GENERAL PUMP

HF/N

Serial #10127003 and Later

Owner's Manual

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

HF18 - HF20 - HF22 - HF25 WK355

HF25N

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

General Pump is a member of the Interpump Group

Ref 300764 Rev. J
04-24

INDEX

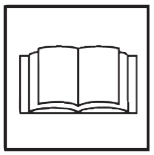
1. INTRODUCTION

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

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

2. SYMBOL DESCRIPTIONS

Warning
Potential Danger



Read carefully and understand the manual before operating the pump

Danger
Electrocution Danger

Danger
Wear protective mask

Danger
Wear goggles

Danger
Wear protective gloves

Danger
Wear protective boots

3. SAFETY

3.1 General Warnings for Safe Operation

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

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

3.2 High Pressure Unit Safety Requirements

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

3.3 Safety of Operation

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

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

1. Make sure that proper water is supplied to the pump and that it is properly powered(see chapter 9 par. 9.5)
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. Attention: Outer surfaces may reach high temps, 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 an 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 them self and of other persons who may be affected by their 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 their arms.

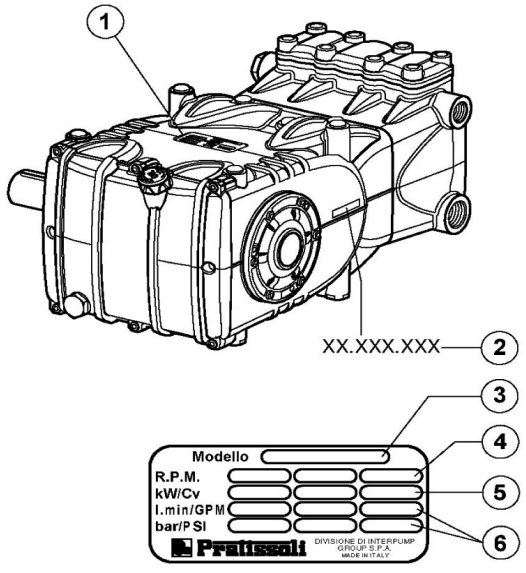
NOTE: *it must be emphasized that whereas protective clothing provides adequate protection against spray and flying particles, it does not constitute complete protection protection against the direct impact of the water jet. Additional protections in the form of suitable metal shields or barriers may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

3. In most jetting operations it is an accepted practice to employ a team of operators consisting of at least 2 members capable of giving mutual and immediate assistance in case of emergency and for taking turns during long and demanding operations.
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 During System Maintenance

1. The high pressure water unit should be maintained in accordance with the Manufacturer's instructions.
2. The unit should be maintained only by authorized 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.

Fig. 1



4. PUMP IDENTIFICATION

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

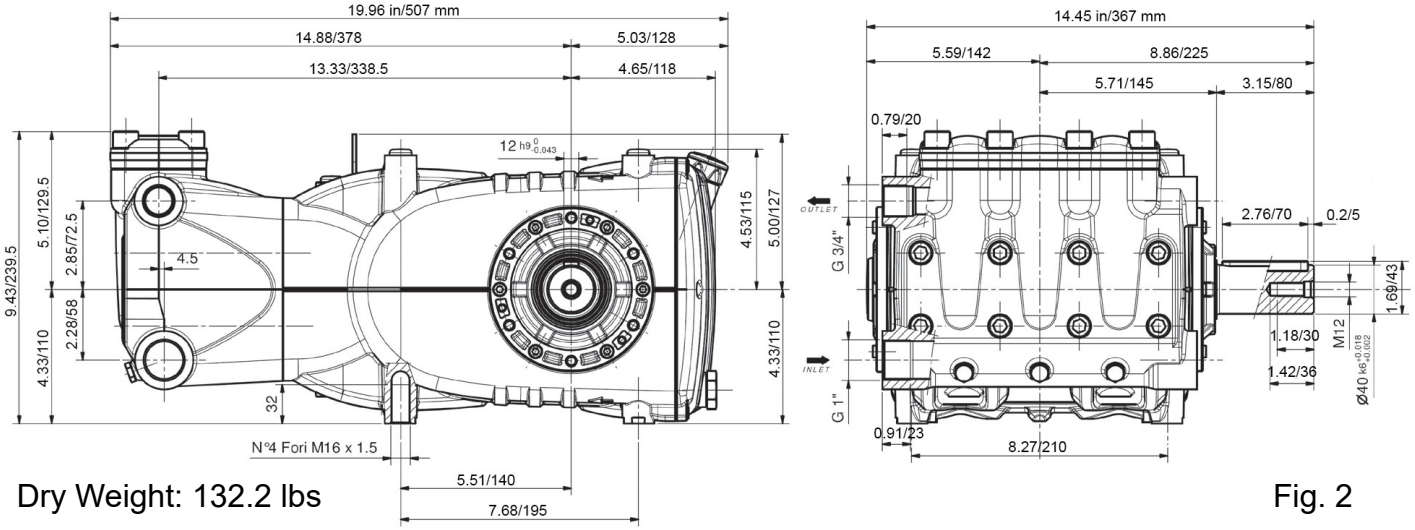
2. Serial number
3. Pump model and version
4. Max RPM
5. Power absorbed
6. Max flow rate (l/min) and pressure (bar)

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

5. TECHNICAL FEATURES

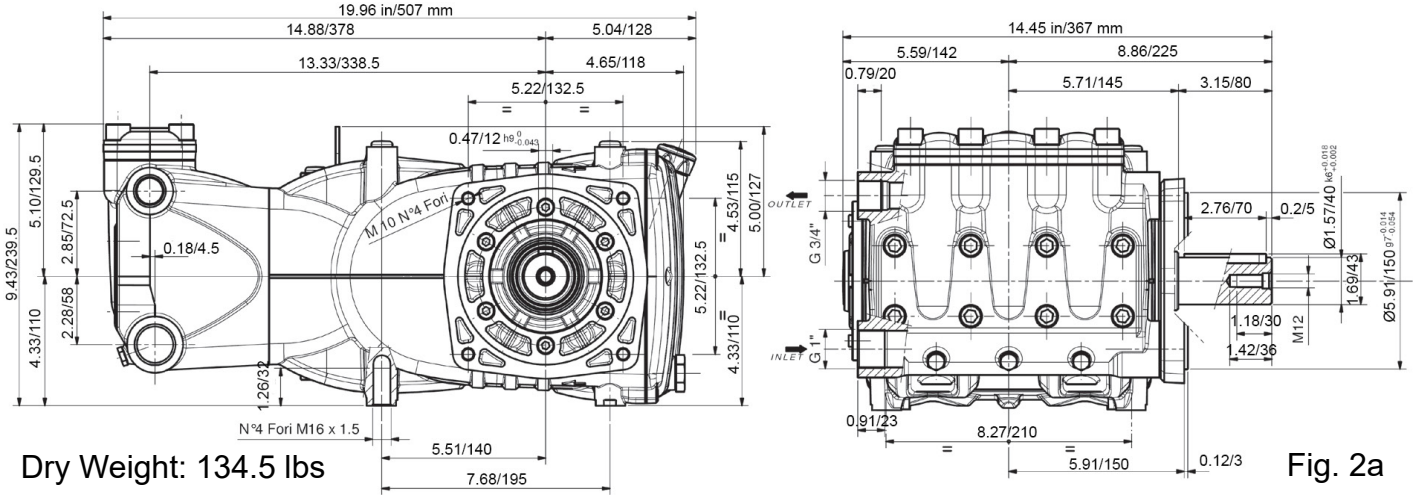
Model	RPM	Flow Rate		Pressure		Power	
		l/min	GPM	bar	PSI	kW	HP
HF18	800 1000	30 38	8.1 10.1	600 500	8700 7250	35.5 36.8	48 50
HF20	1000	47	12.4	400	5800	36.8	50
HF22	800 1000	45 57	12 15	400 350	5800 5070	35.5 36.8	48 50
HF25 HF25N HF25N-F	1000	73	19.3	280	4060	36.8	50
WK355	1000	57	15.1	350	5075	38.1	51.8

6. DIMENSIONS AND WEIGHT



Dry Weight: 132.2 lbs

Fig. 2



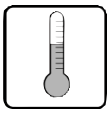
Dry Weight: 134.5 lbs

Fig. 2a

7. GENERAL INFORMATION ABOUT PUMP USE

The HF pump has been designed to operate in environments with atmospheres that are not potentially explosive, with filtered water (see par. 9.7) and at a maximum temperature of 104° F (40° C). Other liquids can be used only upon approval by **Customer Service Department.**

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. The maximum permissible water temperature is 104° F (40° C). However, the pump can be used with water temperature of 140° F (60° C), but only for a short period of time. In this case, it is best to consult **Customer Service Department.**

7.2 Maximum Pressure and Flow Rate

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

7.3 Lowest operating RPM

The lowest operating speed allowed for these types of pumps is 100 RPM for non-continuous periods; any rpm other than as shown in the performance table (see chapter 5) must be expressly and authorized **Customer Service Department.**

7.4 Vibration

The detection of vibration shall be carried out only with the pump set up on the plant and at the performance declared by the customer. Values must be in accordance with regulations.

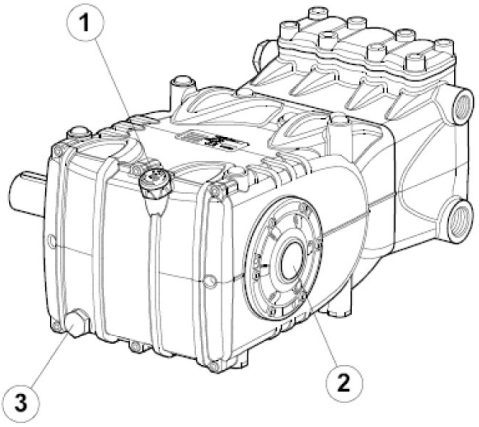
7.5 Brands and Types of Oil Recommended

The pump is supplied with oil suitable for room temperatures for 32° F to 86° F (0° C to 30° C).
Some types of recommended oil are indicated in the table below, these oils have additives to increase corrosion resistance and fatigue resistance (DIN 51517 Part 2). Alternatively you can also use Automotive Gear SAE 85W-90 oil.

