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1. General

1.1 Foreword



This product complies with the safety requirements of EC Machinery Directive 2006/42/EC.

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 authorised 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 unauthorised 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 us, or subject to our written approval. Otherwise the guarantee ceases to apply.

Longer-term guarantees basically only cover correct handling and use of the specified material. 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 as specified in DIN 4844:



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 as a result of dangerous substances leaking out.

Safety instructions 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. Immediately the work has been completed, all safety and protective devices must be replaced or restarted.
- Under EC Machinery Directives, every machine must be fitted with one or more emergency command devices by which situations which represent an immediate danger or which could later be dangerous

can be avoided. This does not include machines in which the emergency switches cannot reduce the danger, either because they do not reduce the time required to stop the machine or because they do not allow the measures required by the danger to be taken. This emergency switch must:

- have controls that are clearly marked, easy to see and within easy reach;
- stop the dangerous movement as quickly as possible without causing any additional danger;
- trigger any specified safety movements or allow these to be started up.

If the emergency command device is no longer operated after an emergency "off" switch has been triggered, this must be maintained by blocking the emergency command device until it is released again. It should not be possible to block the device without this triggering an emergency "off" switch. It should only be possible to release the device through an appropriate action; this release should not start the machine up again - it should only make it possible to start it up again.

- If the power supply is interrupted or restored after being interrupted or if it is changed in any other way, this should not cause any danger (e.g. pressure surges).

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 admission 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, the figures given in the Appendix "Permitted forces and moments" should not under any circumstances be exceeded.

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 if 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. We should be pleased to advise on 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 Models

Design MPE

Design Features:

- Horizontal configuration with bearings on both sides
- Closed impeller design with diffusers reduces radial loads and minimizes the shaft loads and shaft deflection
- Thrust balancing by balancing drum, and pressure balancing at the discharge side shaft seal for increased life time of bearings and shaft seals
- Pump casing with integral casted feet, rigid design for transmission of pipeloads to the foundation without deformation
- Branch directions: Suction flange left viewed from the driver, discharge flange radially upwards as standard. Optional other 90 ° increments possible.

See "Appendix" in Operating Instructions for sectional drawing

2.2 Shaft sealing

There are basically two methods of shaft sealing: the stuffing box and the mechanical seal. The type of the shaft sealing of your pump you can find on the data sheet.

Attention *You will find more information on stuffing boxes and 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

Bearings at both ends; thrust bearing at discharge side, ball bearing at suction side.

Lubrication of roller bearings

Oil sump lubrication with oil level sight glass

When changing the oil typ, ensure compatibility with the residual oil.

Oil lubricants to be chosen from Table T 011 in Appendix.

Bearing types (roller bearings) Oilquantity/Bearing

Pump size MPE	Bearing typ		Oil quantity *) in liter/bearing bracket
	Suction side	Discharge side	
100.1	6310-C3	2x7310 (X- arrangement)	ca. 2,0
100.2	6310-C3	2x7310 (X- arrangement)	ca. 2,0
125.0	6312-C3	2x7312 (X- arrangement)	ca. 2,5
125.1	6312-C3	2x7312 (X- arrangement)	ca. 2,5
125.2	6312-C3	2x7312 (X- arrangement)	ca. 2,5

*) Oil quantities are appr. discription, the effective oil amount see oil level indicator (middle of the oil level sight glass).

3. Transport, Handling, Storage

3.1 Transport, Handling

- Check the pump/pump unit immediately upon delivery/receipt of despatch 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.*

