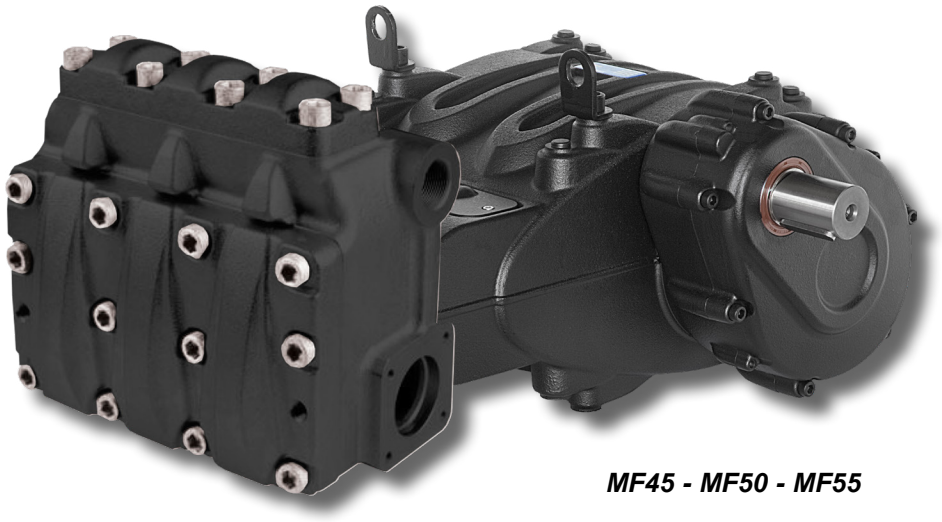
GENERAL PUMP

MF

Owner's Manual

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



MF45 - MF50 - MF55

General Pump is a member of the Interpump Group

QUALITY SYSTEM CERTIFICATION DNV·GL ISO 9001

Ref 310069 Rev. C
02-20

INDEX

1. INTRODUCTION

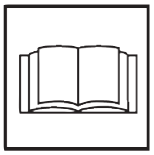
This manual describes the use and maintenance instructions of the MF pump, and should be carefully read and understood before using the pump.

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
High Voltage

Danger
Wear protective mask

Danger
Wear goggles

Danger
Wear protective gloves

Danger
Wear protective boots

Symbol for protection against explosion.
This defines special safety requirements for the us of the pumps in areas indentified in accordance with the ATEX Directive. **When pumps are ordered in the ATEX configuration** because they are going to work in areas with a potentially explosive atmosphere, you must **STRICTLY comply with the notes given under the headings marked with this symbol and the instructions in the supplementary instructions manual "ATEX EXPLOSION PROTECTION".**
(Versions available in compliance with **ATEX:MF**)

3. SAFETY

3.1 General Safety Indications

Improper use of pumps and high pressure systems, and the non-compliance with installation and maintenance instructions may cause severe injury to people and/or damage to property. Anyone assembling or usinge high pressure systems must possess the necessary competence to do so, should be aware of the characteristics of the components assembled/used, and must take all precautions necessary to ensure maximum safety in any operating condition. In the interest of safety, both for the Installer and the Operator, no reasonably applicable should be omitted.

3.2 High pressure unit safety requirements

1. The pressure line must always be equipped with a safety valve.
2. High pressure system components, in particular for those units working outside, must be adequately protected against rain, frost and heat.
3. The electrical control system must be adequately protected from water spray, and must comply with the specific regulations in force.
4. High pressure hoses must be properly sized for maximum operating pressure of the system and always and only used within the operating pressure range specified by the hose manufacturer. The same rules should be observed for all other auxiliary systems affected by high pressure.
5. The ends of high pressure hoses must be sheathed and secured to a solid structure to prevent dangerous whiplash in case of bursting or broken connections.
6. Appropriate safety guards must be provided for the pump transmission systems (couplings, pulleys and belts, auxiliary drives).

3.3 Safety During Operation

The working area of a high pressure system must be clearly marked. Access must be prohibited to un-authorized personnel and, wherever possible, the area should restricted or fenced. The personnel authorized to access this area should first be 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 system is properly powered (see paragraph 9.5).
2. That pump intake filters are perfectly clean; we advise the use of a device that indicates the filters clogging level.
3. Electrical parts are adequately protected and in perfect condition.
4. The high pressure hoses do not show apparent signs of abrasion, and that fittings are in perfect shape.

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

3.4 General Procedures For Using Nozzles

1. The Operator must always place his/her safety and security first, as well as that of others that may be directly affected by his/her actions, or any other assessments or interests. The operator's work must be dictated by common 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. It is generally best to organize personnel into teams of at least two people capable of giving mutual and immediate assistance in case of necessity and of taking turns during long and demanding operation.
4. Access to the work area that is within the water jets' range must be absolutely prohibited to and free from objects that, inadvertently under a pressure jet, can be damaged and or create dangerous situations.
5. The water jet must only and always be directed in the direction of the work area, including during testing or preliminary tests or checks..
6. The Operator must always pay attention to the trajectory of the debris removed by the water jet. If necessary, suitable guards must be provided by the Operator to protect anything that may be accidentally exposed.
7. The Operator should not be distracted for any reason during operation. Workers needing to access the operating area must wait for the Operator to stop work, and then immediately make their presence known.
8. For safety reasons, it is important that each member of the team is fully aware of the intentions and actions of other team members in order to avoid dangerous misunderstandings.
9. The high pressure system must not be started up and run under pressure without all team members in position and without the Operator having already directed his/her lance toward the work area.

3.5 Safety During System Maintenance

1. The pressure system maintenance must be carried out in the time intervals set by the manufacturer who is responsible for the whole group according to law.
2. Maintenance should always be carried out by trained and authorized personnel.
3. Assembly and disassembly of the pump and its various components must be performed exclusively by authorized personnel, using appropriate equipment in order to avoid damage to components and connections.
4. Always use original spare parts to ensure total reliability and safety.