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

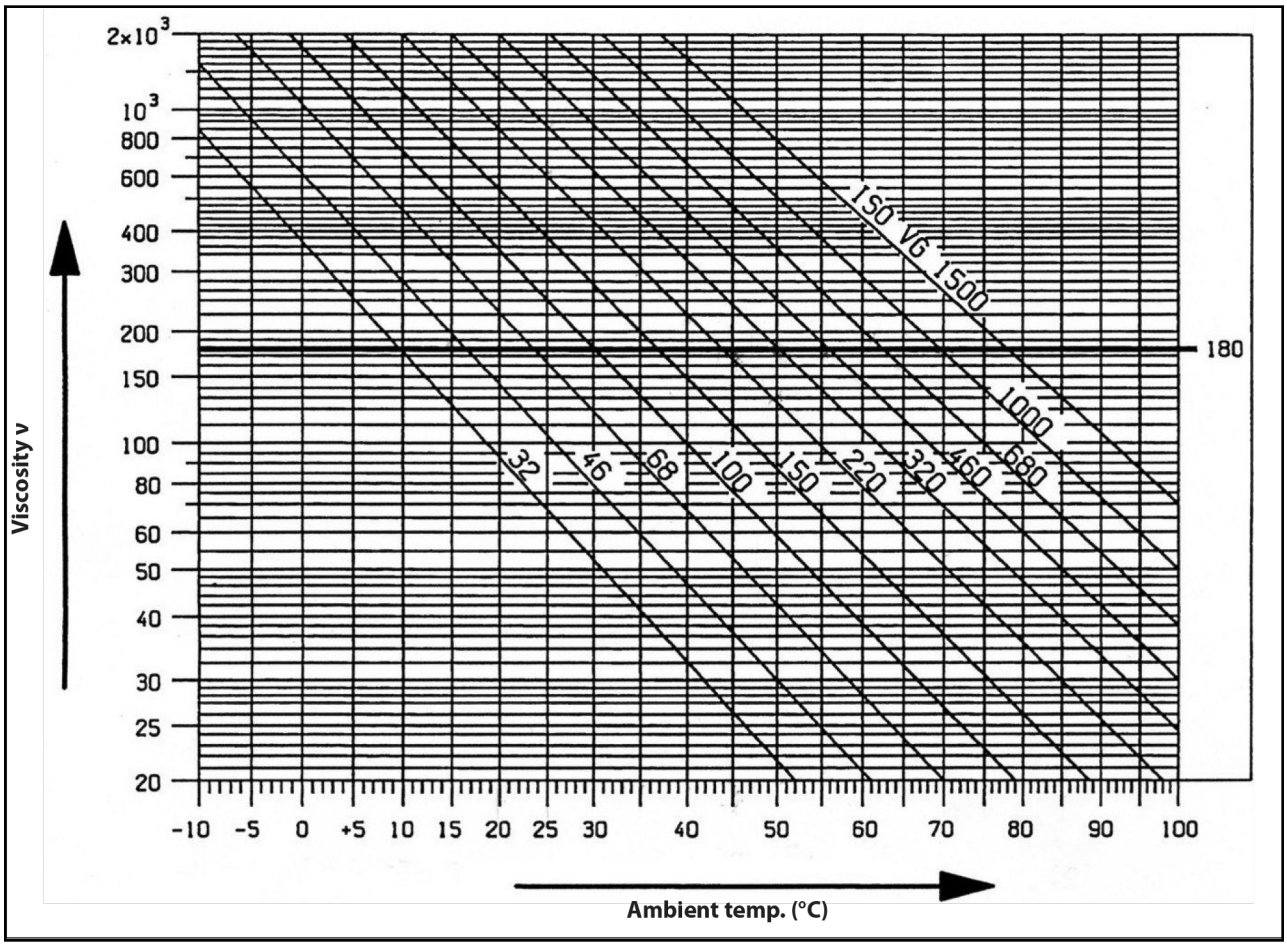
Check the oil level and top up if necessary using the oil dipstick pos. 1, Fig. 3.
The correct checking of the oil level is made with the pump not running, at room temperature. The oil change must be made with the pump at working temperature, removing: the oil dipstick, pos. 1, and then the plug pos. 2, fig. 3. The oil check and change must be carried out as indicated in the table in fig. 14 chapter 11.
The quantity required is 128 oz (3.8 litres).

Fig. 3



In any case oil must be changed at least one a year, as it is degraded by oxidation.

For room temperatures other than 32° F to 86° F (0° C to 30° C), follow the instructions in the following diagram, considering that oil must have a minimum viscosity of 180 cSt.

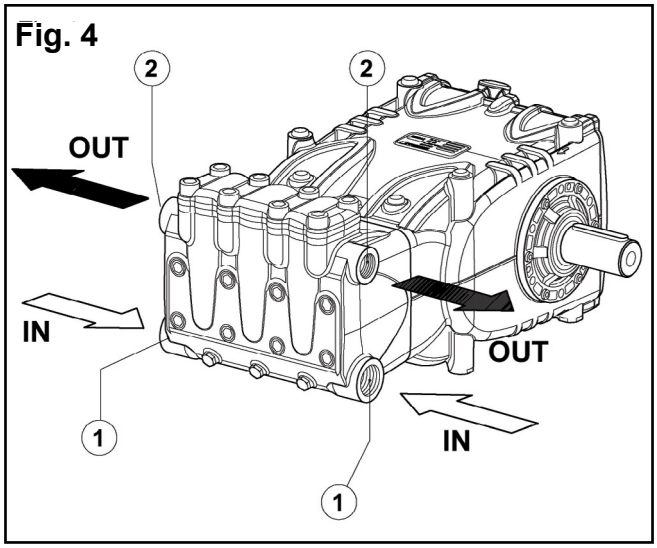


The used oil must be properly disposed of at an authorized recycling center. Under any circumstances, do not release used oil into the environment.

8. CONNECTIONS AND PLUGS

HF pumps are provided with (Fig. 4):
1 - 2 inlet ports IN Ø 1" NPT
Either inlet port can be used; the one not used must be hermetically plugged.
2 - 2 outlet ports OUT Ø 3/4" NPT

Fig. 4



9. PUMP INSTALLATION

9.1 Positioning

The pump must be installed on a rigid and perfectly flat and horizontal base by means of the proper four M16 x 1.5 threaded feet. Tighten the screws to 155 ft lbs (210 Nm). The base should be rigid enough to avoid any misalignment or flexing on the pump/transmission coupling axis due to the torque involved during operation.
The unit should not be rigidly fixed on the floor but be installed upon vibration dampeners. For special applications contact our technical department.

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

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

Never use rigid coupling on the shaft.

The following transmission types are suggested:
- Hydraulic by means of a flange
- Pulleys
- Cardan joint (within the max working angles indicated by the manufacturer).
- Flexible coupling

9.2 Direction of Rotation

An arrow situated on the crankcase near the shaft indicates the correct direction of rotation. Fig. 5 shows the direction of rotation looking at the pump from the fluid end side.

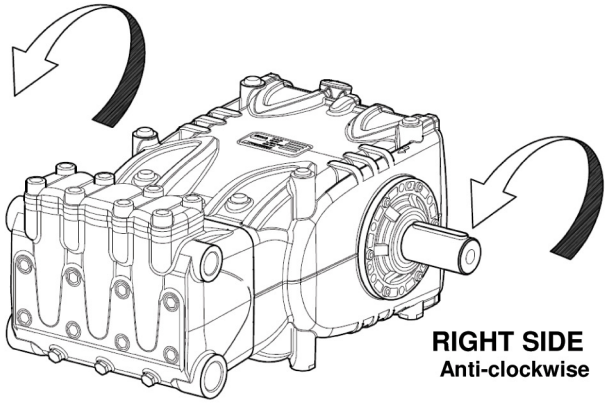


Fig. 5

9.3 Version Change

The pump version is defined as right when:
Observing the pump facing the head side, the pump shaft must have a PTO shank on the right side.
The pump version is defined as left when:
Observing the pump facing the head side, the pump shaft must have a PTO shank on the left side.
Note. The version shown in Fig. 5 is right.

The pump can only be modified by trained and authorized personnel and carefully following the instructions below:

1. Separate the hydraulic part from the mechanical part as indicated in chapter 2 par. 2.2.1 of the Repair Manual.
2. Turn the mechanical part 180° and reposition the rear casing cover in such a way that the oil dipstick is turned upward. Reposition the lifting bracket and relative hole closing plugs in the upper part of the casing. Finally, properly reposition the specification label in its housing on the casting.

Make sure that the lower casing draining holes in correspondence with the pistons are open and not closed from the plastic plugs provided for the previous version.

3. Unite the hydraulic part to the mechanical part as indicated in chapter 2 par. 2.2.5 of repair manual.

9.4 Hydraulic Connections

In order to isolate the system from vibrations produced by the pump, it is advisable to make the first section of the duct adjacent to the pump (both suction and outlet) with flexible piping. The suction hose must be sufficiently rigid to prevent deformation due to the negative pressure exerted by the action of the pump.

9.5 Pump Supply

To obtain the best volumetric efficiency, feed the pumps with a positive head (NPSHr).
The recommended value, measured on the head suction flange, is given in the following table:

	HF18	HF20	HF22	HF25
$NPSH_r$(m)	2.5	4.0	4.0	4.5

The values given apply to the rated speed of rotation; otherwise, contact our Customer Service Department.

For any supply conditions other than those specified above, contact our Customer Service Department.

9.6 Inlet Line

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

1. The minimum internal diameter as indicated in the graph in par. 9.9 and in any case equal to or exceeding that of the pump head.

Localized restrictions should be avoided along the piping, as these can cause pressure drops resulting in cavitation. Avoid 90° elbows, connections with other piping, restrictions, reverse gradients, inverted U-curves and Tee connections.

