



VOGEL PUMPEN

a xylem brand

en VOGEL-Volute Casing Pumps
Model: **LS, LC, LCP**

Installation, Operation and Maintenance Instruction

Translation of the Original Operation Manual



en **Keep for further use !**
Pay attention to this operating instruction before the delivery, installation, start-up a.s.o.!

Xylem Water Solutions Austria GmbH

Ernst Vogel-Straße 2

A-2000 Stockerau

Telefon: +43 (0) 2266 / 604

Fax: +43 (0) 2266 / 65311

E-Mail: info.austria@xylem.com

Internet: www.xylemaustria.com

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Pump Name Plate

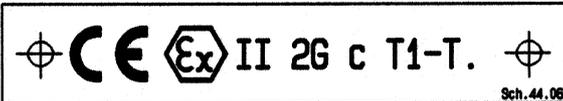
Type	<input type="text"/>	
S/N	<input type="text"/>	Year
Q	<input type="text"/> m ³ /h	P
H	<input type="text"/> m	n
P _{all w c}	<input type="text"/> bar at t _{max op}	<input type="text"/> °C
Item No	<input type="text"/>	Imp∅
	<input type="text"/> mm	

Sch. 44.03

- Type *) Type of pump
 S/N *) Serial number
 Year Year of construction
 Q Rated capacity at the operating point
 P Rated power at the operating point
 H Head (Energy head) at the operating point
 n Speed
 P_{all w c} Max permitted casing-operation-pressure
 (=highest discharge pressure at the rated
 operating temperature to which the pump
 casing can be used).
 t_{max op} Maximum permitted operating temperature of
 pumped liquid
 Item No Customer related order number
 Imp∅ Outer diameter of the impeller

*) All details of design and materials are defined with this information. They must be stated on all inquiries to the manufacturer resp. orders of spare.

ATEX-Label (only for pumps in compliance with EC directive 94/9/EG)



- CE Marking of compliance with the EC directive 94/9/EG
 Ex specific marking for explosion protection
 II Symbol for the appliance group
 2G Symbol for the category (2), explosive atmosphere due to gases, vapours or mist (G)
 c Symbol for used ignition protection (constructive safety "c")
 T1-T. Symbol for classification of the theoretically available range of the temperature classes - data for temperature class refer to chapter 2.7.5; Data for maximum permitted temperature of pumped liquid refer to pump name plate, data sheet and / or order confirmation.

The conformity with the EC directive 94/9/EG "Appliances and Protection Systems for designated use in areas endangered to explosion" is declared by the issue of the EC-Declaration of Conformity and the attachment of the ATEX-label at the pump (bearing bracket). The ATEX-label is attached additionally to the pump name plate.

1. General

This product corresponds with the requirements of the Machine directive 2006/42/EG.



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 the staffs do not have the relevant knowledge, they should be provided with suitable instruction.

The operation safety of the delivered pump resp. unit (= pump with motor) can only be guaranteed on designated use according to the attached data sheet and / or order confirmation resp. chapter 6 "Start-up, Operation, Shut down".

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.

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.

1.1 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 sealing, 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 name 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.

2. 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 available at the place where the pump or pump unit is in use.

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).

Equally, instructions and safety devices regarding handling and disposal of the pumped media and/or auxiliary media for flushing, lubrication a.s.o., especially if they are explosive, toxically, hot a.s.o., are not part of this operating instruction.

For the competent and prescribed handling only the operator is responsible.

2.1 Marking of References in the Operating Instructions

The safety regulations contained in these Operating Instructions are specially marked with safety signs acc. to DIN 4844:



Safety reference!

Non-observance can impair the pump and its function.



EC-Ex Marking

Products intended for use in explosive atmospheres must be marked.



General Symbol for Danger!

Persons can be endangered.



Warning of electric voltage!

Safety instructions attached directly to the pump resp. unit must be followed under any circumstances. Further they must be kept in good readable condition.

In the same way, as these Operating Instructions of the pump, all possibly attached Operating Instructions of accessories (e.g. motor) must be noticed and kept available.

2.2 Dangers of non-observance of the Safety Instructions

Non-observance of the Safety Instructions can lead to loss of any claim for damages.

Further, non-observance can lead to following risks:

- Failure of important functions of the machine or facility.
- Failure of electronic appliances and measuring instruments by magnetic fields.
- Endangering of persons and their personal property by magnetic fields.
- Endangering of persons by electric, mechanic and chemical influences.
- Endangering of environment through leakage of dangerous substances.



On application of the unit in areas endangered to explosion special attention must be paid to sections marked with Ex.