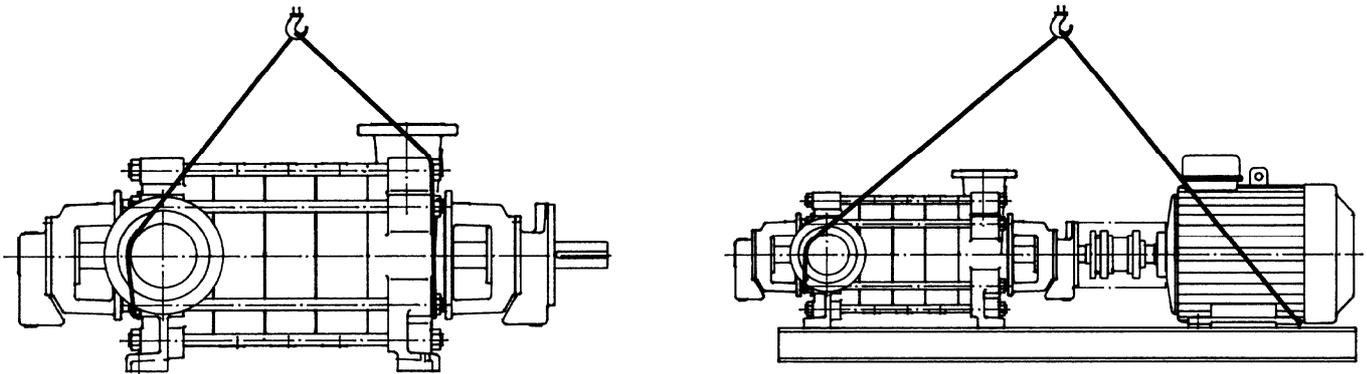
- Lifting devices (e.g. fork-lift truck, crane, crane device, pulleys, sling ropes, etc.) must be sufficiently strong. The weight of the pump/pump unit is given in the Data Sheet.
- The pump/pump unit may only be lifted by solid points such as the casing, flanges or frame. The following illustration 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.

Attention *Sling ropes must not be fixed to ends of shafts or the ring loops of the motor.*



3.2 Storage/Preservation

Pumps 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. When storing the pump outside and not opening the packing you must keep the pump/unit dry and protect it against dirt.

Preservation

On storing the pump longer than 3 month (depends on order; also see adhesive plate on the pump): 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 Base

Assembly of a pump with free shaft end

The pump and motor (= pump unit) must be provided with a base frame made of steel or cast iron or a fabricated (welded) frame, where this does not exist already or if it is not included in the delivery. This base frame must be placed on a foundation which can withstand all loads that arise during operation (refer to chapter 5.1.2).

When mounting the pump onto the base frame the following must to be noticed:

The base frame must be solid, so that there won't occur any twists or vibrations during the operation.

The mounting surfaces of the pump feet and motor on the base frame must be flat (machining is recommended). Bracing of the pump leads to premature breakdown of the pump and to a loss of warranty.

The drillings for the pump mounting must be in such a way, that safe fastening is guaranteed.

Between pump and motor shaft an adequate space must be left depending on the used coupling, refer to chapter 5.3.

Between pump and base frame there must be an adequate shimming, so that in the case of replacement of the pump the equal height between bottom and centreline can be adjusted (recommended vertical adjustment 4 to 6 mm).

Align pump and motor, refer to chapter 5.3, as well.

Assembly of the unit (Pump, Motor and base frame)

The place, where the pump is mounted must be prepared acc. to the dimensions of the dimensional drawings. The concrete foundations should have sufficient firmness acc. to DIN 1045 or equal standard (min. BN 15), to ensure a secure, functional mounting.

The concrete foundation must have set, before the unit is erected. The surface must be horizontal and even.

 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.

- For the set of anchor bolts according recesses must be provided. If that is not the case, concrete expansion bolts resp. epoxy capsule anchor bolts can be used.
- When mounting the pump on the foundation it must be adjusted at the discharge nozzle by means of a spirit-level (at discharge nozzle). The permitted deviation is 0,5 mm/m. After inserting the foundation bolts they must be cast in the foundation with concrete. After setting of the grout the coupling alignment must be checked according chapter 5.3.1 and possible misalignments must be corrected by adjusting foundation frame in the area of the drive motor. The smoothness of the base frame must be 0,5 mm/m before it is filled up resp. fastened. For adjustment levelling shims or levelling screws (optional, not delivered standard wise) can be used. Levelling shims must be inserted next to the foundation anchors and must lie plainly. After that fasten foundation bolts symmetrically but only slightly. Fill in base frame with non shrinking grout.

Notice:

- Avoid air bubbles (e.g. by vibrating).
- Check that the grout has properly set and hardened.
- Take care for the after-treatment of the concrete acc. to DIN 1045.