2. The layout must be such as to prevent cavitation problems.
3. It should be perfectly airtight.
4. It must be positioned in such a way to prevent the pipe emptying after the pump stops.
5. Do not use 3 or 4-way hydraulic fittings, adapters, swivel joints, etc. as they could jeopardies pump performance.
6. Do not install any kind of detergent injector along the suction line.
7. Avoid use of foot valves or other types of unidirectional valves.
8. Do not recirculate the by-pass valve drain directly to the suction line.
9. Provide for proper guards inside the tank to prevent that water flow from the bypass and the tank supply line can create vortexes or turbulence near the pump supply pipe port.
10. Make sure the inlet line is thoroughly clean inside before connecting it to the pump.

9.7 Filtration

With a manually activated control valve

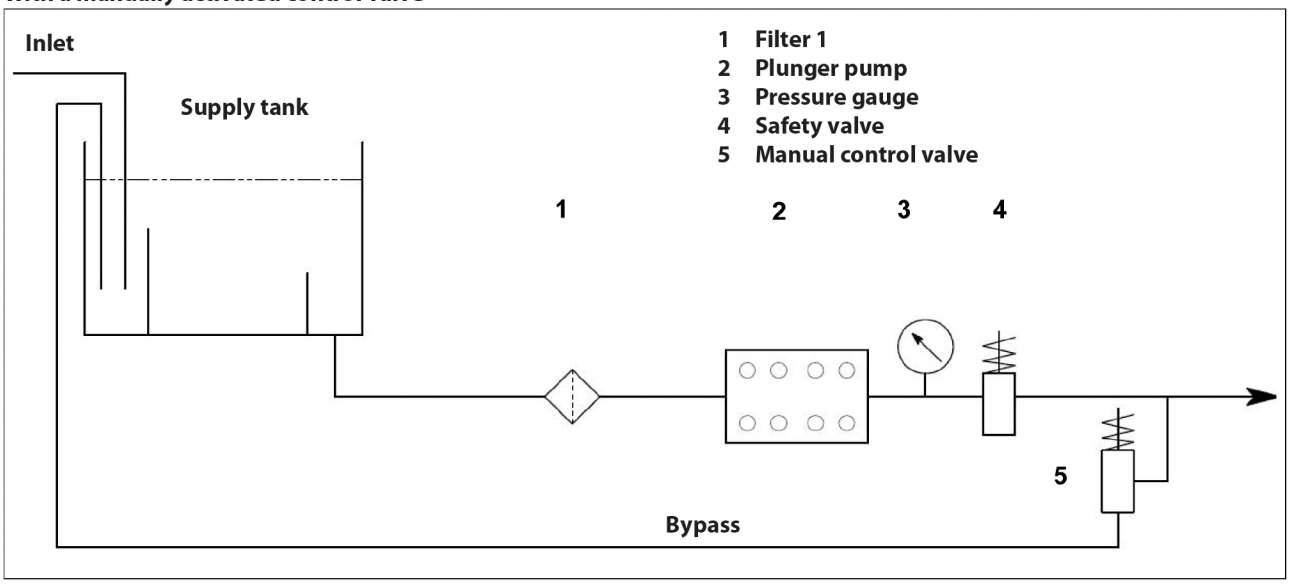


Fig. 6

With pneumatic control valve

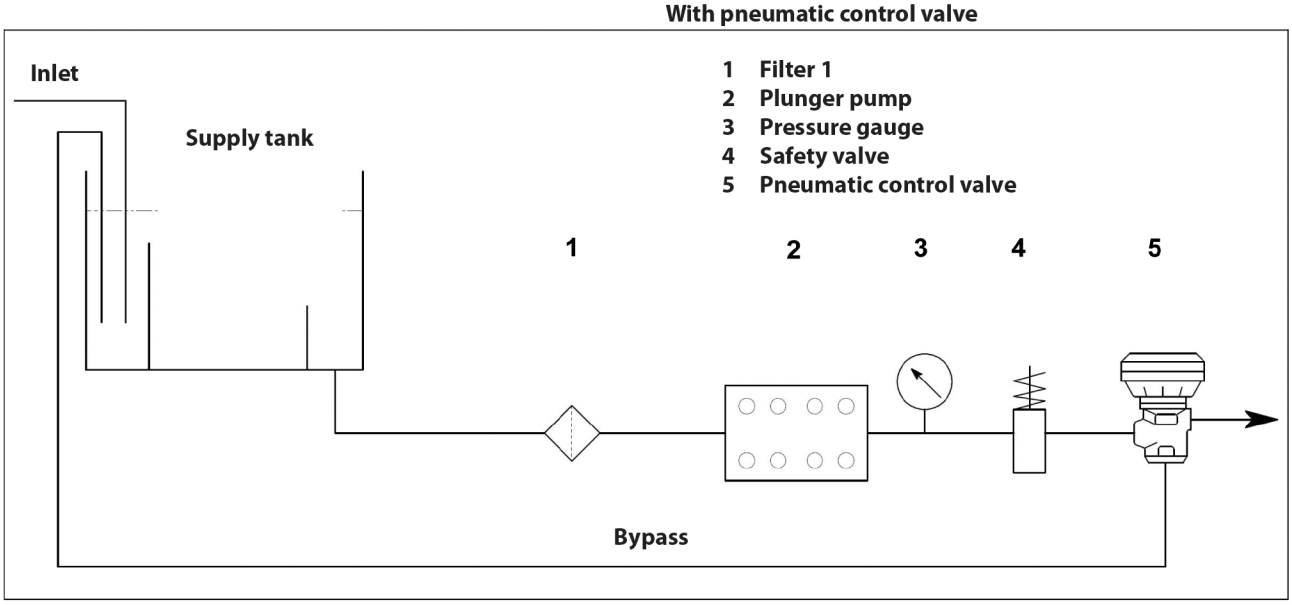


Fig. 6/a

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).

For smooth pump operation, regular filter cleaning is necessary, planned according to the actual use of the pump in relation to the quality of water used and actual clogging conditions.

9.8 Outlet Line
For a correct delivery line comply with the following instructions:

1. The internal diameter of the pipe must be sufficient to ensure correct fluid velocity, see graph in par 9.9.
2. The first section of the line connected to the pump outlet must be a flexible hose, in order to isolate vibration produced by the pump from the rest of the system.
3. Use high pressure hoses and fittings to ensure high safety margins in all operating conditions.
4. The outlet line must always be provided with a Max. pressure valve.
5. Use pressure gauge capable of withstanding the pulsating loads typical of plunger pumps.
6. During design, keep in mind the line pressure drops that lead to a pressure measured at the pump.
7. If necessary, the effects of the pump pulsations can be reduced by installing a proper pulsation dampener in the pressure line.

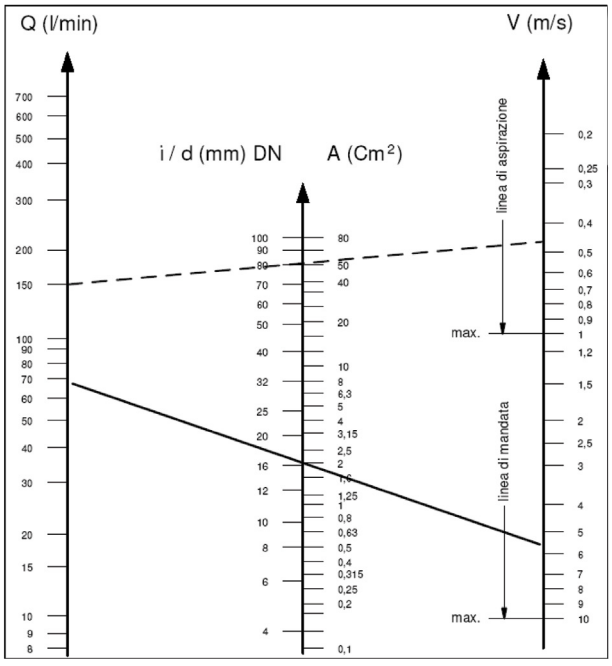
9.9 Internal Diameter of Hose

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

Inlet Hose
With a flow rate of ~74 l/min and a water velocity of 0.5 m/sec. The graph line joining the two scales meets the central scale showing the diameters, corresponding to a value of ~55 mm.

Outlet Hose
With a flow rate of ~74 l/min and a water velocity of 0.5 m/sec. The graph line joining the two scales meets the central scale showing the diameters, corresponding to a value of ~19 mm.

Optimal speeds:
- Inlet: ≤ 0.5 m/sec.
- Outlet: ≤ 5.5 m/sec.



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

If necessary, contact our technical department.

9.10 V-Belt Transmission

The pump can be controlled by a V-belt system. For this pump model, we recommend use of 4 XPB belts (16.5 x 13 serrated). Use an XPC profile only for long durations. Both the characteristics and transmissible power of each belt can verified in the diagram in fig. 7, in relation to the number of rpm normally declared by the manufacturer. Minimum duct pulley diameter (on pump shaft): ≥ 250 mm. The radial load on the shaft must not exceed 5532 Ft lbs (7500 N) (value necessary for layout definition). The transmission is considered adequate if the load is applied to a maximum distance a=1.57 in (40 mm) from the shaft shoulder (P.T.O) as shown in fig. 10.