2.3 Safety Instructions for the Operator / Worker

- 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 is 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 the sound level of a pump or pump unit is above 85 dB(A) an ear protection has to be used when staying near the pump for some time.
- 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.

2.4 Safety Instructions for Maintenance, Inspections and Mounting Work

- The operator is responsible that any maintenance, inspections and mounting work is made by authorized competent personnel, which must be informed by having read the Operating Instructions.
- 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 after finishing work, all safety and protective devices must be replaced or restarted.

2.5 Unauthorized Alteration and Spare Parts Production

Alteration or changes of the machine are permitted after agreement with the manufacturer. Original spare parts and accessory authorized by the manufacturer are serving the safety. The use of other parts can lead to loss of liability for there from resulting consequences.

2.6 Undue Operation

The operating safety of the delivered machine can only be guaranteed by designated use acc. to the following chapters of the Operating Instructions. The limits stated in the data sheet and / or order confirmation must not be exceeded under any circumstances.

2.7 Explosion Protection

On application of units in areas endangered to explosion measures and references in the chapters 2.7.1 to 2.7.6 must be observed, so that explosion protection is guaranteed.

2.7.1 Filling of unit



During operation of the pump the system of the suction and pressure pipe and the pump itself must permanently be filled with the pumped liquid. Thus, no explosive atmosphere can develop and the danger of dry-run is avoided.



If the operator can't guarantee that, according monitoring measures must be provided.

 Equally all seal casings, auxiliary systems of the shaft sealing, as well as heating and cooling systems must be filled carefully.

2.7.2 Marking

 The marking of the pump refers to the pump itself. For coupling and motor resp. further additions a separate Declaration of Conformity, as well as a corresponding marking must be available.

Example of of marking at pump:

CE Ex II 2 G c T... .

The marking shows the theoretically applicable range of temperature classes. The different temperatures, permitted acc. to pump design, result as shown in chapter 2.7.5. The same is valid for the drive.

For a whole unit (pump, coupling, motor) with different temperature classes the lowest is valid.

2.7.3 Rotation Control

 Carry out rotation control with separated coupling halves only! Refer to chapter 5.5 and 6.1 as well.

 If danger of explosion is also existing during installation, the rotation control must not be carried out by short start-up of the empty pump, to avoid undue temperature increase in case of contact of rotating and stationary parts.

2.7.4 Operation of pump

The pump must only be started up with fully opened suction side and slightly opened pressure side valve. The start-up against closed non-return valve, however, is possible. Immediately after the start-up the discharge side valve must be adjusted to the operating point.

Refer to chapter 6.2, as well.

Operation with closed valve in suction and / or discharge pipe is not permitted!

 There's a danger, that high surface temperatures are developing at the pump casing after relatively short time, through fast heating of the liquid inside the pump.

 Fast pressure increase inside the pump can lead to overload and, thus, the pump can burst.

In chapter 6.4.1 the minimum flow is stated. Longer operating phases with these flows and the named liquids don't cause additional increase of surface temperature at the pump.

Furthermore the references in chapter 6 of these operating Instructions must be taken into consideration.

 On pumps with mech. seals the permitted temperature limits can be exceeded due to dry-run. Dry run not only can occur on insufficiently filled seal casing, but also because of too much gas in the medium.

Operation of the pump out of the permitted operating range can lead to dry-run, as well.

2.7.5 Temperature Limits

 Under normal operating conditions the highest temperatures must be expected at the surface of the pump casing and in the area of the bearings.

The surface temperature occurring at pump casing corresponds with the temperature of the pumped liquid.

 If the pump is heated (e. g. heating jacket), care must be taken, that the temperature classes, prescribed for the plant are observed.

In the area of the bearing bracket free contact from surface to surrounding must be given.

 During operation of the pump it must be secured that an overabundant sedimentation of dust is avoided (regular cleaning), to prevent heating of pump surface over the permitted temperature.

The operator of the plant must secure that the defined operating temperature is observed. The max. allowed temperature of the pumped liquid at suction depends on the particular temperature class.

The following table shows the theoretical temperature limits of the pumped liquid in consideration of the temperature classes acc. to EN 13463-1.

Temperature class acc. EN 13463-1	Temperature limit of pumped liquid
T4 (135°C)	135°C
T3 (200°C)	180°C
T2 (300°C)	180°C
T1 (450°C)	180°C

 The particular allowed operating temperature of the pump is shown in the data sheet and / or the order confirmation resp. the type plate at the pump.

In the area of the bearings the temperature class T4 is guaranteed, provided that the ambient temperature is 40°C and the appliance is duly operated and maintained.

2.7.6 Maintenance

 For a secure and reliable operation it must be secured by regular inspections, which the unit is maintained competently and is kept in good technical condition.

