

Installation, Operation and Maintenance Instructions

Model MPVN



Covers Pump Sizes:

40.2

40.3

65.1

65.2

100.1

100.2

125.1

125.2

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1. GENERAL

1.1 Foreword

This product complies with the safety requirements of EC Machinery Directive 89/392/EEC, 91/368/EEC, 93/44 EEC and the Austrian Machine Safety Order (MSO) of 27 April 1994.



The staff employed on installation, operation, inspection and maintenance must be able to prove that they know about the relevant accident prevention regulations and that they are suitably qualified for this work. If staff do not have the relevant knowledge, they should be provided with suitable instruction.

The operating safety of the pumps or units (i.e. pump plus motor) supplied is only guaranteed if these are used in accordance with the provisions given in the attached Data Sheet and/or Point 4 in "Installation and Operation".

The operator is responsible for following the instructions and complying with the safety requirements given in these Operating Instructions.

Smooth operation of the pump or pump unit can only be achieved if installation and maintenance are carried out carefully in accordance with the rules generally applied in the field of engineering and electrical engineering.

If not all the information can be found in these Operating Instructions, please contact us.

The manufacturer takes no responsibility for the pump or pump unit if the Operating Instructions are not followed.

These Operating Instructions should be kept in a safe place for future use.

If this pump or pump unit is handed on to any third party, it is essential that these Operating Instructions and the operating conditions and working limits given in the Confirmation of Order are also passed on in full.

These Operating Instructions do not take into account all design details and variants nor all the possible chance occurrences and events which might happen during installation, operation and maintenance.

Alterations or changes to the machine are only permitted by agreement with the manufacturer. Original spare parts and accessories authorized by the manufacturer should be used for greater safety. We bear no responsibility for the consequences of using other parts.

We retain all copyright in these Operating Instructions; they are intended only for personal use by the owner of the pump or the pump unit. The Operating Instructions contain technical instructions and drawings which may not, as a whole or in part, be reproduced, distributed or used in any unauthorized way for competitive purposes or passed on to others.

1.2 Guarantee

The guarantee is given in accordance with our Conditions of Delivery and/or the confirmation of order. Repair work during the guarantee period may only be carried out by our authorized distributor. Otherwise the guarantee ceases to apply.

The guarantee shall not cover natural wear and tear and all parts subject to wear, such as impellers, shaft sealings, shafts, shaft sleeves, bearings, wear rings etc., or damage caused by transport or improper handling.

In order for the guarantee to apply, it is essential that the pump or pump unit is used in accordance with the operating conditions given on the type plate, confirmation of order and in the Data Sheet. This applies particularly for the endurance of the materials and smooth running of the pump and shaft sealing.

If one or more aspects of the actual operating conditions are different, we should be asked to confirm in writing that the pump is suitable.

1.3 Safety Regulations

These Operating Instructions contain important instructions which must be followed when the pump is assembled and commissioned and during operating and maintenance. For this reason, these Operating Instructions must be read by the skilled staff responsible and/or by the operator of the plant before it is installed and commissioned, and they must be left permanently ready to hand at the place where the pump or pump unit is in use. The operator must ensure that the contents of the Operating Instructions are fully understood by the staff. The operator must confirm this by signing the "Plant Manager List" (see Point 10). These Operating Instructions do not refer to the General Regulations on Accident Prevention or local safety and/or operating regulations. The operator is responsible for complying with these (if necessary by calling in additional installation staff).

The safety instructions contained in these Operating Instructions have the following special safety markings.



Warning against personal accidents which could occur if the safety instructions given in this part of the Operating Instructions are not followed.



Warning against dangerous electrical voltage.

ATTENTION: WARNING AGAINST POSSIBLE DAMAGE TO PROPERTY OR THE ENVIRONMENT.

It is absolutely essential that safety information affixed directly to the pump or pump unit is followed and maintained so that it is always easily legible.

1.4 Safety Instructions

Dangers of not following safety instructions

Failure to follow the safety instructions can result in the following, for example:

- People being at risk because of electrical, mechanical and chemical factors.
- Important functions of the pump or pump unit failing.
- Dangers to the environment.

Safety instruction for the operator

• Depending on the operating conditions, wear and tear, corrosion or age will limit the working life of the pump/pump unit, and its specified characteristics. The operator must ensure that regular inspection and maintenance are carried out so that all parts are replaced in good time which would otherwise endanger the safe operation of the system. If abnormal operation or any damage are observed, the pump must cease operation immediately.

• If the breakdown or failure of any system or unit could lead to people being hurt or property being damaged, such system or unit must be provided with alarm devices and/or spare modules, and they should be tested regularly to ensure that they function properly.

