GENERAL PUMP

MK2/MKS2

Owner's Manual

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

MK240A - MK245A - MK250A
MKS240A - MKS245A - MKS250A

MK255A - MK260A - MK265A
MKS255A - MKS260A - MKS265A

General Pump is a member of the Interpump Group

QUALITY SYSTEM CERTIFICATION DNV·GL ISO 9001

Ref 310199 Rev. A
02-21

INDEX

INDEX (continued)

1. INTRODUCTION

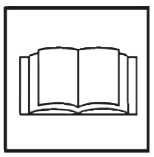
This manual describes the use and maintenance instructions of the MK2 and MKS2 pump, and should be carefully read and understood before using the pump.

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 signaled. 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.
5. The outer surfaces of the pump may reach high temperatures. Therefore we recommend to take precautions to avoid contact with hot parts.

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 their 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 special ized 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) is equipped with a rating plate that indicates:

Pump model and version
Serial Number
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.

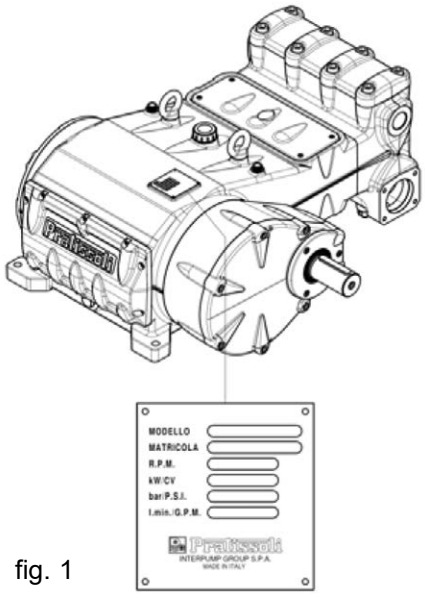


fig. 1

5. TECHNICAL FEATURES

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		GPM	l/min	PSI	Bar	Hp	kW
MK2 40A	1500	40.4	153	5800	400	159	117
	1800	39.4	149	5800	400	155	114
MK2 45A	1500	51.0	193	4350	300	150	110
	1800	49.9	189	4350	300	147	108
MK2 50A	1500	63.1	239	3625	250	155	114
	1800	61.6	233	3625	250	151	111
MK2 55A	1500	76.4	289	2900	200	150	110
	1800	74.5	282	2900	200	146	107
MK2 60A	1500	90.6	343	2465	170	151	111
	1800	88.5	335	2465	170	148	109
MK2 65A	1500	106.5	403	2175	150	157	115
	1800	104.1	394	2175	150	154	113

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		GPM	l/min	PSI	Bar	Hp	kW
MKS2 40A	1500	48.6	184	5800	400	191	140.5
	1800	48.3	183	5800	400	190	140
	2200	48.1	182	5800	400	189	139
MKS2 45A	1500	61.6	233	4350	300	182	134
	1800	61.3	232	4350	300	181	133
	2200	61.0	231	4350	300	180	132
MKS2 50A	1500	76.1	288	3625	250	187	137.5
	1800	75.6	286	3625	250	186	137
	2200	75.3	285	3625	250	185	136
MKS2 55A	1500	92.2	349	2900	200	181	133
	1800	94.4	346	2900	200	180	132
	2200	90.9	344	2900	200	179	132
MKS2 60A	1500	109.6	415	2465	170	183	135
	1800	108.6	412	2465	170	182	134
	2200	108.3	410	2465	170	181	133
MKS2 65A	1500	128.7	487	2175	150	190	140
	1800	127.9	484	2175	150	189	139
	2200	127.1	481	2175	150	187	137.5

6. DIMENSIONS AND WEIGHT

For dimensions and weight of MK240A, MK245A, MK250A, MKS240S, MKS245A, and MKS250A pumps, please refer to fig. 2.

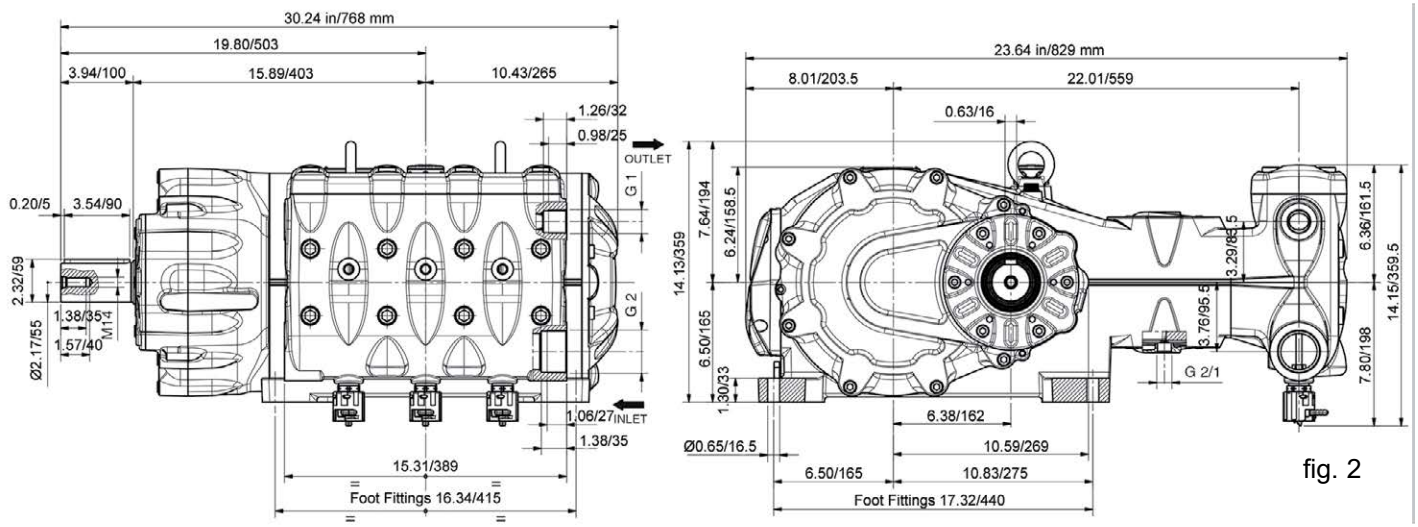


fig. 2

Weight: 877 Lbs./398 Kg.

For dimensions and weight of MK255A, MK260A, MK265A, MKS255A, MKS260A, and MKS65A pumps, please refer to fig. 2a.

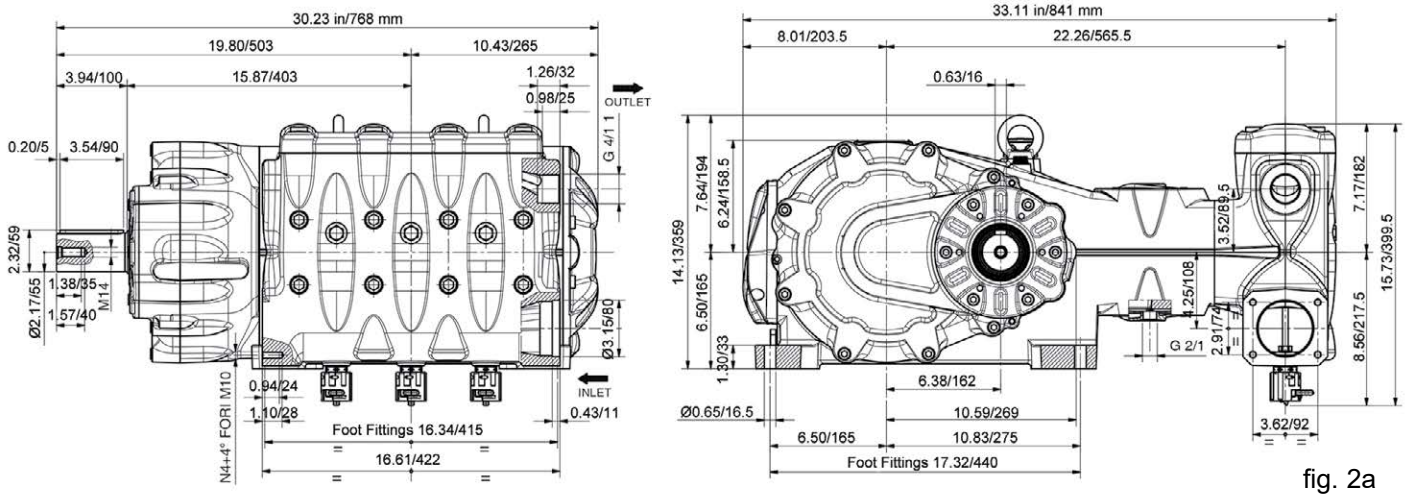


fig. 2a

Weight: 906 Lbs./411 Kg.

6. DIMENSIONS AND WEIGHT (cont.)

For dimensions MK240A, MK245A and MK250A pumps with Hydraulic Pack, please refer to fig. 2b.

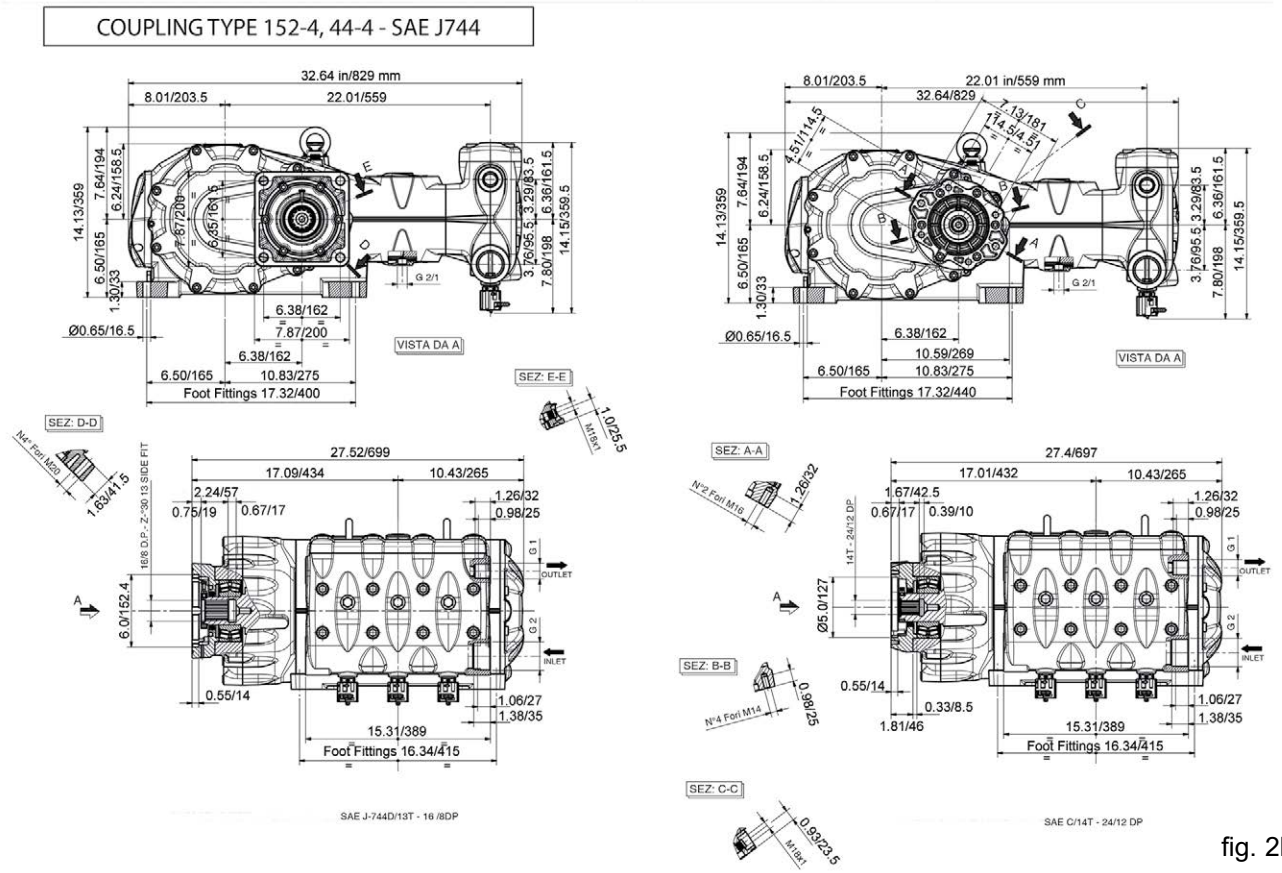


fig. 2b

For dimensions MK255A, MK260A and MK265A pumps with Hydraulic Pack, please refer to fig. 2c.

