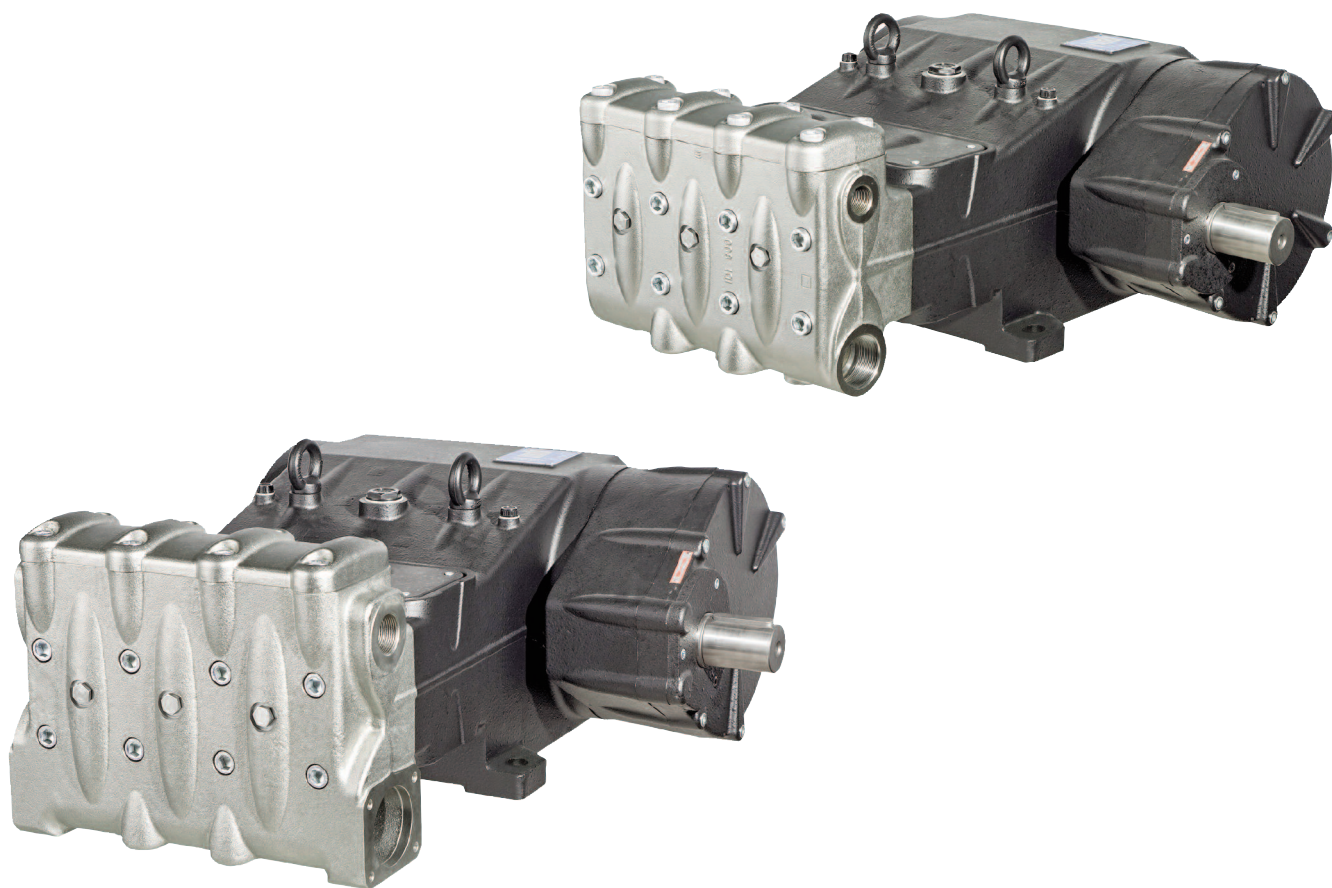


Owner's Manual

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



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1. INTRODUCTION

This manual describes the use and maintenance instructions of the MK 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.

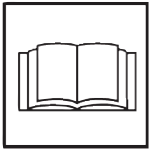
Upon receiving the pump, check that it is complete and in perfect condition.. Should anything be found out of order, please contact us before installing and starting the pump.

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

3. SAFETY

3.1 General Safety Indications

The misuse of pumps and high pressure units, and the non-observance of installation and maintenance instructions 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 unit's maximum operating pressure, and must only be used within the pressure range indicated by the hose manufacturer. The same conditions apply to 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.