- If there is any risk of injury from hot or cold machine parts, these parts must be protected against contact by the user, or suitable warning signs must be affixed.
- Contact protection on moving parts (e.g. Coupling guards) must not be removed from systems that are in operation.
- If dangerous media (e.g. explosive, toxic, hot) leak out (e.g. from shaft seals), these must be directed away so that there is no danger to people or the environment. The provisions of the law must be observed.
- Measures should be taken to exclude any danger from electricity (e.g. by complying with the local regulations on electrical equipment). If work is carried out on live electrical components, they should be unplugged from the mains or the main switch turned off and fuse unscrewed. A motor protection switch is to be provided.
- Basically, all work on the pump or pump unit should only be carried out when the pump is stationary and not under pressure. All parts must be allowed to return to ambient temperature. Make sure that no-one can start the motor during such work. It is essential that the procedure for stopping the system described in the Operating Instructions is observed. Pumps or pump systems that carry media that are dangerous to health must be decontaminated before being taken apart. Safety Data Sheets for the various liquids handled. After the work has been completed, all safety and protective devices must be replaced or restarted.

Speed, Pressure, Temperature

Suitable safety measures must be taken at the plant to ensure that the speed, pressure and temperature of the pump and the shaft sealing do not exceed the limit values given in the Data Sheet. The given suction pressures (system pressures) must also be sufficiently high. In addition, the pump must be protected against pressure surges such as can be caused by switching off the plant quickly (e.g. by non-return valve on the pressure side, flywheel, air vessel).

Permitted Forces on Flanges

Basically, the suction and pressure lines should be such that the forces on the pump are kept to a minimum. If this is not feasible, contact your distributor for limits.

NPSH

When entering the impeller, the liquid being handled must have a minimum pressure NPSH to prevent cavitation or breaking off of flow. This requirement is met if the unit NPSH value (NPSHA) is well above the pump NPSH value (NPSHR) under all operating conditions.

Attention must be paid to the NPSH value in particular when liquids close to boiling point are being handled. If the value falls below the pump NPSH value, this can lead to damage resulting from cavitation or serious damage from overheating.

The NPSHR for each pump type is given in the sheets of characteristic curves. We can supply leaflets for calculation of NPSH values on request.

Sealing, Flushing, Cooling

Suitable facilities for the regulation and monitoring of sealing, flushing or cooling are to be provided. When handling dangerous liquids or if temperatures are high, care should be taken to ensure that the pump ceases operating of the sealing, flushing or cooling system fails.

Sealing, flushing and cooling systems must always be operational before the pump is started up. They should not be taken out of operation until the pump has stopped, provided that the nature of the operation allows this at all.

Minimum Flows

If the pump is started against a closed pressure line valve, it should be noted that the power taken up by the pump is transmitted to the liquid handled in the form of heat. This can cause the liquid to heat up excessively within a relatively short time, which will then cause damage to the pump's internal fittings. After the pump has reached operating speed, the discharge valve should therefore be opened as quickly as possible. If operating conditions mean that $Q = 0$ is unavoidable, or if hot water is circulating, a free flow non-return valve, or, on smaller systems, a by-pass pipe, should be provided. Your distributor can help in determining the minimum flow or designing the by-pass line.

Protection against Running Dry

The pumps must not run dry under any circumstances, since overheating can damage pump components (e.g. mechanical seals).

Back Flow

In systems where pumps are operating in closed circuits under pressure (gas cushions, steam pressure), the pressure of the gas cushion must not be reduced via the pump, since the back flow speed may be much higher than the operating speed, which would destroy the unit.

2. DESCRIPTION

2.1 Model

Design MPVN

Design Features:

- Vertical configuration with separate thrust bearing, grease lubrication with grease nipples.
- Motors according NEMA-Standard MG 1-4.07.
- Flexible coupling between pump and motor.
- Medium lubricated sleeve bearing in suction casing.
- Maintenance friendly design. Shaft sealing maintainable without pump disassembly.

Installation Position

Shaft vertical.

Other installation positions only by agreement.

2.2 Shaft Sealing

Basic design with mechanical seal. Seal code SA with unbalanced seal; seal code SB with balanced seal.

ATTENTION: YOU WILL FIND MORE INFORMATION ABOUT MECHANICAL SEALS, AND THE RISKS OF ACCIDENTS THAT THESE MAY INVOLVE, UNDER POINT 4.6 "OPERATION AND MONITORING" AND IN POINT 5 "MAINTENANCE AND REPAIRS".

2.3 Bearings and Lubrication

Drive Side: re-lubricatable roller bearings (thrust bearing).

Pump Side: medium-lubricated slide bearing in the suction casing.

Lubrication of Roller Bearings

Standard: grease lubrication with grease nipples.

Grease lubricants to be of Lithium Base Grade 2.

The bearings are already filled with grease and are thus ready for use.