For dimensions differing from those specified above, contact our **Customer Service Department.**

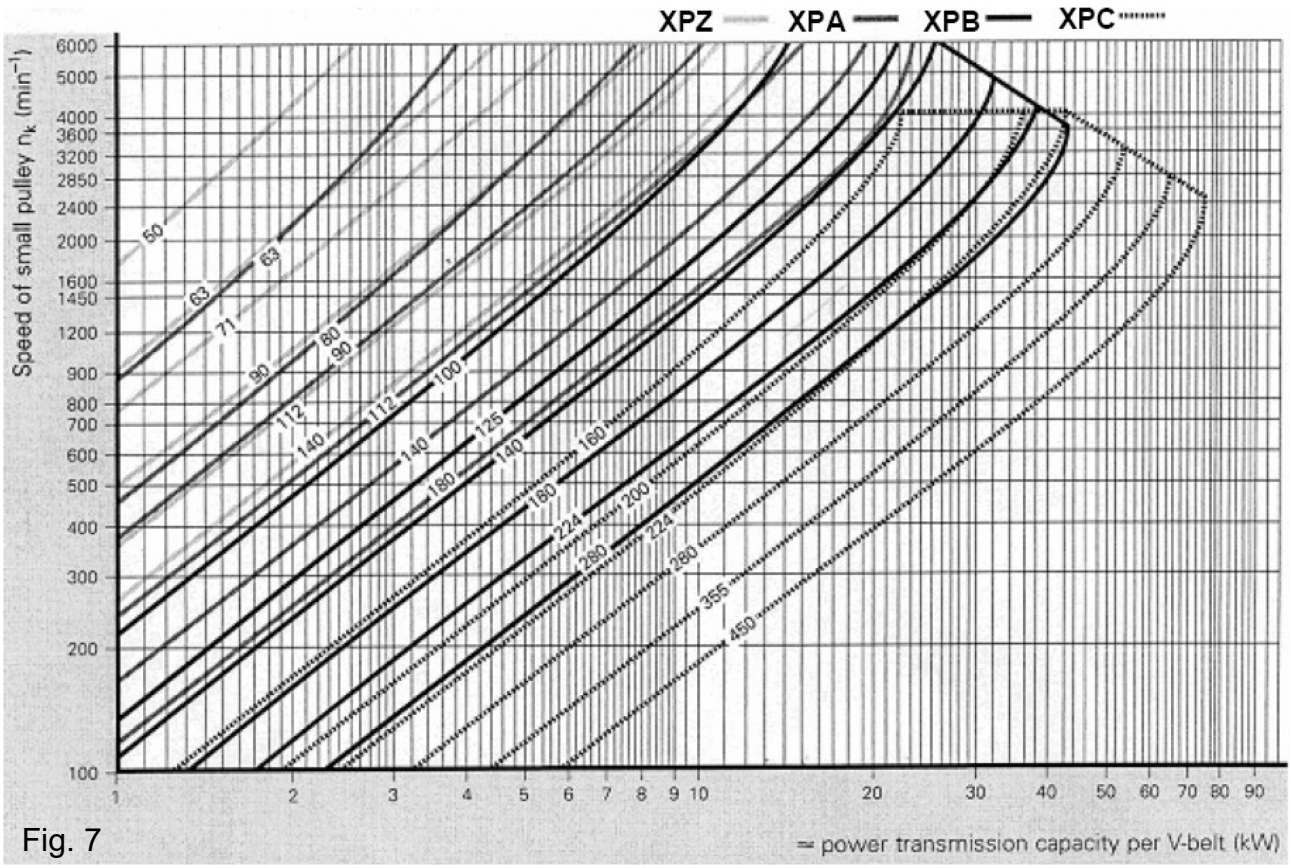


Fig. 7

9.11 Transmission Definition

To prevent irregular radial loads on the shaft and the relative bearing, follow these directions:

A) Use pulleys with V-belts with the size of the groove required/recommended by the manufacturer of belt used. In the absence of directions, follow fig. 8 and the table in fig. 9.

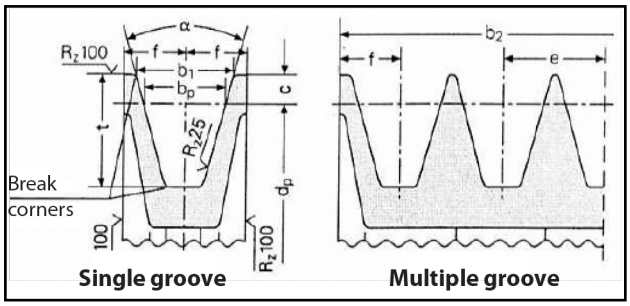


Fig. 8

Dimensions (in mm)

Belt section as per DIN 7753 part 1 and B.S. 3790		DIN symbol symbol B.S./ISO		XPB/SPB SPB	XPC/SPC SPC
Belt section as per DIN 2215 and B.S. 3790		DIN symbol symbol B.S./ISO		17 B	22 C
Pitch width			b_w	14.0	19.0
Increased grooving width $b_1 \approx$		α = 34°		18.9	26.3
		α = 38°		19.5	27.3
			c	8.0	12.0
Distance between grooving			e	23 ± 0.4	31 ± 0.5
			f	14.5 ± 0.8	20.0 ± 1.0
Increased grooving depth			t_{min}	22.5	31.5
α	34°	by primitive diameter narrow-section V-belts DIN 7753 part 1	d_w	from 140 to 190	from 224 to 315
	38°			> 190	> 315
α	34°	by primitive diameter classic section V-belts DIN 2215	d_w	from 112 to 190	from 180 to 315
	38°			> 190	> 315
Tolerance for α = 34°-38°				± 1°	± 30'
Pulleys for b2 by grooving number 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
Minimum pulley diameter must be respected. Do not use laminated V-belts.					

Fig. 9

B) Use high performance belts - for example **XPB** instead of **SPB** - as a lower quantity of belts for the same transmitted power may be necessary and a consequent shorter resulting distance compared to the shaft shoulder (P.T.O) “a” fig. 10.

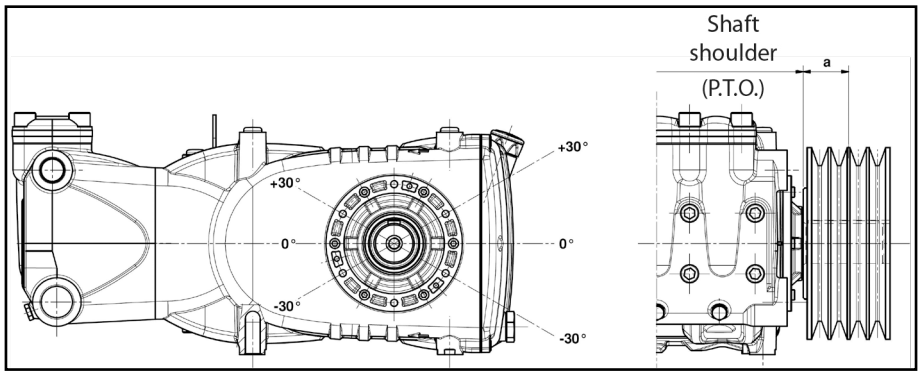


Fig. 10

C) Pull the belts according to manufacturer instructions. Excessive pulling can cause reduced bearing life and wear out the pulley prematurely. Pulling depends on different variables as indicated in par. 9.12.
D) Belt length has a natural tolerance ≥ 0.75%. For this reason, the 2 belts must be purchased as a pair.
E) Follow the direction of the belt pull as shown in fig. 9 for other needs, contact out **Customer Service Department.**
F) Take care of the alignment of the driving pulley and driven pulley grooves.

9.12 Static Pull to Apply on Belts

Static pull depends on:
A) The wheelbase between the two pulleys (belt length).
B) The load due to static pull of the belt.
C) The number of belts.
D) The winding angle of the smallest pulley.
E) Average speed.
F) Etc.

Value of the static pull to be applied can be obtained from the diagram in fig. 11 for belts with an XPB profile in relation to the wheelbase.

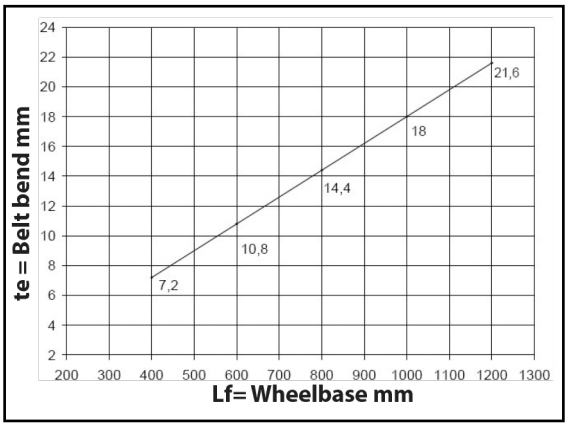
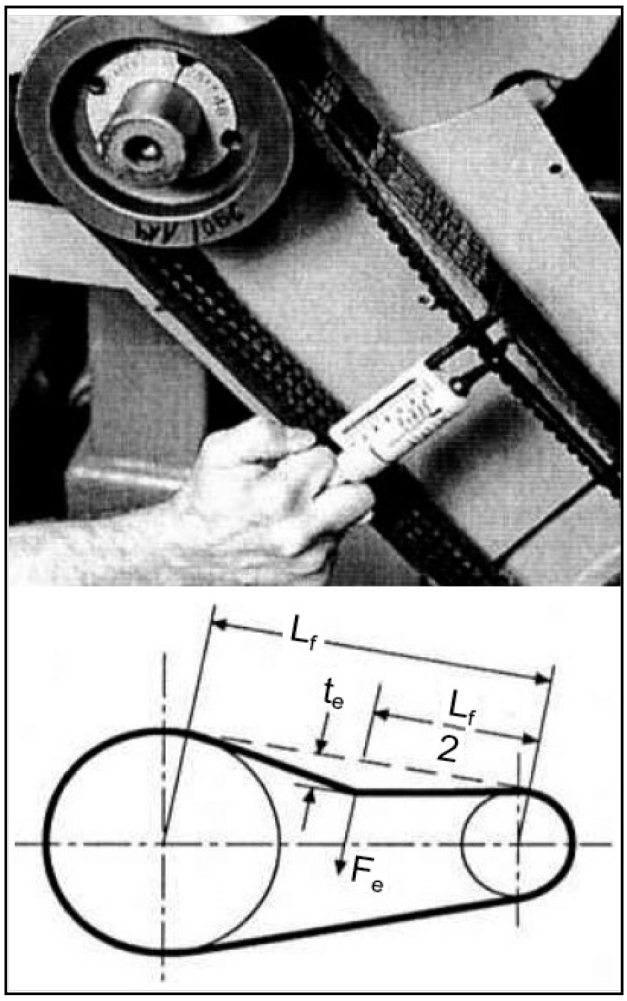


Fig. 11

Conclusion: with a wheelbase of 23.62 (600 mm) and with a dynomometer, loading the belt branch with 16.86 ft lbs (75 N) as indicated in fig, a “te” bend of approximately 0.43 in (10.8 mm) is obtained.



Lf = Wheelbase
te = Belt bend
Fe = 75 N Dynamometer load

Fig. 12

Note 1 • Unless otherwise stated by the supplier of the belts, control of proper pull and its relative re-tensioning should be performed after no less than 30 minutes of motion necessary for the normal adjustment of the belts. Best performance and durability will be achieved with proper tensioning.
Note 2 • In case of necessity or for routine maintenance, never replace a single belt but the complete set.