After setting, tighten the foundation anchor evenly and firmly. Check alignment of coupling acc. to chapter 5.3.1 and re-adjust, if necessary. Further, check that all screws between pump / motor and the base frame fit snugly. Although the original MP-base frames are designed solidly, the filling in of the adjusted base frame up to the rim is recommended.

- If vibrations are transmitted to the foundation from adjoining components, it must be guarded through adequate vibration damping padding (vibrations from outside can impair the bearing).

- To prevent vibrations being transmitted to adjoining components, the foundation should be laid on a suitable insulating base.



The size of these insulating pads will vary, depending on circumstances, and should therefore be determined by an experienced specialist.

4.2 Installation and Alignment of Coupling



Make sure that nobody can start the motor during work on the coupling.

According to Accident Prevention Regulations, the pump unit may only be operated when the coupling guard is mounted.

Installation

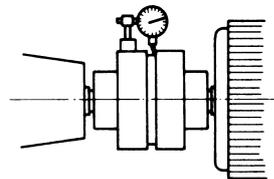
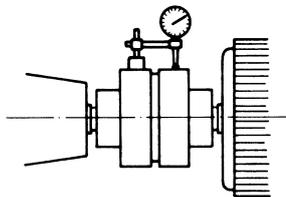
If the pump unit is not completely assembled until it reaches its place of use and no separate operating instructions have been supplied by the manufacturer, you should proceed according to the following points:

- Before starting installation, carefully clean shaft ends and coupling components.
- Pull coupling onto shaft end, do not hit. The coupling may be heated beforehand in an oil bath to approx. 100°C (pulling on is then easier). Remove rubber packs from coupling section first.
- The coupling sections must be flush with the shaft end surfaces.
- Secure coupling hubs against axial sliding using a pin screw.

Alignment

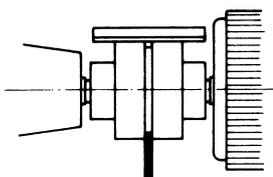
Even if units are completely mounted on a base frame the coupling has to be re-aligned after the installation.

Adjustment using dial gauge:



Adjustment using precision ruler:

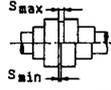
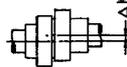
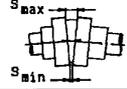
Normal coupling



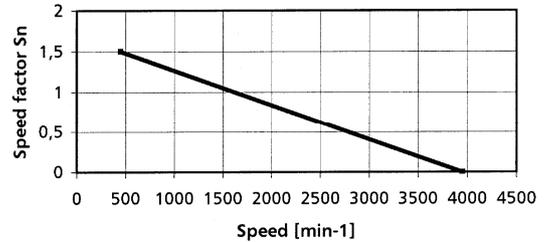
- Check/measure the alignment at several points using a precision ruler and sensor. If a dial gauge is used, one coupling side is to be turned.
- When aligning, keep the parallel and angular displacement of the shaft ends to a minimum. The alignment can be more precise if a dial gauge is used. The permitted displacement for your coupling is given in the following table (this only applies for couplings supplied originally by us). You will find the exact designation for your coupling on the Data Sheet.

Permitted displacement for flexible couplings

Design A..FK, A..KK, B..FK, B..KK

Coupling size		B 95 FK - B 95 KK	B 110 FK - B 110 KK	B 125 FK - B 125 KK	B 140 FK - B 140 KK	B 160 FK - B 160 KK	B 180 FK - B 180 KK	B 190 FK - B 190 KK	B 200 FK - B 200 KK	B 225 FK - B 225 KK	B 250 FK - B 250 KK	B 280 FK - B 280 KK	A 315 FK - A 315 KK	A 350 FK - A 350 KK	A 400 FK - A 400 KK
Outer diameter of coupling [mm]		95	110	125	140	160	180	190	200	225	250	280	315	350	400
Axial distance S 	Smax	6	3		6			8							
	Smin	5	2			3									
Max. radial displacement ΔKr 		0,1			0,2			0,3		0,4					
Max. angular displacement Smax . Smin $\Delta Kw = Smax - Smin$ 		0,1	0,2			0,3			0,4						

The given values ΔKr and ΔKw apply for 1500 min⁻¹.
For all other speeds, the following applies:
 $\Delta Kw \cdot Sn$ bzw. $\Delta Kr \cdot Sn$



- Align the coupling again after pump has reached normal operating temperature and system pressure (if applicable), check once again and if necessary adjust. Read Point 4.5 "Starting up" first.
- It must be possible to turn the unit by hand smoothly and easily.
- Mount coupling guard as shown in drawing no. 6396-312 (appendix).