Bearing Types (roller bearings)

| Pump Size | Grease Lubrication Bearing Type |
|-------------------------|---------------------------------|
| MPVN 40.2 / MPVN 40.3 | B306CŞ |
| MPVN 65.2 / MPVN 65.2 | B307CŞ |
| MPVN 100.1 / MPVN 100.2 | 2 x 7308 (X-arrangement) |
| MPVN 125.1 / MPVN 125.2 | 2 x 7310 (X-arrangement) |

Interval of re-lubrication / grease quality

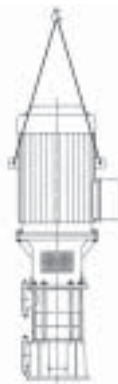
| Pump Size | Grease Qty. [cm ³] | Interval of re-lubrication in operating hrs | | | | |
|-------------------------|--------------------------------|---|--------------|--------------|--------------|--------------|
| | | 3550 [min-1] | 2950 [min-1] | 2200 [min-1] | 1750 [min-1] | 1450 [min-1] |
| MPVN 40.2 / MPVN 40.3 | 12,1 | 3800 | 4300 | 5500 | 6000 | 6500 |
| MPVN 65.1 / MPVN 65.2 | 15,5 | 3500 | 4000 | 5000 | 5500 | 6000 |
| MPVN 100.1 / MPVN 100.2 | 23,0 | 3300 | 3800 | 4500 | 5000 | 5500 |
| MPVN 125.1 / MPVN 125.2 | 33,0 | 2500 | 3300 | 4300 | 4800 | 5000 |

Intervals of re-lubrication on approx. 50% operating time (Length of cycle 1 hour).
On approx. 100% operating time halve the intervals of lubrication.

3. TRANSPORT, HANDLING, STORAGE

3.1 Transport, Handling

- Check the pump/pump unit immediately upon delivery/receipt of shipment for damage or missing parts.
- The pump/pump unit must be transported carefully and by competent personnel. Avoid serious impacts.
- Keep the pump/pump unit in the same position in which it was supplied from the factory. Take note of the instructions on the packaging.
- The intake and discharge side of the pump must be closed with plugs during transport and storage.



ATTENTION: DISPOSE OF ALL PACKING MATERIALS IN ACCORDANCE WITH LOCAL REGULATIONS.

- Lifting devices (e.g. fork-lift truck, crane, crane device, pulleys, sling ropes, etc.) must be sufficiently strong.
- The pump/pump unit may only be lifted by solid points such as the casing, flanges or frame. The illustration above shows the correct method of carrying by crane.

Do not stand underneath suspended loads; take note of the general regulations on prevention of accidents.



The pump/pump unit must be secured against tipping over and slipping until it has been fixed in its final location.

3.2 Storage

Pump or pump units that are stored for a long time before use must be protected against moisture, vibrations and dirt (e.g. by wrapping in oil paper or plastic sheeting). Pumps must basically be stored in a place where they are protected from the weather, e.g. under cover. During this time, all suction and discharge branches and all other intakes and outlets must be closed with dummy flanges or plugs.

Preservation

On storing the pump longer than 3 months (depends on order): A special preservation has been made ex works. The product used for that must be flushed away from the unit before the first normal operation.

4. INSTALLATION, OPERATION

4.1 Assembly and Connection of Pump

MPV type pumps must be bolted to a fixed subframe (e.g. concrete foundation, steel plate, steel beam, etc.). The subframe must withstand all loads that arise during operation. The size of the subframe and the location and size of the recesses for the foundation anchors are given in the dimension drawing, which is binding.

ATTENTION: SUFFICIENT SPACE MUST BE PROVIDED FOR MAINTENANCE AND REPAIR WORK, ESPECIALLY FOR REPLACING THE DRIVE MOTOR OR THE COMPLETE PUMP UNIT. THE MOTOR FAN MUST BE ABLE TO TAKE IN ENOUGH COOL AIR, AND THE INTAKE GRILLE MUST THEREFORE BE AT LEAST 10 CM AWAY FROM ANY WALL, ETC.

To prevent vibrations being transmitted to adjoining components, the foundation should be laid on a suitable insulating base (panels providing insulation against structure-borne sound or vibration panels).

ATTENTION: THE SIZE OF THESE INSULATING PANELS WILL VARY, DEPENDING ON CIRCUMSTANCES, AND SHOULD THEREFORE BE DETERMINED BY AN EXPERIENCED SPECIALIST.

Concrete foundations must be completely set and the surfaces must be smooth before the pump unit is mounted. Put pump unit onto the foundation and, if necessary, level vertically with the help of thin sheet-metal panels (with spirit level). Tighten foundation anchor evenly and firmly.



The alignment must be carried out with the utmost care and attention, so that the unit will operate without failure. If you do not pay attention to this hint you will lose your warranty!