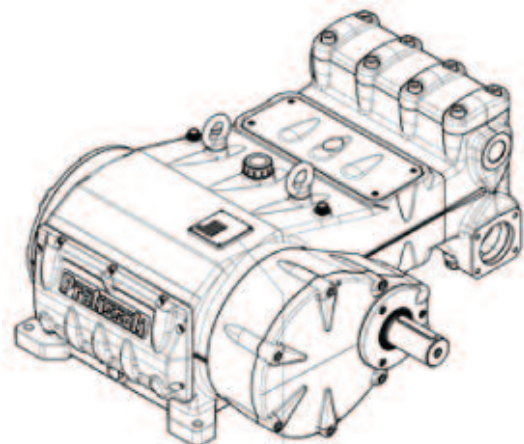


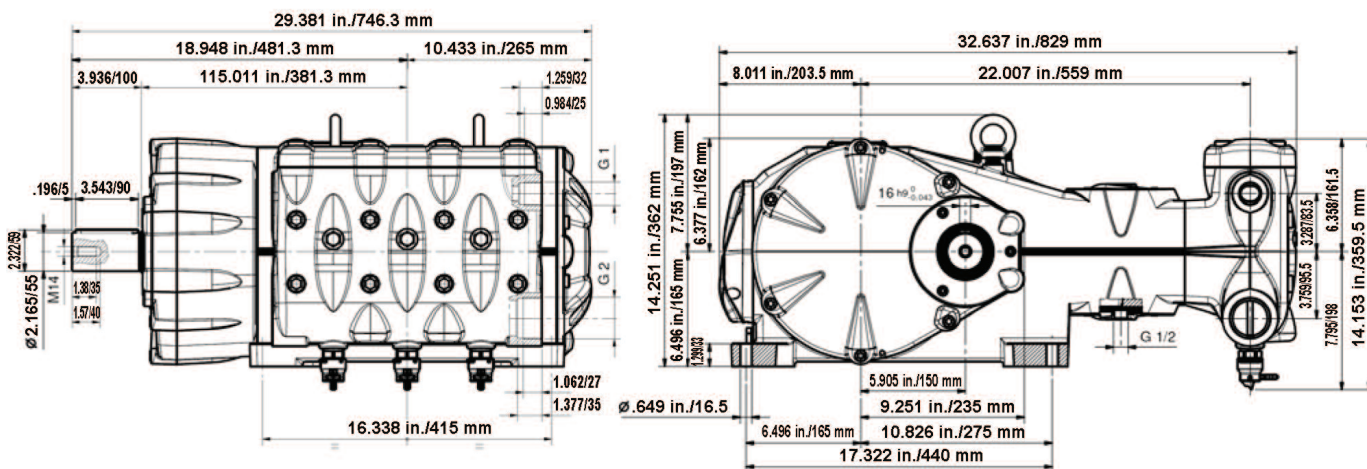
fig. 1

5. TECHNICAL FEATURES

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		GPM	l/min	PSI	Bar	Hp	kW
MK40A	1500/1800	40.0	151	5800	400	159	118
MK45A	1500/1800	50.0	190	4350	300	149	111
MK50A	1500/1800	62.0	235	3625	250	154	115
MK55A	1500/1800	75.0	283	2900	200	149	111
MK60A	1500/1800	90.0	340	2465	170	152	112.5
MK65A	1500/1800	107.0	406	2175	150	160	116

6. DIMENSIONS AND WEIGHT

For dimensions and weight of MK40A, MK45A and MK50A pumps, please refer to fig. 2.



Weight: 833 Lbs./378 Kg.

fig. 2

For dimensions and weight of MK55A, MK60A and MK65A pumps, please refer to fig. 2a.

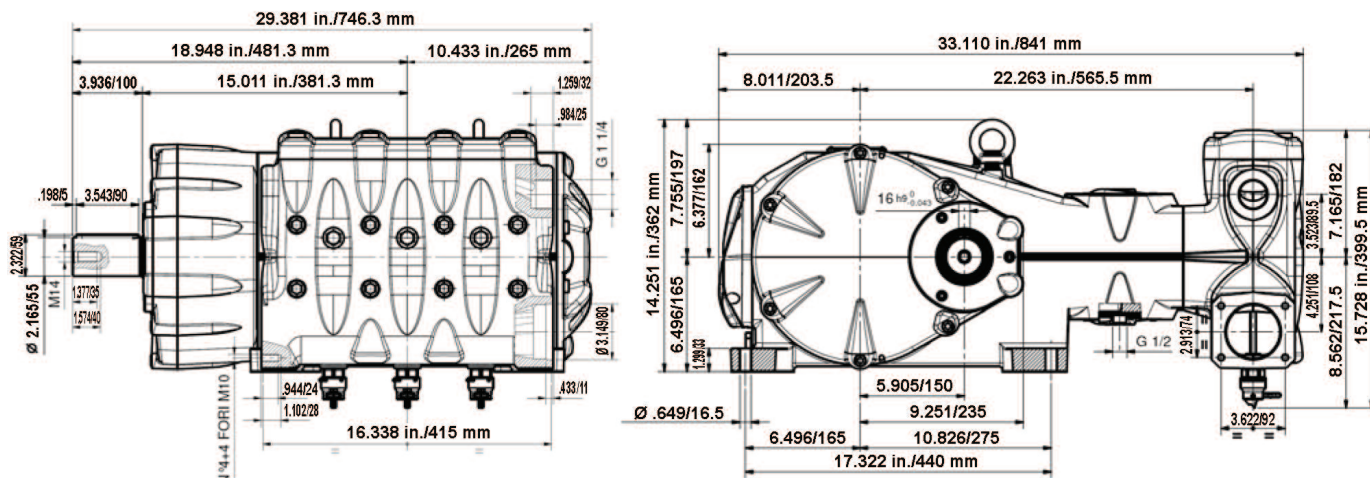


fig. 2a

[illegible]

fig. 2b

6. DIMENSIONS AND WEIGHT (cont.)

For dimensions MK55A, MK60A and MK65A pumps with Hydraulic Pack, please refer to fig. 2c.