4. PUMP IDENTIFICATION

Each pump has a specific label (1, fig. 1) which contains:

Pump model and version
Serial Number
Maximum RPM
Power Hp-kW
Presure - P.S.I.
Flow Rate - GPM

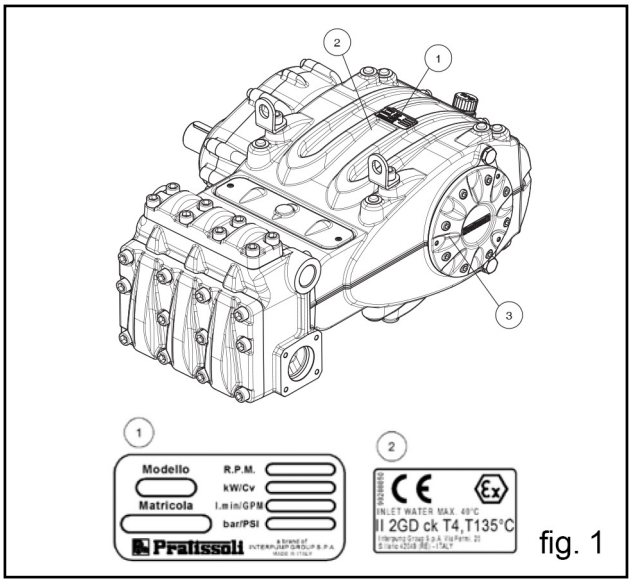


fig. 1

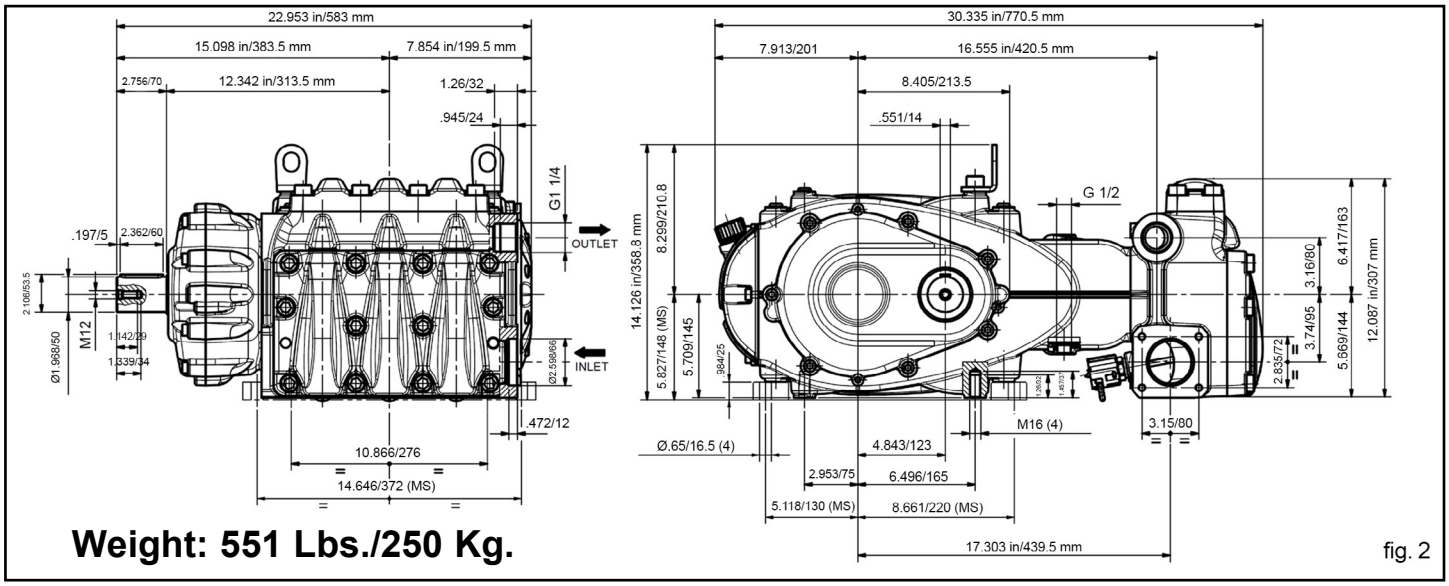
For pumps ordered with the ATEX configuration.
(2, fig. 1) **With specific ATEX marking for explosion protection.**
(3, fig. 1) For locating the **grounding screw.**

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

5. TECHNICAL FEATURES

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		l/min	GPM	PSI	Bar	Hp	kW
MF 45	800	267	70.6	2900	200	139	102.2
	1500	267	70.6			139	102.2
	1800	269	71			140	102.9
	2200	270	71.3			140	102.9
	2600	270	71.3			140	102.9
MF 50	800	330	87.2	2465	170	146	107.3
	1500	330	87.2			146	107.3
	1800	332	87.6			147	108.1
	2200	333	88			147	108.1
	2600	333	88			147	108.1
						147	
MF 55	800	399	105.4	2032	140	145	106.6
	1500	399	105.4			145	106.6
	1800	401	106			146	107.3
	2200	403	106.5			147	108.1
	2600	403	106.5			147	108.1

6. DIMENSIONS AND WEIGHT



Weight: 551 Lbs./250 Kg.

fig. 2

7.INFORMATION ABOUT PUMP USE

The MF pump, when not ordered with the ATEX configuration, is designed to operate in environments with atmosphers that are not potentially explosive, and with filtered water (see par. 9.7)

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

7.1 WaterTemperature

The max water temperature is 104^0 F (40^0 C).However, it is possible to use the pump at temperatures of up to 140^0F (60^0C) for short periods of time. In this case we advise consulting the Customer Service Department.

7.2 Max Pressure and Flow Rate

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 Minimum Operating Speed

The minimum speed of the crankshaft for these types of pumps is 300 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 32^0 and 89.6^0 F (0^0 and 30^0C). Some recommended lubricant types are indicated in the table below; these lubricants are treated with 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 BG 220
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 oil level dipstick (1, fig. 3). Refill if necessary to top off level. 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).
Checking and changing oil is to be carried out as indicated in Chapter 11. The amount required is 287 oz. (8.5 liters) for pumps with reduction units and 253 oz (7.5 liters) for pumps with no reduction units.

Set up the pump so that the oil temperature does not exceed in any case **212°F (100°C)** during pump operation.
Use a temperature probe to be inserted into the oil drain plug (2, fig. 3). See the “ATEX EXPLOSION PROTECTION” manual.
ATTENTION: Use only oil with flash point higher than 392°F (200°C).