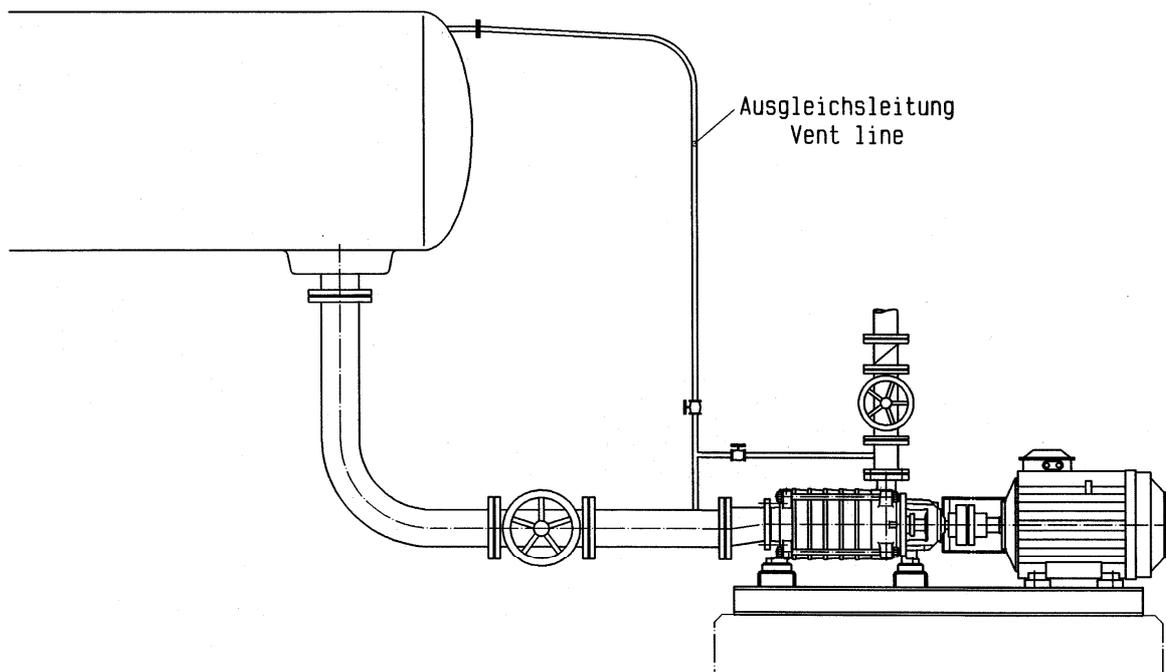
Attention *The installation and alignment of the coupling must be carried out with the utmost care and attention, and the motor will then run more reliably and last longer. Badly aligned couplings cause noise, vibration and increased wear on bearings, couplings and shaft seals.*

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.
- If the suction supply is under vacuum the installation of a vent line is recommended. The nominal diameter of this line should be at least 25 mm and it should return to the suction supply, above the max. liquid level.

An additional flushed piping – discharge branch-vent line – makes it easier to de-aerate the pump before start.



- 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.
- Before starting up, the pipe system, fittings and equipment must be cleaned, flushed and blown through. In many cases globules or oxide scale (tinder) come off the castings after a certain period of time only. Those have to be kept out of the pump by installing a strainer into the suction pipe. 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
- To protect the shaft sealing (especially mech. seal) against foreign bodies it is recommended that a strainer is installed in the suction pipe (e.g. suction strainer with a threefold cross-section of piping, approx. 800 µm).
- 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 preserved properly (danger of rust and problems when starting up).
- In the case of pumps with stuffing boxes, replace the packing after pressure test (packing may be overcompressed and thus no longer suitable for use).