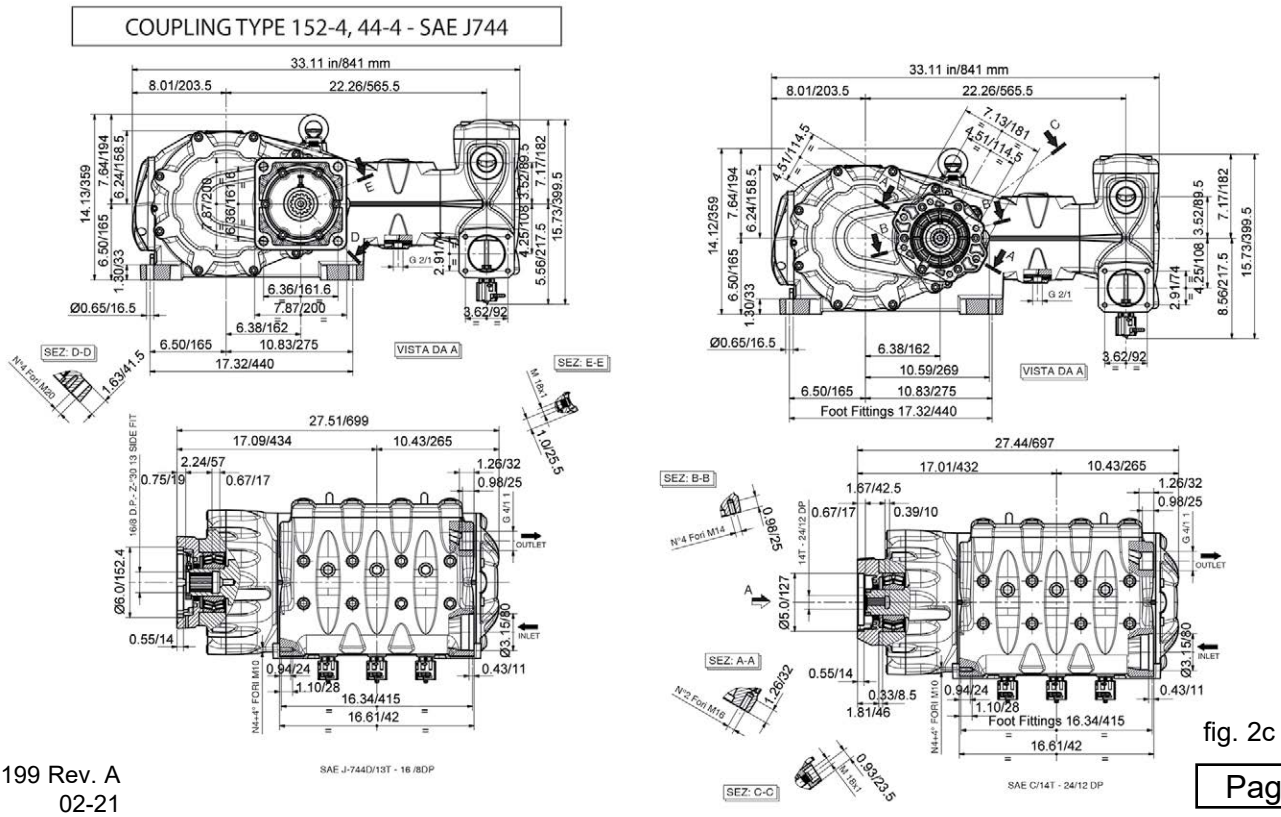


fig. 2c

7.INFORMATION ABOUT PUMP USE

The MK2/MKS2 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 Water Temperature
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 with minimum and maximum value notches (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).

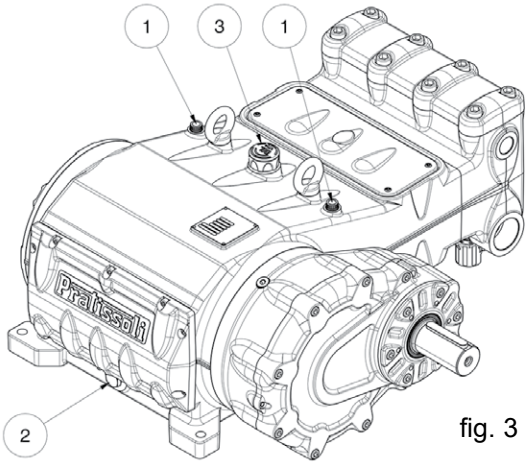
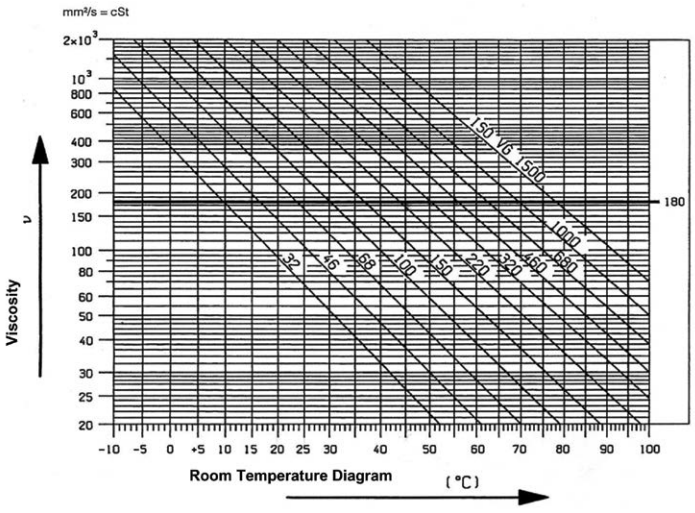


fig. 3

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

8. PORTS AND CONNECTIONS

MK2 Series pumps (see fig. 4 and 4a) are provided with:

1. 2 inlet ports “IN”, 2” NPT (MK2/S 40A, 45A, 50A).
   2 inlet ports “IN”, 3” NPT (MK2/S 55A, 60A, 65A).
   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 (MK2/S 40A, 45A, 50A).
   2 outlet ports “OUT”, Ø 1-1/4” NPT-F (MK2/S 55A, 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.

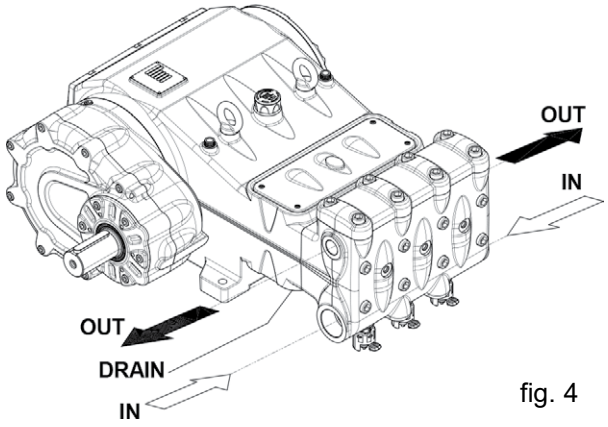


fig. 4

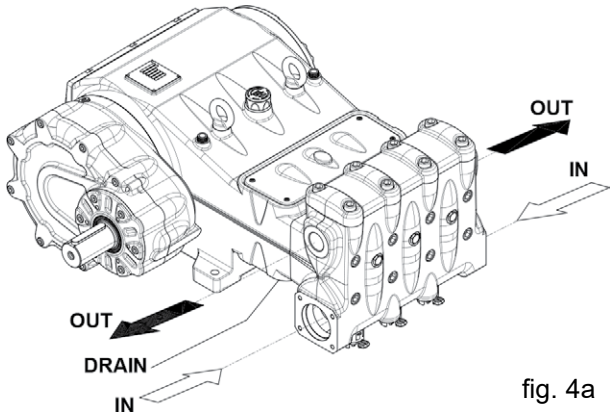


fig. 4a

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 <u>not</u> be removed.

The eyebolts are for lifting the pump only and mys must never be used to handle additional loads.

Replace the oil filler plug located on the crank-case with the dipstick.
The dipstick must always be reachable, even when the unit is assembled.

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

- 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.

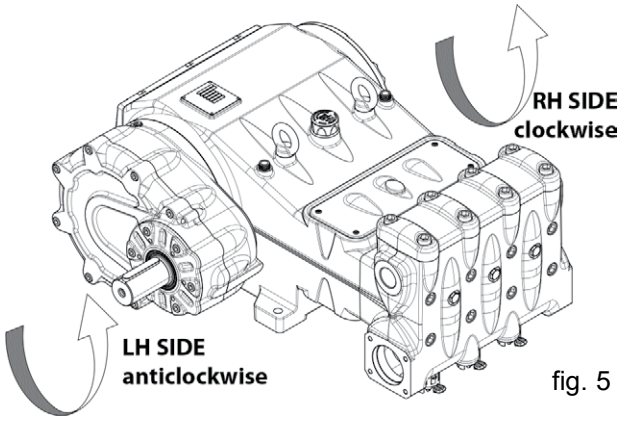


fig. 5

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.

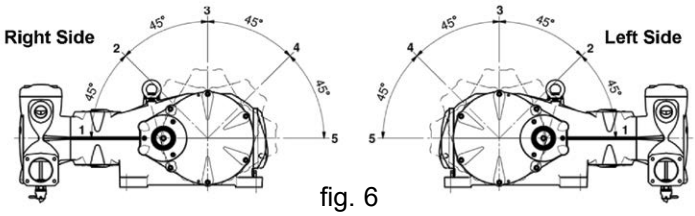


fig. 6

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
MK2/MKS2 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.

	MK240A MKS240A	MK245A MKS245A	MK250A MKS250A	MK255A MKS255A	MK260A MKS260A	MK265A MKS265A
$NPSH_r$ (ft)	14.8	18	21.3	24.6	26.2	29.5

For the pumps with higher displacement (MK255A-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 45 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 90^0 elbows, connections with other hoses, bottlenecks, counter-slopes, upside down "U" shaped curves, "T" connections.

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

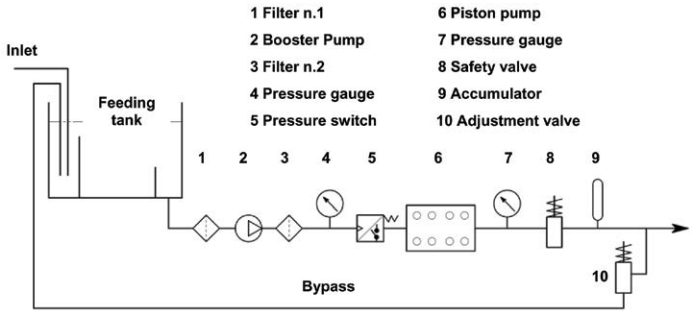


fig. 7

With the pneumatic adjustment valve:

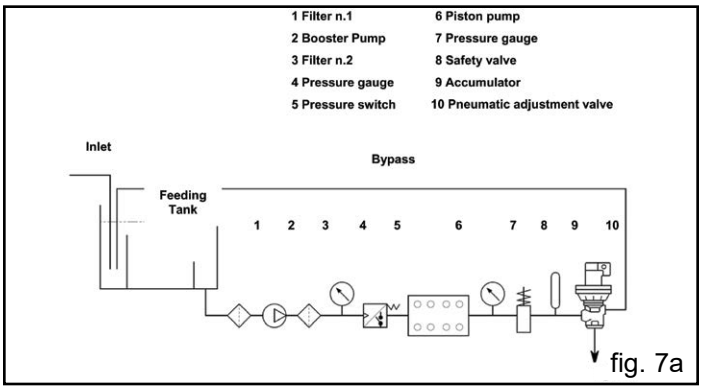


fig. 7a

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 guar antee 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 appli cations, install an appropriately sized pulsation damp ener 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

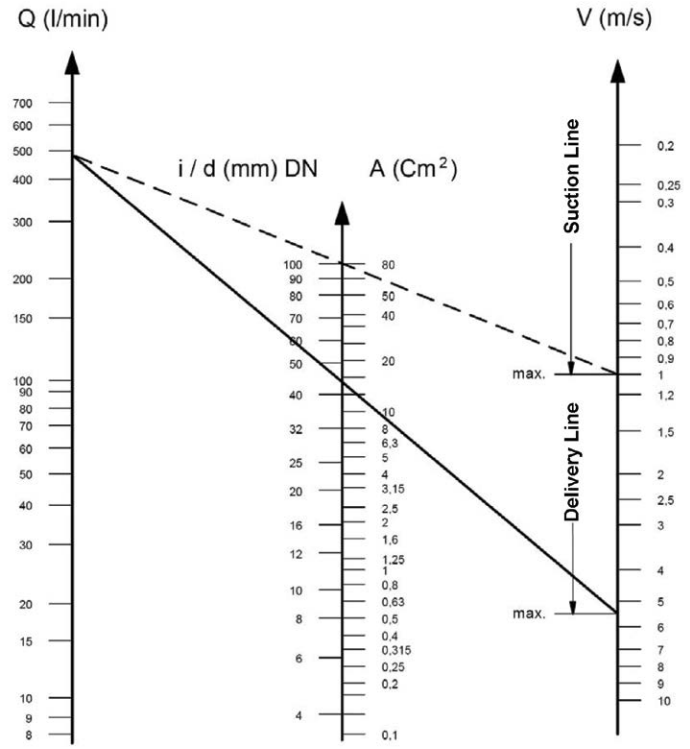
With a flow rate of ~106 GPM (400 l/mn) and water speed of 1 m/sec. the diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 3.5 inch (90 mm).