4.2 Installation and Alignment of Coupling

ATTENTION: *Make sure that nobody can start the motor when work is being carried out on the coupling. In accordance with the Accident Prevention Regulations, the pump unit may only be operated when the coupling guard is mounted.*

- Before starting installation, carefully clean shaft ends and coupling components.
- Pull coupling hub onto motor shaft end. The coupling may be heated beforehand in an oil bath to approx. 100°C. The motor hub will need to be mounted flush to the motor shaft.
- The motor coupling hub will have an interference fit and the pump coupling hub will have a clearance fit. The clearance allows the pump hub to be adjusted on the pump shaft. Keep pump hub loose for adjusting the elastomer element.
- Place half of the coupling elastomer element around the hubs and secure with self-locking capscrews.

- The elastomer element will space the pump hub. Now secure the pump hub to the shaft.
- Mount other half of the elastomer element. Tighten all capscrews to recommended torques.
- Mount coupling guard.

Capscrew Torques

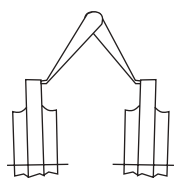
| Recommended Capscrew Torques | Coupling Size | Torque – Dry | |
|--|---------------|--------------|----------|
| | | In. lbs. | Ft. lbs. |
| <p>IMPORTANT</p> <p>Capscrews have self-locking patches which should not be reused more than twice. Capscrews can be further used with applications of a thread-locking adhesive.</p> <p>Do Not Lubricate Capscrew Threads.</p> | 2 | 204 | 17 |
| | 3 | | |
| | 4 | | |
| | 5 | | |
| | 10 | | |
| | 20 | 360 | 30 |
| | 30 | | |
| | 40 | | |
| | 50 | | |
| | 60 | 900 | 75 |
| | 70 | | |
| | 80 | | |
| | 100 | 3240 | 270 |
| | 120 | | |
| 140 | 7080 | 590 | |

Equipment Alignment

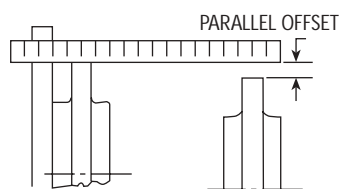
(coupling alignment is directly related to equipment and coupling life.)

Although Omega couplings can withstand gross misalignment, care should be taken for best possible alignment to assure optimum performance. The caliper/straightedge alignment procedure is described below. If greater alignment accuracy is desired, a dial indicator method is recommended. There are occasions when equipment manufacturers require more specific alignment tolerances, in which case, the manufacturer's recommendations should be followed.

- To correct for angular misalignment, use calipers to check the gap between hubs. Adjust or shim equipment until the gap is the same at all points around the hubs.
- To correct parallel offset, place a straightedge across the hub flanges in two places at 90° to each other. Adjust or shim equipment until the straightedge lays flat on both sides.
- Tighten down connected equipment and recheck alignment.
- Install elastomer element, tightening all capscrews to the values shown in table.
- If practical, recheck and tighten capscrews after several hours of operation.



ADJUST FOR ANGULAR MISALIGNMENT



ADJUST FOR PARALLEL OFFSET

4.3 Connecting the Pipes to the Pump Suction and Discharge Pipe

- The pipes must be of a size and design that liquid can flow freely into the pump and that the pump functions without problems. Particular attention is to be paid to ensuring that suction pipes are airtight and that the NPSH values are observed. Lay the suction pipe in the horizontal section towards the pump so that it is slightly inclined upwards so that no air pockets occur. In most cases, it is recommended that a non-return valve is installed in the discharge pipe shortly after the pump.

- When laying the pipes, make sure that the pump is accessible for maintenance and installation.
- Please note 1.4: “Permitted Forces on Flanges”.
- Before connecting up to pump: remove protective coverings from suction and discharge branches.
- To protect the shaft sealing (especially mechanical seals) against foreign bodies, it is recommended that a sieve, 800 micron, is installed in the suction/intake pipe when the motor is being started up.
- Before starting up, the pipe system, fittings and equipment must be cleaned to remove weld spatter, scale etc. Any pollutants are to be completely removed from pump units that are directly or indirectly connected to drinking water systems before being installed and taken into use.
- If the pipe system is tested with the pump installed, do not exceed the maximum permitted casing pressure of the pump and/or shaft sealing (see Data Sheet).
- When emptying the pipe after the pressure test, make sure that the pump is treated properly (danger of rust and problems when starting up).
- In the case of pumps with stuffing boxes, replace packing after pressure test (packing may be over-compressed and thus no longer suitable for use).

Auxiliary Pipes

Any sealing, flushing or cooling pipe connections that are necessary must be installed. Please consult the Data Sheet to see which pipes, pressures and quantities are necessary. The position and size of connections to the pump are given on the Dimension Sheet in the Appendix.