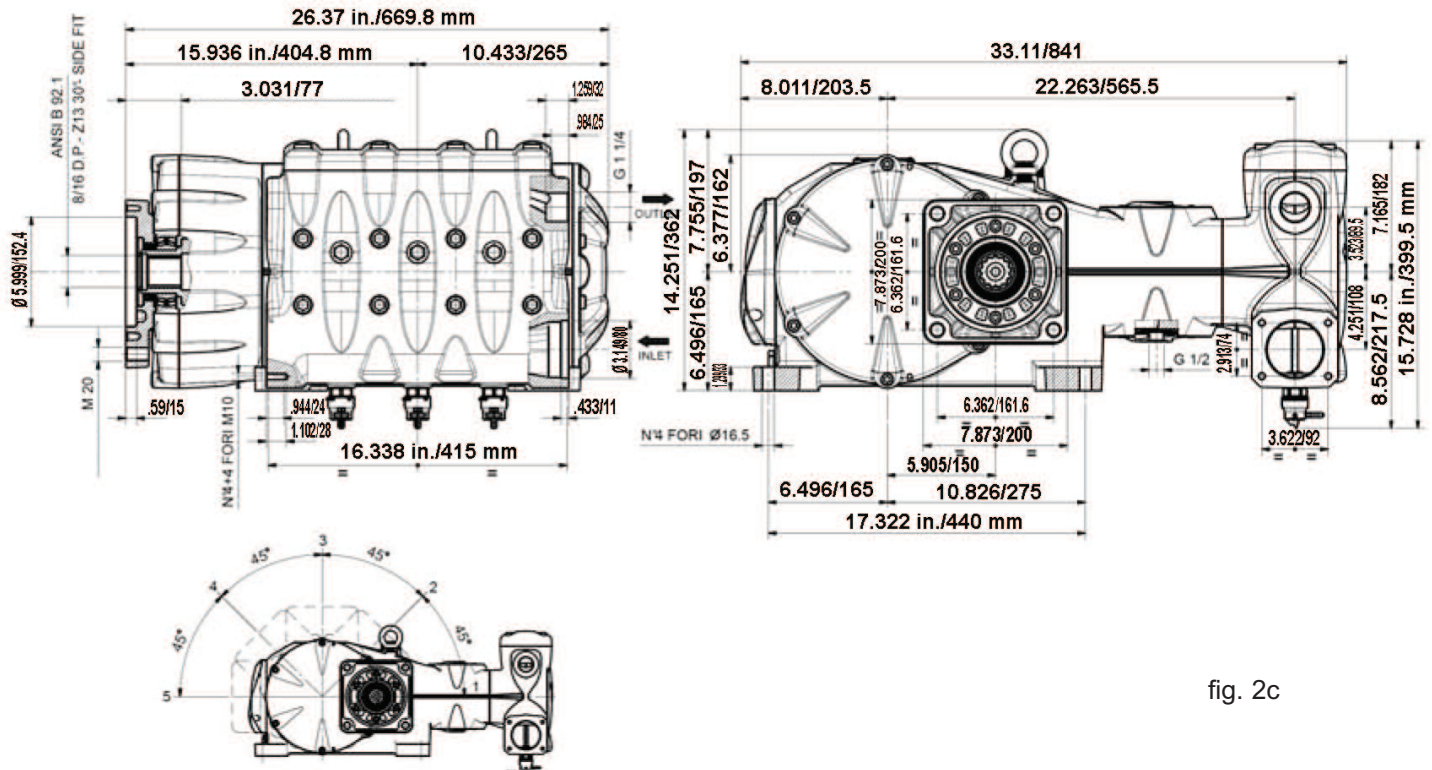


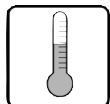
fig. 2c

7. INFORMATION ABOUT PUMP USE



The MK pump has been designed to operate with filtered water (see paragraph 9.7) and at maximum temperature of 104° F (40° C).

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



7.1 WaterTemperature

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

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**.

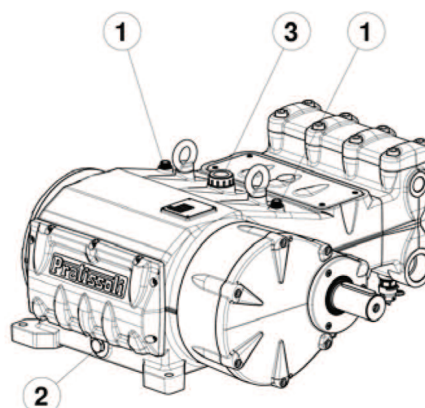
7.4 Recommended Lubricant Oil Types & Manufacturers

The pump is delivered with lubricant oil compliant with room temperatures ranging between 32° and 89.6° F (0° and 30° C). 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 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 oil level dipstick (1), fig. 3. Refill if needed from the oil cap (3), fig. 3. 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..