Delivery Hose

With a flow rate of ~106 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 diame-ters at a value of ~ 1.6 inch (40 mm).

Optimum speed values:

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



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:

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 ex-pulsed easily, thus facilitating pump priming.
3. All suction/delivery connections and fittings must be correctly tightened.
4. Coupling tolerances on the pump/transmis sion 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).

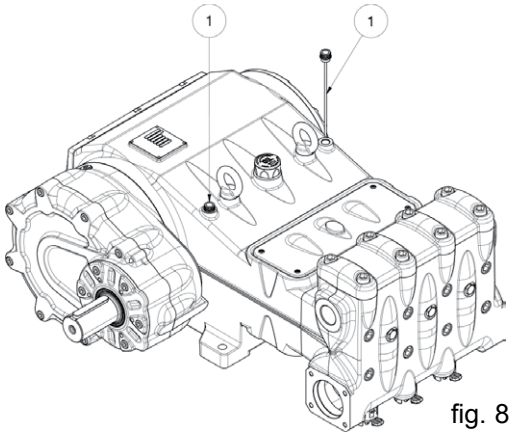


fig. 8

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.

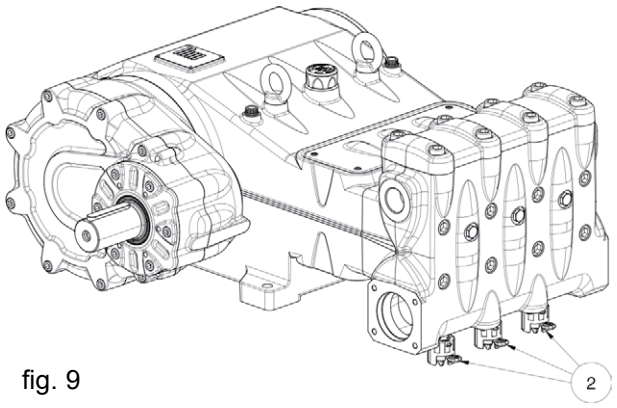


fig. 9

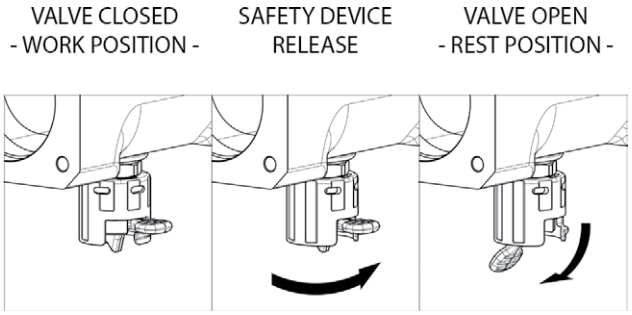


fig. 10

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).

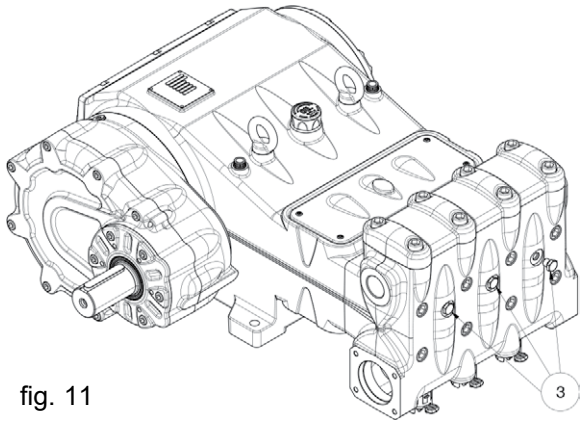


fig. 11

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 1500 HOURS**
Check oil level	Change oil
	Check / Replace: • Valves • Valve seats • Valve springs • Valve guides
fig. 14	Check / Replace: • H.P packings • L.P. packings

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 con nections using compressed air.
b) Cover with polyethylene.
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 dis connected.
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 adjust ment valve
- Transmission problems

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

- Insufficient feeding (see the causes listed above)
- RPM are less than the rated value
- 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 adjust- ment valve
- Worn valves

15. TROUBLESHOOTING (continued)

Overheated pump:

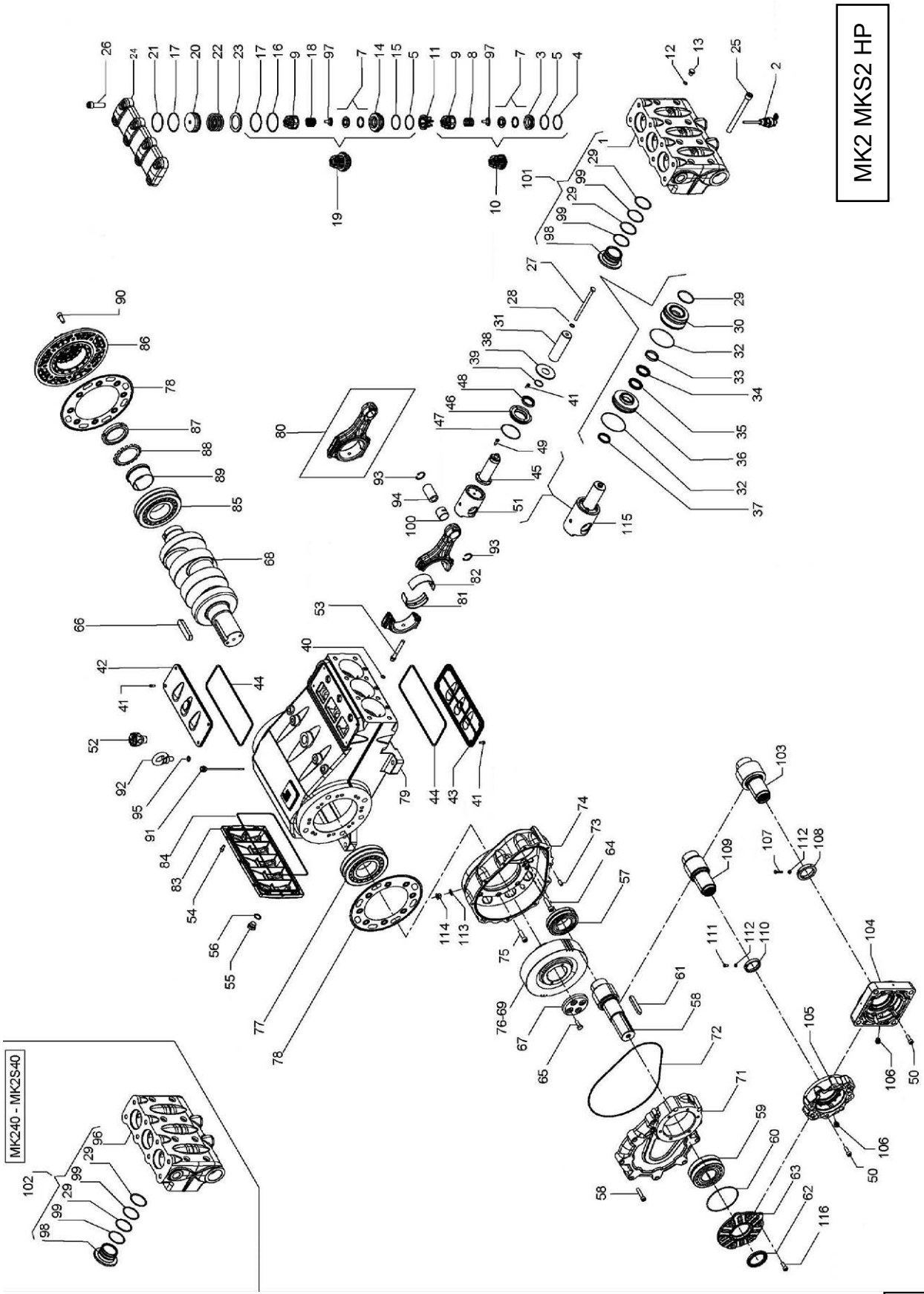
- The pump is overloaded (pressure or RPM exceed the rated values)
- Oil level is too low, or the oil is not of a suit able type, indicated in Chapter 7 (see para graph 7.4)
- Incorrect alignment of the joint or pulleys
- Excessive inclination of the pump during operation

Pump vibrations or knocking:

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

16. EXPLODED VIEW AND PARTS LIST

MK240A, MK2S40A, MK245A, MKS245A, MKS250A, MKS2S50A



Item	Part No.	Description	QTY.
1	F74120501	Manifold, MK245A, MK250A, MKS245A, MKS250A NPT	1
2	F10744401	Suction Valve Device	3
3	F36206766	Inlet Valve Seat	3
4	F90526000	Anti-extrusion Ring, Suction Valve Spring61.2 x 67 x 2	3
5	F90389000	O-ring, Ø 50.47 x 2.62	6
7	F36208801	Suction Valve Spring	6
8	F94760000	Spring, Ø 28.3 x 30.7	3
9	F36206101	Suction/Delivery Valve Guide	6
10	F36715101	Suction Valve Assembly	3
11	F74210651	Spacer, Valve Guide	3
12	F90358400	O-ring, Ø 10.82 x 1.78	3
13	F98204600	Plug, G 1/4" x 13	3
14	F36206966	Valve Seat	3
15	F90526500	Anti-extrusion Ring, Ø 51.7 x 56.2 x 1.5	3
16	F90527600	Anti-extrusion Ring, Ø 67.5 x 72 x 1.5	3
17	F90391100	O-ring, 66.35 x 2.62	6
18	F94760500	Spring, Ø 28.5 x 32	3
19	F36715301	Outlet Valve Assembly	3
20	F74211070	Valve Plug, H.P.	3
21	F90528000	Anti-extrusion Ring, Ø 67.7 x 72.2 x 1.5	3
22	F94775000	Spring, Ø 58 x 45.4	3
23	F74210866	Ring, Valve Seat	3
24	F74210315	Valve Cover, H.P.	1
25	F99522200	Screw, M16 x 180	8
26	F99514700	Screw, M16 x 55	8
27	F99385000	Plunger Screw	3
28	F96710500	Washer, Ø 10x18x0.9	3
29	F90410200	O-ring, Ø 58.74 x 3.53	9
30	F74211156	Plunger Sleeve, MK240A, MKS240A	3
	F74211256	Plunger Sleeve, MK245A, MKS245A	3
	F74211356	Plunger Sleeve, MK250A, MKS250A	3
31	F74040009	Plunger, MK240A, MKS240A	3
	F74040109	Plunger, MK245A, MKS245A	3
	F74040209	Plunger, MK250A, MKS250A	3
32	F90372200	O-ring,Ø 96 x 2	6
33	F74100092	Head Ring, MK240A, MKS240A	3
	F74100192	Head Ring, MK245A, MKS245A	3
	F74100292	Head Ring, MK250A, MKS250A	3
34	F90283200	H.P. Packing, MK240A, MKS240A	3
	F90285000	H.P. Packing, MK245A, MKS245A	3
	F90286300	H.P. Packing, MK250A, MKS250A	3
35	F90283800	Restop Ring, MK240A, MKS240A	3
	F90284800	Restop Ring, MK245A, MKS245A	3
	F90286500	Restop Ring, MK250A, MKS250A	3
36	F74211768	Gasket Holder, MK240A, MKS240A	3
	F74211868	Gasket Holder, MK245A, MKS245A	3
	F74211968	Gasket Holder, MK250A, MKS250A	3
37	F90282800	L.P. Packing, MK240A, MKS240A	3
	F90284600	L.P. Packing, MK245A, MKS245A	3
	F90286000	L.P. Packing, MK250A, MKS250A	3
38	F74213351	Wiper	3
39	F90386500	O-ring, Ø 29.82 x 2.62	3
40	F90382500	O-ring, Ø 10.78 x 2.62	3
41	F99183700	Screw, M6 x 14	14
42	F74150122	Upper Cover	1
43	F74150222	Lower Cover	1
44	F90450000	O-ring, Ø 266.06 x 5.34	2
45	F74050336	Plunger	3
46	F74213171	Plunger Oil Seal Cover	3
47	F90391400	O-ring, Ø 72.69 x 2.62	3
48	F90167900	Ring, Ø 40 x 52 x 7	3
49	99188400	Screw, M6x20	12
50	F99369700	Screw, M10 x 35	6
51	F79050443	Plunger Guide	3
	F79050543	Plunger Guide, +1.0	3
52	F98233300	Oil Plug	1
53	F99441000	Connecting Rod Screw, M12 x 1.25 x 87	6
54	F99304500	Screw, M8 x 18	6
55	98218700	Plug, G 1/2" x 13	1
56	F96751400	Washer, Ø 21.5 x 27 x 1.5	1
57	F91870000	Bearing	1