The relevant detail drawing of the shaft sealing contains a diagrammatic proposal for the pipework and fittings. This proposal does not take into account the safety requirements for each specific pump unit.

ATTENTION: POINT 1.4, “SEALING, COOLING” MUST BE OBSERVED AS REGARDS REGULATION AND MONITORING.

It is recommended that a pipeline is installed to take off any leakage from the shaft seal. For connection, see the Dimension Sheet.

4.4 Electrical Connection



Electrical connection work may only be carried out by an authorized professional. The rules and regulations valid for electrical technology, especially those concerned with safety measures, must be observed. The regulations of the power supply companies operating in that area must also be observed.

Before starting work, check that the information on the motor rating plate is the same as the local mains network. The power supply cable of the coupled drive motor must be connected up in accordance with the wiring diagram produced by the motor manufacturer. A protective motor switch is to be provided.

ATTENTION: THE DIRECTION OF ROTATION SHOULD ONLY BE CHECKED WHEN THE PUMP IS FULL. DRY RUNNING WILL CAUSE DAMAGE TO THE PUMP.

4.5 Starting Up



The plant may only be started up by people who are familiar with the local safety regulations and with these Operating Instructions (especially with the safety regulations and safety instruction given here).

In order to be able to observe and monitor the shaft sealing, no protective covering is provided in this area. If the pump is running, particular care should therefore be taken (watch out for long hair, loose pieces of clothing etc.).

Hints for the Use as Boiler Feed Pump

Limits for cast iron when used in boiler feed or condensate applications: pH-value • e 9,0 (optimum • e 9,3), short term: pH-value • e 8,5.

The above stated values must be guaranteed at the suction side of the pump in any case.

The water treatment must be in acc. With the specifications for water treatment of boiler feed water in steam plants up to 64 bar.

Air traps in the system must be avoided in any case.

Starting up for the First Time

- With MPV type pumps, no further lubrication is needed before initial start-up.
- Pump and suction pipe must be completely exhausted from air and filled with handling liquid before each start up of the pump unit. When filling the pump open screwed plug "PM2". Close it when water is flowing out.
- Open slide valve in suction/intake pipe.
- Turn pump unit once again by hand and check that it moves smoothly and evenly.
- Check that coupling guard is installed and that all safety devices are operational.
- Switch on any sealing, flushing or cooling devices that are provided. See Data Sheet for quantity and pressure.
- Set discharge side slide valve to approx. 25% of rated flow quantity. With pumps with a discharge branch rated width less than 200, the slide valve can remain closed when starting up (see also Point 1.4 "Minimum Quantities").
- Check direction of rotation by switching on and off briefly. It must be the same as the directional arrow on the bearing frame.
- Start drive device.
- As soon as it reaches normal operating speed, open discharge valve immediately and adjust the required operating point (see Data Sheet).
- Mechanical seals don't need to be maintained and are almost free of leakage.

Putting into Operation Again (after longer standstill; 1 month)

Each time you put the pump into operation again you have to do the same things you do when starting the pump for the first time. The control of the rotation direction of the unit can be dropped. You are only allowed to put the pump into operation again automatically when the pump remained filled with liquid during standstill and the required test drives have been made, see point 4.7.

4.6 Operation and Monitoring



Be particularly careful not to touch hot machine parts and when working in the unprotected shaft seal area. Remember that automatically controlled systems may switch themselves on

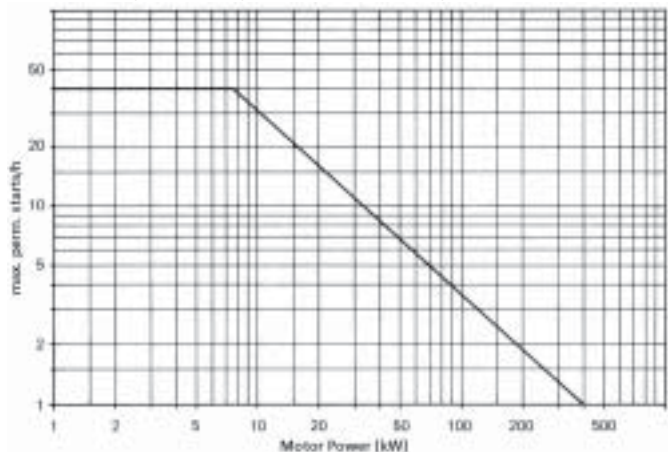
suddenly at any time. Suitable warning signs should be affixed.

ATTENTION: REGULAR MONITORING AND MAINTENANCE WILL EXTEND THE LIFE OF YOUR PUMP OR PUMP SYSTEM.

