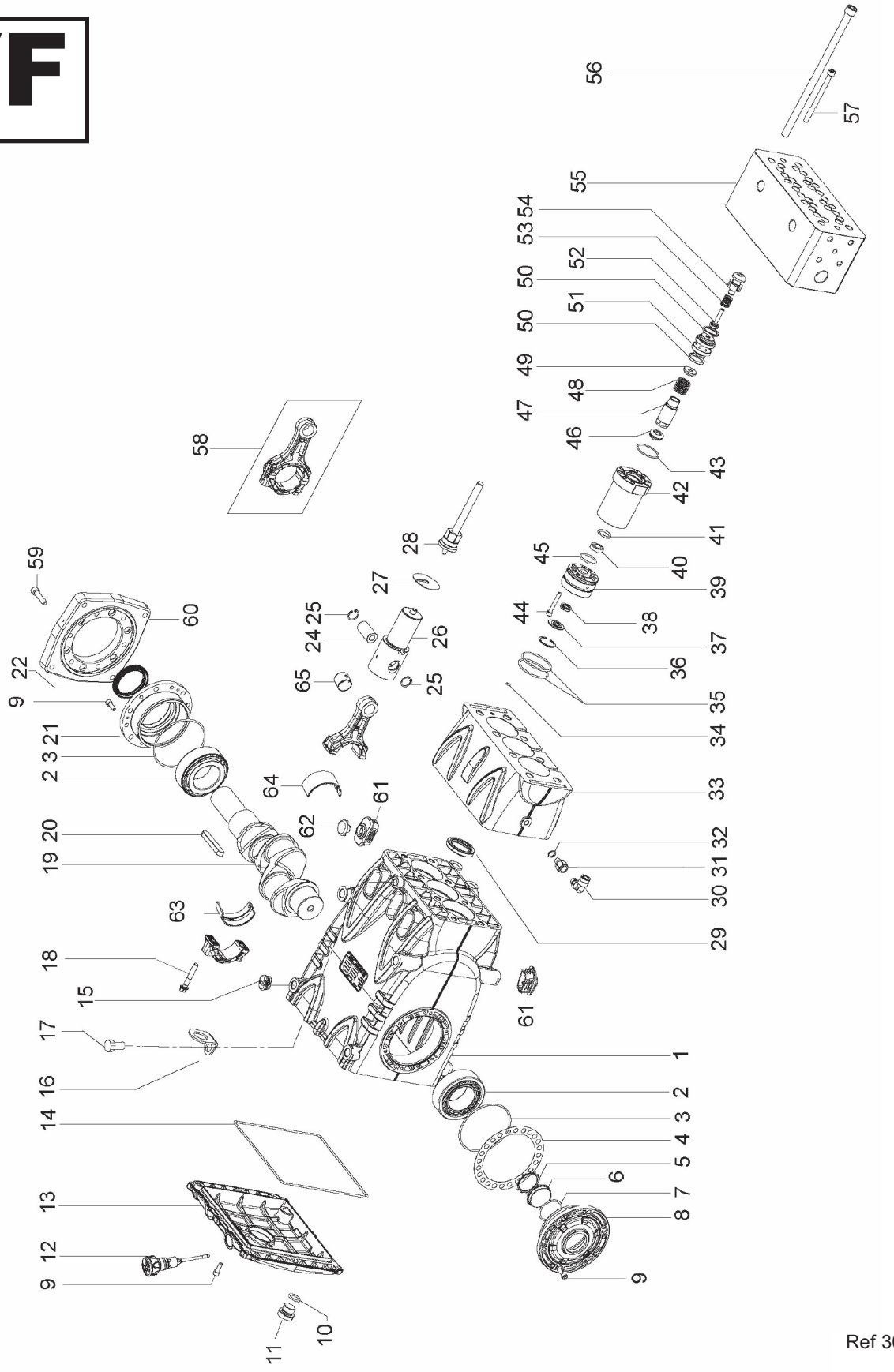
- The pump is overloaded (pressure or RPM exceed the rated values)
- Oil level is too low, or the oil is not of a suit able type, indicated in Chapter 7 (see paragraph 7.4)
- Excessive belt tension or incorrect alignment of the joint or the pulleys
- Excessive inclination of the pump during operation

Hose vibrations or knocking:

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

16. EXPLODED VIEW AND PARTS LIST

VF



Item	Part #	Description	QTY.
1	71010022	Pump Crankcase	1
2	91859000	Roller Bearing	2
3	90391800	O-ring, Ø 94.92 x 2.62	2
4	F71220581	Shim, .35 mm	*
	F71220381	Shim, .25 mm	*
	F71220081	Shim, .1 mm	*
5	90075600	Ring, Ø 45	1
6	70211801	Oil Level Indicator	1
7	90387700	O-ring, Ø 39.34 x 2.62	1
8	F71150122	Oil Level Indicator, Side Bearing Cover	1
9	99186700	Screw, M6 x 18	20
10	90384100	O-ring, Ø 17.13 x 2.62	1
11	F98218300	Plug, G 1/2" x 13	1
12	98212000	Dipstick	1
13	F71160022	Crankcase Cover	1
14	F90400000	O-ring, Ø 215 x 3	1
15	98206000	Plug for Ø 15 Port	6
16	F71223074	Lifting Eye Bolt	1
17	F99512000	Screw, M16 x 1.5 x 25	1
18	F99313800	Connecting Rod Screw, M8 x 48	6
19	F71020035	Crankshaft	1
20	F91500000	Crankshaft Key	1
21	F71150022	Motor Side Bearing Cover	1
22	90170000	Ring, Ø50 x 65 x 8	1
23	F71030701	Connecting Rod	3
24	F97743000	Pin, Ø 20 x 38	3
25	F90060600	Seal, Ø 20	6
26	71050015	Plunger Guide	3
27	96714000	Wiper, Ø 10 x 50 x 1	3
28	F71040802	Plunger, Ø 14 (VF14)	3
	F71040702	Plunger, Ø 12 (VF12)	3
29	90167800	Seal, Ø 38 x 52 x 7	3
30	F96416000	Connector, 90 degree, G 1/4" M	1
31	F21223566	Connector, Ø2.5, 1/8"M X 1/4"F	
32	96710000	Wiper, Ø 10 x 14 x 1.5	1
33	F71165020	Spacer	1
34	F90366300	O-ring, Ø 4 x 2	1
35	90389100	O-ring, Ø 52.07 x 2.62	6
36	F90067200	Seal, Ø 30	3

Item	Part #	Description	QTY.
37	F71216866	Packing Ring, VF14	3
	F71216766	Packing Ring, VF12	3
38	F90260400	L.P. Packing, VF14	3
	F90258800	L.P. Packing, VF12	3
39	F71214866	Packing Support, VF14	3
	F71214766	Packing Support, VF12	3
40	F71211470	Gasket, VF14	3
	F71211370	Gasket, VF12	3
41	F71224668	Anti-extrusion Ring, VF14	3
	F71224368	Anti-extrusion Ring, VF12	3
42	F71060066	Sleeve	3
43	F90370200	O-ring, Ø 38 x 2	3
44	F99194400	Screw M6 x 40	30
45	90386100	O-ring, Ø 26.65 x 2.62	3
46	F90260600	H.P. Packing, VF14	3
	F90259000	H.P. Packing, VF12	3
47	F71211782	Plunger Gasket, VF14	3
	F71211682	Plunger Gasket, VF12	3
48	F94751800	Spring, Ø 21.6 x 37	3
49	F36205366	Valve Plate	3
50	F93186500	Gasket, Ø 24 x 29 x 3.8	6
51	F36205266	Plunger Valve Seat, VF14	3
	F36205166	Plunger Valve Seat, VF12	3
52	F36205666	Valve	3
53	F94742300	Spring, Ø 13.9 x 23	3
54	F36205570	Valve Guide	3
55	F71127056	Manifold	1
56	F99455000	Screw, M12 x 60	8
57	F99455000	Screw, M8 x 100	24
59	99309900	Screw, M8 x 35	6
60	F10067720	Motor Flange-Optional	1
61	F71225851	Plig Cover	6
62	F71225951	Crankcase Plug Cover	3
63	F90924300	Babbitt Bearing, Non-load Side, With Groove	3
	F90924400	Babbitt Bearing, Non-load Side, With Groove, +0.25	3
	F90924500	Babbitt Bearing, Non-load Side, With Groove, +0.50	3
64	F90924000	Babbitt Bearing, Load Side, Smooth	3
	F90924100	Babbitt Bearing, Load Side, Smooth, +0.25	3
	F90924200	Babbitt Bearing, Load Side, Smooth, +0.50	3
65	F90911000	Bronze Bushing	3

REPAIR KITS

F2037 (Plunger Packing Kit-VF12)	F2035 (Plunger Packing Kit-VF14)	F2038 (Valve Seals Kit)	F2036 (Complete Seals Kit-VF12)	F2039 (Complete Seals Kit-VF14)	F2109 (Inlet/Outlet Valves Kit-VF12)	F2110 (Inlet/Outlet Valves Kit-VF14)	F2135 (Babbit Bearing Set)	F2154 (Babbit Bearing Set, +0.25)	F2155 (Babbit Bearing Set, +0.50)
34, 35, 38, 40, 41, 43, 45, 46,	34, 35, 38, 40, 41, 43, 45, 46,	50	3, 7, 10, 14, 22, 29, 34, 35, 38, 40, 41, 43, 45, 46, 50	3, 7, 10, 14, 22, 29, 34, 35, 38, 40, 41, 43, 45, 46, 50	48, 49, 50, 51, 52, 53, 54	48, 49, 50, 51, 52, 53, 54	63, 64	63, 64	63, 64

MAINTENANCE LOG

	HOURS & DATE						
OIL CHANGE							
GREASE							
PACKING REPLACEMENT							
PLUNGER REPLACEMENT							
VALVE REPLACEMENT							

GENERAL PUMP

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