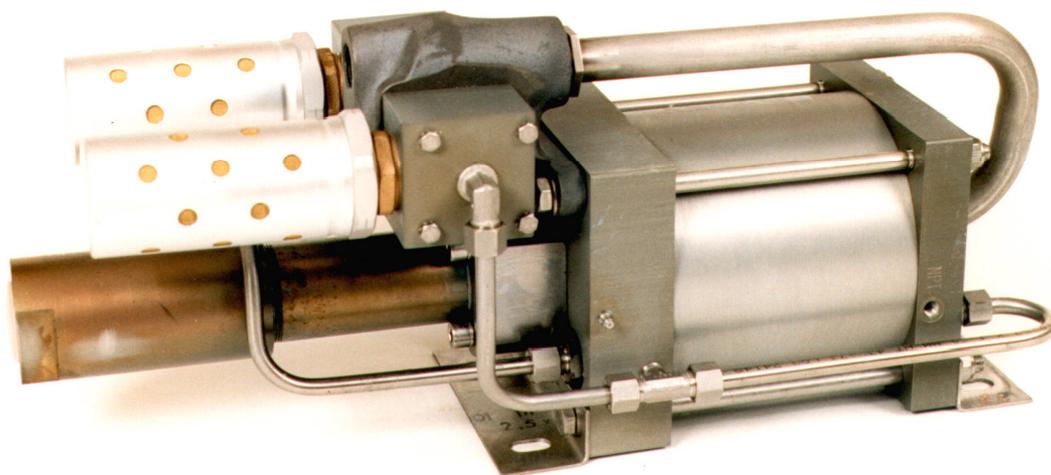


Operating instructions

MAXIMATOR Pump

Types GX35, GX60, GX100



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Attention!

These operating and maintenance instructions for a MAXIMATOR product have been prepared for operators.

The instructions will defeat their purpose when they are not passed on to system operators and are not studied and used.

The documentation prepared by us reflects the current manufacturing status.

We reserve minor design changes.

If an operator fails to understand any of the instructions we invite them to call us and quote the relevant serial No. indicated in the cover sheet of this documentation and in the machine plate.

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Important!

We as the manufacturer of this product have taken account of the fundamental health and safety requirements during the design and fabrication of the entire product.

The owner of the system has to see to it that the operating personnel will continue to adhere to the applicable regulations during any required work.

Specific requirements are laid in the following standards:

- EC Machine Directive in the version 98/37/EG
- EC Pressure Equipment Directive 97/23/EC
- EN 292-1 Machinery safety - Basic concepts, general principles for design.
Part 1: Basic terminology, methodology.
- EN 292-2 Machinery safety - Basic concepts, general principles for design.
Part 2: Technical principles and specifications.
- EN 294 Machinery safety, Safety distances to prevent danger zones from being reached by the upper limbs.

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1. Operating instructions for MAXIMATOR pumps

Type GX35; GX 60; GX 100

1.1 Technology

The MAXIMATOR Pump described below is a slide-valve piston that is driven by gaseous media and has been especially conceived for offshore applications. It can be employed in the pumpage and compression of water or oil. Its construction resembles a pneumatic cylinder.

The pump coefficient denotes approximate ratio between drive pressure and working pressure.

The connection for the drive medium (Marking P_L) is located at the bottom cap of the flanged-on servovalve casing to which also the silencers are fixed. The pressure nozzle (Marking P) is located laterally at the HP location of the pump.

The pumps are designed in such a manner that medium is pumped in both travel directions of the HP piston which provides them with a high pump capacity. The intake (Marking S) is arranged in longitudinal direction. The bottom cap has a bore to discharge any leakages of the drive or compression medium.

The pump runs automatically and is driven by a floating slide valve that reciprocally admits pressure or vents the drive piston. The control system operates without any springs or interlocking because pressure is admitted reciprocally the floating slide valve.

Major components of the hydraulic part are the pump head, piston rod with HP piston, HP sealings with back-up rings and the non-return valve at the suction connection.