Item	Part No.	Description	QTY.
58	F10088055	Pinion, Z30 R. 1.600 - Elicoid, MK2	1
	F10088255	Pinion, Z24 R. 2.208 - Elicoid, MKS2	1
	F10088355	Pinion, Z21 R. 2.667 - Elicoid, MK2 MKS2	1
	F10088435	Pinion, Z18 R. 3.278 - Elicoid, MK2 MKS2	1
59	F91861000	Bearing	1
60	F90392650	O-ring, 126.67 x 2.62	1
61	F91503000	Key, 16 x 10 x 90	1
62	F90180000	Ring, Ø 60 x 80 x 8	1
63	F74217322	Gearbox Flange	1
64	F99433500	Screw, M12 x 50	2
65	99368400	Screw, M10 x 30	4
66	F91512000	Pinion Key	1
67	F74225255	Gear Stop	1
68	F74020235	Crankshaft	1
69	F10088635	Gear, Z48 R. 1.600 - Elicoid, MK2	1
	F10088835	Gear, Z53 R. 2.208 - Elicoid, MKS2	1
	F10088935	Gear, Z56 R. 2.667 - Elicoid, MK2 MKS2	1
	F10089035	Gear, Z59 R. 3.278 - Elicoid, MK2 MKS2	1
70	F99373000	Screw, M10 x 50	10
71	F74217413	Gearbox Cover	1
72	F90417300	O-ring, 338.00 x 3.60	1
73	F97623000	Retainer Pin, Ø 12 x 40	2
74	F74217513	Gearbox Housing	1
75	F99430500	Screw, M12 x 40	6
76	F10090735	Gear, Z56 R. 2.667 - Elicoid, SAE-D	1
	F10090735	Gear, Z60 R. 3.75 - Elicoid, SAE-C	1
77	F91885000	Bearing	1
78	F74213084	Gasket, Lateral	2
79	F74010113	Pump Body	1
80	F74030201	Connecting Rod Assembly	3
81	F90930000	Bearing, Lower	3
	F90930100	Bearing, +0.25, Lower	3
	F90930200	Bearing, +0.50, Lower	3
82	F90931000	Bearing, Upper	3
	F90931100	Bearing, +0.25, Upper	3
	F90931200	Bearing +0.50, Upper	3
83	F74160022	Crankcase Cover	1
84	F90416000	O-ring, Ø 304.39 x 3.53	1
85	F91885200	Bearing	1
86	F74150022	Bearing Cover	1
87	F93080000	Ring Nut	1
88	F96830000	Washer, MB	1
89	F91880000	Bearing Bushing	1
90	F99428000	Screw, M12 x 30	8
91	F98209200	Dipstick	2
92	F93105000	Eye Bolt	2
93	F90069700	Ring	6
94	F97745000	Piston Pin, Ø 35 x 64	3
95	F90383300	O-ring, Ø 13.95 x 2.62	2
96	F74120715	Manifold, MK240A, MKS240A	1
97	F36209051	Internal Valve Guide	6
98	F74215156	Bushing	3
99	F90526880	Anti-extrusion Ring, Ø59x65x1.5	6
100	F90917300	Bushing	3
101	F74120601	Packing Stack, MK245A, MK250A, MKS245A, MKS250A	1
102	F74120301	Packing Stack, MK240A, MKS240A	1
103	F10090555	Pinion, Z21 R. 2.667 Elicoid	1
104	F10090920	Motor Flange, SAE-D	1
105	F10090820	Motor Flange, SAE-C	1
106	F90206500	Plug, Ø 17	2
107	F74217834	Screw, M6 x 30	1
108	F74217671	Ring, Ø 55	1
109	F10090655	Pinion, Z16 R. 3.375 Elicoid	1
110	F74217171	Ring, Ø 50	1
111	F70227034	Screw, M6x12	1
112	F92202500	Nut, M6x5	1
113	F96738000	Washer, Ø 17.5 x 23.0 x 1.5	2
114	F98208600	Plug, G 3/8" x 12	2
115	F74606201	Complete Piston Guide	3
116	F99366800	Screw, M10 x 25	6

REPAIR KITS

KIT NUMBER	**F2052 (MK240A MKS240A)** Plunger Packing Kit	**F2053 (MK245A MKS245A)** Plunger Packing Kit	**F2054 (MK250A MKS250A)** Plunger Packing Kit	**F2055** Valve Kit	**F2056 (MK240A MKS240A)** Complete Seals Kit	**F2057 (MKS45A MKS245A)** Complete Seals Kit	**F2058 (MK250A MKS250A)** Complete Seals Kit	**F2076 (F2077 +0.25) (F2078 +0.50)** Connecting Rod Kit
Positions Included	29, 32, 34, 35, 37, 40	29, 32, 34, 35, 37, 40	29, 32, 34, 35, 37, 40	4, 5, 17, 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, 35, 37, 39, 40, 44, 47, 48, 60, 62, 72, 78, 84, 95	81, 82

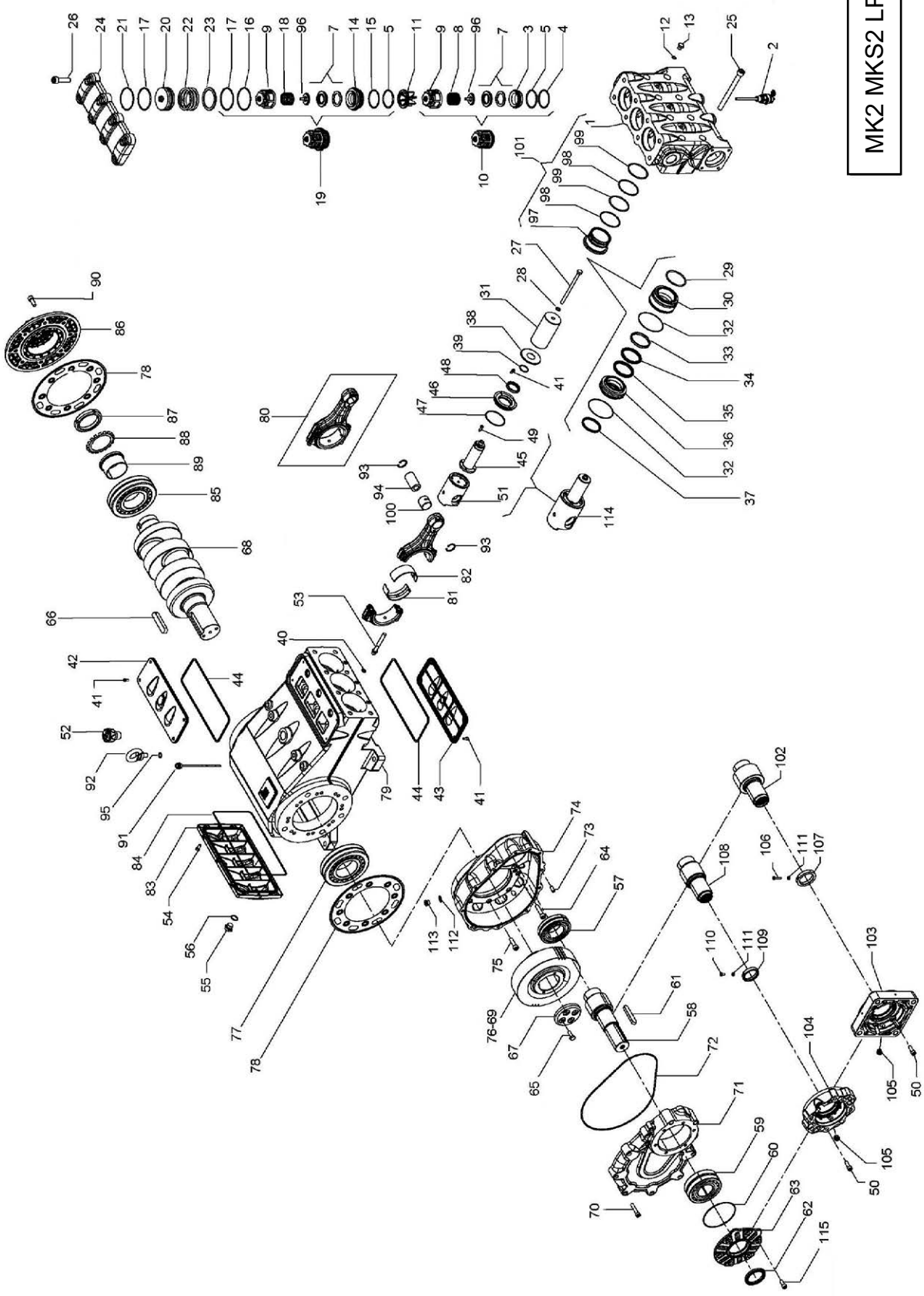
TORQUE SPECS

No.	Ft. Lbs	Nm
2	29.5	40
13	29.5	40
25	245.6	333
26	245.5	333
27	29.5	40
41	7.4	10
49	7.4	10
50	29.5	45
53	55.3	75
54	14.7	20
55	29.5	40
58	33.2	45
64	54.2	73.5
65	59	80
75	54.2	73.5
90	29.5	40
107	7.4	10
111	7.4	10
114	29.5	40
116	33.2	45