9.13 Transmission of Power From the Second PTO

Upon request, HF series pumps can be supplied with an auxiliary PTO on the opposite side to the driver (transmission of power from the second PTO).

Transmission can be carried out:
- By means of the V-belt
- By means of the joint

By means of the V-belts, withdraw-able Max Torque is:
14.61 Ft lbs (65 N) which corresponds to:
7 HP at 750 RPM;
7.4 HP at 800 RPM;
8.3 HP at 900 RPM;
9.3 HP at 1000 RPM;
11.1 HP at 1200 RPM.
By means of the joint, withdraw-able Max Torque is:
29.23 Ft lbs (130 N) which corresponds to:
14 HP at 750 RPM;
14.8 HP at 800 RPM;
16.6 HP at 900 RPM;
18.6 HP at 1000 RPM;
22.2 HP at 1200 RPM.

By means of V-belt, the transmission id considered suitable if: belt pull is applied at a max distance of 0.87 in (22 mm) from the bend shaft shoulder fig. 13 Min diameter of pulley to be used = Ø 100 mm.

With transmission by means of the joint, pay particular attention to perfect alignment so that no transverse forces are generated on the pump shaft.

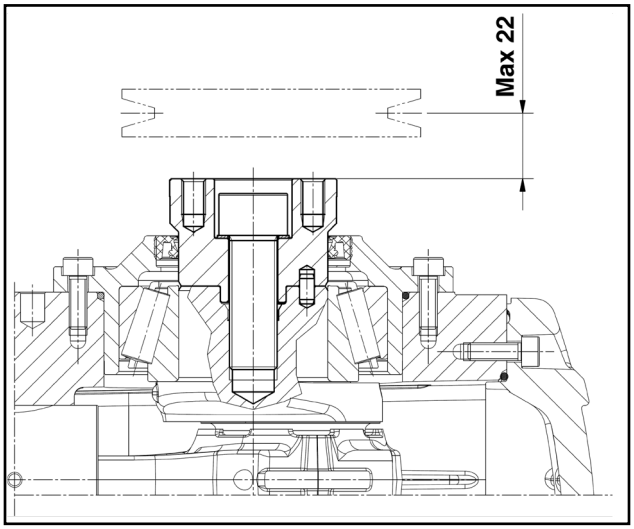


Fig. 13

For applications differing from those specified above, contact our **Customer Service Department.**

10. START-UP OPERATION

10.1 Preliminary Checks

Before start-up, ensure that:

The suction line is connected and pressurized (see par. 9.4 - 9.5 - 9.6) the pump must never run dry.

1. The suction line ensures a hermetic seal over time.
2. Any shut-off valves between the supply source and the pump are fully open. The outlet line is free discharge, to permit rapid expulsion of the air present in the pump manifold and therefore facilitate fast priming.
3. All suction and outlet fittings and connections are properly tightened.
4. The coupling tolerances on the pump/transmission axis (half-joint misalignment, Cardan joint tilt, belt pulling, etc.) remain within limits required by the transmission manufacturer.
5. Oil in the pump casing is at level, verified with a dipstick (fig. 14, pos. 1) and exceptionally with a level indicator (fig. 14, pos. 2).

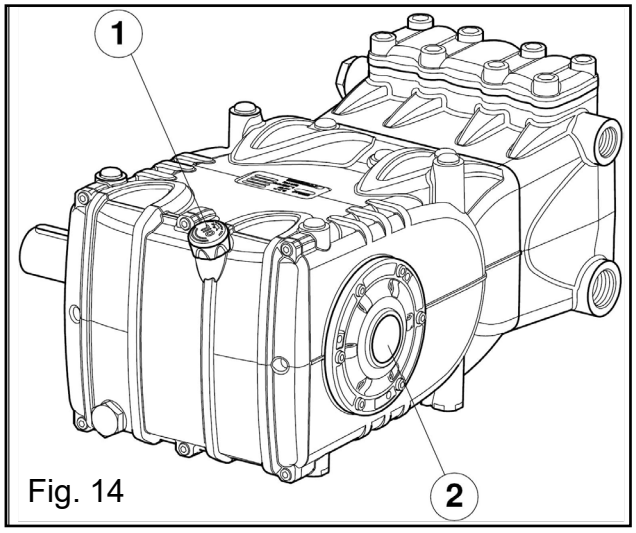


Fig. 14

In case of prolonged storage of long-term inactivity, check proper functioning of the suction and outlet valves.

10.2 Start-Up

1. At first start-up, verify that the rotation direction and the supply pressure are correct.
2. Start-up the pump without any load.
3. Check that the supply pressure is correct.
4. Check that the rotation rpm during operation does not exceed the nominal rpm of the pump.
5. Let the pump run for a period of no less than 3 minutes, before putting it up pressure.
6. Before each pump stop, reset pressure by means of the control valve or with any relieving devices and reduce to a minimum rpm (activation with combustion motors).

11. PREVENTIVE MAINTENANCE

For pump reliability and efficiency, comply with maintenance intervals as shown in the table of fig. 15.

PREVENTIVE MAINTENANCE	
Every 500 hours	**Every 1000 hours**
Check oil level	Change oil level
	Check / Replace: Valves Valve seat Valve springs Valve guides
Fig. 15	Check / Replace: H.P. seals L.P. seals

12. PUMP STORAGE

12.1 Long Term Inactivity

If the pump is started for the first time after a long period from the date of shipment, before operation check the oil level, inspect the valves as specified in chapter 10, then follow described start-up procedures.

12.2 Filling Pump with Anti-Corrosion Emulsion or Anti-Freeze Solution

Method for filling pump with anti-corrosion emulsion or anti-freeze solution using and external diaphragm pump based on the layout shown in par. 9.7, between pos. 1 and pos. 2 of fig. 6 and fig. 6/a:

- In place of the service tank, use a suitable container containing the solution to be pumped.
- Close the filter drainage, if open.
- Make sure that the hoses to be used are clean inside and spread grease on their connections.
- Connect the high pressure exhaust hose to the pump.
- Connect the suction hose to the diaphragm pump.
- Connect the suction hose between the pump head and the diaphragm pump.
- Fill the service container with solution / emulsion.
- Insert the free ends of the suction hoses and the high pressure exhaust hose inside the container.
- Switch on diaphragm pump.
- Pump the emulsion until it exits from the high pressure exhaust pipe.
- Continue pumping for at least another minute.
- Stop the pump and remove the previously connected hose.
- Clean, grease and plug the connections on the pump head.

The characteristics of the emulsion can be strengthened if necessary by adding, for example, Shell Donax.

13. PRECAUTIONS AGAINST FROST

Follow the instructions in chapter 12 in areas and times of the year at risk of frost (see par. 12.2).

In the presence of ice, do not run the pump for any reason until the circuit has been fully defrosted, in order to avoid serious damage to the pump.

14. WARRANTY CONDITIONS

The guarantee period and conditions are contained in the purchase agreement.

A) The pump is used for purposes other than the agreed

B) The pump is driven by an electric motor or internal combustion engine having performance values exceeding those shown in the table.

C) The safety devices have been tampered with or they have been disconnected.

D) The pump has been used as accessories or spare parts not supplied by General Pump.

E) Damage has been caused by:

1) Improper use
2) Failure to follow maintenance instructions
3) Any use different from that described in the operating instructions
4) Lack of sufficient flow rate
5) Defective installation
6) Improper positioning or sizing pipes
7) Unauthorized design modifications
8) Cavitation

15. 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.

THE PUMP KNOCKS:

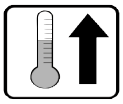
- Air suction.
- Insufficient Suppy.
- Bends elbows, fittings on the suction line are choking the passage of liquid.
- Suction filter is dry or too small.
- The booster pump, where installed, is supplying insufficient pressure or flow rate.
- The pump is not primed due to insufficient head or the outlet is closed during priming.
- The pump is not primed due to valve jamming.
- Worn valves.
- Worn pressure seals.
- Imperfect functioning of the pressure control valve.
- Problems on the transmission.

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.
- Cavitaion due to:
  1) Impropor sizing of suction ducts / undersized diameters.
  2) Insufficient flow rate.
  3) High water temperature.

INSUFFICIENT PUMP PRESSURE:

- The nozzle is (or has become) too large.
- RPM are less than rated
- Excessive leakage from pressure packings
- Excessive leakage from the pressure seal.
- Worn out valves.



OVERHEATED PUMP:

- The pump is working in overpressure conditions or pump rpm is higher than the nominal value.
- Oil in the pump casing is not at level or not the recommended type as stated in chapter 7 (par. 7.6).
- Excess belt tension or joint or pulley alignment is incorrect.
- Excessive pump tilt during operation.