1.3 Technical Data

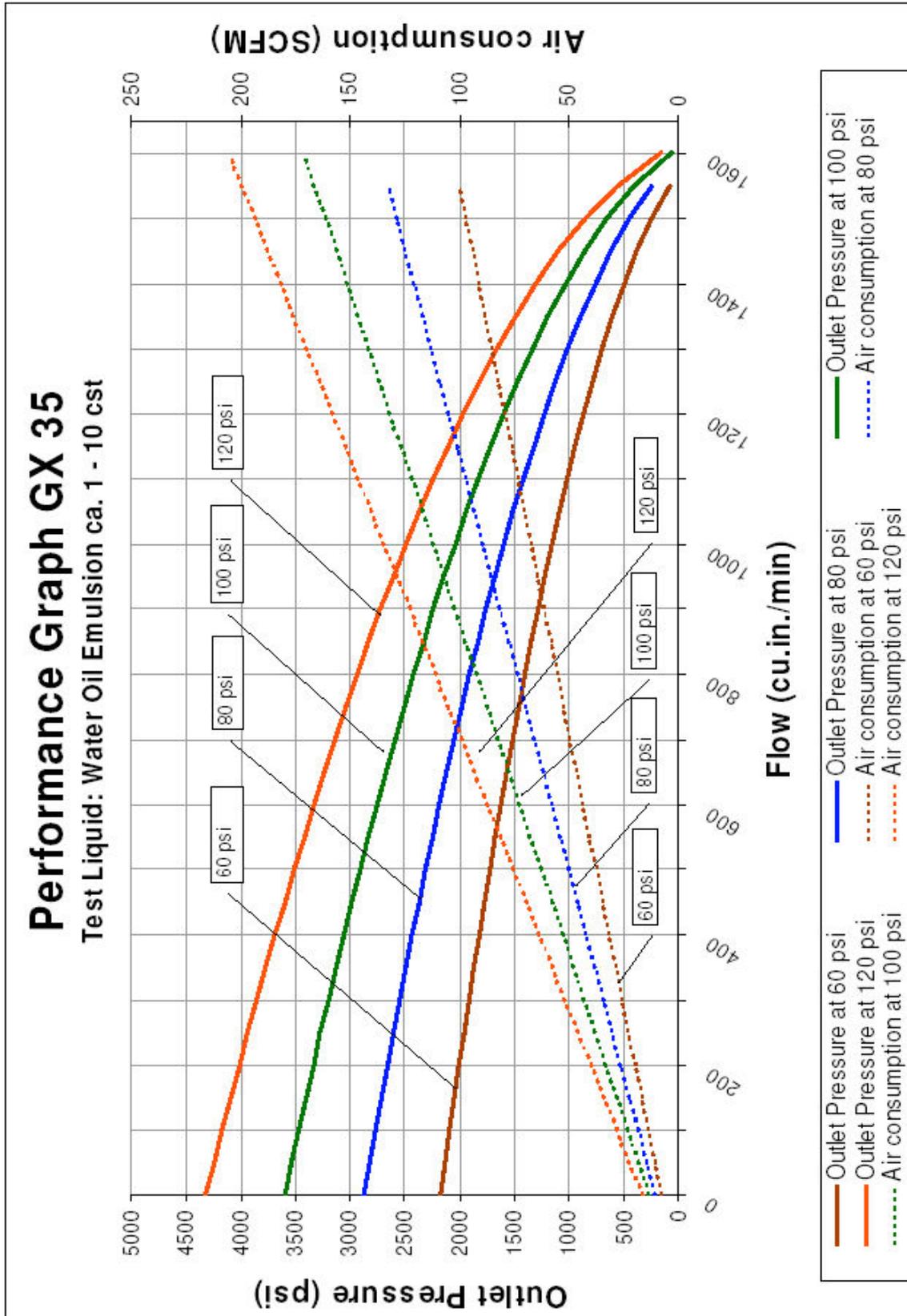
| | GX 35 | GX 60 | GX100 |
|----------------------------------|---------------------------------------|-------------------------------------|-------------------------------------|
| Air piston diameter | 6.30" (160 mm) | | |
| Length of stroke | 4.33" (110 mm) | | |
| Piston diameter | 1.42" (36 mm) | 1.10" (28 mm) | 0.83" (21 mm) |
| Pressure ratio | 1 : 36 | 1 : 65 | 1 : 117 |
| Piston capacity | 10.98 cu.in (180 cm ³) | 3.97 cu.in (65 cm ³) | 2.20 cu.in (36 cm ³) |
| Max. working pressure | 5220 psi (360 bar) | 8700 psi (600 bar) | 14500 psi (1000 bar) |
| Max. drive pressure | 145 psi (10 bar) | | |
| Air connection (P _L) | 3/4 FNPT | | |
| Suction connection (S) | 1 FNPT | | |
| Pressure outlet (P) | 3/8 FNPT | | |
| Length | approx. 24.88" (ca. 632 mm) | | |
| Width | approx. 9.33" (ca. 237 mm) | | |
| Height | approx. 9.60" (ca. 244 mm) | | |
| Weight | approx. (ca.) 24 kg | | |
| Max. operating temperature | approx. (ca.) 50 °C | | |