Example: Function of bearings. Operation and application conditions are essentially responsible for their achievable life cycle.

By regular control of the lubricant and the running sound the danger of occurring over temperatures by bearings running hot or defect bearing seals is avoided. Refer to chapter 6.6 and 7.4.

The function of the shaft sealing must be secured by regular control.

If auxiliary systems (e.g. external flushing, cooling, heating) are installed, it must be checked, if monitoring devices are necessary to secure the function.

2.7.7 Electric switches and control device, instrumentation and accessories

 Electric switches and control devices, instrumentation and accessories like e.g. flush tanks, a.s.o., must correspond with the valid safety requirements and regulations for explosion protection.

2.8 Use acc. to Regulations

2.8.1 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 and / or order confirmation. The given admission pressures (system pressures) must also be sufficiently high.

Further, pressure shocks, as can occur on too fast shut down of the facility, must be kept away from the pump (e.g. by non-return valve at pressure side, fly wheel, air tanks). Quick temperature changes must be avoided. They could cause a temperature shock and lead to damage or impair the function of single components.

2.8.2 Permitted Nozzle Loads and Torques

 Basically the suction and discharge piping must be designed in such way, that as little forces as possible are effective to the pump. If that is not possible, the values shown in chapter 3.5 must not be exceeded under any circumstances. This is valid for the operation as well as for the standstill of the pump and therefore for all possible pressures and temperatures of the unit.

3. Description

3.1 Design

LS-Pumps are single stage volute-casing pumps with closed impeller in process design; they are in accordance with the technical specifications of ISO 5199 / EN 25199.

LC-Pumps as model LS, but qualified for higher casing pressure.

2.8.3 NPSH

 The pumped liquid must have a min. pressure NPSH at the impeller inlet; so that cavitations free work is secured resp. a "break off" of the pump flow is prevented. This condition is fulfilled, when NPSH-value of the system (NPSHA) lies above NPSH-value of the pump (NPSHR) under all operating conditions.

Attention must especially be paid to the NPSH-value on pumping liquids near the vapour pressure. If the NPSH-value of the pump remains under, this can lead from damage of the material due to cavitations to destruction by overheating.

The NPSH-value of the pump (NPSHR) is shown in the curves of every pump type.

2.8.4 Sealing, Flushing, Cooling

Suitable provisions 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.

2.8.5 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.

LCP-Pumps as model LC, but with casing feet in centre line.

The pumps are designed as modular systems and can, therefore, be delivered in many variants (e.g. different materials, shaft sealing, different kinds of lubrication, cooling / heating, a.s.o.).

The permitted application conditions and design details of the delivered pump are shown in the attached data sheet and / or order confirmation.

3.1.1 Designation scheme

The permitted application conditions and design details of the delivered pump are shown in the attached data sheet and / or order confirmation.

For example:

LS 200 - 500 S1 N L 1 2500 4
 (0) (1) (2) (3) (4) (5) (6) (7) (8)

Position (0) - Model designation:

- LS - Foot mounted casing design (12 / 16 bar)
- LC - Foot mounted casing design (25 bar)
- LCP - Casing feet centre line (25 bar)

Position (1) - Nominal diameter of discharge nozzle in mm

Position (2) - Nominal impeller size in mm

Position (3) - Method of shaft sealing:

- S1 - Single mechanical seal acc. EN 12756, design K, form U (unbalanced)
- S2 - Single mechanical seal acc. EN 12756, design K, form B (balanced)
- S4 - Single mechanical seal acc. EN 12756, design K, form U (unbalanced), with Quench (with throttle bush)
- S5 - Single mechanical seal acc. EN 12756, design K, form B (balanced), with Quench (with throttle bush)
- S6 - Single mechanical seal acc. EN 12756, design K, form U (unbalanced), with throttle (throttle bush) between pump and mechanical seal chamber
- S7 - Single mechanical seal acc. EN 12756, design K, form B (balanced), with throttle (throttle bush) between pump and mechanical seal chamber
- T3 - Single mechanical seal acc. EN 12756, design K, form B (balanced), in dead-end-configuration with extended throttle bush
- D1 - Double mechanical seal back-to-back, 2 single mechanical seals acc. EN 12756, design K, both form U (unbalanced)
- D3 - Double mechanical seal back-to-back, 2 single mechanical seals acc. EN 12756, design K, on fluid side form U (unbalanced), atmospheric side form B (balanced)
- C1 - Cartridge mechanical seal on pump sleeve
- C3 - Cartridge mechanical seal on the shaft
- P1 - Packing without lantern ring
- P2 - Packing with lantern ring, with barrier by pumped fluid
- P3 - Packing with lantern ring, with barrier by external fluid
- P4 - Packing with lantern ring, with flush
- P5 - Packing without lantern ring, with external cooling