Auxiliary pipes

Any sealing, flushing or cooling pipe connections must be installed. Please consult the Data Sheet to see which pipes, pressures and quantities are necessary.

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, flushing, 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. (Connection see dimension drawing in the appendix).

4.4 Electrical connection



Electrical connection work may only be carried out by an authorised professional. The rules and regulations valid for electrical technology, especially those concerned with safety measures, must be observed. The regulations of the national 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 instructions 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 boilerfeed or condensate applications: pH-value $\geq 9,0$ (optimum $\geq 9,3$), short term: pH-value $\geq 8,5$.

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 63 bar.

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

Starting up for the first time

- Open oil drain plug (AS) and drain off any liquid that may have collected.
- Close oil drain and fill in oil inn the bearing bracket (see point 2.3) up to the middle of the oil level sight glass.
- Pump and suction pipe must be filled completely with liquid when starting up. Open the screwed plugs "PM1" resp. "PM2" when filling the pump. Close them when water is flowing out.
- Open all valves in the suction- resp. supply-pipes completely.
- 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. On pumps with a starting performance of less than 30 kW, the slide valve can stay 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.



On staring without counter pressure, the latter must be produced through throttling at the discharge side.

After reaching counter-pressure open slide.

- Packing:
Packings need leakage to operate perfectly (liquid being handled to drip out).
To start with, set the leakage rate fairly high. During the first few hours of operation, slowly reduce the leakage rate as the pump is running by gradually tightening the packing gland (see item "69" and "M3" in the sectional drawing). The leakage must flow out liquid in any case (not vaporous).

Attention *Packings that run dry will harden and then destroy the shaft sleeve and/or the shaft.*

- Mechanical seals:
Mech. seals don't need to be maintained and are almost free of leakage.

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.*

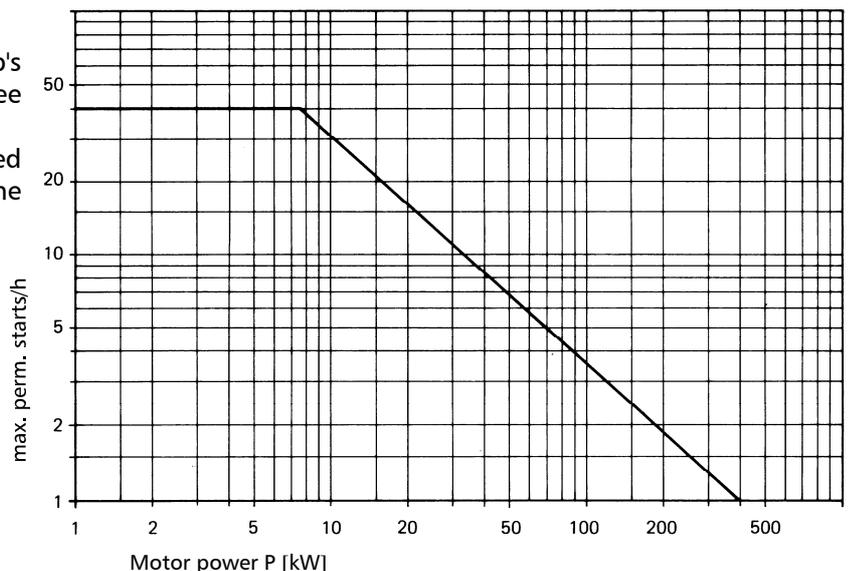
- You must observe the area of application given on the Data Sheet.
- Do not exceed the output given on the motor rating plate.
- Avoid dry running, running against closed discharge valves or operation whilst the liquid handled is in the vapour phase.
- Avoid sudden changes in temperature (temperature shocks, e.g. sudden inflow of hot water).
- The pump and motor should run evenly and without vibrations; check at least once a week.
- The bearing temperature (measured on the bearing frame) should be max. 50°C above ambient temperature and should not exceed 90°C; check at least once a week. (be aware of inaccuracies due to air drawn by motor fan).
- Check the oil level at least over a week. If necessary fill up.
Attention: check oil level only when the pump is stopped.
- Check leakage rate of packings at least once a week (daily at the beginning) (see point 4.5 "Packings").
- Check the regulating and monitoring facilities of any sealing, flushing or cooling systems once a week to ensure that they function properly.
- 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 attached 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 of motor (make sure it runs down quietly).
- Close slide valve on suction side.
- Close auxiliary systems. Do 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 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.