- You must observe the area of application given on the Data Sheet.
- Do not exceed the output given on the motor rating plate.
- Avoid dry running, running against closed discharge valves or operation while the liquid handled is in the vapor phase.
- Avoid sudden changes in temperature (temperature shocks).
- The pump and motor should run evenly and without vibrations; check at least once a week.
- Check the regulating and monitoring facilities of any sealing, flushing or cooling systems once a week to ensure that they function properly. Outgoing cool water should be body temperature.
- Pumps which are exposed to corrosive chemicals or to wear through abrasion must be inspected periodically for corrosion or wear and tear. The first inspection should be carried out after six months. All further inspection intervals should be determined on the basis of the state of the pump.

Permitted Number of Starts

Do not exceed the pump's permitted number of starts – see diagram. With electric motors, the permitted number of starts is given in the motor operating instructions. If two different figures are given, the lower figure is valid.



4.7 Shutting Down

- Close slide valve in discharge pipe. This is not necessary if there is a spring-loaded non-return valve.
- Switch off motor (make sure it runs down quietly).
- Close slide valve on suction side.
- Close auxiliary systems. So not shut down cooling system until pump has cooled down.
- If there is any risk of freezing, empty pump, cooling areas and pipes completely.
- If the pump also remains under operating conditions (pressure and temperature) when stationary: leave all sealing, flushing and cooling systems switched on.
- If the pump remains under operating conditions when stationary test drives have to be made in regular intervals with a duration of at least 5 minutes. The intervals

between the test drives depend on the unit, but they should be made at least once a week.

4.8 Dismantling



The operator's or manufacturer's fitters should be informed as to the nature of the liquid handled. In the case of pumps handling dangerous liquids, the liquid handled should be disposed of by environmentally acceptable means before the pump is dismantled.

- Before starting to disassemble the pump unit make sure that it cannot be switched on again.
- The pump casing must be depressurized and empty.
- All valves in the suction, intake and discharge pipes must be closed.
- All components must have cooled down to ambient temperature.
- To avoid corrosion it is recommended to flush the pump and fill it with a water-repellant preservative, e.g. KLÜBERTOP K01.601 or equal.
- To spread the preservative turn the pump several times with the hand. Then drain the pump and lock the nozzles.

5. MAINTENANCE, SERVICING



Work should only be carried out on the pump or pump unit when it is not in operation. You must observe Point 1.4 "Safety Instructions".

ATTENTION: MAINTENANCE AND SERVICING WORK MUST ONLY BE CARRIED OUT BY TRAINED, EXPERIENCED STAFF WHO ARE FAMILIAR WITH THE CONTENTS OF THESE OPERATING INSTRUCTIONS, OR BY THE DISTRIBUTOR'S OWN SERVICE STAFF. THE WORK CARRIED OUT MUST BE DULY ENTERED IN THE "LOG BOOK" (SEE POINT 11) AND CONFIRMED BY BEING SIGNED.

Mechanical Seals



Before opening the pump, it is essential that you note Point 1.4 "Safety Instructions", Point 4.8 "Dismantling" and Point 8 "Repairs".

Mechanical seals do not need to be maintained and are completely free of leakage. Pumps with mechanical seals must only be operated when completely filled and vented. The seal casing where the mechanical seal is located must always be filled with the sealing liquid. If the liquid being handled drips out at the mechanical seal, it is damaged and must be replaced.

When installing the mechanical seal make sure that the seal casing is absolutely clean, particular care has to be paid to the surface of the seal rings. To facilitate the slip-on of the rotating components of the seal onto the shaft lubricate all moving components and sliding areas by means of water, soapy water or soft soap. Use mineral oils only in case all elastomers are oil resistant. Do not lubricate the surface of the seal rings. Do not force elastomeric elements over sharp edges, if necessary use assembling aiding sleeves.

Lubrication of Bearing

- Intervals of re-lubrication/grease quantities (see point 2.3 "bearing and lubrication").

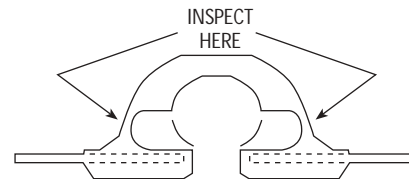
- If the pump is left non-operational for any length of time, the grease in the bearings should be changed after 2 years.

Coupling

When inspecting the element, look for fatigue cracks (over 1/2") originating near the stress relief grooves (approximately 1/4" – 1/2" above the metal shoe), discoloration (a darker faded orange color signals possible material degradation) or surface cracking if used in adverse conditions such as cooling towers or severe environments ($4 < \text{pH} < 10$).

In critical applications, the probability of unexpected downtime can be greatly diminished by scheduling flexible element replacement at regular intervals. The frequency of replacement will depend upon the severity of the application and environmental conditions. A properly sized element which is stored and operated under normal conditions (i.e. under 85% humidity and 85°F) should obtain a minimum of 6 to 8 years of service life after the date of manufacture. A production date sticker is applied to all elements for ease of inspection (I.E. 3Q93 indicates Third Quarter 1993 production).