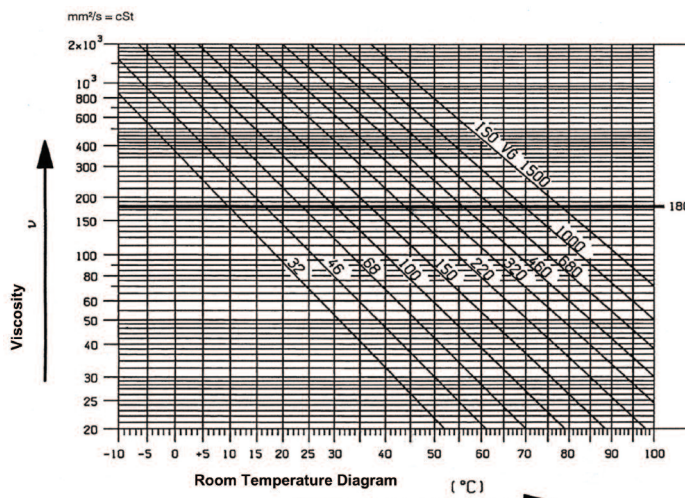
Checking and changing oil is to be carried out as indicated in Chapter 11. The amount required is 456.5 oz. (13.5 liters).



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



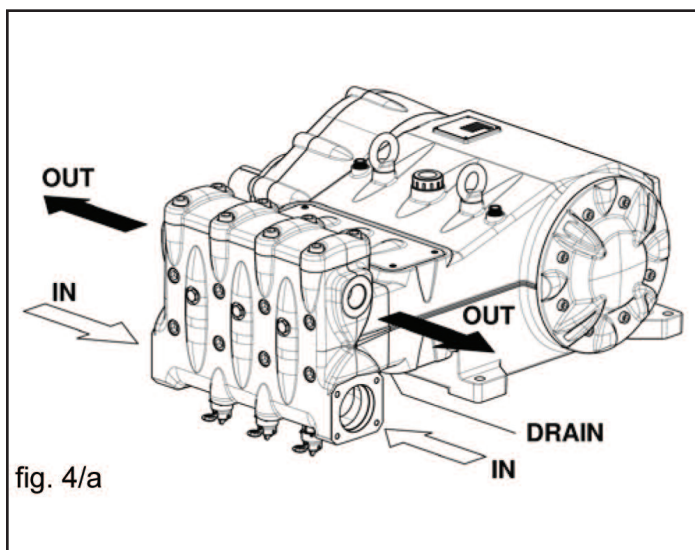
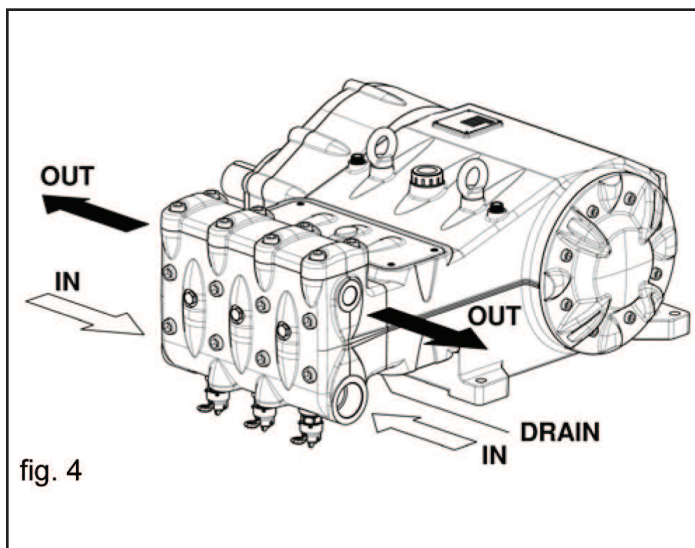
Exhausted oil must be collected in an appropriate recipient and disposed of in appropriate locations. In absolutely no case may it be dispersed into the environment.

8. PORTS AND CONNECTIONS

MK Series pumps (see fig. 4 and 4a) are provided with:

1. 2 inlet ports "IN", 2" NPT (MK40A, MK45A, MK50A).
2 inlet ports "IN", 3" NPT (MK55S, MK60A, MK65A).
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 1" NPT-F (MK40A, 45A, 50A).
2 outlet ports "OUT", Ø 1-1/4" NPT-F (MK55A, 60A, 65A).
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.



9. PUMP INSTALLATION

9.1 Installation

The pump must be installed in a horizontal position using the correct perforated feet Ø .649in (16.5 mm). 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 pump is equipped with two lifting eyebolts to facilitate installation, as shown in the following figure.



The lifting eyebolts must not be removed.