4.9 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.
- All valves in the suction, intake and discharge pipes must be closed.
- The pump casing must be without pressure.

Attention *The existing drain plugs do not guarantee complete emptying.*

- 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-repellent 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

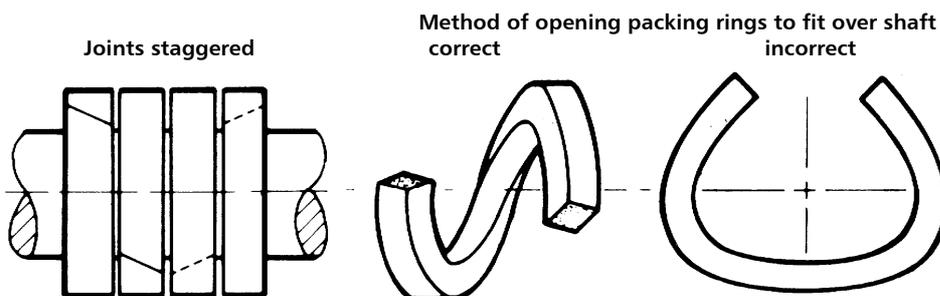


Work should only be carried out on the pump or pump unit when it is not in operation. You must observe Point 1.4 "Safety instructions".

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 Manufacturer's own service staff. The work carried out must be duly entered in the "Log Book" (see Point 11) and confirmed by being signed.*

Stuffing boxes

Stuffing boxes require constant maintenance (see also Point 4.5, "Starting up for the first time"). If the leakage rate can no longer be set correctly, the packing is worn out and must be replaced in good time (increased wear on shaft). If employing new packings tight at the beginning the gland only gentle (heavy leakage). Arrange ends of packing rings at opposite positions (refer to drawing). After a while tighten the gland smoothly until leakage is reduced to only a few drops per minute. Avoid dry run.





Because of the risk of accidents, addition of packing to pumps during operation or at operating pressure or temperature is strictly forbidden.

Mechanical seals



Before opening the pump, it is essential that you note Point 1.4 "Safety Instructions", Point 4.9 "Dismantling" and Point 8 "Repairs".

Mech. seals do not need to be maintained and are completely free of leakage. Pumps with mech. 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.

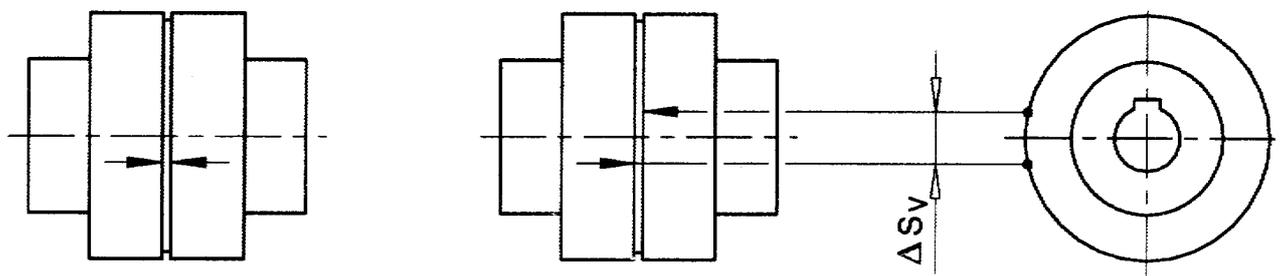
When installing the mechanical seal make sure that the seal casing is absolutely clean, particular care has to be paid to the surface of the seal rings. To facilitate the slip-on of the rotating components of the seal onto the shaft lubricate all moving components and sliding areas by means of water, 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.

Oil change

- After the first 200 operating hours discharge oil (oil drain plug "AS") and fill with fresh oil and close oil drain plug "AS".
- In Succession change oil every six month or annual (addicted for the humidity)
- When the pump shutdown longer, the oil have to change after 2 years.
- Assortment and quantity of oil see point 2.3 "Bearing and Lubrication".