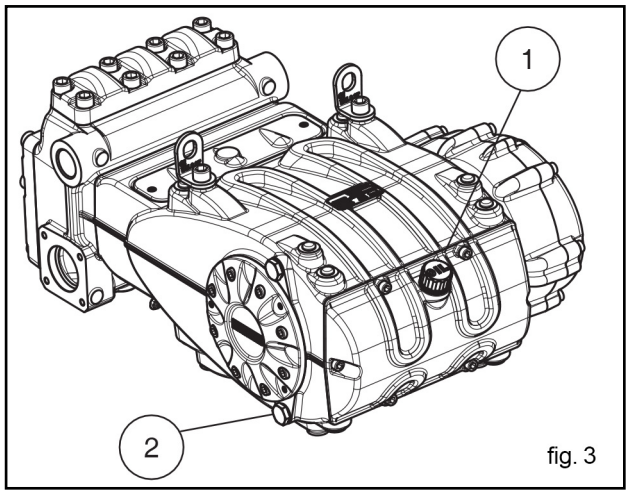
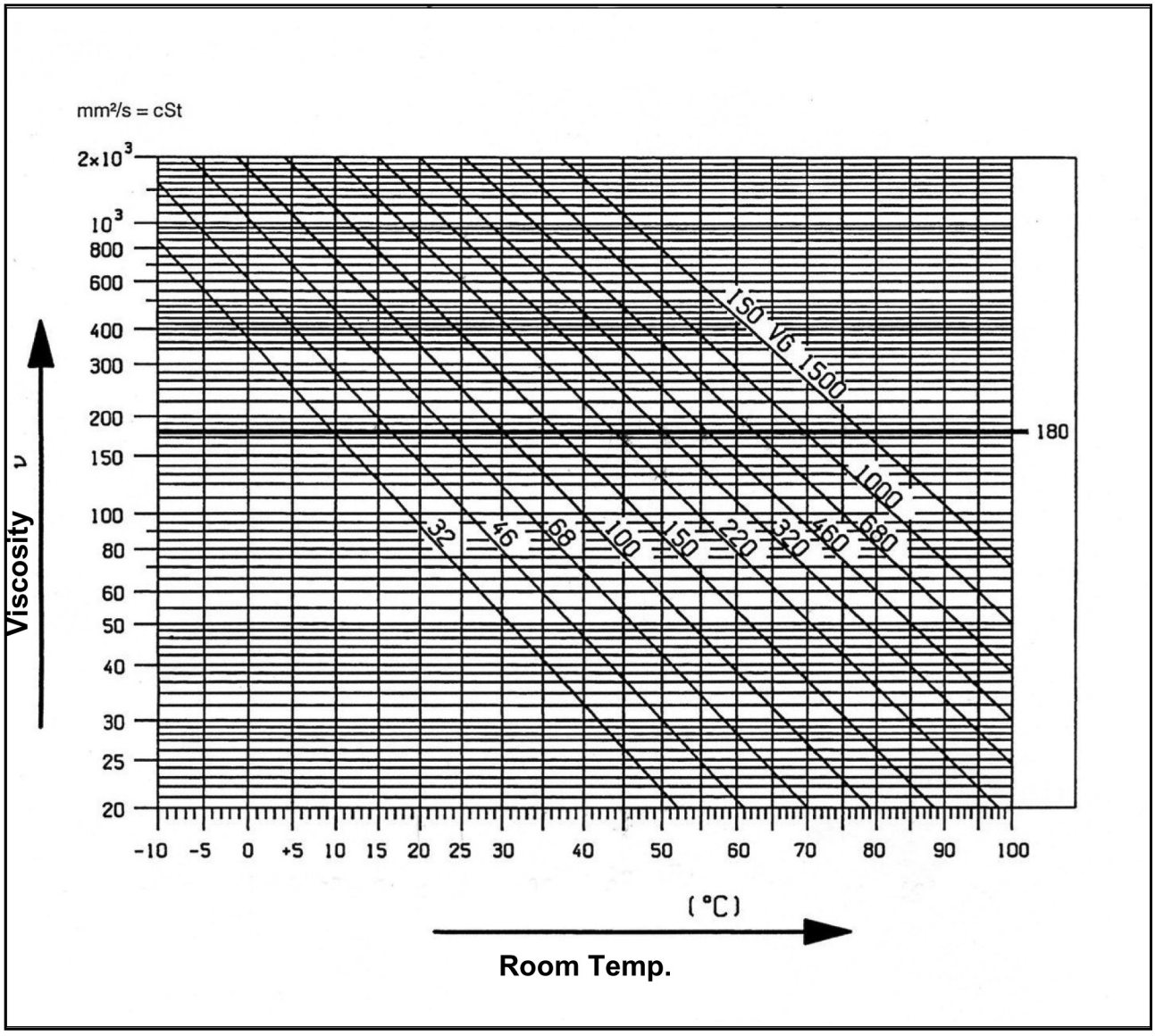


fig. 3

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 container and disposed of in appropriate locations. In absolutely no case may it be dispersed into the environment.

8. PORTS AND CONNECTIONS

MF Series pumps are equipped with (see fig. 4):

1. 2 inlet ports “IN”, Ø2.598 inch (66 mm) (on MF45, MF50, MF55 versions).

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”, G1 1/4” (on MF45, MF50, MF55 versions).

3. 1 drain port “DRAIN” with G1/2” hole in the lower cover to monitor any water leakage due to wear of the pressure packings. In case of leaks, please consult the repair manual.
   This hole must always be kept open.

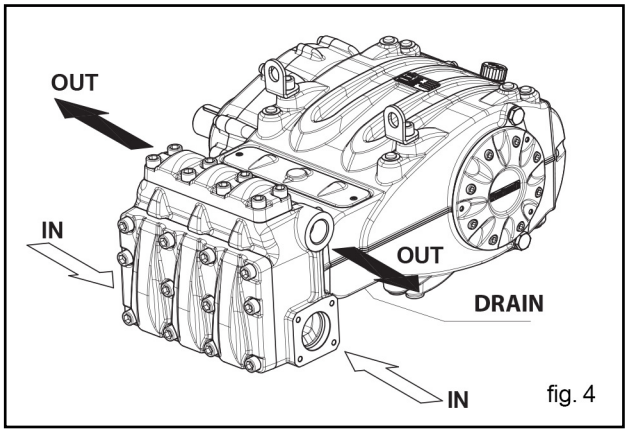


fig. 4

9. PUMP INSTALLATION

9.1 Installation
The pump must be installed in a horizontal position using the M16 threaded support feet.
Tighten the screws with a torque of 200 Nm (147.5 Ft-Lb)

The base must be perfectly flat and rigid enough as not to allow bending or misalignment on the pump coupling and axis/transmission due to torque transmitted during operation.

Two lifting brackets are mounted on the pump for easy installation, as per the figure below.

The brackets are sized soley for pump lifting and therefore are absolutely not permitted for use of additional loads.

Replace the oil filling hole closing service plug positioned on the rear casing cover with the plug with oil dipstick. Check the correct quantity.
The dipstick must always be reachable, even when the unit is assembled.

Gounding: It is necessary to fix a grounding cable to the pump by means of the M8 stainless steel screw and the stainless steel toothed washer properly marked by the YELLOW label. See the “ATEX EXPLOSION PROTECTION” manual.

The pump’s shaft (PTO) must not be rigidly connected to the motor unit.
The following transmission types are suggested:
- Flexible joint
- Cardan Joint (please respect the maximum working angles indicated by the manufacturer)
- Belts; for correct application, please contact the Customer Service Department.