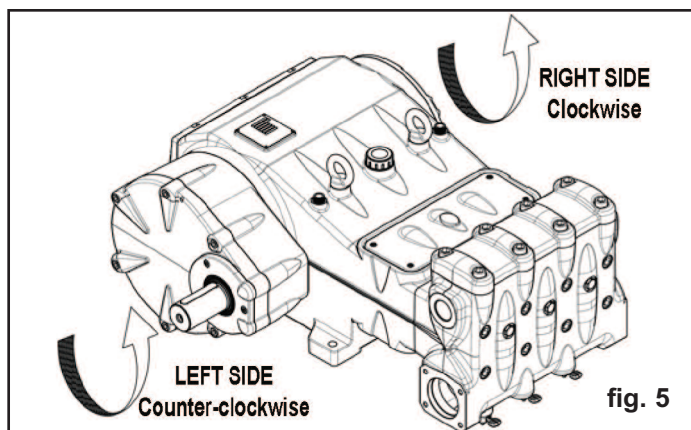


The pump's shaft (PTO) must not be rigidly connected to the motor unit. The following transmission types are suggested:

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

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. 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 specialized and authorized personnel by carefully following the instructions in the repair manual.

Furthermore, it is possible to position the reducer in 5 different positions, both on the right and left sides, as shown in fig. 6.

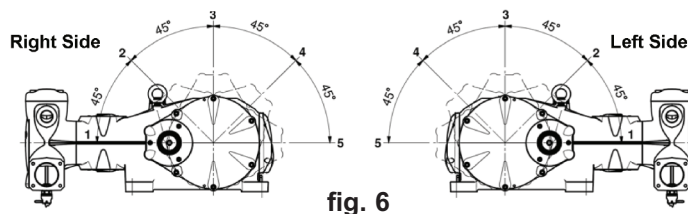


fig. 6



The reducer's position may be changed only by specialized 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 Feeding

MK pumps must always be installed under positive head, i.e. they must receive water by gravity or by forced feeding, and never suck 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.

	MK40A	MK45A	MK50A	MK55A	MK60A	MK65A
NPSH _r (ft)	14.8	18	21.3	24.6	26.2	29.5

For the pumps with higher displacement (MK55A-60A-65A), it is strongly recommended to use a booster pump to avoid cavitation, in view of the geometry on the hydraulic section and of the remarkably high 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 in all running conditions.



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.



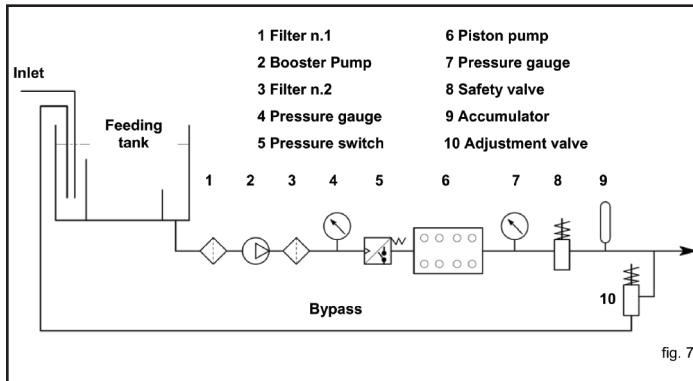
Along the duct, avoid localized diameter reductions that may cause pressure drops with subsequent cavitation. Absolutely avoid 90° elbows, connections with other hoses, bottlenecks, counter-slopes, upside down "U" shaped curves, "T" connections.

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 flows coming from both the by-pass and feeding lines may create turbulence 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 outlet port, and always after the filters.

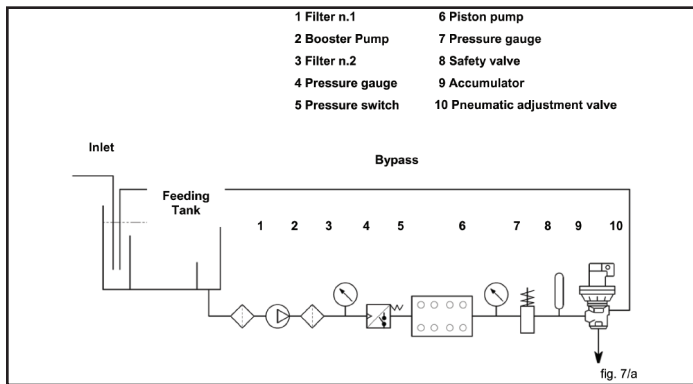
9.7 Filtering

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

With the manual adjustment valve:



With the pneumatic adjustment valve:



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 real clogging conditions.

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.
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

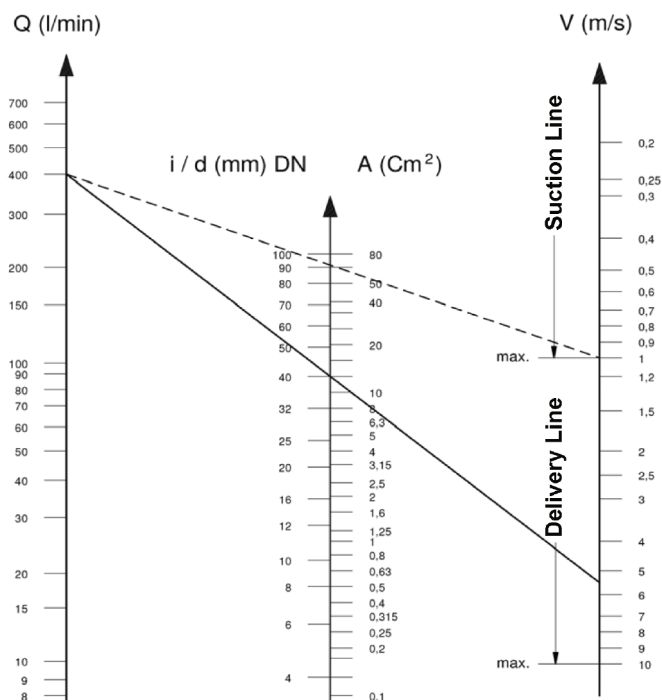
With a flow rate of ~105 GPM (400 l/mn) and water speed of 1 m/sec. the diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 3.5 inch (90 mm).