Coupling

Check the play in the coupling components approx. every 1000 operating hours, at least once a year. As far as a small circumferential backlash of the coupling is not necessary for operation, the plastic flexibles can be worn by approx. $\frac{1}{4}$ of their original thickness before they should be changed. To measure the clearance in the coupling place a mark on the O.D. of each coupling hub. Then, fixing one hub, turn the opposite hub as far as possible. Then measure the distance (ΔS_v) between the marks of the coupling. If this measurement exceeds the value in the chart, the packings have to be changed. The packings must be changed in pairs.



Size	80	95	110	125	140	160	180	200	225	250	280	315	350	400
ΔS_v [mm]	5,0	6,0	7,0	8,0	8,5	8,0	8,0	8,5	9,0	10,0	11,5	10,5	11,5	13,0

Attention *If wear is heavy, it must be assumed that the motor is not properly aligned with the pump or that the distance between the coupling sections has changed. Replace worn elements and re-install or adjust coupling, as described in Point 4.2.*

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 pressurised water - water will get into the bearings.*

6. Longer periods of non-operation

Attention *After long stationary periods, packings may have hardened; these must be replaced before start-up. When starting up, follow the instructions for starting up for the first time.*

6.1 Drained pumps

- Turn by hand at least 1x week (do not switch on because of dry running).
- If necessary, unblock by tapping gently on the shaft in axial direction
- Change the oil in the bearings after 2 years (see point 2.3).

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: leave all sealing, flushing and cooling systems switched on.
- Change the oil in the bearings after 2 years (see point 2.3).
- Do not tighten the stuffing box until there are no leaks.

7. Faults - Causes and Solutions

The following notes on causes of faults and how to repair them are intended as an aid to recognising the problem. The manufacturer'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 manufacturer must be obtained.

Faults	Code no. For cause and method of repair
Discharge too low	1, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15
Discharge stops after a time	8, 10, 11, 14, 15
Head too low	2, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, 31, 34
Head too high	3, 5, 30, 34
Drive mechanism overloaded	2, 3, 5, 15, 16, 25, 27, 29, 31
Pump not running quietly	7, 10, 14, 22, 23, 24, 25, 29, 30, 31, 33
Pump casing warms up during operation	8, 10, 14, 30
Temperature in the shaft sealing too high	16, 17, 18, 20
Temperature at the bearing too high	1, 2, 3, 14, 22, 23, 24, 25, 26, 29, 30, 31, 32
Pump leaking	25, 28
Leakage rate at shaft sealing too high	16, 18, 19, 20, 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

	<ul style="list-style-type: none"> • compare speed of motor with specified pump speed (rating plate) • when adjusting speed (frequency transformer) check reference value setting
4.	<p>Speed too low</p> <ul style="list-style-type: none"> • 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.	<p>Impeller diameter too large</p> <ul style="list-style-type: none"> • use smaller impeller
6.	<p>Impeller diameter too small</p> <ul style="list-style-type: none"> • use larger impeller (check available motor power)
7.	<p>Pump and/or pipes not completely filled with liquid</p> <ul style="list-style-type: none"> • fill • vent
8.	<p>Pump or suction/intake pipe blocked</p> <ul style="list-style-type: none"> • clean
9.	<p>Air pocket in pipeline</p> <ul style="list-style-type: none"> • vent • improve course of pipe
10.	<p>NPSH of system too small</p> <ul style="list-style-type: none"> • increase liquid level • increase admission pressure • reduce resistance in the intake/suction pipe (change course and rated width, open shutoff valves, clean filters)
11.	<p>Air being sucked in</p> <ul style="list-style-type: none"> • increase liquid level • check suction pipe is vacuum-tight • provide spindles in suction pipe fittings with water seal
12.	<p>Air being sucked in through shaft sealing</p> <ul style="list-style-type: none"> • clean sealing pipe • increase sealing pressure • replace shaft sealing
13.	<p>Direction of rotation is wrong</p> <ul style="list-style-type: none"> • swap over two phases of power supply (to be done by a specialist electrician)
14.	<p>Inner components suffering from wear</p> <ul style="list-style-type: none"> • replace worn parts
15.	<p>Density and/or viscosity of liquid handled is too high</p> <ul style="list-style-type: none"> • seek assistance
16.	<p>Stuffing box not straight</p> <ul style="list-style-type: none"> • tighten evenly
17.	<p>Stuffing box too tight</p> <ul style="list-style-type: none"> • loosen
18.	<p>Shaft sealing worn</p> <ul style="list-style-type: none"> • tighten packing • replace packing and/or mechanical seal • check sealing, flushing and cooling pipes (pressure) • avoid dry running
19.	<p>Lines and roughness on shaft or shaft sleeve</p> <ul style="list-style-type: none"> • replace parts
20.	<p>Unsuitable packing material</p> <ul style="list-style-type: none"> • use suitable material (check shaft or shaft sleeve for damage beforehand)
21.	<p>Deposits on mechanical seal</p> <ul style="list-style-type: none"> • clean • replace mechanical seal if necessary • if necessary provide additional rinsing or quench
22.	<p>Impeller out of balance</p>