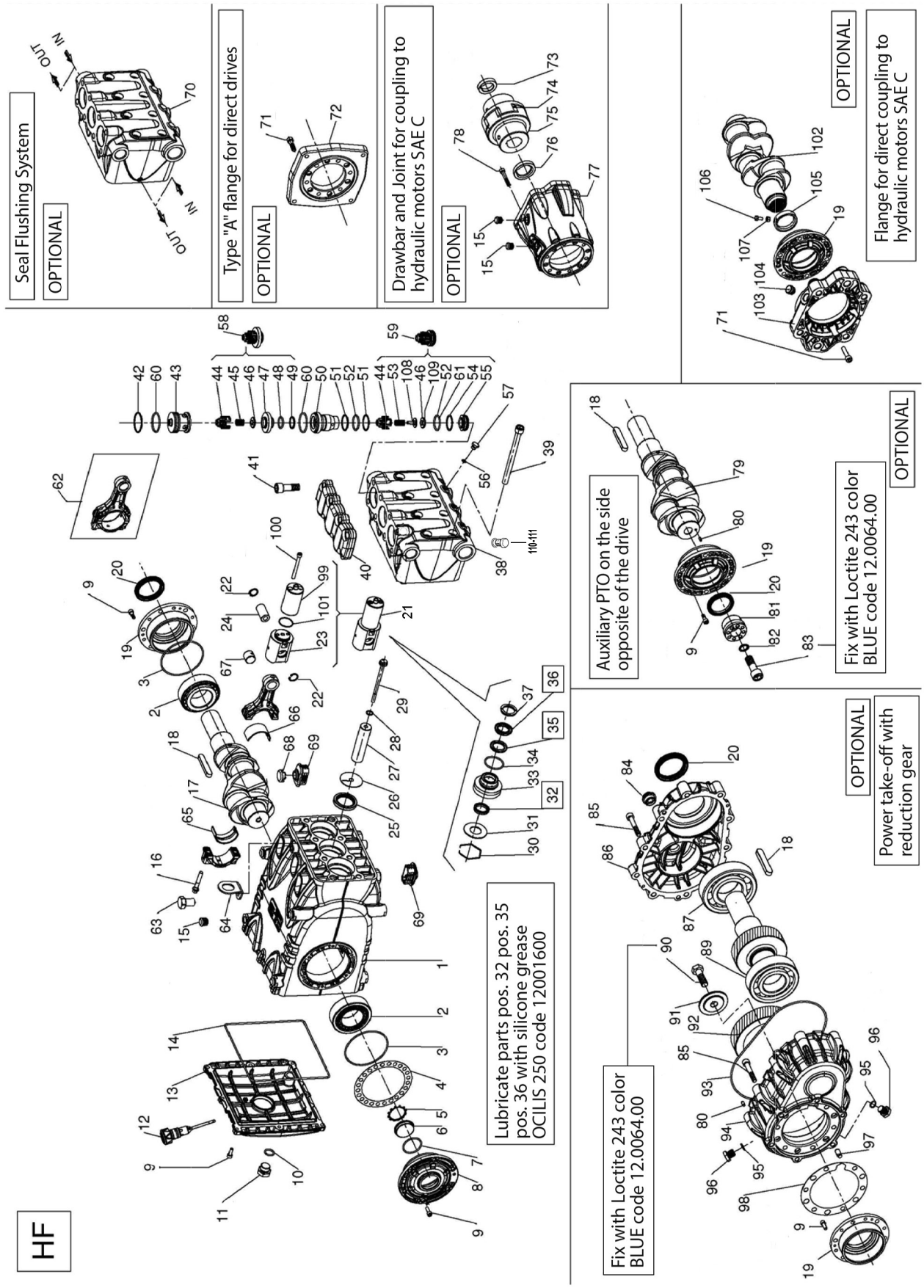
PIPE VIBRATIONS OR KNOCKING:

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

EXCESSIVE WATER LEAKAGE FROM THE PUMP:

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

16. EXPLODED VIEW AND PARTS LIST



Item	Part No.	Description	QTY.
1	71010022	Pump Crankcase	1
2	91859000	Roller Bearing 33210/Q	2
3	90391800	O-ring, Ø 97.92 x 2.62	2
4	F71220081	Shim, 0.1	-
	F71220381	Shim, 0.25	
5	90075600	Ring, ZJ45	1
6	70211801	Oil Level Indicator	1
7	90387700	O-ring, Ø 39.34 x 2.62	1
8	F71150122	Oil Level Indicator, Bearing Cover Side	1
9	99186700	Screw, TCEI M6 x 18 UNI 5931, Zinc	20
10	701115	O-ring, Ø 17.13 x 2.62	1
11	98218700	Plug, G1/2" x 13, Nickel	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	4
16	F99313800	Connecting Rod Screw	6
17	F71020035	Crankshaft	1
18	F91500000	Crankshaft Key, 12 x 70 x 8	1
19	F71150022	Motor Side Bearing Cover	1
20	90170000	Oil Seal, 50 x 65 x 8, Viton	1
22	F90060600	Ring, Ø 20 UNI 7437	6
21	F71606601	Plunger Guide, Complete	
23	71606601	Plunger Guide	3
24	F97743000	Pin, Ø 20 x 38	3
25	90167800	Seal, 38 x 52 x 7	3
26	96714000	Wiper	3
27	F71040009	Plunger, Ø 18 x 95 (HF18A)	3
	F71041509	Plunger, Ø 20 x 95 (HF20A)	
	F71040109	Plunger, Ø 22 x 95 (HF22A)	
	F71040209	Plunger, Ø 25 x 95 (HF25A)	
28	90367100	O-ring, Ø 11 x 2 - 90 Sh.	3
29	71219566	Plunger Bolt	3
30	90079700	Ring, Ø 52 UNI7437	3
31	F71217070	Packing Ring, Ø 18 (HF18A)	3
	F71224770	Packing Ring, Ø 20 (HF20A)	
	F71217270	Packing Ring, Ø 22 (HF22A)	
	F71217470	Packing Ring, Ø 25 (HF25A)	
32	F90264800	Packing, Ø 18 L.P. (HF18A)	3
	F90268800	Packing, Ø 20 L.P. (HF20A)	
	F90271300	Packing, Ø 22 L.P. (HF22A)	
	F90274600	Packing, Ø 25 L.P. (HF25A)	
33	F71214070	Packing Support, Ø 18 (HF18A)	3
	F71224870	Packing Support, Ø 20 (HF20A)	
	F71215170	Packing Support, Ø 22 (HF22A)	
	F71215270	Packing Support, Ø 25 (HF25A)	
34	F90387500	O-ring, Ø 37.77 x 2.62	3
35	F90268700	Restop, Ø 18 (HF18A)	3
	90270400	Restop, Ø 20 (HF20A)	
	90273000	Restop, Ø 22 (HF22A)	
	F90274800	Restop, Ø 25 (HF25A)	
36	F90268600	Packing, Ø 18 H.P. (HF18A)	3
	90270500	Packing, Ø 20 H.P. (HF20A)	
	90272500	Packing, Ø 22 H.P. (HF22A)	
	F90274900	Packing, Ø 25 H.P. (HF25A)	
37	F71100051	Front Ring, Ø 18 (HF18A)	3
	F70100051	Front Ring, Ø 20 (HF20A)	
	F70100151	Front Ring, Ø 22 (HF22A)	
	F71100151	Front Ring, Ø 25 (HF25A)	
38	F71124036	Manifold for Plunger Ø 18, NPT(HF18A)	1
	F71124136	Manifold for Plunger Ø 22, NPT (HF20A, HF22A)	
	F71124236	Manifold for Plunger Ø 25, NPT (HF25A)	
39	F99448000	Screw TCEI M12 x 150 UNI 5931	8
40	F71210036	Valve Cover	1
41	F99485000	Screw TCEI M14 x 40 UNI5931	8
42	F90522000	Back-up Ring, OR Ø 40.9 x 45 x 5	3
43	F71211070	Valve Plug	3
44	F71211070	Suction/Delivery Valve Guide	6
45	F94740100	Valve Spring, Delivery Kit	3
46	F36205066	Spherical Valve (HF18A)	6
	F36203966	Spherical Valve (HF20A, 22A, 25A)	
47	F36204366	Valve Seat, Delivery	3
48	F90385100	O-ring, Ø 21.89 x 2.62	3
49	F90514500	Back-up Ring, Ø 22.9 x 27 x 1.5	3
50	F71211566	Valve Spacer	3
51	F90517900	Back-up ring, Ø 31.4 x 35.5 x 1.5	6
52	F90386600	O-ring, Ø 29.82 x 2.62	6

Item	Part No.	Description	QTY.
53	F94739700	Valve Spring, Suction	3
54	91515500	Back-up Ring, Ø23.9 x 28 x 2 (HF18A)	3
	F90517700	Back-up Ring, Ø30 x 34 x 1.5 (HF20A, 22A, 25A)	
55	F36204966	Valve Seat, Suction (HF18A)	3
	F36204266	Valve Seat, Suction (HF20A, 22A, 25A)	
56	90357600	O-ring, Ø 6.75 x 1.78	3
57	F98197200	Plug, G 1/8" x 8	3
58	F36713901	Valve Assembly, Delivery	3
59	F36714401	Valve Assembly, Suction (HF18A)	3
	F36713801	Valve Assembly, Suction (HF20A, 22A, 25A)	
60	F90387800	O-ring, Ø 39.34 x 2.62	6
61	F90386600	O-ring, Ø 29.82 x 2.62	3
	F90385600	O-ring, Ø 23.47 x 2.62	
62	71030701	Complete Connecting Rod	3
63	F99426600	Screw, M12 x 25	1
64	F71223074	Lifting Eyebolt	1
65	F90924300	Babbitt Bearing, Non-load Side, With Groove	3
	F90924400	Babbitt Bearing, Non-load Side, With Groove, +0.25	
	F90924500	Babbitt Bearing, Non-load Side, With Groove, +0.50	
66	F90924000	Babbitt Bearing, load Side, Smooth	3
	F90924100	Babbitt Bearing, load Side, Smooth, +0.25	
	F90924200	Babbitt Bearing, load Side, Smooth, +0.50	
67	F90911000	Bushing	1
68	F71225951	Crankcase Plug Cover	3
69	F71225851	Crankcase Plug	6
70	-	Manifold, Flushing	1
71	F99309800	Screw, M8 x 35	6
72	F10067720	Hydraulic "A" Motor Flange	1
73	F10074570	Spacer, Ø 31.75	1
74	F10074947	Flex Coupler	1
75	F10742801	Flex Coupler, Ø 40 x 31.75	1
76	F10074670	Spacer, Ø 40	1
77	F10075020	Hydraulic Motor Flange, SAE-C	1
78	F99314600	Screw, M8 x 50	1
79	F71020735	Crankshaft, PTO	1
80	F97615200	Plug, Ø 5 x 10	1
81	F71226554	Auxiliary Power Take-off	1
82	F96737800	Washer, Ø 17 x 45	1
83	F99514200	Screw, M16 x 16	1
84	F97594000	Oil Level Indicator, G1/2"	1
85	F99314600	Screw, M8 x 5	16
86	F72210920	Reducer Gearbox	1
87	F91859300	Bearing	1
88	F10070835	Pinion, Z27, R1.250, Helical	1
	F10070935	Pinion, Z25, R1.500, Helical	
	F10071035	Pinion, Z22, R1.830, Helical	
89	F91857700	Bearing	1
90	F99430700	Screw, M12 x 40	1
91	F72211055	Fastening Washer	1
92	F10071135	Gear Ring, Z34 R1.250	1
	F10071235	Gear Ring, Z37 R1.500	
	F10071335	Gear Ring, Z40 R1.830	
93	F90394800	O-ring, Ø 209.22 x 2.62	1
94	F72210820	Reducer Box Cover	1
95	F90358500	O-ring, Ø 10.82 x 1.78	2
96	F98204250	Plug, G1/4" x 13	2
97	F97618500	Pin, Ø 8 x 18	1
98	F72210784	Reducer Box Seal	1
99	F71050866	Piston Guide Rod	3
100	F99199400	Screw, M6 x 65	6
101	F90352800	O-ring, Ø 30.00 x 1.5	3
102	F71020835	Crankshaft, C. 50, SAE C	1
103	F10085422	Hydraulic Flange, SAE C	1
104	F90206500	Plug, Ø 17	1
105	F71228971	Ring, Ø 40	2
106	F70227034	Screw, M6 x 12	3
107	F92202500	Nut, M6 x 5	4
108	F36210151	Internal Guide Valve, HF18 Only	3
109	F36205066	Ball Valve, HF18 Only	3
110	F872043002	Washer, Aluminum, Ø 1/2"	1
111	98218000	Jetter Port Plug	1
	200082	Bolt, M16-1.5 x 40	4
	200083	Lock Washer, M16	4