16. EXPLODED VIEW AND PARTS LIST

MK255A, MKS255A, MK260A, MKS260A, MK265A, MKS265A

MK2 MKS2 LP



Item	Part #	Description	QTY.
1	F74120415	Manifold	1
2	F10744301	Suction Valve Device	3
3	F36206666	Inlet Valve Seat	3
4	F90527000	Anti-extrusion Ring, Suction Valve Spring61.2 x 67 x 2	3
5	F90410500	O-ring, Ø 50.47 x 2.62	6
7	F36208701	Suction Valve Spring	6
8	F94769800	Spring, Ø 28.3 x 30.7	3
9	F36206051	Suction/Delivery Valve Guide	6
10	F36715001	Suction Valve Assembly	3
11	F74210551	Spacer, Valve Guide	3
12	F90358400	O-ring, Ø 10.82 x 1.78	3
13	F98204600	Plug, G 1/4" x 13	3
14	F36206866	Valve Seat	3
15	F90527300	Anti-extrusion Ring, Ø 61.4 x 676.2 x 1.5	3
16	F90529000	Anti-extrusion Ring, Ø 77.2 x 83 x 1.5	3
17	F90413400	O-ring, 75.8 x 3.53	6
18	F94770000	Spring, Ø 41.5 x 38.3	3
19	F36715201	Outlet Valve Assembly	3
20	F74210970	Valve Plug, H.P.	3
21	F90529300	Anti-extrusion Ring, Ø 77.4 x 83.2 x 1.5	3
22	F94800000	Spring, Ø 75 x 49.6	3
23	F74210766	Ring, Valve Seat	3
24	F74210115	Valve Cover, H.P.	1
25	F99522200	Screw, M16 x 180	8
26	F99514700	Screw, M16 x 55	8
27	F99385000	Plunger Screw	3
28	F96710500	Washer, Ø 10x18x0.9	3
29	F90418500	O-ring, Ø 72 x 4	3
30	F74211456	Plunger Sleeve, MK255A, MKS255A	3
	F74211556	Plunger Sleeve, MK260A, MKS260A	3
	F74211656	Plunger Sleeve, MK265A, MKS265A	3
31	F74040309	Plunger, MK255A, MKS255A	3
	F74040409	Plunger, MK260A, MKS260A	3
	F74040509	Plunger, MK265A, MKS265A	3
32	F90372200	O-ring,Ø 96 x 2	6
33	F74100392	Head Ring, MK255A, MKS255A	3
	F74100492	Head Ring, MK260A, MKS260A	3
	F74100592	Head Ring, MK265A, MKS265A	3
34	F90287300	H.P. Packing, MK255A, MKS255A	3
	F90288300	H.P. Packing, MK260A, MKS260A	3
	F90289300	H.P. Packing, MK265A, MKS265A	3
35	F90287500	Restop Ring, MK255A, MKS255A	3
	F90288500	Restop Ring, MK260A, MKS260A	3
	F90289500	Restop Ring, MK265A, MKS265A	3
36	F74212068	Gasket Holder, MK255A, MKS255A	3
	F74212168	Gasket Holder, MK260A, MKS260A	3
	F74212268	Gasket Holder, MK265A, MKS265A	3
37	F90287000	L.P. Packing, MK255A, MKS255A	3
	F90288000	L.P. Packing, MK260A, MKS260A	3
	F90289000	L.P. Packing, MK265A, MKS265A	3
38	F74213351	Wiper	3
39	F90386500	O-ring, Ø 29.82 x 2.62	3
40	F90382500	O-ring, Ø 10.78 x 2.62	3
41	F99183700	Screw, M6 x 14	14
42	F74150122	Upper Cover	1
43	F74150222	Lower Cover	1
44	F90450000	O-ring, Ø 266.06 x 5.34	2
45	F74050336	Plunger	3
46	F74213171	Plunger Oil Seal Cover	3
47	F90391400	O-ring, Ø 72.69 x 2.62	3
48	F90167900	Ring, Ø 40 x 52 x 7	3
49	99188400	Screw, M6 x 20	12
50	F99368600	Screw, M10 x 30	6
51	F79050443	Plunger Guide	3
	F79050543	Plunger Guide, +1.0	3
52	F98233300	Oil Plug	1
53	F99441000	Connecting Rod Screw, M12 x 1.25 x 87	6
54	F99304500	Screw, M8 x 18	10
55	98218700	Plug, G 1/2" x 13	1
56	F96751400	Washer, Ø 21.5 x 27 x 1.5	1
57	F91870000	Bearing	1

Item	Part #	Description	QTY.
58	F10088055	Pinion, Z30 R. 1.600 - Elicoid, MK2	1
	F10088255	Pinion, Z24 R. 2.208 - Elicoid, MKS2	1
	F10088355	Pinion, Z21 R. 2.667 - Elicoid, MK2, MKS2	1
	F10088455	Pinion, Z18 R. 3.278 - Elicoid, MK2, MKS2	1
59	F91861000	Bearing	1
60	F90392650	O-ring, Ø 126.67 x 2.62	1
61	F91503000	Key, 16 x 10 x 90	1
62	F90180000	Ring, Ø 60 x 80 x 8	1
63	F74212722	Gearbox Flange	1
64	F99433500	Screw, M12 x 50	2
65	99368400	Screw, M10 x 30	4
66	F91512000	Pinion Key	1
67	F73225255	Gear Stop	1
68	F74020135	Crankshaft, MK2	1
	F74020235	Crankshaft, MKS2	1
69	F10088635	Gear, Z48 R. 1.600 - Elicoid, MK2	1
	F10088835	Gear, Z53 R. 2.208 - Elicoid, MKS2	1
	F10088935	Gear, Z56 R. 2.667 - Elicoid, MK2, MKS2	1
	F10089035	Gear, Z59 R. 3.278 - Elicoid, Mk2, MKS2	1
70	F99373000	Screw, M10 x 50	10
71	F74217413	Gearbox Cover	1
72	F90417300	O-ring, Ø 338.00 x 3.60	1
73	F97623000	Retainer Pin, Ø 10.0 x 24.0	3
74	F74217513	Gearbox Housing	1
75	F99430500	Screw, M12 x 40	6
76	F10088935	Gear, Z56 R. 2.667 - Elicoid, SAE-D	1
	F10090735	Gear, Z60 R. 3.75 - Elicoid, SAE-C	1
77	F91885000	Bearing	1
78	F74213084	Gasket, Lateral	2
79	F74010113	Pump Body	1
80	F74030201	Connecting Rod Assembly	3
81	F90930000	Bearing, Lower	3
	F90930100	Bearing, +0.25, Lower	3
	F90930200	Bearing, +0.50, Lower	3
82	F90931000	Bearing, Upper	3
	F90931100	Bearing, +0.25, Upper	3
	F90931200	Bearing +0.50, Upper	3
83	F74160022	Crankcase Cover	1
84	F90416000	O-ring, Ø 304.39 x 3.53	1
85	F91885200	Bearing	1
86	F74150022	Bearing Cover	1
87	F93080000	Ring Nut	1
88	F96830000	Washer, MB	1
89	F91880000	Bearing Bushing	1
90	F99428000	Screw, M12 x 30	8
91	F98209200	Dipstick	2
92	F93105000	Eye Bolt	2
93	F90069700	Ring	6
94	F97745000	Piston Pin, Ø 35 x 64	3
95	F90383300	O-ring, Ø 13.95 x 2.62	2
96	F36208951	Internal Valve Guide	6
97	F74215056	Manifold Bushing	3
98	F90528500	Anti-extrusion Ring, Ø 72.5x72.5x1.5	6
99	F90412900	O-ring, Ø 72.62x3.53	6
100	F90917300	Bushing	3
101	F74120101	Packing Stack	1
102	F10090555	Gear, Z21 R. 2.667 - Elicoid	1
103	F10090920	Motor Flange, SAE-D	1
104	F10090820	Motor Flange, SAE-C	1
105	F90206500	Plug, Ø 17	1
106	F74217834	Screw, M6 x 30	1
107	F74217671	Ring, Ø 55	1
108	F10090655	Gear, Z16 R. 3.750	1
109	F74217171	Ring, Ø 50	1
110	F70227034	Screw, M6 x 12	1
111	F92202500	Nut, M6 x 5	1
112	F96738000	Washer, Ø 17.5 x 23.0 x 1.5	2
113	F98208600	Plug, G 3/8" x 12	2
114	F74606201	Complete Piston Guide	3
115	F99366800	Screw, M10 x 25	6

REPAIR KITS

KIT NUMBER	**F2045 (MK255A MKS255A)** Plunger Packing Kit	**F2046 (MK260A MKS260A)** Plunger Packing Kit	**F2047 (MK265A MKS265A)** Plunger Packing Kit	**F2048** Valve Kit	**F2447 (MK255A MKS255A)** Complete Seals Kit	**F2448 (MK260A MKS260A)** Complete Seals Kit	**F2449 (MK265A MKS265A)** Complete Seals Kit	**F2076 (F2077 +0.25) (F2078 +0.50)** Connecting Rod Kit
Positions Included	29, 32, 34, 35, 37, 40	29, 32, 34, 35, 37, 40	29, 32, 34, 35, 37, 40	4, 5, 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, 35, 37, 39, 40, 44, 47,48, 60, 62, 72, 78, 84, 95	81, 82

TORQUE SPECS

No.	Ft. Lbs	Nm
2	29.5	40
13	29.5	40
25	245.6	333
26	245.5	333
27	29.5	40
41	7.4	10
49	7.4	10
50	33.2	45
53	55.3	75
54	14.7	20
55	29.5	40
58	33.2	45
64	54.2	73.5
65	59	80
70	33.2	45
75	54.2	73.5
90	29.5	40
106	7.4	10
110	7.4	10
113	29.5	40
115	33.2	45

17. MK2R PUMP VERSION

The following information is helpful in deciding how to use the MK2R and MK2SR pumps
Unless specified, use the above instructions for the standard MK pump.

17.1 MK2R - MK2SR Pump

17.1.1 Operating Instructions

The MK2R/MK2SR series pumps have been designed to operate in environments that are not potentially explosive and use water that contains particulates, they are ideal for systems with fluid recirculation.

The durability of the plunger seals are directly related to the amount of solids in the fluid as regards to size and density.
For a long seal life it is recommended that particulates size no larger than 200 micron and 20% max. in volume.
For more information and a general system layout, see par. 17.2.6.

17.1.2 Max Pressure and Flow Rate

The specifications stated in our catalog are the maximum performance of the pump. Regardless of the power used, pressure, and maximum RPM values indicated on the label plate may not be exceeded unless authorized by the **Customer Service Department.**

17.1.3 Technical Features

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		GPM	l/min	PSI	Bar	Hp	kW
MK2R 40A	1500	40.4	153	5800	400	159	117
	1800	39.4	149	5800	400	155	114
MK2R 45A	1500	51.0	193	4350	300	150	110
	1800	49.9	189	4350	300	147	108
MK2R 50A	1500	63.1	239	3625	250	155	114
	1800	61.6	233	3625	250	151	111
MK2R 55A	1500	76.4	289	2900	200	150	110
	1800	74.5	282	2900	200	146	107
MK2R 60A	1500	90.6	343	2465	170	151	111
	1800	88.5	335	2465	170	148	109
MK2R 65A	1500	106.5	403	2175	150	157	115
	1800	104.1	394	2175	150	154	113

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		GPM	l/min	PSI	Bar	Hp	kW
MK2SR 40A	1500	48.6	184	5800	400	188	140.5
	1800	48.3	183	5800	400	188	140
	2200	48.1	182	5800	400	186	139
MK2SR 45A	1500	61.6	233	4350	300	180	134
	1800	61.3	232	4350	300	178	133
	2200	61.0	231	4350	300	177	132
MK2SR 50A	1500	76.1	288	3625	250	184	137.5
	1800	75.6	286	3625	250	183	137
	2200	75.3	285	3625	250	182	136
MK2SR 55A	1500	92.2	349	2900	200	178	133
	1800	94.4	346	2900	200	177	132
	2200	90.9	344	2900	200	177	132
MK2SR 60A	1500	109.6	415	2465	170	181	135
	1800	108.6	412	2465	170	179	134
	2200	108.3	410	2465	170	178	133
MK2SR 65A	1500	128.7	487	2175	150	188	140
	1800	127.9	484	2175	150	186	139
	2200	127.1	481	2175	150	184	137.5

17.1.4 Dimensions and Weight
For dimensions and weight of pump, refer to the diagrams in chapter 6.

17.1.5 Pump Supply
The pump must be installed with a positive suction head, that receives the water by gravity or by forced feeding, while never drawing water lower than pump.
The pump is able to withstand minimum suction heads of even 1 meter. For best volumetric efficiency and to avoid cavitation, the available positive suction head (NPSH avail) measured at the suction flange in the manifold must be equal to or greater that the values below

	NPSH (m)
MK2R40/MK2SR40	17.76' (4.5)
MK2R45/MK2SR45	18.04' (5.5)
MK2R50/MK2SR50	21.33' (6.5)
MK2R55/MK2SR55	24.61' (7.5)
MK2R60/MK2SR60	26.25' (8)
MK2R65/MK2SR65	29.53' (9)

17.1.5 Pump Supply (continued)
For greater displacements, of pumps with plungers Ø 55 - 60 - 65, forced feeding by a booster pump is recommended in order to avoid cavitation, considering the geometry of the hydraulics and the considerable flow rates.
The booster pump must have at least twice the flow rate of the rated flow rate of the plunger pump and a pressure of 2 and 3 bars.
These supply conditions must be observed at all operating speeds

The booster pump must always be started up before the plunger pump.
It is recommend to install a pressure switch on the supply line downstream of the filters protecting the pump.