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).

Optimum speed values:

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



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 expelled 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 pump's oil level must be verified using the correct dipsticks (position 1, fig 8).



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.

10. START-UP AND OPERATION

10.1 Preliminary Inspections

Before Start-up Be sure that:

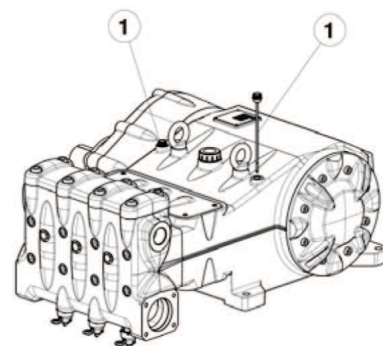


fig. 8



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 the valve positions.

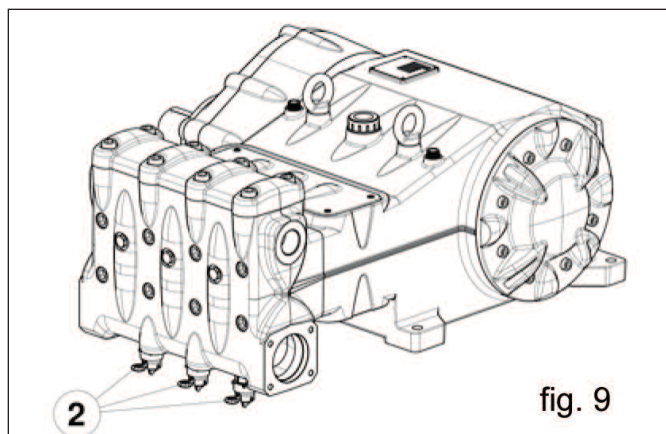


fig. 9

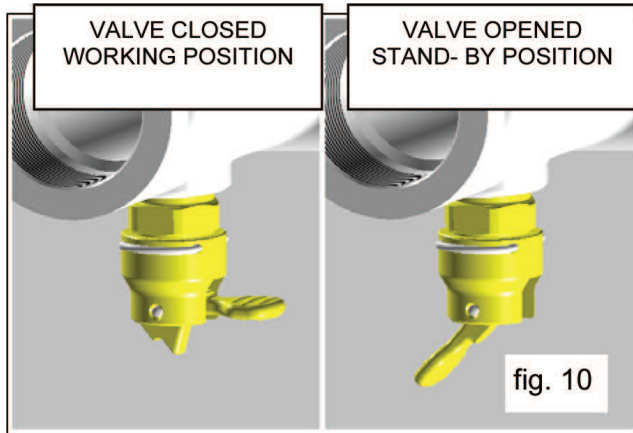


fig. 10

10.2 Start-up

1. When starting the pump for the first time, check for the correct direction of rotation.
2. 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.



In case of priming problems caused by insufficient feeding, it's possible to intervene by removing the three front caps on the head (see position 3, fig. 11).

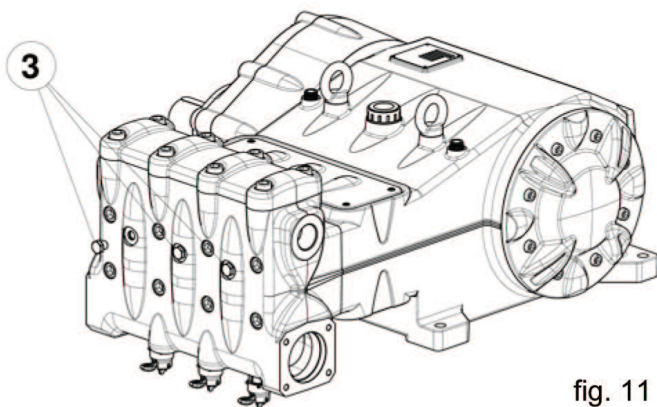


fig. 11

11. PREVENTIVE MAINTENANCE

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

PREVENTIVE MAINTENANCE	
EVERY 500 HOURS	EVERY 1000 HOURS
Check oil level	Change oil
	Check / Replace: <ul style="list-style-type: none"> • Valves • Valve seats • Valve springs • Valve guides
	Check / Replace: <ul style="list-style-type: none"> • H.P packings • L.P. packings

fig. 14

12. STOPPING THE PUMP FOR LONG PERIODS

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 membrane pump. Open the pump suction connection and fit hose between it and the membrane pump.
- d) Fill the container with the solution/emulsion.
- e) Put the free extremities of the suction line 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 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, 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 pump is guaranteed for a period of 12 months from the delivery date or for 1000 hours of operation, 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