1.4 Wearing part kits

| | GX 35 | GX 60 | GX 100 |
|--------------------|--------------|--------------|---------------|
| Servo valve | 3620.2029 | 3620.2029 | 3620.2029 |
| Air drive part | 3620.1742 | 3620.1742 | 3620.1742 |
| High-pressure part | 3620.2155 | 3620.2195 | 3620.2198 |

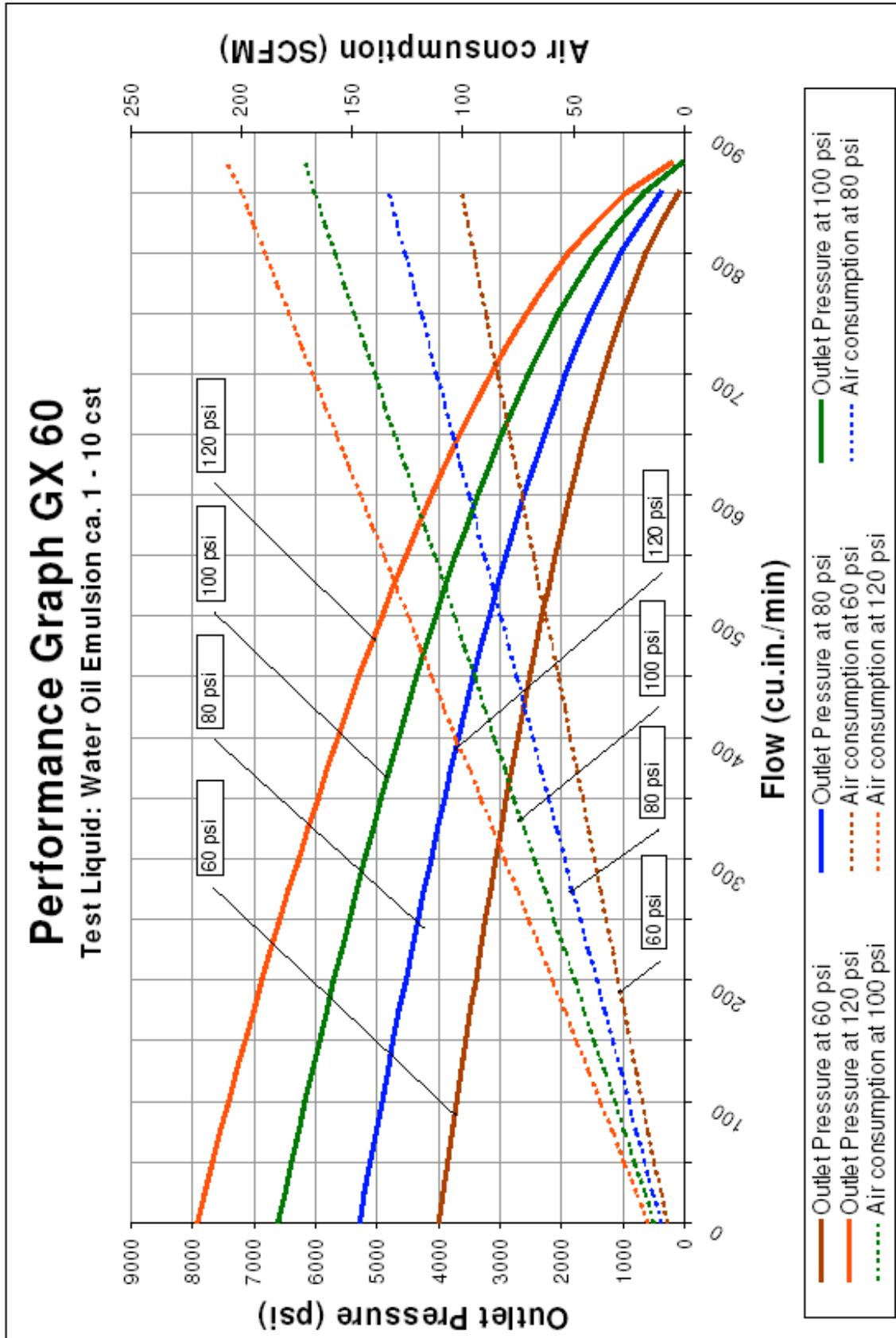
1.5 Performance curve of MAXIMATOR pump

Type GX35



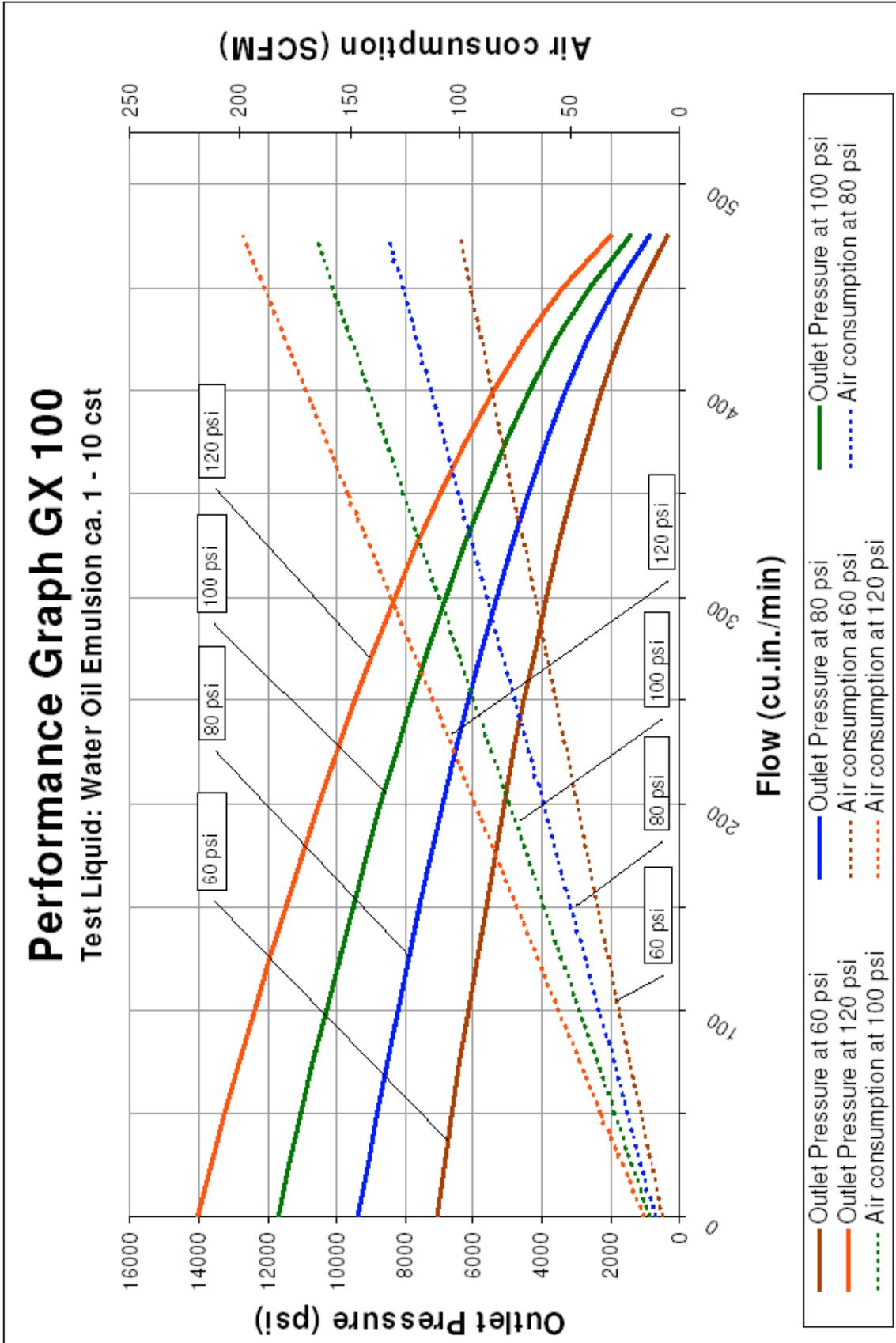
1.6 Performance curve of MAXIMATOR pump

Type GX60



1.7 Performance curve of MAXIMATOR pump

Type GX100



2. Mode of operation

As a rule, the pump may be operated in any position but the longest service life of sealings is ensured when it is installed vertically.

2.1 Drive part

The drive part consists of an air cylinder (22), bottom cap (20), top cap (26) and air piston (48) to which compressed air is admitted reciprocally that prompts it to make an oscillating motion.