17.1.6 Filtration
Our customer service department is at your disposal to define the system better, as examples, we provide the following layouts. (fig. 12 and fig. 12/a).

With a manually activated control valve

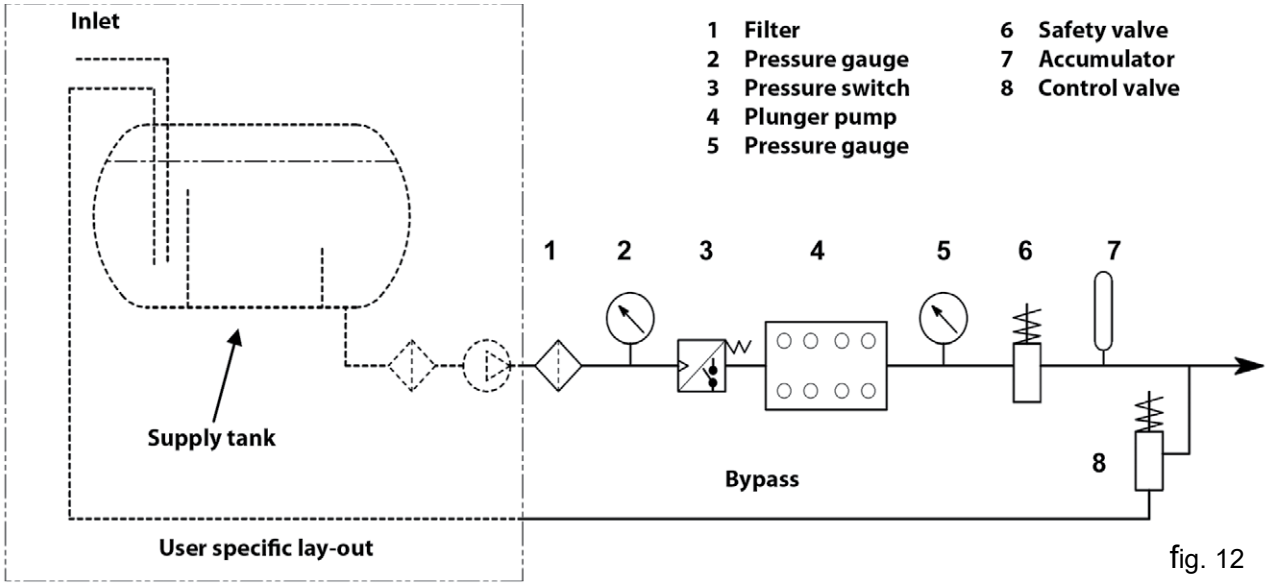


fig. 12

With a pneumatically activated control valve

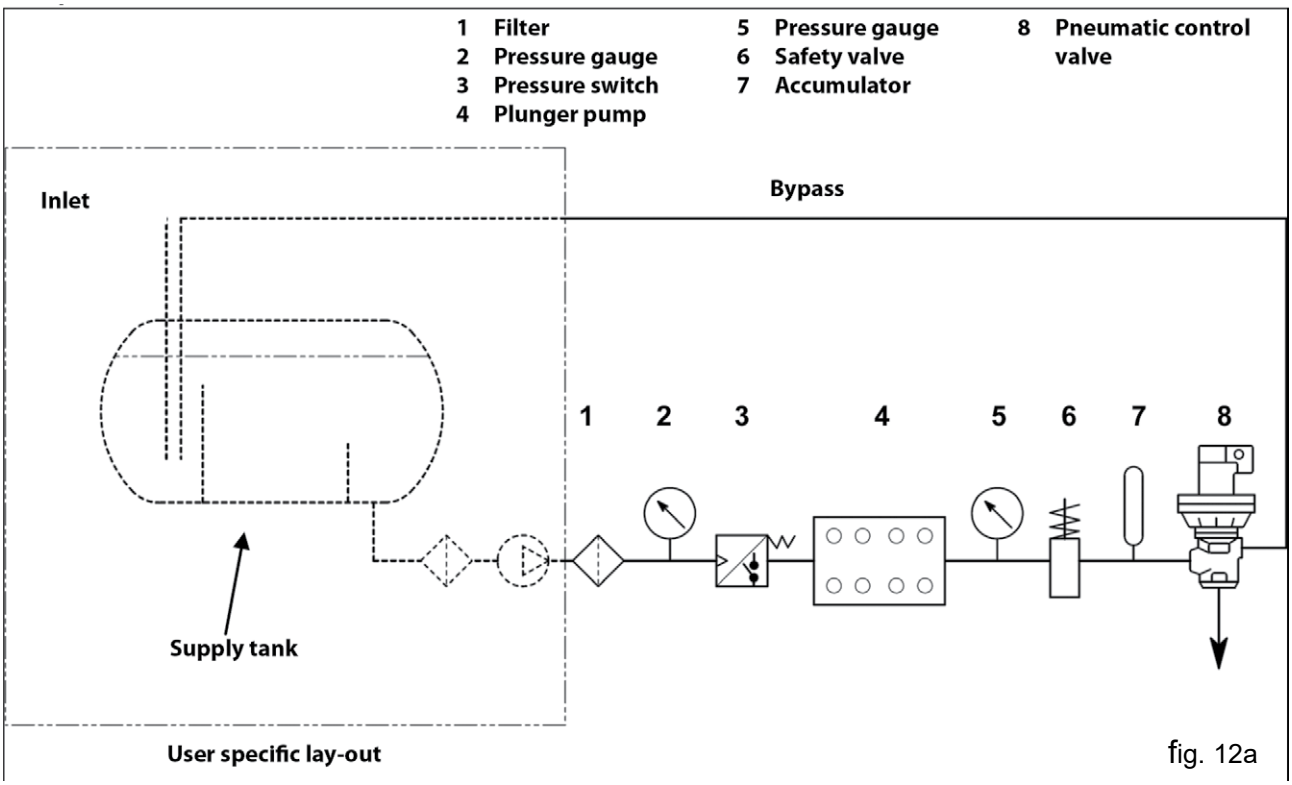


fig. 12a

The filter must be installed as close as possible to the pump and be easily inspected.

For the pump to work properly, the degree of filtration and accumulating capacity of the filtering system must be sized to achieve the best compromise between each filling with water.

The best recommended compromise is the one illustrated in par. 17.1.1.

It is important that after using the pump, to wash it with particulate-free water.

17.1.7 Preventive Maintenance

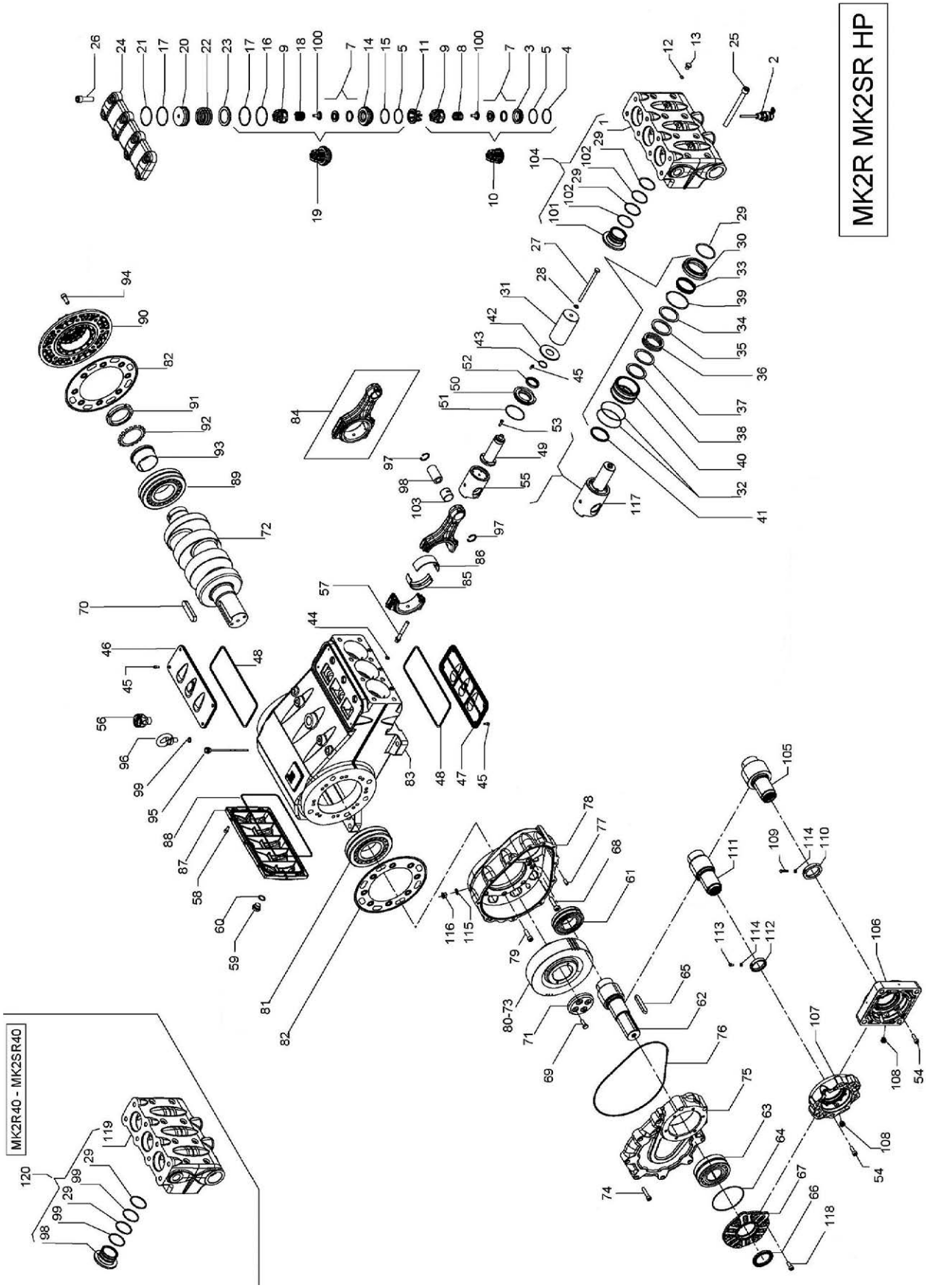
For pump reliability and efficiency, comply with maintenace intervals as shown in the table below.