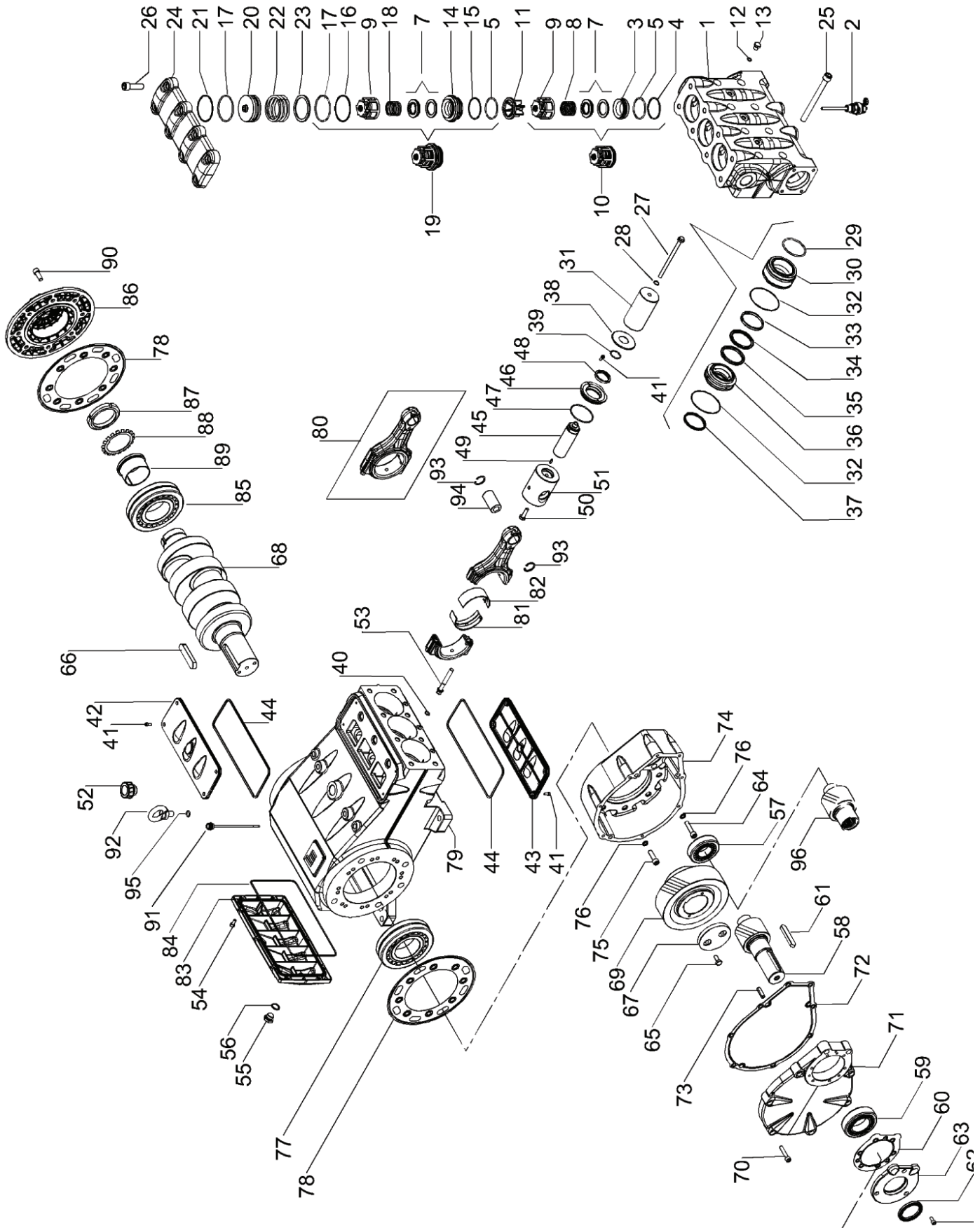
15. TROUBLESHOOTING (continued)**Overheated pump:**