In its stop positions the air piston (48) actuates the pilot valve plungers (53,85).

These pilot valves control the servovalve (31) by means of compressed air.

The pump is driven with compressed air (other gases upon request). When compressed air is employed as drive we recommend our maintenance unit, consisting of a filter, water separator, shut-off valve, pressure controller and master pressure gauge.

If the maintenance unit is not installed, a suitable filter with a 5 µm mesh should be used.

A lubricator is not required since the pump is treated with a high-performance grease prior to shipment.

If a lubricator is provided in the drive system, a silicon- and acid-free oil should be used to avoid swelling of packing rings. A pump that is equipped with a lubricator may only be used in lubricator-equipped systems.

2.2 Control part

The control part consists of the servovalve (31), and servovalve runner (35), all accommodated in the servovalve casing (83).

The servovalve (31) is actuated with compressed air by the pilot valves (53,85). The servovalve feeds drive air to the right or left side of the air drive piston (48).

2.3 High-pressure part

The pump is envisaged for pumpage and compression of water or oil. The hydraulic pressure can be determined by adjustment of the drive pressure.

Please, use the attached diagram for this purpose (Technical Data). The piston frequency decreases with rising hydraulic pressure. Operate the pump at a low frequency until the pump is fully primed with fluid and the hydraulic system is ventilated.

The hydraulic pipework and accoutrements should be matched to the pump as regards their pressure, cross-section and medium. The nominal width of pipework should not be dimensioned smaller than the connection cross-section of the pump. The suction diameter may only be reduced when fluid is charged under pressure. The suction pipeline should be equipped with filter with a mesh size of max. 100 μ m.

3. Safety

The design of MAXIMATOR pump is based on the generally accepted engineering standards and on the laws relating to technical equipment safety, TÜV [German Technical Inspectorate] regulations as well as the accident prevention regulations of the German Employers' Liability Insurance Association [Berufsgenossenschaft].

Those codes and regulations must also be adhered to during installation and application of the pumps.

Only the specified media may be used both at the drive- and the compression-side.

The hydraulic pipework and accoutrements should be matched to the system pressure and the medium and be of appropriate sizes.

The pressure of the drive medium must not exceed 10 bar.

Make sure to vent the hydraulic part of the pump prior to start-up. Check secure fastening of all fixed pipework in order to prevent fatigue pipe fractures during pump operation.

Do not loosen the hydraulic bolted union at the suction and pressure nozzles to facilitate installation of pipe connections. These bolted unions must be firmly tightened to prevent leakages and damage.

The pump must NOT be installed in enclosed containers because the drive medium must be able to escape.

Repair work may only be performed after the system has been depressurised.

Make sure to observe all relevant safety regulations when the pump is driven with explosive media. The connections must be tight and the depressurised medium from the exhaust pipe, the leakage bore and the venting bore in the top cap must be safely disposed of.

4. Maintenance

The air drives of all fluid pumps are pre-treated with high-performance grease and do not require any other kind of lubrication. In order to extend the service life of the piston rod sealing the grease filling should be topped up after 14 days of operation. Use the lubricating nipple at the bottom cap. Only during overhauls of the pump, the servovalve and drive piston should be treated with acid- and silicon-free grease. We recommend the use of a MAXIMATOR grease.

5. Repair instructions

Please, use for a necessary repair only original MAXIMATOR spare parts, otherwise the proper functioning may be impaired. Ensure the highest possible level of cleanliness during servicing work at the pump in order to ensure both the proper functioning and service lives of the precision-machined parts.

Ensure the same torques for the nuts of the four stud bolts during assembly in order to avoid distortions of the top and bottom caps.

5.1 Replacement of high-pressure sealing

Depressurise the pump and disconnect all tube connections from the pump.

Dismantle the pipeline 1 (Item 58).

Remove the four hexagon socket screws (Item 69).

Now the pump head (Item 71) can be drawn off to the front.

After dismantling of the pump head the two dowel pins (Item 84 and 85) can be removed.

Now the pressure section (Item 1) can be dismantled.

Then the HP piston can be unscrewed.

The sealings can be replaced.

5.2 Replacement of servovalve sealings

Depressurise the pump and disconnect all tube connections from the pump.

Loosen the bolted union at the pipeline (Item 45).

Loosen the 8 hexagon bolts and disassemble the covers of the servovalve (Item 30 and 40).

Draw out the servovalve (Item 31) and disassemble the O-rings (Item 33, 38 and 39).