After the coupling has been in operation for some time, a "torsional set" may develop in the flex element (up to 1/4" on a size E40, even more on larger sizes). This does not affect the performance of the coupling, as it is simply the material creeping under the applied stress. A very large torsional set may suggest a sizing problem and will warrant a close review of the application and coupling selection parameters. For ease of assembly/disassembly, elements should be re-installed in the same "position of rotation" in which they were removed.



Cleaning the Pump

Dirt on the outside of the pump has an adverse effect on transmission of heat. The pump should therefore be cleaned with water at regular intervals (depending on the degree of dirt).

ATTENTION: THE PUMP SHOULD NOT BE CLEANED WITH PRESSURIZED WATER – WATER WILL GET INTO THE BEARINGS AND INTO THE MOTOR.

6. LONGER PERIODS OF NON-OPERATION

6.1 Drained Pumps

- Turn by hand at least 1 x week (do not switch on because of dry running).
- If necessary, unblock by tapping gently on the coupling in axial direction.
- Change the grease in the bearings after 2 years.
- Replace bearings after 5 years.

6.2 Filled Pumps

- Switch stand-by pumps on and immediately off again once a week.
- If the stand-by pump is at operating pressure and temperature:
- Change the grease in the bearings after 2 years.
- Replace bearings after 5 years.

7. FAULTS – CAUSES AND SOLUTIONS

The following notes on causes of faults and how to repair them are intended as an aid to recognizing the problem. The distributor's Customer Service Department is available to help repair faults that the operator cannot or does not want to repair. If the operator repairs or changes the pump, the design data on the Data Sheet and Points 1.2 – 1.4 of these Operating Instructions should be particularly taken into account. If necessary, the written agreement of the distributor must be obtained.

FAULTS

DISCHARGE TOO LOW

Code no. 1, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

DISCHARGE STOPS AFTER A TIME

Code no. 8, 10, 11, 12, 30

HEAD TOO LOW

Code no. 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 30, 34

HEAD TOO HIGH

Code no. 3, 5, 34

DRIVE MECHANISM OVERLOADED

Code no. 2, 3, 5, 15, 25, 27

PUMP NOT RUNNING QUIETLY

Code no. 7, 10, 14, 22, 23, 24, 25, 29, 30, 33

TEMPERATURE IN THE PUMP TOO HIGH

Code no. 7, 10, 30

TEMPERATURE IN THE SHAFT SEALING TOO HIGH

Code no. 18, 19, 21

TEMPERATURE AT THE BEARING TOO HIGH

Code no. 2, 14, 23, 24, 25, 26, 29, 31, 32

PUMP LEAKING

Code no. 25, 28

LEAKAGE RATE AT SHAFT SEALING TOO HIGH

Code no. 19, 21, 22, 25

MEANING OF CODE NUMBER FOR CAUSE AND METHOD OF REPAIR

1. Back-pressure too high
 - open discharge valve further
 - reduce resistance in discharge pipe (e.g. clean filter if necessary)
 - Use larger impeller (note available motor power)
2. Back-pressure too low, discharge too low
 - throttle discharge valve
3. Speed too high
 - reduce speed
 - compare speed of motor with specified pump speed (rating plate)
 - when adjusting speed (frequency transformer) check reference value setting
4. Speed too low
 - increase speed (check available motor power)
 - compare speed of motor with specified pump speed (rating plate)
 - when adjusting speed (frequency transformer) check reference value settings
5. Impeller diameter too large
 - use smaller impeller
6. Impeller diameter too small
 - use larger impeller (check available motor power)
7. Pump and/or pipes not completely filled with liquid
 - fill
 - vent
8. Pump or suction/intake pipe blocked
 - clean
9. Air pocket in pipeline
 - vent
 - improve course of pipe
10. NPSH of system too small
 - increase liquid level
 - increase admission pressure
 - reduce resistance in the intake/suction pipe (change course and rated width, open shutoff valves, clean filters)
11. Air being sucked in
 - increase liquid level
 - check suction pipe is vacuum-tight
 - provide spindles in suction pipe fittings with water seal
12. Air being sucked in through shaft sealing
 - clean sealing pipe
 - increase sealing pressure
 - replace shaft sealing
13. Direction of rotation is wrong
 - swap over two phases of power supply (to be done by a specialist electrician)
14. Inner components suffering from wear
 - replace worn parts
15. Density and/or viscosity of liquid handled is too high
 - seek assistance
18. Shaft sealing worn
 - check sealing, flushing and cooling pipes (pressure)
 - avoid dry running
19. Lines and roughness on shaft or shaft sleeve
 - replace parts
21. Deposits on mechanical seal
 - clean
 - replace mechanical seal if necessary
 - if necessary provide additional rinsing or quench
22. Impeller out of balance
 - remove blocks/deposits
 - replace if broken or unevenly worn
 - check shafts to ensure that they are running true
23. Coupling not aligned
 - align pump unit better
24. Coupling distance too small
 - change
25. Forces in pipeline too high (pump unit under strain)
 - change (support pipes, use copensators, etc.)
 - is foundation plate/frame properly cast in place?
26. Too much, too little or the wrong type of lubricant
 - change
27. Electricity supply not right
 - check voltage of all phases (2-phase running)
 - check cable connections
 - check fuses
28. Sealing insufficient
 - tighten screws
 - replace sealing
29. Bearing damaged
 - replace
 - check lubricant and bearing space for pollutants (rinse oil area)
30. Discharge too small
 - increase min. amount carried (open slide valves, bypass)
31. Discharge too high
 - reduce amount carried (throttle slide valve)