In all cases, the transmission must be properly assembled to avoid incorrect or harsh operation of the connection parts and prevent excessive wear, an increase in temperature and/or hazardous breakages that may create potential sources of ignition and explosion. See the “ATEX EXPLOSION PROTECTION” manual.

9.2 Direction of rotation
The PTO rotation is indicated by an arrow located on the reduction gear cover. From a position facing the pump head, the rotation direction will be as in fig. 5.

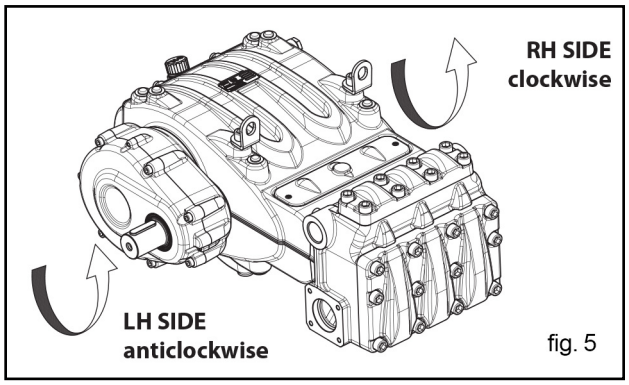


fig. 5

9.3 Version Change and Reducer Positioning
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. See fig. 5.

The version may be changed only by trained and authorized personnel by carefully following the instructions in the repair manual.

1. Separate the hydraulic part from the mechanical part as indicated in Chapter 2 in points 2.2.1 and 2.2.2 of the Repair Manual.

2. Turn the mechanical part 180º 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. Invert the two inspection covers, ensuring that the open one is positioned lower. Finally, properly reposition the specification label in its housing on the casing.

Make sure that the lower inspection cover draining holes are open.

3. Reassemble the hydraulic part to the mechanical part as indicated in Chapter 2 in points 2.2.1, 2.2.4 and 2.2.5 of the Repair Manual.

It is also possible to place the reduction gear in 5 different positions as per fig. 6.

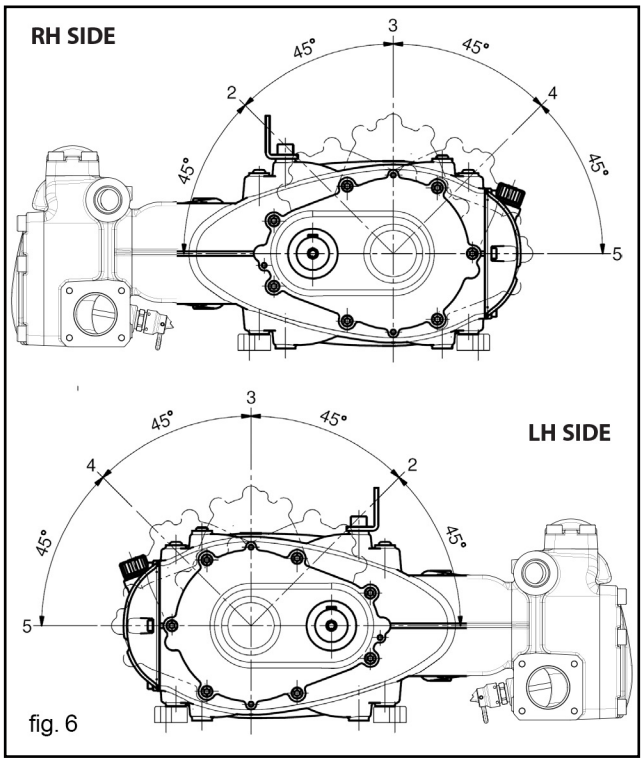


fig. 6

The reducer's position may be changed only by trained and authorized personnel by carefully following the instructions in 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 Power Supply

MF pumps must always be installed with a positive suction head i.e. they must receive water by gravity or by forced feeding, and never suctioned from a lower level. The pumps can tolerate minimum NPSH even as low as 1 m. (3.28 ft.), however, to obtain a better volumetric efficiency and above all to avoid cavitation, the minimum NPSH available, measured at the pump inlet flange, will have to be at least equal or higher than the values shown in the chart below.

	MF45	MF50	MF55
$NPSH_r$ (ft)	7.5	8	9

Forced feeding by a booster pump is highly recommended in order to avoid cavitation, considering the geometry of the hydraulics and the considerable flow rates.

The booster pump must have the following specifications: flow rate at least double the rated flow rate of the pump, and pressure between 30 to 40 PSI (2 to 3 Bar). These feeding conditions must be respected at any operating RPM.

The booster pump must always be started up before the plunger pump. 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. With a layout that is set in such a way to prevent 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 fittings, 3 or 4 way fittings, adapters, swivel joints, 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 base 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 flows coming from both the by-pass and feeding lines which may create turbulance near the tank's outlet port.
10. Make sure that the suction line is perfectly clean inside before connecting it to the pump.
11. The pressure gauge for checking booster pressure must be installed near the plunger pump's inlet port, and always downstream from the filters.

9.7 Filtering

On the suction line, install two filters as indicated in fig. 7 and fig. 7/a.

With the manual adjustment valve:

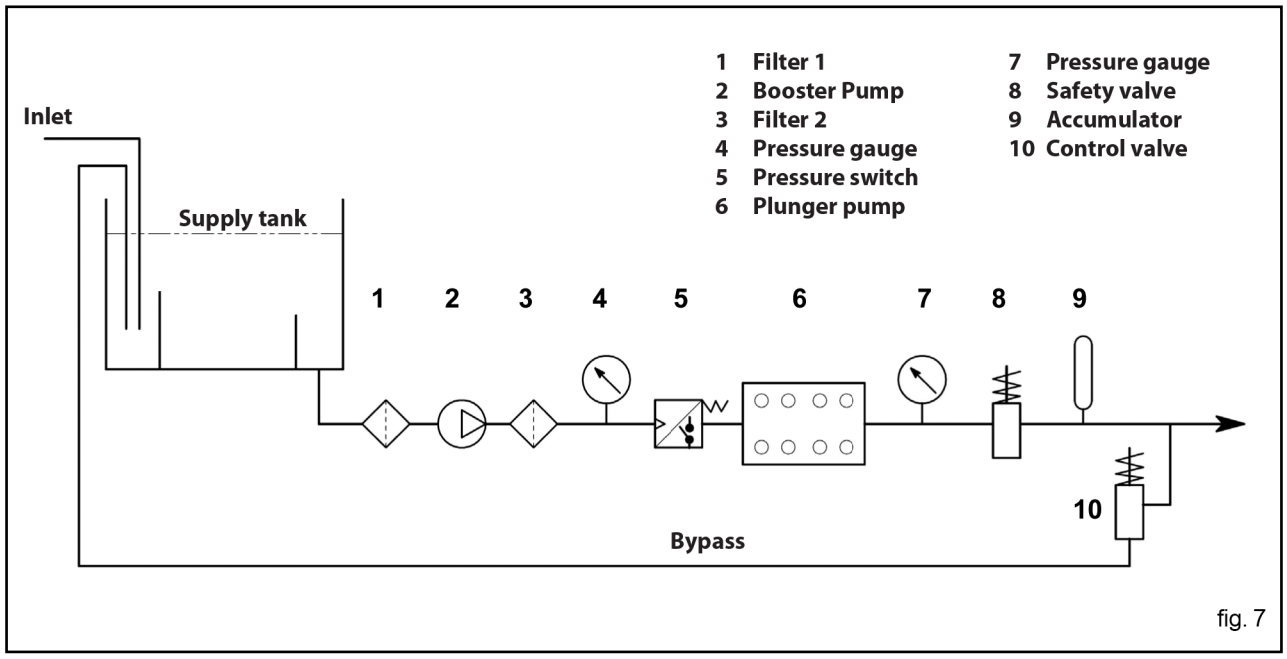


fig. 7

With the pneumatic adjustment valve:

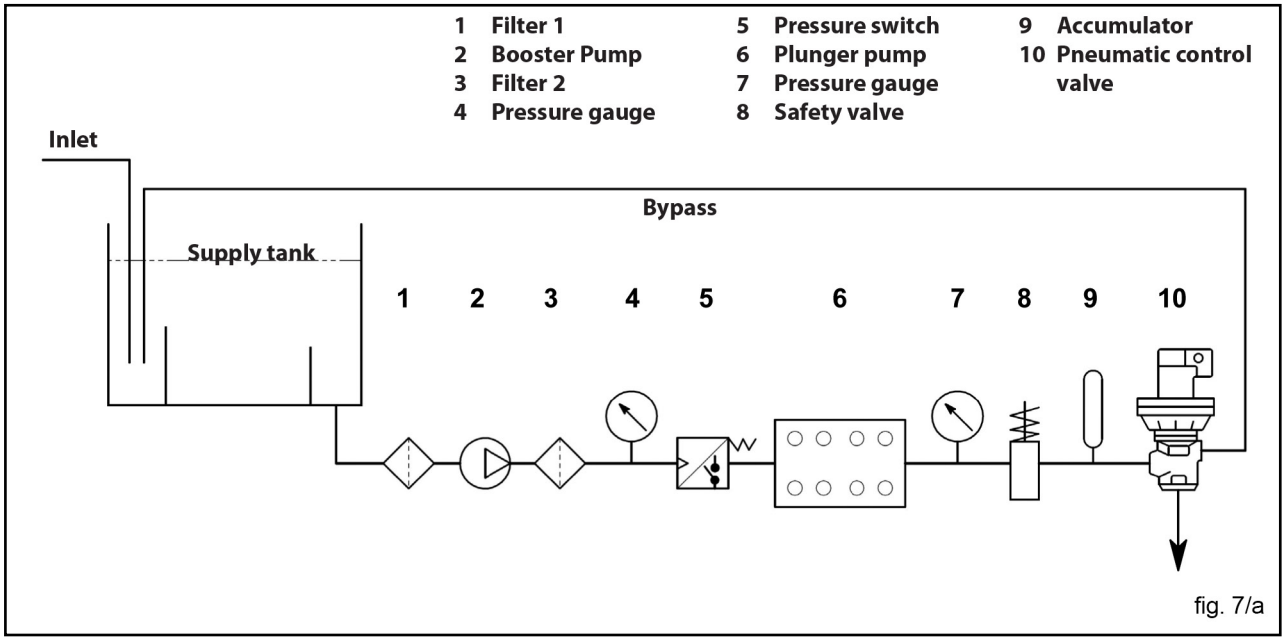


fig. 7/a

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 ranging between 200 and 360 µm.

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 actual clogging conditions.

9.8 Outlet Line

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

1. The internal diameter of the hose must allow to guarantee correct fluid speed; see digram 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.
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 outlet 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

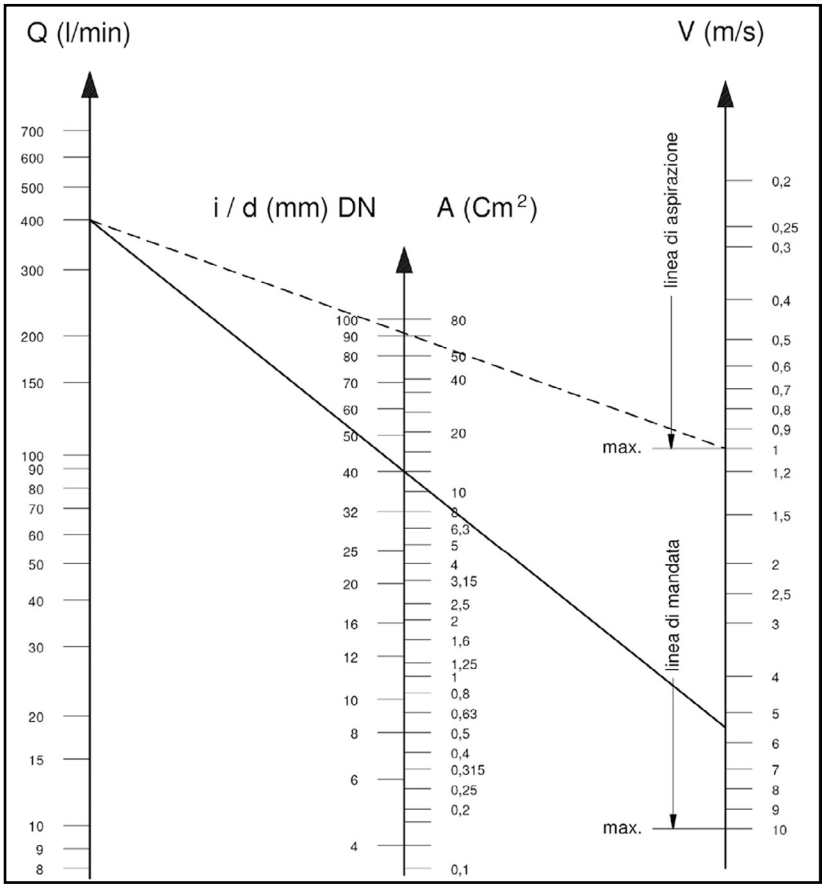
With a flow rate of ~105 GPM (400 l/mn) and water speed of 1 m/sec. the diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 3.5 inch (90 mm).

Delivery Hose

With a flow rate of ~105 GPM (400 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 ~ 1.6 inch (40 mm).