Preventive Maintenance	
Every 500 Hours	**Every 1000 Hours**
Check Oil Levels	Change Oil
	Check/Replace*: Valves Valve Seats Valve Springs Valve Guides

HP-LP seals: durability depends on the degree of filtration, type of fluid and percentage in volume (see chapter 7)

* To replace, follow instructions contained in the **Repair Manual.**

17.1.8 Exploded View and Parts List
MK2R40A, MK2R45A, MK2R50A, MK2SR40A, MK2SR45A, MK2SR50A



Parts List

Item	Part No.	Description	QTY.
1	F74120501	Manifold MK2R45A MK2R50A, NPT	1
2	F10744401	Suction Valve	3
3	F36206766	Inlet Valve Seat	3
4	F90526000	Antiextrusion Ring, Ø 51.5 x 56 x 1.5	3
5	F90389000	O-ring, Ø 50.47 x 2.62	6
7	F36208801	Suction Valve Spring	6
8	F94760000	Spring, Ø 28.3 x 30.7	3
9	F36206101	Valve Cage	6
10	F36715101	Suction Valve Assembly	3
11	F74210651	Spacer, Valve Guide	3
12	F90358400	O-ring, Ø 10.82 x 1.78	3
13	F98204600	Plug, G 1/4" x 13	3
14	F36206966	Valve Seat	3
15	F90526500	Anti-extrusion Ring, Ø 51.7 x 56.2 x 1.5	3
16	F90527600	Anti-extrusion Ring, Ø 67.5 x 72 x 1.5	3
17	F90391100	O-ring, 66.35 x 2.62	6
18	F94760500	Spring, Ø 28.5 x 32	3
19	F36715301	Outlet Valve Assembly	3
20	F74211070	Valve Plug, H.P.	3
21	F90528000	Anti-extrusion Ring, Ø 67.7 x 72.2 x 1.5	3
22	F94775000	Spring, Ø 58 x 45.4	3
23	F74210866	Ring, Valve Seat	3
24	F74210315	Valve Cover, H.P.	1
25	F99522200	Screw, M16 x 180	8
26	F99514700	Screw, M16 x 55	8
27	F99385000	Plunger Bolt, M10 x 160	3
28	F96710500	Washer, Ø 10 x 18 x 0.9	3
29	F90410200	O-ring Ø 58.74 x 3.53	9
30	F74101056	Plunger Sleeve, Ø 40	3
	F74101156	Plunger Sleeve, Ø 45	3
	F74100656	Plunger Sleeve, Ø 50	3
31	F74104009	Plunger, Ø 40	3
	F74040109	Plunger, Ø 45	3
	F74040209	Plunger, Ø 50	3
32	F90372200	O-ring, Ø 96 x 2	6
33	F94773000	Spring, Ø 51.5 x 36, Ø40-45	3
	F94777000	Spring, Ø 61.5 x 35, Ø50	3
34	F74216556	Ring, Spring Ø 40	3
	F74216956	Ring, Spring Ø 45	3
	F74213456	Ring, Spring Ø 50	3
35	F74216472	Scraper Ring, Ø 40	3
	F74216872	Scraper Ring, Ø 45	3
	F74213882	Scraper Ring, Ø 50	3
36	F90565500	Packing, Ø 40	3
	F90568000	Packing, Ø 45	3
	F90570000	Packing, Ø 50	3
37	F90523200	Anti-extrusion Ring, Ø 40 x 56 x 2.5	3
	F90523600	Anti-extrusion Ring, Ø 45 x 61 x 2.5	3
	F90524500	Anti-extrusion Ring, Ø 50 x 66 x 2.5	3
38	F74216360	Support Ring, Ø 40	3
	F74216760	Support Ring, Ø 45	3
	F74214260	Support Ring, Ø 50	3
39	F90411000	O-ring, Ø 61.91 x 3.53, Ø 40	3
	F90411700	O-ring, Ø 66.27 x 3.53, Ø 45	3
	F90413400	O-ring, Ø 75.80 x 3.53, Ø 50	3
40	F74216256	Packing Support, Ø 40	3
	F74216656	Packing Support, Ø 45	3
	F74214656	Packing Support, Ø 50	3
41	F90282800	Ring, Ø 40 x 48 x 5.5	3
	F90284600	Ring, Ø 45 x 53 x 5.5	3
	F90286000	Ring, Ø 50 x 58 x 5.5	3
42	F74213351	Splash Guard	3
43	F90386500	O-ring. Ø 29.82 x 2.62	3
44	F90382500	O-ring, Ø 10.78 x 2.62	3
45	F99183700	Screw, M6 x 14	14
46	F74150122	Upper Cover	1
47	F74150222	Lower Cover	1
48	F90450000	O-ring, Ø 266.06 x 5.34	2
49	F74050336	Plunger Guide	3
50	F74213171	Plunger Oil Seal Cover	3
51	F90391400	O-ring Ø 72.69 x 2.62	3
52	F90167900	Ring, Ø 40 x 52 x 7	3
53	99188400	Screw, M6 x 20	12
54	F99368600	Screw, M10 x 30	6
55	F79050443	Piston Guide	3
	F79050543	Piston Guide, +1.0	3

Item	Part No.	Description	QTY.
56	F98233300	Oil Plug	1
57	F99441000	Connecting Rod Screw	6
58	F99304500	Screw, M8 x 18	6
59	98218700	Plug, G 1/2" x 13	1
60	F96751400	Washer, Ø 21.5 x 27 x 1.5	1
61	F91870000	Gearbox Flange	1
62	F10088055	Pinion, Z30 R. 1.600 - Elicoid - MK2R	1
	F10088255	Pinion, Z24 R. 2.208 - Elicoid - MK2SR	1
	F10088355	Pinion, Z21 R. 2.667 - Elicoid - MK2R MK2SR	1
	F10088435	Pinion, Z18 R. 3.278 - Elicoid - MK2R MK2SR	1
63	F91861000	Bearing	1
64	F90392650	Gear Box Flange Gasket	1
65	F91503000	Key, 16 x 10 x 90	1
66	F90180000	Ring, Ø 60 x 80 x 8	1
67	F74217322	Gearbox Flange	1
68	F99433500	Screw, M12 x 50	2
69	99368400	Screw, M10 x 30	4
70	F91512000	Pinion Key, 22 x 14 x 100	1
71	F74225255	Gear Stop	1
72	F74020235	Crankshaft, MK2RS	1
	F74020135	Crankshaft, MK2R	1
73	F10088635	Gear, Z48 R. 1.600 - Elicoid - MK2R	1
	F10088835	Gear, Z53 R. 2.208 - Elicoid - MK2SR	1
	F10088935	Gear, Z56 R. 2.667 - Elicoid - MK2R MK2RS	1
	F10089035	Gear, Z59 R. 3.278 - Elicoid - MK2R MK2RS	1
74	F99373000	Screw, M10 x 50	10
75	F74217413	Gearbox Cover	1
76	F90417300	O-ring, Ø 338 x 3.60	1
77	F97623000	Retainer Pin, Ø 10 x 24	2
78	F74217513	Gearbox Housing	1
79	F99430500	Screw, M12 x 40	6
80	F10088935	Gear, Z56 R. 2.667 - Elicoid, SAE-D	1
	F10090735	Gear, Z60 R. 3.75 - Elicoid, SAE-C	1
81	F91885000	Bearing	1
82	F74213084	Gasket, Lateral	2
83	F74010113	Pump Body	1
84	F74030201	Connecting Rod Assembly	3
85	F90930000	Bearing, Lower	3
	F90930100	Bearing, +0.25, Lower	3
	F90930200	Bearing, +.050, Lower	3
86	F90931000	Bearing, Upper	3
	F90931100	Bearing, +0.25, Upper	3
	F90931200	Bearing, +0.50, Upper	3
87	F74160022	Crankcase Cover	1
88	F90416000	O-ring, Ø 304.39 x 3.53	1
89	F91885200	Bearing	1
90	F74150022	Bearing Cover	1
91	F93080000	Ring Nut	1
92	F96830000	Washer, MB	1
93	F91880000	Bearing Bushing	1
94	F99428000	Screw, M12 x 30	8
95	F98209200	Dipstick, G 3/8" x 168	2
96	F93105000	Eye Bolt, M16	2
97	F90069700	Seeger Ring, Ø 35	6
98	F97745000	Piston Pin, Ø 35 x 64	3
99	F90383300	O-ring, Ø 13.95 x 2.62	2
100	F36209051	Internal Valve Guide	6
101	F74215156	Bushing	3
102	F90526880	Anti-extrusion Ring Ø 59 x 65 x 1.5	6
103	F90917300	Bushing	3
104	F74120601	Head Bushing Ø 40	1
	F74120301	Head Bushing Ø 45 - 50	1
105	F10090555	Pinion, Z21 R. 2.667 -Elicoid	1
106	F10090920	Motor Flange, SAE-D	1
107	F10090820	Motor Flange, SAE-C	1
108	F90206500	Plug, Ø 17	2
109	F74217834	Screw, M6 x 30	1
110	F74217671	Ring, Ø 55 Hy-Pac	1
111	F10090655	Pinion, A16 R. 3.375	1
112	F74217171	Ring, Ø 50 Hy-Pac	1
113	F70227034	Screw, M6 x 12	1
114	F92202500	Nut, M6x5	1
115	F96738000	Washer, Ø 17.5 x 23 x 1.5	2
116	F98208600	Plug, G 3/8" x 12	2
117	F74606201	Complete Piston Guide	3
118	F99366800	Screw, M10 x 30	6
119	F74120715	Manifold, Ø 40	1
120	F74120601	Head Bushing, Ø 40	1

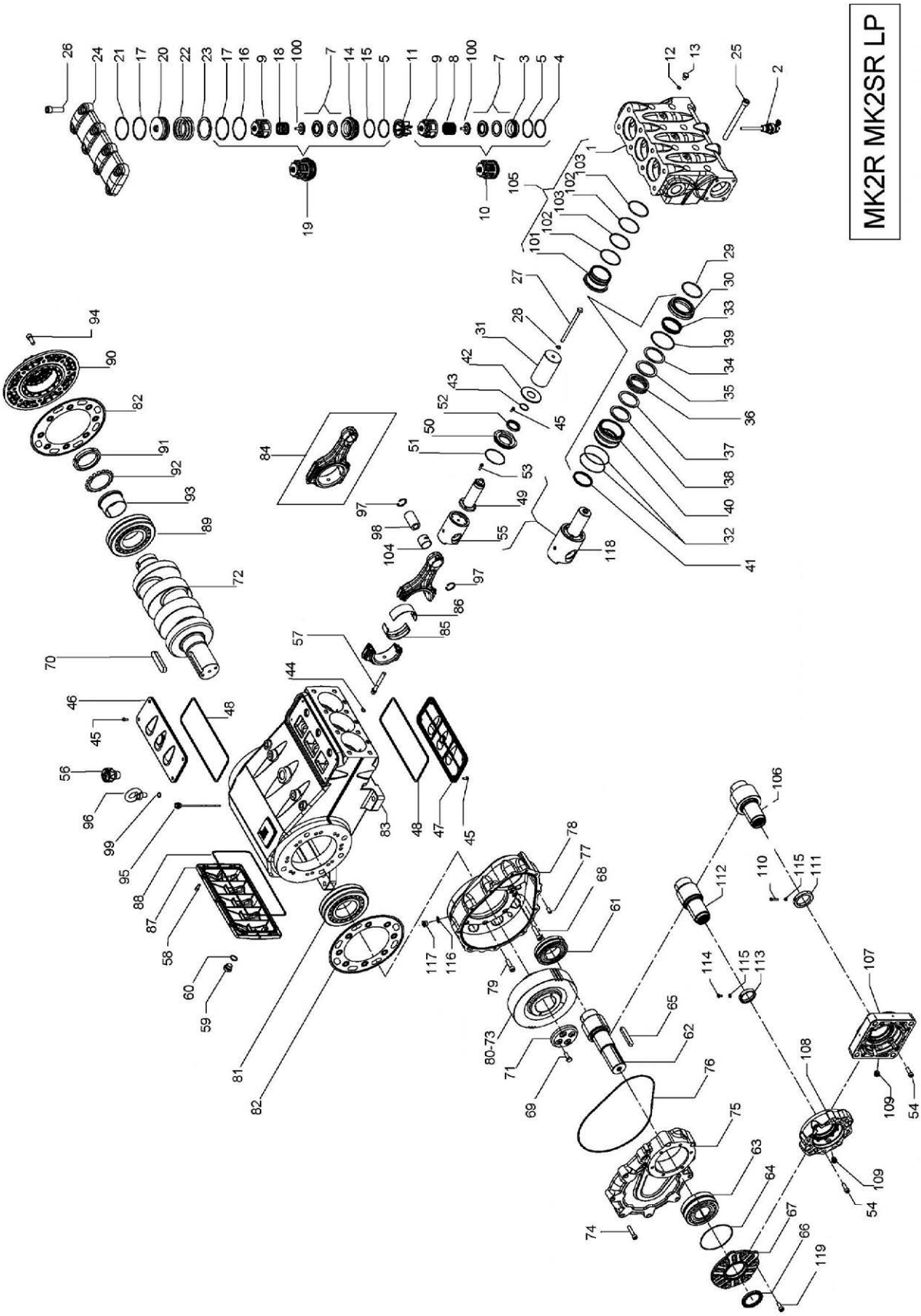
REPAIR KITS

KIT NUMBER	**F2430 (MK2R40A MK2RS40A)** Plunger Packing Kit	**F2431 (MK2R45A MK2SR45A)** Plunger Packing Kit	**F2100 (MK2R50A MK2SR50A)** Plunger Packing Kit	**F2055** Valve Kit	**F2456 (MK2R40A MK2SR40A)** Complete Seals Kit	**F2457 (MK2R45A MK2SR45A)** Complete Seals Kit	**F2458 (MK2R50A MK2SR50A)** Complete Seals Kit	**F2076 (F2077 +0.25) (F2078 +0.50)** Connecting Rod Kit
Positions Included	29, 32, 35, 36, 37, 39, 41, 44,	29, 32, 35, 36, 37, 39, 41, 44,	29, 32, 35, 36, 37, 39, 41, 44,	4, 5, 10, 11, 17, 19, 21	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 35, 36, 37, 39, 41, 43, 44, 48, 51, 52, 64, 66, 76, 82, 88, 99	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 35, 36, 37, 39, 41, 43, 44, 48, 51, 52, 64, 66, 76, 82, 88, 99	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 35, 36, 37, 39, 41, 43, 44, 48, 51, 52, 64, 66, 76, 82, 88, 99	85, 86