- 32. Relief fittings insufficient
 - clean relief openings in impeller
 - replace worn parts (impeller, split rings)
 - adjust in line with the system pressure/intake pressure given on ordering
- 33. System-related vibrations (resonance)
 - seek assistance
- 34. Flow indicator wrong
 - check flowmeter
 - get rid of blockages
 - put flowmeter in suitable place (no flow distortion or burbling)

8. REPAIRS



Repairs to the pump or pump system may only be carried out by authorized skilled personnel or by the distributor's specialist staff.

Trained Customer Service engineers are available to assist with installation and repair work on request. When removing the pump, you must comply with Point 1.4 "Safety Instructions", Point 1.3 "Transport, Handling" and Point 4.8 "Dismantling".

9. SPARE PARTS, SPARE PUMPS

9.1 Spare Parts

Spare parts should be selected to last for two-years continuous operation. If no other guidelines are applicable, we recommend that you stock the number of parts listed below.

| Spare Part | Number of Pumps (including stand-by pumps) | | | | | | | |
|--------------------------------------|--|-----|-----|----|-----|------|------|--|
| | 2 | 3 | 4 | 5 | 6/7 | 8/9 | 10+ | |
| Impeller | i | i | i | 2i | 2i | 3i | 30% | |
| Diffuser | i/2 | i/2 | i/2 | i | i | 3i/2 | 15% | |
| Shaft with key and shaft screws/nuts | 1 | 1 | 2 | 2 | 2 | 3 | 30% | |
| Bearing (roller bearing) | 1 | 1 | 2 | 2 | 2 | 3 | 30% | |
| Shaft sleeve | 2 | 2 | 2 | 3 | 3 | 4 | 50% | |
| Joints for Pump Casing†- sets | 4 | 6 | 8 | 8 | 9 | 12 | 150% | |
| Other joints†- sets | 4 | 6 | 8 | 8 | 9 | 10 | 100% | |
| Mechanical seal | 2 | 3 | 4 | 5 | 6 | 7 | 90% | |

i = no. of steps

ATTENTION: TO ENSURE OPTIMUM AVAILABILITY, WE RECOMMEND THAT SUITABLE QUANTITIES OF SPARE PARTS ARE HELD IN STOCK, ESPECIALLY IF THESE ARE MADE FROM SPECIAL MATERIALS AND IN THE CASE OF MECHANICAL SEALS, BECAUSE OF THE LONGER DELIVERY TIMES.

Ordering Spare Parts

When ordering spare parts, please supply the following information:

Type: _____

Order No. _____

Part Designation in sectional drawing _____

All the information is given in the Data Sheet and the relevant sectional drawing.



9.2 Stand-By Pumps

It is essential that a sufficient number of stand-by pumps are kept ready for use in plants where failure of a pump could endanger human life or cause damage to property or high costs. Regular checks should be carried out to ensure that such pumps are always ready for use (see Point 6.2).

10. PLANT MANAGER LIST

Each plant manager should sign below to confirm that he has received, read and understood these Operating Instructions. He undertakes to follow the instructions conscientiously. If these instructions are not followed, the manufacturer's guarantee and liability shall cease to apply.

| Name: | Date: | Signature: |
|-------|-------|------------|
| | | |

11. LOG BOOK

Each plant operator shall duly enter all maintenance and service work that has been carried out, and shall see that the person responsible confirms such work by signing below.

| Maintenance Work | | Date | Signature Plant Operator | Confirmed By Person Responsible |
|------------------|--|------|-----------------------------|------------------------------------|
| | | | | |

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

- (a) Labor, transportation and related costs incurred by the dealer;
- (b) Reinstallation costs of repaired equipment;
- (c) Reinstallation costs of replacement equipment;
- (d) Consequential damages of any kind; and,
- (e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
- (3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.