Optimal speed to be obtained with the booster pump:

- Suction: ≤ 1 m/sec.
- Delivery: ≤ 5.5



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

9.10 V-belt Transmission
As indicated in paragraph 9.1, only in exceptional cases may the pump be driven by a v-belt system. For correct lay-out sizing, please contact our Customer Service Department.

9.11 Transmission of power from the second PTO
Upon request the MF series pump can be supplied with an auxiliary PTO on the opposite side to drive.
Transmission can be carried out:

- By means of V-belts
- By means of a coupling

With V-Belts, Max Torque output is: 110 ft/lb (150 Nm) corresponding to 17 HP (12.5 kW) at 800 rpm.
With coupling, Max Torque output is: 162 ft/lb (220 Nm) corresponding to 25 HP (18.4 kW) at 800 rpm.

With transmission by means of coupling, pay close attention to perfectly align, so that no transverse forces are generated on the pump shaft. If necessary, contact our Customer Service Department.

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 Chapter 9) 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 joint tilt belt tightening, etc.) must remain within the limits indicated by the transmission Manufacturer.
5. The pump's oil level must be verified using the correct dipsticks (position 1, fig 8).

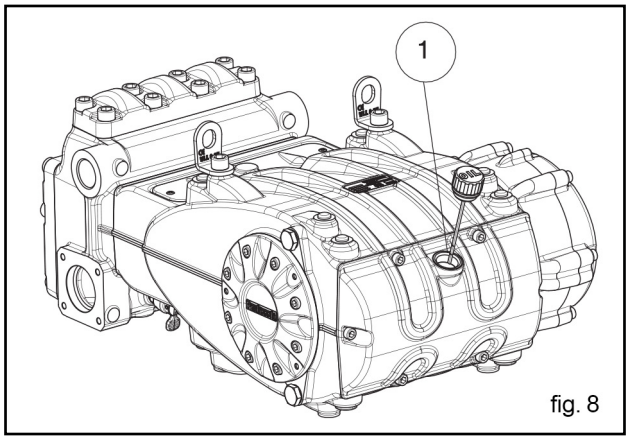


fig. 8

In case the pump has not run for a long period of time, recover the correct operation of the suction valves by opening the three valve-lifting devices (see position 2, fig. 9). Be sure to reclose the valves before the pump start-up. See fig. 10 for "work" and "rest" positions.

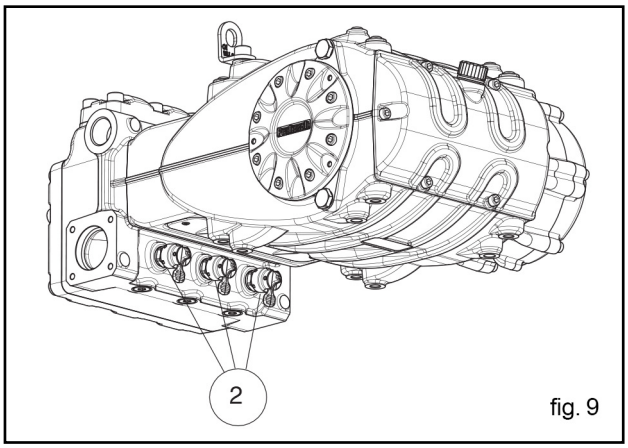


fig. 9

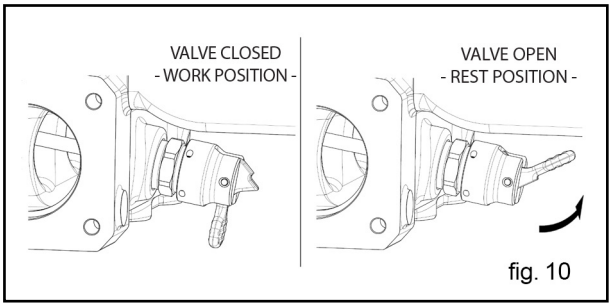


fig. 10

10.2 Start-up

1. When starting the pump for the first time, check for the correct direction of rotation.
2. Verify correct feeding pressure.
3. The pump must be started off-load.
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.

11. PREVENTIVE MAINTENANCE

To guarantee pump reliability and efficiency, comply with the maintenance intervals as indicated in the table below.

PREVENTIVE MAINTENANCE	
EVERY 500 HOURS	**EVERY 1500 HOURS**
Check oil level	Change oil
	Check / Replace:* Valves Valve seats Valve springs Valve guides
	Check / Replace: H.P packings L.P. packings

* For replacement follow instructions contained in the repair manual.

Attention: On pumps without reduction unit, replace bearings and the corresponding seal rings every 7000 hours of operation. On pumps with a reduction unit, replace all the bearings and the corresponding seal rings every 10000 hours of operation. Perform periodical checks on cleaning and maintenance on the pump. See the "ATEX EXPLOSION PROTECTION" manual.

12. PUMP STORAGE

12.1 Filling the Pump With An Anti-Corrosion Emulsion or Anit-freeze By Using An External Diaphragm Pump As In The Layout Shown in Paragraph 9.7.

a) Close the filter draining, if open.
b) Be sure that the connecting hose is clean, spread with grease and connect it to the high pressure outlet port.
c) Fit a suction hose to the diaphragm pump. Open the pump suction connection and fit hose between it and the diaphragm pump.
d) Fill the container with the solution/emulsion.
e) Put the free extremeties of the suction line and the high pressure outlet hose inside the container.
f) Start up the diphragm pump.
g) Pump the emulsion until it comes out of the high pressure hose.
h) Continue pumping for at least another minute; if needed, the emulsion can be 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.

12.2 Hoses

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

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, do not start the pump for any reason unitl the circuit has been fully defrosted, otherwise there can be serious damage to the pump.

14. WARRANTY TERMS

The pump is guaranteed for a period of 5 years from the delivery date, with the exception of parts subject to wear. In any case, please refer to the contract terms for other warranty conditions. 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 un-adjusted 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 is not primed due to valve seizing
- Worn valves
- Worn pressure packings
- Incorrect operation of the pressure adjustment valve
- Transmission problems