TORQUE SPECS

No.	Ft. Lbs	Nm
2	29.5	40
13	29.5	40
25	245.6	333
26	245.5	333
27	29.5	40
41	7.4	10
49	7.4	10
50	33.2	45
53	55.3	75
54	14.7	20
55	29.5	40
58	33.2	45
64	54.2	73.5
65	59	80
70	33.2	45
75	54.2	73.5
90	29.5	40
106	7.4	10
110	7.4	10
113	29.5	40
115	33.2	45

17.1.8 Exploded View and Parts List
MK2R55A, MK2R60A, MK2R65A, MK2SR55A, MK2SR60A, MK2SR65A



MK2R Parts List

Item	Part No	Description	QTY.
1	F74120415	Manifold LP - NPT	1
2	F10744301	Suction Valve Device	3
3	F36206666	Inlet Valve Seat	3
4	F90527000	Anti-extrusion Ring, Suction Valve Spring 61.2 x 67 x 2	3
5	F90410500	O-ring, Ø 59.92 x 3.53	6
7	F36208701	Suction Valve Spring	6
8	F94769800	Spring, Ø 41.5 x 37.9	3
9	F36206001	Suction/Delivery Valve Guide	6
10	F36715001	Suction Valve Assembly	3
11	F74210551	Spacer, Valve Guide	3
12	F90358400	O-ring, Ø 10.82 x 1.78	3
13	F98204600	Plug, G 1/4" x 13	3
14	F36206866	Valve Seat	3
15	F90527300	Anti-extrusion Ring, Ø 61.4 x 67.5 x 1.5	3
16	F90529000	Anti-extrusion Ring, Ø 77.2 x 83 x 1.5	3
17	F90413400	O-ring, 75.8 x 3.53	6
18	F94770000	Spring, Ø 41.5 x 38.3	3
19	F36715201	Outlet Valve Assembly	3
20	F74210970	Valve Plug, L.P.	3
21	F90529300	Anti-extrusion Ring, Ø 77.4 x 83.2 x 1.5	3
22	F94800000	Spring, Ø 75 x 49.6	3
23	F74210766	Ring, Valve Seat	3
24	F74210115	Valve Cover, L.P.	1
25	F99522200	Screw, M16 x 180	8
26	F99514700	Screw, M16 x 55	8
27	F99385000	Plunger Screw, M10x160	3
28	F96710500	Washer, Ø 10 x 18 x 0.9	3
29	F90418500	O-ring, Ø 72 x 4	3
30	74100756	Plunger Sleeve, Ø 55	3
	F74100856	Plunger Sleeve, Ø 60	3
	F74100956	Plunger Sleeve, Ø 65	3
31	F74040309	Plunger, Ø 55 x 127	3
	F74040409	Plunger, Ø 60 x 127	3
	F74040509	Plunger, Ø 65 x 127	3
32	F90372200	O-ring, Ø 96 x 2	6
33	F94777000	Spring, Ø 61.5 x 35, MK2R MK2SR 50	3
	F94790000	Spring, Ø 71.5 x 35 MK2R MK2SR 60-65	3
34	F74213556	Ring, Spring, Ø 55	3
	F74213656	Ring, Spring, Ø 60	3
	F74213756	Ring, Spring, Ø 65	3
35	F74213982	Scraper Ring, Ø 55	3
	F74214082	Scraper Ring, Ø 60	3
	F74214182	Scraper Ring, Ø 65	3
36	F90572500	Packing, Ø 55	3
	F90575000	Packing, Ø 60	3
	F90577500	Packing, Ø 65	3
37	F90526700	Anti-extrusion Ring, Ø 55 x 71 x 2.5	3
	F90526900	Anti-extrusion Ring, Ø 60 x 76 x 2.5	3
	F90527500	Anti-extrusion Ring, Ø 65 x 81 x 2.5	3
38	74214360	Support Ring, Ø 55	3
	F74214460	Support Ring, Ø 60	3
	F74214560	Support Ring, Ø 65	3
39	F90413400	O-ring, Ø 75.8 x 3.53, MK2R MK2SR 55	3
	90414100	O-ring, Ø 85.32 x 3.53, MK2R MK2SR 60 65	3
40	74214756	Packing Support, Ø 55	3
	F74214856	Packing Support, Ø 60	3
	F74214956	Packing Support, Ø 65	3
41	F90287000	Ring, Ø 55 x 63 x 5.5, LP	3
	F90288000	Ring, Ø 60 x 68 x 5.5, LP	3
	F90289000	Ring, Ø 65 x 73 x 5.5, LP	3
42	F74213351	Splash Guard	3
43	F90386500	O-ring, Ø 29.82 x 2.62	3
44	F90382500	O-ring, Ø 10.78 x 2.62	3
45	F99183700	Screw, M6 x 14	14
46	F74150122	Upper Cover	1
47	F74150222	Lower Cover	1
48	F90450000	O-ring, Ø 266.06 x 5.34	2
49	F74050336	Plunger Guide	3
50	F74213171	Plunger Oil Seal Over	3
51	F90391400	O-ring, Ø 72.69 x 2.62	3
52	F90167900	Ring, Ø 40 x 52 x 7	3
53	99188400	Screw, M6 x 20	12
54	F99368600	Screw, M10 x 10	6

Item	Part #	Description	QTY.
55	F79050443	Piston Guide	3
	F79050543	Piston Guide, +1.0	3
56	F98233300	Oil Plug, G1"	1
57	F99441000	Connecting Rod Screw	6
58	F99304500	Screw, M8 x 18	6
59	98218700	Plug, G 1/2" x 13	1
60	96751400	Washer, Ø 21.5 x 27 x 1.5	1
61	F91858000	Bearing	1
62	F10088055	Pinion Z30 R. 1.600 - Elicoid - MK2R	1
	F10088255	Pinion Z24 R. 2.208 - Elicoid - MK2SR	1
	F10088355	Pinion Z21 R. 2.667 - Elicoid - MK2R MK2SR	1
	F10088435	Pinion Z18 R. 3.278 - Elicoid - MK2R MK2SR	1
63	F91861000	Bearing	1
64	F90392650	O-ring, Ø 126.67 x 2.62	1
65	F91503000	Key, 16 x 10 x 90	1
66	F90180000	Ring, Ø 60 x 80 x 8	1
67	F74217322	Gearbox Flange	1
68	F99433500	Screw, M12 x 50	2
69	99368400	Screw, M10 x 25	4
70	F91512000	Pinion Key, 22 x 14 x 100	1
71	F74225255	Gear Stop	1
72	F74020235	Crankshaft, MK2R	1
	F74020135	Crankshaft, MK2SR	1
73	F10088635	Gear, Z48 R. 1.600 - Elicoid - MK2R	1
	F10088835	Gear, Z53 R. 2.208 - Elicoid - MK2SR	1
	F10088935	Gear, Z56 R. 2.667 - Elicoid - MK2R MK2SR	1
	F10089035	Gear, Z59 R. 3.278 - Elicoid - MK2R MK2SR	1
74	F99373000	Screw, M10 x 50	10
75	F74217413	Gearbox Cover	1
76	F90417300	O-ring, Ø 338 x 3.6	1
77	F97623000	Retainer Pin, Ø 10 x 24	2
78	F74217513	Gearbox Housing	1
79	F99430500	Screw, M12 x 40	6
80	F10088935	Gear, Z56 R. 2.667 Elicoid, SAE-D	
	F10090735	Gear, Z60 R. 3.75 Elicoid, SAE-C	
81	F91885000	Bearing	1
82	F74213084	Gasket, Lateral	2
83	F74010113	Pump Body	1
84	F74030201	Connecting Rod Assembly	3
85	F90930000	Bearing, Lower	3
	F90930100	Bearing, +0.25, Lower	3
	F90930200	Bearing, +0.50, Lower	3
86	F90931000	Bearing, Upper	3
	F90931100	Bearing, +0.25, Upper	3
	F90931200	Bearing, +0.50, Upper	3
87	F74160022	Crankcase Cover	1
88	F90416000	O-ring, Ø 304.39 x 3.53	1
89	F91885200	Bearing	1
90	F74150022	Bearing Cover	1
91	F93080000	Ring Nut	1
92	F96830000	Washer, MB	1
93	F91880000	Bearing Bushing	1
94	F99428000	Screw, M12 x 30	8
95	F98209200	Dipstick, G 3/8" x 168	2
96	F93105000	Eye Bold. M16	2
97	F90069700	Seeger Ring, Ø 35	6
98	F97745000	Piston Pin, Ø 35 x 64	3
99	F90383300	O-ring, Ø 13.95 x 2.62	2
100	F36208951	Internal Valve Guide	6
101	F74215056	Bushing	3
102	F90528500	Anti-extrustion Ring, Ø 72.5 x 78.5 x 1.5	6
103	F90412900	O-ring, Ø 72.62 x 3.53	6
104	F90917300	Bushing	3
105	F74120101	Head Bushing	1
106	F10090555	Pinion, Z21 R. 2.667 - Elicoid	1
107	F10090920	Motor Flange - SAE-D	1
108	F10090820	Motor Flange - SAE-C	1
109	F90206500	Plug, Ø 17	2
110	F74217834	Screw, M6 x 30	1
111	F74217671	Ring, Ø 55	1
112	F10090655	Pinion, Z16 R. 3.375	1
113	F74217171	Ring, Ø 50	1
114	F70227034	Screw, M6 x 12	1
115	F92202500	Nut, M6 x 5	1
116	F96738000	Washer, Ø 17.5 x 23 x 1.5	2
117	F98208600	Plug, G 3/8" x 12	2
118	F74606201	Complete Piston Guide	3
119	F99366800	Screw, M10 x 25	6

REPAIR KITS

KIT No.	**KIT2102 (MK2R55 MK2SR55)** Plunger Packing Kit	**KIT2103 (MK2R60 MK2SR60)** Plunger Packing Kit	**KIT2104 (MK2R65 MK2SR65)** Plunger Packing Kit	**KIT2048** Valves Kit	**KIT2105** Complete Seal Kit	**KIT2106** Complete Seal Kit	**KIT2107** Complete Seal Kit	**KIT2076 (KIT2077 +0.25) KIT2078 +0.50)** Connecting Rod Kit
Positions Included	29, 32, 35, 36, 37, 39, 41, 44	29, 32, 35, 36, 37, 39, 41, 44	29, 32, 35, 36, 37, 39, 41, 44	10, 11, 17, 19, 21	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 35, 36, 37, 39, 41, 43, 44, 48, 51, 52, 64, 66, 76, 82, 88, 99	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 35, 36, 37, 39, 41, 43, 44, 48, 51, 52, 64, 66, 76, 82, 88, 99	4, 5, 12, 15, 16, 17, 21, 28, 29, 32, 35, 36, 37, 39, 41, 43, 44, 48, 51, 52, 64, 66, 76, 82, 88, 99	85, 86

TORQUE SPECS

No.	Ft. Lbs	Nm
2	29.5	40
13	29.5	40
25	245.6	333
26	245.5	333
27	29.5	40
45	7.4	10
53	7.4	10
54	33.2	45
57	55.3	75
58	14.7	20
59	29.5	40
68	54.2	73.5
69	59	80
74	33.2	45
79	54.2	73.5
94	29.5	40
110	7.4	10
114	7.4	10
117	29.5	40
119	33.2	45

18. MAINTENANCE LOG

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

GENERAL PUMP

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