REPAIR KITS

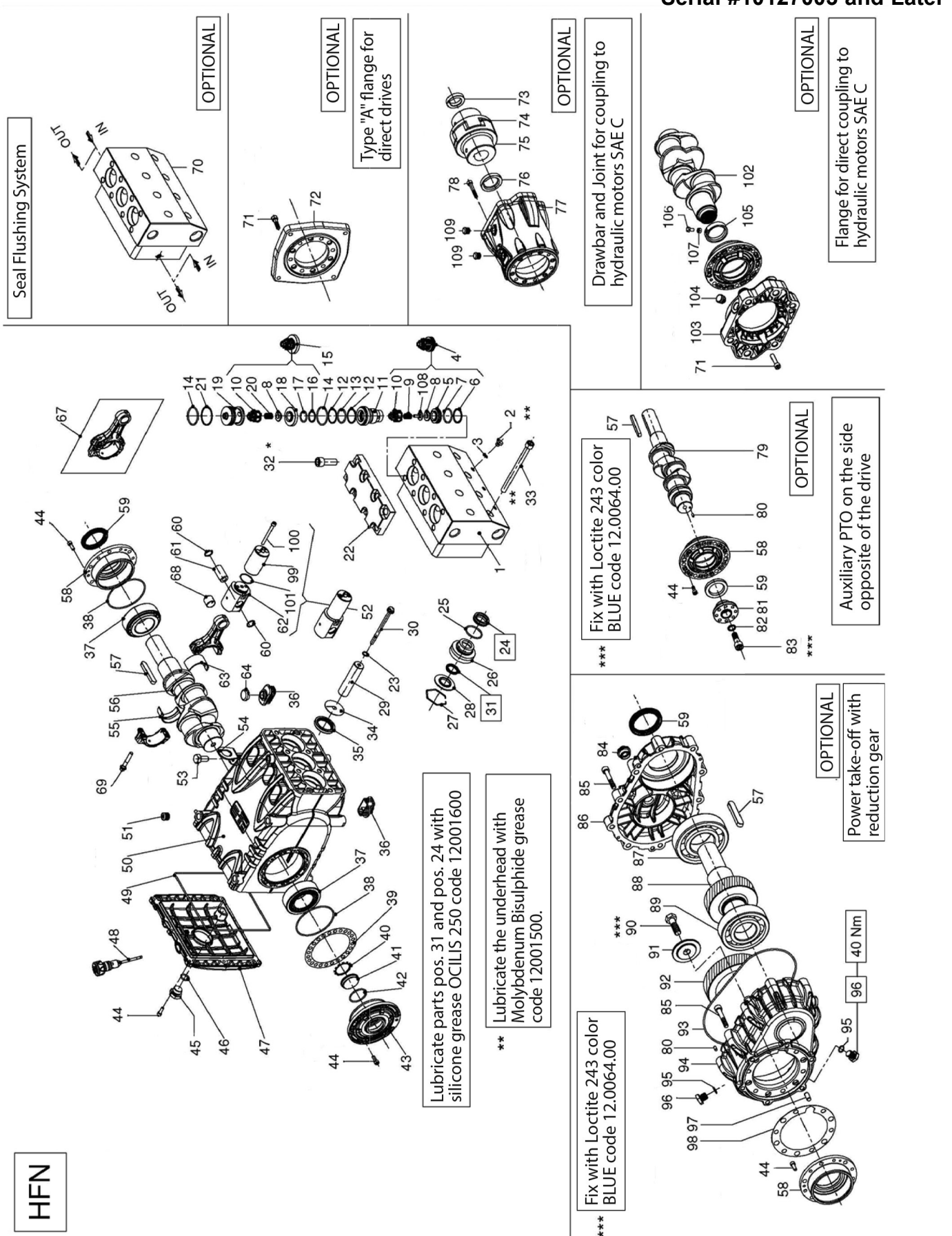
F2024 (Plunger Packing Kit-HF18A)	**F2071** (Plunger Packing Kit-HF20A)	**F2026** (Plunger Packing Kit-HF22A)	**F2028** (Plunger Packing Kit-HF25A)	**F2031** (Inlet Valves Kit HF18A)	**F2022** (Inlet Valves Kit HF20A,22A, 25A)	**F2023** (Outlet Valves Kit)	**F2025** (Complete Seals Kit-HF18A)	**F2072** (Complete Seals Kit-HF20A)	**F2027** (Complete Seals Kit-HF22A)	**F2135** (Babbit Bearing Set)	**F2154** (Babbit Bearing Set, +0.25)	**F2155** (Babbit Bearing Set, +0.50)
32, 34, 35, 36	32, 34, 35, 36	32, 34, 35, 36	32, 34, 35, 36	59	59	58	3, 5, 7, 10, 14, 20, 25, 28, 32, 34, 35, 36, 37, 42, 48, 49, 51, 52, 54, 60	3, 5, 7, 10, 14, 20, 25, 28, 32, 34, 35, 36, 37, 42, 48, 49, 51, 52, 54, 60	3, 5, 7, 10, 14, 20, 25, 28, 32, 34, 35, 36, 37, 42, 48, 49, 51, 52, 54, 60	65, 66	65, 66	65, 66

TORQUE SPECS*

Position	Ft.-Lbs.	Nm.
9	7.4	10
11	29.5	40
16	22	30
29	14.7	20
39	59.0	80
41	132.8	180
57	9.6	13
63	29.5	40
71	29.5	40
78	29.5	40
83***	256.5	360
84	7.4	10
85	29.5	40
90***	51.6	70
96	29.5	40
100	7.4	10
106	7.4	10

*Decrease torque by 20% if threads are lubricated.

***Use Loctite 243.


HFN
Seal Flushing System
OPTIONAL
OUT
IN
70
Type "A" flange for direct drives
OPTIONAL
71
72
Drawbar and Joint for coupling to hydraulic motors SAE C
OPTIONAL
73
74
75
76
77
78
109
Flange for direct coupling to hydraulic motors SAE C
OPTIONAL
102
105
106
107
103
104
71
Auxiliary PTO on the side opposite of the drive
OPTIONAL
Fix with Loctite 243 color BLUE code 12.0064.00
***
57
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80
58
59
81
82
83
44
Power take-off with reduction gear
OPTIONAL
Fix with Loctite 243 color BLUE code 12.0064.00
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84
85
86
87
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95
96
40 Nm
97
98
Lubricate parts pos. 31 and pos. 24 with silicone grease OCILIS 250 code 12001600
Lubricate the underhead with Molybdenum Bisulphide grease code 12001500.
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Item	Part No.	Description	QTY.
1	F71120356	Manifold Ø 22	1
	F71120456	Manifold Ø 22 - NPT	
	F71128156	Manifold Ø 25	
	F71128056	Manifold Ø 25 - NPT	
2	F98197200	Plug G 1/8" x 8	3
3	F90357600	O-ring, Ø 6.75 x 1.78	3
4	F36718901	Inlet Valve Group	3
5	F36210566	Inlet Valve Seat	3
6	F90517700	Back-up Ring Ø 30 x 34.5 x 1.5	3
7	F90386600	O-ring, Ø 29.82 x 2.62	3
8	F36217766	Inlet, Ball Valve	3
	F36209566	Outlet, Ball Valve	
9	F94739700	Spring Ø 11.4 x 20	3
10	F36209751	Valve Guide	6
11	F71226356	Valve Bushing	3
12	F90517900	Back-up Ring Ø 31.4 x 35.5 x 1.5	6
13	F90386600	O-ring, Ø 29.82 x 2.62	3
14	F90387800	O-ring, Ø 39.34x2.62	6
15	F36718801	Delivery Valve Group	3
16	F90514500	Back-up Ring Ø 22.9 x 27 x 1.5	3
17	F90385100	O-ring, Ø 21.89 x 2.62	3
18	F36210466	Outlet Valve Seat	3
19	F71226466	Plug Ø 45	3
20	F94740100	Spring Ø 12 x 17	3
21	F90522000	Back-up Ring Ø 40.9 x 45 x 1.5	3
22	F71226256	Valve Cover	1
23	F90367100	O-ring, Ø 11 x 2	3
24	F90231000	Seal Ø 22 x 35 x 9, HP	3
	F90237000	Seal Ø 25 x 38 x 10, HP	
25	F90387500	O-ring, 37.77 x 2.62	3
26	F71228266	Support Seal Ø 22	3
	F71226166	Support Seal Ø 25	
27	F90079700	Stop Ring Ø 52	3
28	F71228166	Seal Ring Ø 22	3
	F71226066	Seal Ring Ø 25	
29	F71040109	Plunger Ø 22 x 95	3
	F71040209	Plunger Ø 25 x 95	
30	F71223856	Plunger Screw	3
31	F90230000	Packing Ø 22 x 28.15	3
	F90236800	Packing Ø 25 x 31.15	
32	F99485000	Screw M14 x 40	8
33	F99448000	Screw M12 x 150	8
34	F96714000	Wiper Ø 10 x 50 x 1	3
35	F90167800	Seal Ø 38 x 52 x 7	3
36	F71225851	Plug Housing	6
37	F91859000	Roller Bearing	2
38	F90391800	O-ring, Ø 94.92x2.62	2
39	F71220081	Shim 0.1 mm	-
	F71220381	Shim 0.25 mm	
40	F90075600	Ring Ø 45	1
41	F70211801	Oil Level Indicator	1
42	F90387700	O-ring, Ø 39.34 x 2.62	1
43	F71150122	Oil Level Indicator Side Cover	1
44	F99186700	Screw M6x18	20
45	F98218700	Plug G 1/2" x 13	1
46	F90384100	O-ring, Ø 17.13 x 2.62	1
47	F71160022	Rear Cover Housing	1
48	F98212000	Dipstick	1
49	F90400000	O-ring, Ø 215 x 3	1
50	F71010022	Pump Housing	1
51	F98206000	Hole Pug, Ø 15	4
52	F71606601	Plunger Guide, Complete	3
53	F99426600	Screw M12x25	1
54	F71223074	Lifting Bracket	1