Use a mandrel (PTFE or wood) to force out the servovalve runner (Item 35) and remove the O-rings (Item 34).

Treat all sealing and guiding elements with a resin- and acid-free grease. Re-assembly is performed in reverse order than disassembly.

5.3 Sealing replacement at the drive side

Depressurise the pump and disconnect all tube connections from the pump.

Disassemble the union nut (Item 18) and the pipe (Item 19).

Loosen and remove the 4 hexagon nuts (Item 28).

Disassemble the pipeline (Item 45) and the hexagon bolts (Item 29 and 46).

Disassemble the pipelines (Item 58 and 79) from the top and bottom caps.

Now the top cap (Item 26) and the air cylinder (Item 22) can be drawn off.

Treat all sealing and guiding elements with a resin- and acid-free grease. Re-assembly is performed in reverse order than disassembly.

6. Troubleshooting

6.1 Compressed air system

| Symptom | Cause | Remedy |
|---|---|--|
| Pump fails to run at low drive pressure | Excessive friction of O-rings on servovalve | Re-greasing or renewal of O-rings at the servovalve |
| | Swelling of O-rings due to wrong oil or lubricant | Replacement of O-rings, use acid- and silicon-free lubricant |
| Pump fails to run or runs only slowly | Iced exhaust pipe or servovalve | Use water separator to dehydrate compressed air |
| | Forming of deposits in the silencer | Cleaning of silencer |
| Pump fails to operate and drive medium escapes via the exhaust pipe | Defective O-rings at servovalve | Exchange and grease O-rings |
| | Defective or worn out sealing at drive piston | Exchange and grease sealings |
| Pump operates at high frequency and with short strokes | Defective pilot valve in top or bottom cap | Check pilot valve, if need be: clean, grease and replace |

6.2 Hydraulic system

| Symptom | Cause | Remedy |
|--|---|--|
| Pump operates without conveying medium or operates irregular or fails to achieve the arithmetic final pressure | Air in hydraulic system | Vent the system Check tightness of suction pipelines and bolted unions. |
| | Suction pipeline too long | Shorten the suction pipeline as much as possible |
| | Suction cross-section too small | Extend the cross-section, otherwise the suction flow is disrupted |
| | Failures of suction or non-return valves in HP piston | Check both valves, if need be: clean and replace |
| | Suction filter is clogged | Clean suction filter |
| | Worn off HP sealing | Replace sealing set at HP piston |
| Fluid escapes via the exhaust pipe | Worn off HP sealing der piston rod | Replace sealing set |

7. Warranty

The pump described above has a warranty for material quality and fabrication workmanship of twelve (12) months, commencing upon the original shipment date.

This warranty does not include packaging, sealings, defects due to improper handling or failure due to uses of unauthorised fluids, foreign matter in the drive or conveying medium or application of excessive pressures.

8. General operating instructions for a MAXIMATOR pump

8.1. Compressed air quality

Drive air should have a quality grade of 3 to 4 (solids/water/oil), i.e. the following contents as defined in the PNEUROP recommendation 611/1984 (PNEUROP = European Committee of Manufacturers of Compressors, Vacuum Pumps and Compressed Air Equipment).

Solids: Max. particle size 5 micron
Max. particle concentration 5 mg/m³

Pressure dew point: +10 °C = Water content 9.4 g/m³ to
+2 °C = Water content 5.6 g/m³

Oil content: 1.0 to 5 mg/m³

The above-mentioned compressed air quality ensures an optimal service life of sealing and guiding elements.

8.2 Compressed air lubricator Yes or No

The following problems may occur when MAXIMATOR pumps are operated with dried drive air (**dew point below -10 °C**):

* Dried drive air may cause the hardening of installation lubricant. This may result in malfunctions in the control and drive parts of the pump.

The following measures should be initiated.

- Install a mist lubricator the drive air pipeline. This mist lubricator feeds a precisely proportionable oil volume to the compressed air. The drop quantity should be 1 to 8 drops per 1000 litres of compressed air.

The following oils may be used.

- Avia Avilub RSL 10
- BP Energol HLP 10
- Blaser Blasol 154
- Esso Spinesso 10
- Mobil DTE 21
- Shell Tellus oil C10

Important advice:

When a MAXIMATOR pumps is operated with a lubricator the drive air must always be oil (The oil washes the installation lubricant off sealing and guiding elements).

OR

the pump should be returned to the manufacturer in order to perform a new assembly lubrication.