- 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



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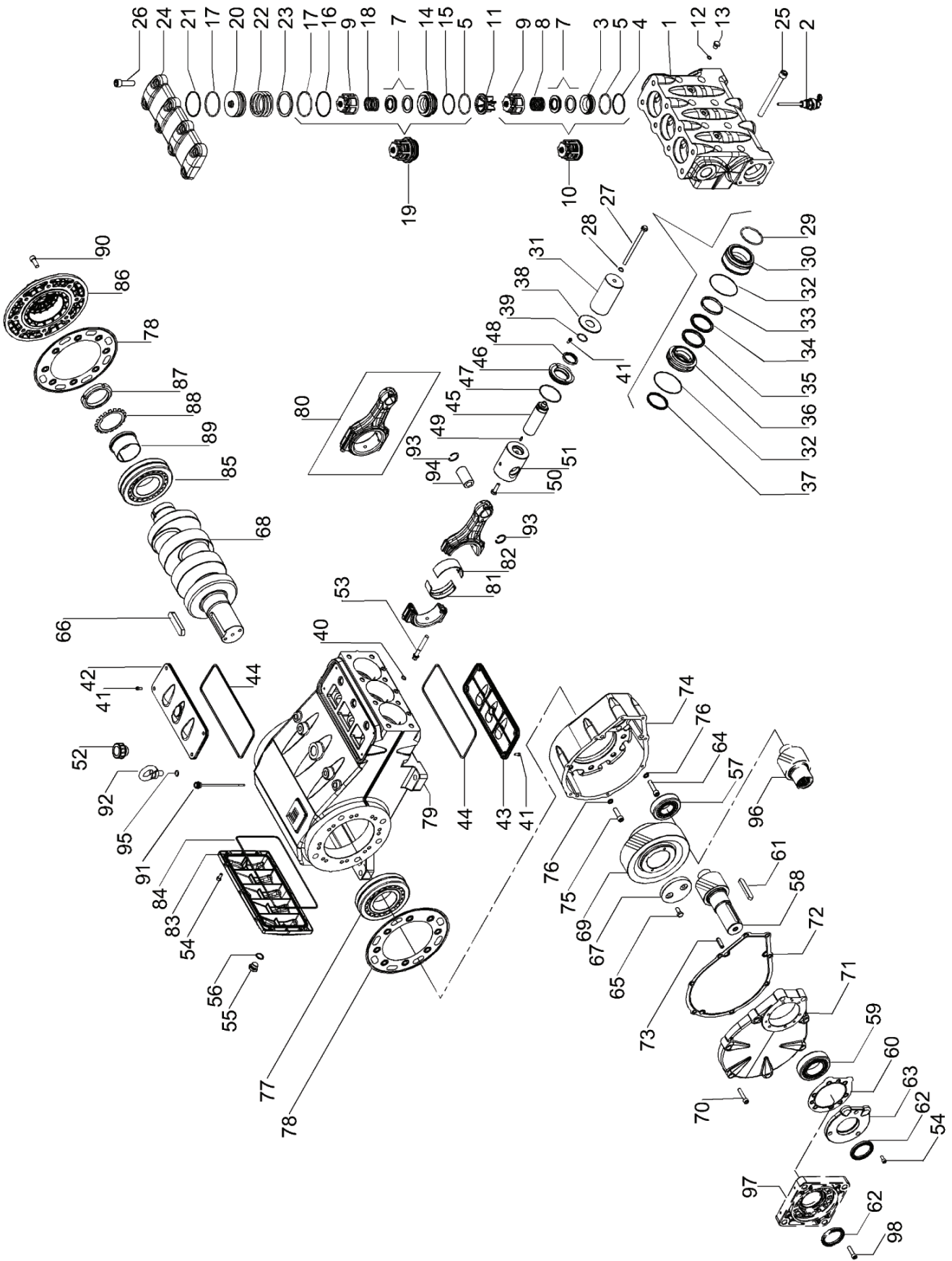
MK45 SERIES

[illegible][illegible]

REPAIR KITS

KIT NUMBER	KIT2052 (MK40A) Plunger Packing Kit	KIT2053 (MK45A) Plunger Packing Kit	KIT2054 (MK50A) Plunger Packing Kit	KIT2055 Valve Kit	KIT2056 (MK40A) Complete Seals Kit	KIT2057 (MK45A) Complete Seals Kit	KIT2058 (MK50A) Complete Seals Kit	KIT2076 Connecting Rod Kit
Positions Included	29, 32, 34, 35, 37, 40	29, 32, 34, 35, 37, 40	29, 32, 34, 35, 37, 40	10, 11, 19	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 34, 35, 37, 39, 44, 47, 48, 60, 62, 72, 78, 84, 95	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 34, 35, 37, 39, 44, 47, 48, 60, 62, 72, 78, 84, 95	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 34, 35, 37, 39, 44, 47, 48, 60, 62, 72, 78, 84, 95	81, 82

16. EXPLODED VIEW AND PARTS LIST



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MK60 SERIES

[illegible][illegible]

REPAIR KITS

KIT NUMBER	KIT2045 (MK55A) Plunger Packing Kit	KIT2046 (MK60A) Plunger Packing Kit	KIT2047 (MK65A) Plunger Packing Kit	KIT2048 Valve Kit	KIT2049 (MK55A) Complete Seals Kit	KIT2050 (MK60A) Complete Seals Kit	KIT2051 (MK650A) Complete Seals Kit	KIT2076 Connecting Rod Kit
Positions Included	29, 32, 34, 35, 37, 40	29, 32, 34, 35, 37, 40	29, 32, 34, 35, 37, 40	10, 11, 17, 19, 21	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 34, 35, 37, 39, 40, 44, 47, 48, 60, 62, 72, 78, 84, 95	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 34, 35, 37, 39, 40, 44, 47, 48, 60, 62, 72, 78, 84, 95	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 34, 4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 34, 35, 37, 39, 40, 44,	81, 82

MAINTENANCE LOG**HOURS & DATE**

OIL CHANGE							
GREASE							
PACKING REPLACEMENT							
PLUNGER REPLACEMENT							
VALVE REPLACEMENT							



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Ref 300669 Rev.A
03/09