Item	Part No.	Description	QTY.
55	F90924300	Babbitt Bearing, Non-load Side	3
	F90924400	Babbitt Bearing, Non-load Side, +0.25	
	F90924500	Babbitt Bearing, Non-load Side, +0.50	
56	F71020035	Crankshaft	1
57	F91500000	Crankshaft Key, 12 x 70 x 8	1
58	F71150022	PTO Side Cover	1
59	F90170000	Oil Seal Ø 50 x 65 x 8	1
60	F90060600	Ring Ø 20	6
61	F97743000	Pin Ø 20 x 38	3
62	F71050715	Plunger Guide	3
63	F90924000	Babbitt Bearing, Load Side	3
	F90924100	Babbitt Bearing, Load Side +0.25	
	F90924200	Babbitt Bearing, Load Side +0.50	
64	F71225951	Crankcase Plug	3
66	F90387800	O-ring, Ø39.34 x 2.62	6
67	F71030701	Complete Rod	3
68	F90911000	Connecting Rod Bushing	3
69	F99313800	Connecting Rod Screw	3
70	F71128256	Manifold, Ø 25, Flushing, NPT	
71	F99309800	Screw, N8 x 35	6
72	F10067720	Hydraulic "A" Motor Flange	1
73	F10074570	Spacer Ø 31.75	1
74	F10079747	Flex Coupler	1
75	F10742801	Flex Coupler 40 x 31.75	1
76	F10074670	Spacer Ø 40	1
77	F10075020	Hydraulic Motor Flange, SAE-C	1
78	F99314600	Screw M8 x 50	6
79	F71020735	Crankshaft, PTO	1
80	F97615200	Plug Ø 5 x 10	1
81	F71226554	Auxiliary Power Take-off	1
82	F96737800	Wiper 17 x 24 x 1	1
83	F99514200	Screw M16 x 45	1
84	F97594000	Oil Level Indicator, G1/2"	1
85	F99314600	Screw M8 x 50	16
86	F72210920	Reducer Housing Cover	1
87	F91859300	Bearing	1
88	F10070835	Pinion Z27 R1.250	1
	F10070935	Pinion Z25 R1.500	
	F10071035	Pinion Z22 R1.830	
89	F91857700	Bearing	1
90	F99430700	Screw M12 x 40	1
91	F72211055	Washer Ring	1
92	F10071135	Ring Gear Z34 R1.250	1
	F10071235	Ring Gear Z37 R1.500	
	F10071335	Ring Gear Z40 R1.830	
93	F90394800	O-ring, 209.22 x 2.62	1
94	F72210820	Reduction Gear Box	1
95	F90358500	O-ring, 10.82 x 1.78	2
96	F98204250	Plug G 1/4" x 3	2
97	F97618500	Plug Ø 8 x 18	1
98	F72210784	Housing Reducer Gasket	1
99	F71050866	Piston Guide Rod	3
100	F99199400	Screw M6x65	6
101	F90352800	O-ring, Ø 30.00x1.5	3
102	F71020835	Crankshaft, C. 50 HYP SAE-C	1
103	F10085422	Hydraulic Motor Flange SAE-C	1
104	F90206500	Plug, Ø 17	1
105	F71228971	Ring, Ø 40	1
106	F70227034	Screw, M6 x 12	1
107	F92202500	Nut, M6 x 5	1
108	F36210151	Internal Valve Guide	3
109	F98206000	Plug, Ø 15	
	200082	Bolt, M16-1.5 x 40	4
	200083	Lock Washer, M16	4

REPAIR KITS

F0202 (Plunger Packing Kit-HF22N)	**F2174** (Plunger Packing Kit-HF25N/F)	**F2172** (Inlet Valves Kit HF22N, HF25/F)	**F2173** (Outlet Valves Kit)	**F2257** (Complete Seals Kit-HF22N)	**F2175** (Complete Seals Kit-HF25N/F)	**F2135** (Babbit Bearing Set)	**F2154** (Babbit Bearing Set, +0.25)	**F2155** (Babbit Bearing Set, +0.50)
24, 31	24, 31	4	15	3, 6, 7, 12, 13, 14, 16, 17, 21, 23, 24, 25, 31, 35, 38, 40, 42, 46, 49, 59	3, 6, 7, 12, 13, 14, 16, 17, 21, 23, 24, 25, 31, 35, 38, 40, 42, 46, 49, 59	55, 63	55, 63	55, 63

TORQUE SPECS*

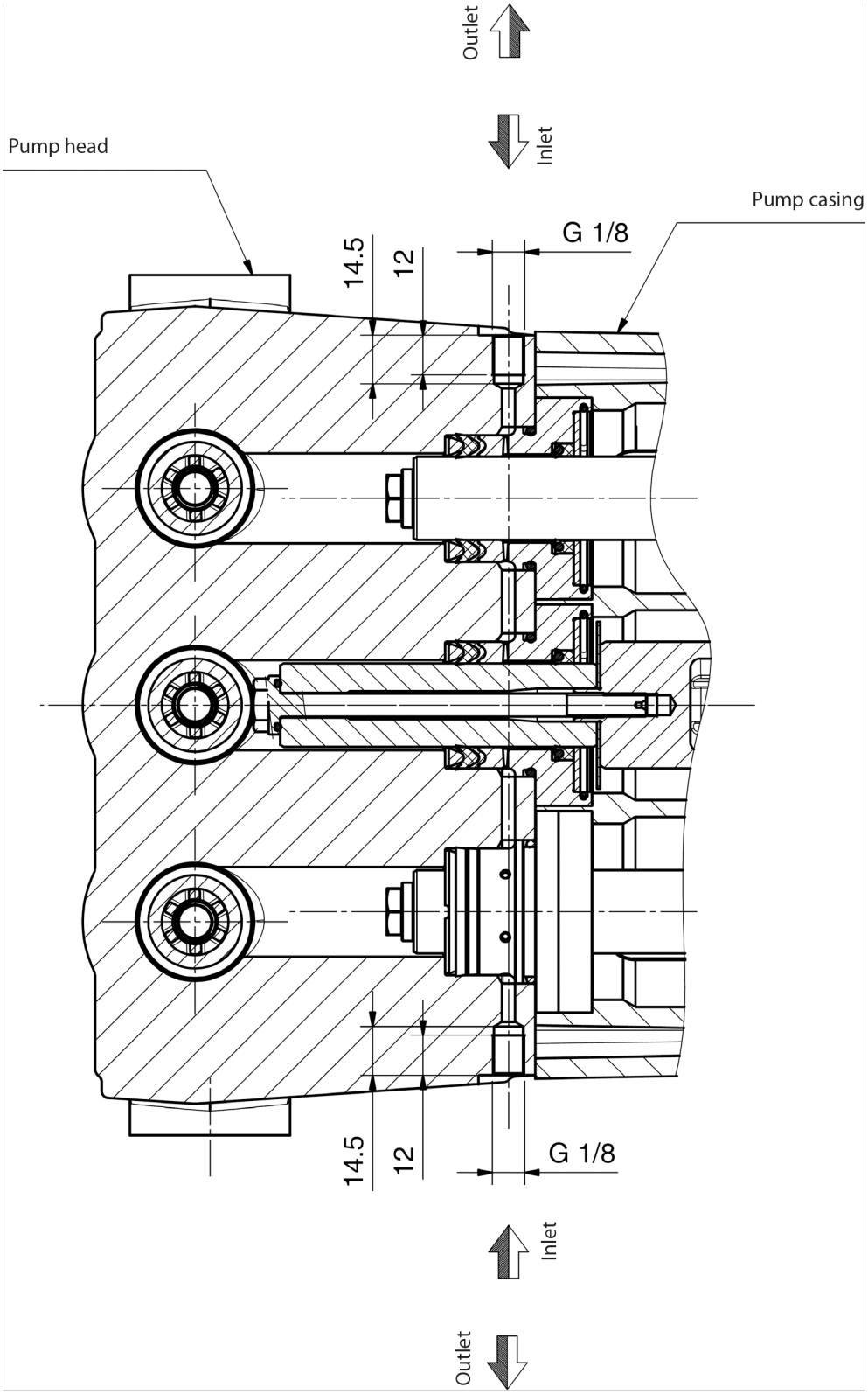
Position	Ft.-Lbs.	Nm.
2	9.6	13
30	14.8	20
32	132.8	180
33	59.0	80
44	7.4	10
45	29.5	40
53	29.5	40
69	22.1	30
71	29.5	40
78	29.5	40
83***	167.0	145
84	7.4	10
85	29.5	40
90	51.6	70
96	29.5	40
100	7.4	10
106	7.4	10

*Decrease torque by 20% if threads are lubricated.

***Use Loctite 243.

17. FLUSHING CIRCUIT DIAGRAM OF USE

Adhere to the following valves for proper system operations:
minimum circuit flow rate 4 l/min, maximum fluid pressure 87.02 PSI (6 bar).



18. MAINTENANCE LOG

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

GENERAL PUMP

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