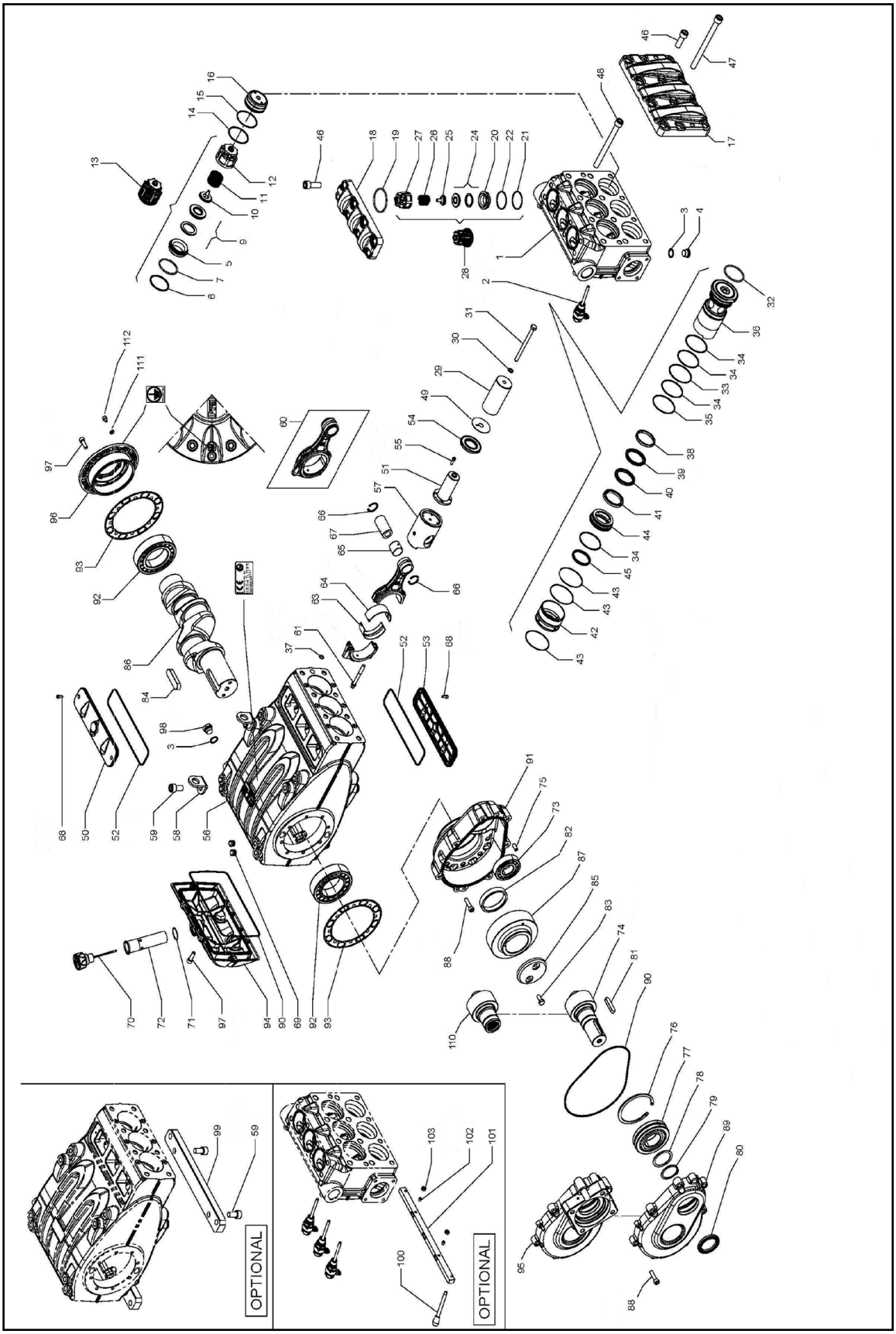
The pump does not deliver the rated flow / is noisy:
- Insufficient feeding (see the causes listed above)
- RPM are less than the rated flow
- Excessive amount of water by-passed by the pressure adjustment valve
- Worn valves
- Leakage from the pressure packings
- Cavitation due to:
  1) Wrong sizing 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 suitable type, indicated in Chapter 7 (see paragraph 7.4)
- Incorrect alignment of the joint or pulleys
- Excessive inclination of the pump during operation

Pump vibrations or knocking:
- Air suction
- Incorrect operation of the pressure adjustment valve
- Valve malfunction
- Irregular drive transmission motion

16. EXPLODED VIEW AND PARTS LIST



Item	Part #	Description	QTY.
1	F73121115 F73121215	MANIFOLD (45-50) MANIFOLD (55)	1
2	F10755401	VALVE OPENING DEVICE	3
3	96751400	WASHER Ø 21.5X27X1.5	5
4	F98218500	STEEL PLUG	3
5	F36206666	INLET VALVE HOUSING	3
6	F90527000	ANTI-EXTRUSION RING, Ø 61.2X67X2	3
7	F90410500	OR Ø59.62X3.53	3
9	F36208701	BALL VAVLE ASSY.	3
10	F36208951	INTERNAL VALVE GUIDE	3
11	F94769800	SPRING, Ø 41.5X37.9	3
12	F36206005	INLET VALVE GUIDE	3
13	F36715001	INLET VALVE UNIT	3
14	F90391100	OR Ø 66.35X2.62	3
15	F90528200	ANTI-EXTRUSION RING, Ø 68.0X72.0X1.5	3
16	F73221556	INLET VALVE PLUG	3
17	F73221415	INLET VALVE COVER	1
18	F73210915	OUTLET VALVE COVER	1
19	F90412000	OR, Ø 68.28X3.53	3
20	F36206766	OUTLET VALVE HOUSING	3
21	F90526000	ANTI-EXTRUSION RING Ø 51.5X56.0X1.5	3
22	F90389000	OR Ø 50.47X2.62	3
24	F36208801	BALL VALVE ASSY.	3
25	F36206766	INTERNAL VALVE GUIDE	3
26	F94760500	SPRING Ø28.5X32	3
27	F36206105	OUTLET VALVE GUIDE	3
28	F36207701	OUTLET VALVE UNIT	3
29	F73040309 F73040409 F73040509	PLUNGER Ø 45X117 PLUNGER Ø 50X117 PLUNGER Ø 55X117	3
30	F96710500	WASHER , Ø 10.0X18.0X0.9	3
31	F99383000	SCREW M10X140	3
32	F90411500	OR Ø 63.5X3.53	3
33	F90528550 F90527000	ANTI-EXTRUSION RING, Ø 72.9X77.0X1.5 (MF45-50) ANTI-EXTRUSION RING, Ø 79.8X80.0X1.5 (MF55)	3
34	F90391400 F90391350	OR, Ø 72.69X2.62 (MF55) OR, Ø 71.12X2.62 (MF45-50)	12
35	F90528650 F90528400	ANTI-EXTRUSION RING, Ø 74.9X79.0X1.5 (MF55) ANTI-EXTRUSION RING, Ø 71.9X76.8X1.5	3
36	F73221856 F73221956 F73222056	CYLINDER SEAL Ø 45 CYLINDER SEAL Ø 50 CYLINDER SEAL Ø 55	3
37	701111	OR, Ø 10.78X2.62	6
38	F74100192 F74100292 F74100392	PISTON HEAD RING, Ø 45 PISTON HEAD RING, Ø 50 PISTON HEAD RING, Ø 55	3
39	90285000 F90286300 F90287300	SEAL RING, Ø 45.0X60.0X4.5/7.5 HP SEAL RING, Ø 50.0X65.0X7.5/4.5 HP SEAL RING, Ø 55.0X70.0X5.0/4.5 HP	3
40	F90284800 F90286500 F90287500	RESTOP RING, Ø 45 RESTOP RING, Ø 50 RESTOP RING, Ø 55	3
41	F73222170 F73222270 F73222370	CENTERING RING Ø 45 CENTERING RING Ø 50 CENTERING RING Ø 55	3
42	F73221691 F73221791	CENTERING HEAD BUSHING Ø 45-50 CENTERING HEAD BUSHING Ø 55	3
43	F90371000	OR, Ø 81.0X2.0	9
44	F73080056 F73080156 F73080256	BOTTOM RING Ø 45 BOTTOM RING Ø 50 BOTTOM RING Ø 55	3
45	F90284600 F90286000 F90287000	SEAL RING, Ø 45.0X53.0X5.5 LP SEAL RING, Ø 50.0X58.0X5.5 LP SEAL RING. Ø 55.0X63.0X5.5 LP	3
46	F99514200	SCREW M16X45	14
47	F99522500	SCREW M16X200	6
48	F99522200	SCREW M16X180	2
49	F96735500	WASHER Ø 16.0X65.0X1.0	3