	<ul style="list-style-type: none">• remove blocks/deposits• replace if broken or unevenly worn• check shafts to ensure that they are running true
23.	Coupling not aligned <ul style="list-style-type: none">• align pump unit better
24.	Coupling distance too small <ul style="list-style-type: none">• change
25.	Forces in pipeline too high (pump unit under strain) <ul style="list-style-type: none">• change (support pipes, use compensators, etc.)• is foundation plate/frame properly cast in place?
26.	Too much, too little or the wrong type of lubricant <ul style="list-style-type: none">• change
27.	Electricity supply not right <ul style="list-style-type: none">• check voltage of all phases (2-phase running)• check cable connections• check fuses
28.	Sealing insufficient <ul style="list-style-type: none">• tighten screws• replace sealing
29.	Bearing damaged <ul style="list-style-type: none">• replace• check lubricant and bearing space for pollutants (rinse oil area)
30.	Discharge too small <ul style="list-style-type: none">• increase minimum amount carried (open slide valves, bypass)
31.	Discharge too high <ul style="list-style-type: none">• reduce amount carried (throttle slide valve)
32.	Relief fittings insufficient <ul style="list-style-type: none">• 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) <ul style="list-style-type: none">• seek assistance
34.	Manometer indicator wrong <ul style="list-style-type: none">• check manometer• get rid of blockages• put manometer in suitable place (no flow distortion or burbling)
35.	unloading attachment used up <ul style="list-style-type: none">• used up parts renew.

8. Repairs



Repairs to the pump or pump system may only be carried out by authorised skilled personnel or by the manufacturer'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 3.1 "Transport, Handling" and Point 4.9 "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 (in accordance with VDMA 24296).

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.*

	Number of pumps (incl. stand-by pumps)						
	2	3	4	5	6/7	8/9	10/more
spare part	number of spare parts						
impeller	i	i	i	2i	2i	3i	30%
diffuser	i/2	i/2	i/2	i	i	3i/2	15%
wear ring-casing	2i	2i	2i	4i	4i	6i	30%
unloading attachment	1	1	2	2	2	3	30%
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%
packing rings	16	16	24	24	24	32	40%
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

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 operatot	Confirmed by person responsible:

Tightening Torques

				Pump Size												
											MPE 100		MPE 125			
	Screw	Nut	Quality								Size	Tightening Torque in Nm (kgm)	Size	Tightening Torque in Nm (kgm)		
	Item	Item	Min.								Thread		Thread			
Screw Connection											Dry	Oiled		Dry	Oiled	
Casing anchor	25	M1	8.8								8 x M24	455 (46,4)	410 (41,8)	8 x M30	785 (80)	710 (72,4)
Bearing support (10) with suction casing (3) and pressure casing (4)	S2	M2	8.8								8 x M16	115 (11,7)	105 (10,7)	8 x M20	200 (20,4)	180 (18,4)
Bearing support (10) with bearing cover (12)	S5	M5	4.6								4 x M10	16 (1,6)	14,5 (1,5)	4 x M12	28 (2,9)	25 (2,6)

Note: Studs must be screwed in to the end of the thread.