Item	Part #	Description	QTY.
50	F73150022	CLOSED INSPECTION COVER	1
51	F73050636	PLUNGER GUIDE ROD	3
52	F90414800	OR Ø 202.8X3.53	2
53	F73150122	OPEN ISPECTION COVER	1
54	F90168500	RAD. RING Ø 40.0X72.0X7.0/8.5	3
55	F99188400	SCREW M6X20	12
56	F73010213	PUMP CASING	1
57	F79050443	PLUNGER GUIDE	3
58	F73210674	LIFTING BRACKET	2
59	F99513000	SCREW M16X30	4
60	F73030301	CONNECTING ROD ASSY.	3
61	F99378800	CONNECTING ROD SCREW	6
63	F90928300 F90928100 F90928200	CONROD HEAD SEMI-BUSHING LOWER - INF CONROD HEAD SEMI-BUSHING LOWER +0.25 CONROD HEAD SEMI-BUSHING LOWER +0.50	3
64	F90928000 F90928400 F90958500	CONROD HEAD SEMI-BUSHING UPPER - INF CONROD HEAD SEMI-BUSHING UPPER +0.25 CONROD HEAD SEMI-BUSHING UPPER +0.50	3
65	F90917300	CONROD BUSHING	3
66	F90069700	STOP RING Ø 35	6
67	F97745000	SPINDLE	3
68	99183700	SCREW M6X14	4
69	98206000	HOLE PLUG Ø 15	6
70	F98233500 F98233600	OIL FILLING PLUG G1” OIL FILLING PLUG G1” - ATEX	1
71	90361600	OR Ø 34.65X1.78	1
72	F73210295	TUBE FOR OIL FILLING PLUG, G1”	1
73	F91854000	CY. ROLLER BEARING	1
74	F10076735 F10076835 F10076935 F10082255	PINION, Z24 Ø 1.875, HELICOL PINION, Z21 Ø 2.238, HELICOL PINION, Z18 Ø 2.722, HELICOL PINION, Z19 Ø 3.211, HELICOL	1
75	F97623000	TMP. CYL PIN. Ø 10.0X24.0	2
76	F90101000	STOP RING Ø 120	1
77	F91859900	ADJUST. ROLLER BEARING	1
78	F73210455	BEARING SUPPORT RING	1
79	F90081000	STOP RING Ø 55	1
80	F90172400	RAD. RING, Ø 55.0X75.0X8.0, VITON	1
81	F91500500	TAB, 14.0X9.0X60.0	1
82	F73210589	RING GEAR SUPPORT RING	1
83	9936700	SCREW M10X25	2
84	F91511000	TAB, 22.0X14.0X80.0	1
85	F74213255	RING GEAR STOP	1
86	F73020035	CRANKSHAFT C.70	1
87	F10077035 F10077135 F10077235 F10082355	RING GEAR, Z46 R.1.875 HELICAL RING GEAR, Z47 R.2.238 HELICAL RING GEAR, Z49 R.2.722 HELICAL RING GEAR, Z61 R.3.211 HELICAL	1
88	F99371000	SCREW M10X40	15
89	F73210113	REDUCTION GEAR COVER	1
90	F90415000	OR, Ø 253.6X3.53	2
91	F73210013	REDUCTION GEAR BOX	1
92	F91881000	CY. ROLLER BEARING	2
93	F73210384	SIDE SEAL	2
94	F73160022	CASING COVER	1
96	F73150222	BEARING COVER	1
97	F99368600	SCREW M10X30	14
98	F98218700 F98218700 F98208150	PLUG G1/2”X10 PLUG G1/2”X10 - ATEX PLUG G1/2”X13 - ATEX	2 1 1
99	F73200064	FOOT	2
100	F94540000	LEVER M8X107	1
101	F73215864	VALVE LIFTER BRACKET	1
102	F99301800	SCREW M8X10	2
103	F92221800	SCREW M8X1.5X5X13	2

REPAIR KITS

KIT NUMBER	**F2312 (MF45)** Plunger Pack.	**F2313 (MF50)** Plunger Pack.	**F2314 (MF55)** Plunger Pack.	**F2142** ***Inlet*** Valve	**F2062 Outlet** Valve	**F2315 (MF45)** Complete Seals	**F2316 (MF50)** Complete Seals	**F2317 (MF55)** Complete Seals	**F2150** Conn. Rod	**F2151** Conn. Rod	**F2153** Conn. Rod	**F2152** Mounting Feet	**F2189** Valve lifter junction
Positions Included	32, 33, 34, 35, 37, 39, 40, 43, 45	32, 33, 34, 35, 37, 39, 40, 43, 45	32, 33, 34, 35, 37, 39, 40, 43, 45	13	28	6, 7, 14, 15, 19, 21, 22, 32, 33, 34, 35, 37, 39, 40, 43, 45, 52, 54, 71, 80, 90, 93	6, 7, 14, 15, 19, 21, 22, 32, 33, 34, 35, 37, 39, 40, 43, 45, 52, 54, 71, 80, 90, 93	6, 7, 14, 15, 19, 21, 22, 32, 33, 34, 35, 37, 39, 40, 43, 45, 52, 54, 71, 80, 90, 93	63, 64	63, 64	63, 64	59, 99	101, 102, 103

18. MAINTENANCE LOG

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

GENERAL PUMP

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