Position (4) *) - Material of impeller:

- N = Cast iron (0.6025)
- S = Bronze (2.1050.01) - only at model LS
- L = Ductil iron (0.7040)
- V = Stainless steel (1.4408)

W = Duplex stainless steel (1.4517)

F = Carbon steel (1.0619)

X = Other materials

Position (5) *) - Material of casing:

N = Cast iron (0.6025)

L = Ductil iron (0.7040)

V = Stainless steel (1.4408)

W = Duplex stainless steel (1.4517)

F = Carbon steel (1.0619)

X = Other materials

Position (6) - Shaft design:

1 - with shaft sleeve

2 - without shaft sleeve

Position (7) - Motor power in 1/10 kW

Only valid, if supplied (eg. 2500 = 250 kW)

Position (8) - Number of motor poles

Only valid, if supplied

*) Position (4) and (5) = Material-Code (eg. NL, VV, WW aso.)

3.2 Shaft Sealing

Basically there are two kinds of shaft sealing: the packing and the mechanical seal, whereas, there again are many variants of both kinds. At the data sheet and / or the order confirmation the shaft sealing type of your pump is shown.

An instruction for the packing of a stuffing box resp. for the mounting and operation of mech. seals can be found in the appendix of the particular "Mounting Instructions of the Shaft Sealing".



Further details about packing and mech. seals, as well as the therewith connected accidental dangers, you can find in chapter 6.6 and in chapters 7.2 and 7.3.



In areas endangered to explosion the use of pumps with packing is forbidden!

3.3 Bearings

The pump shaft is guided by antifriction bearings. In the data sheet and / or order confirmation you can see, if your pump is designed for oil lubrication (standard design) or grease lubrication (special design).



In areas endangered to explosion the use of pumps with grease lubricated bearings is forbidden!

3.3.1 Used bearings

The size of the bearing bracket of your pump is shown in the data sheet and / or order confirmation.

Bearing bracket	Bearing type	
	pump side	drive side
42 S	NU 311 EC	2x 7311 BECB
55 S	NU 315 EC	2x 7315 BECB
75 S, 90 S	NU 320 EC	2x 7320 BECB
100 S	NU 324 EC	2x 7324 BCB

3.3.2 Oil Sump Cooling

On temperatures of the pumped liquid over 180°C an oil sump cooling is required.

For connection refer to list "Connections" in the annex.

- For cooling use pure, non-aggressive water with a maximum incoming temperature of 30°C.
- Cooling water should be hand-warm at discharge.
- The pressure in the cooling system must not exceed max. 6 bar.
- Provide control devices for temperature and pressure monitoring.

3.4 Approximate Value for Sound Pressure Level

Nominal power P_N in kW	Sound pressure level L_{pA} in dB(A)					
	Pump alone			Pump + Motor		
	2950 rpm	1450 rpm	975 rpm	2950 rpm	1450 rpm	975 rpm
5,5	--	61,0	--	--	64,0	--
7,5	--	63,0	--	--	64,5	--
11,0	--	65,0	--	--	66,0	--
15,0	--	66,5	--	--	67,5	--
18,5	68,5	68,0	--	69,0	69,0	--
22,0	69,5	68,5	--	70,0	69,5	--
30,0	71,0	70,5	--	71,5	71,0	--
37,0	72,0	71,5	--	73,0	72,0	--
45,0	73,0	72,5	--	74,0	73,5	--
55,0	74,5	73,5	--	75,0	74,5	--
75,0	76,0	75,5	--	76,5	76,5	--
90,0	77,0	76,5	--	77,5	77,5	--
110,0	78,0	77,5	77,0	79,0	78,5	80,0
132,0	79,0	78,5	78,0	79,5	79,5	80,0
160,0	80,0	79,5	79,0	80,5	81,0	80,5
200,0	81,5	81,0	80,5	81,5	82,0	83,0
250,0	82,5	82,0	81,5	84,5	83,0	84,0
315,0	83,5	83,0	83,0	85,0	85,5	84,5
355,0	84,5	84,0	--	85,5	86,0	--
400,0	85,0	84,5	--	88,0	86,5	--
450,0	--	85,0	--	--	87,0	--
500,0	--	85,5	--	--	87,0	--

Sound pressure level L_{pA} measured in 1 m distance from pump surface acc. to DIN 45635, part 1 and 24. Room and foundation influences are not considered. The tolerance for these values is ± 3 dB(A).

Addition with 60 Hz-operation:

Pump alone: –

Pump with motor: +4 dB(A)

3.5 Permitted Nozzle Loads and Torques at the Pump Nozzles ...

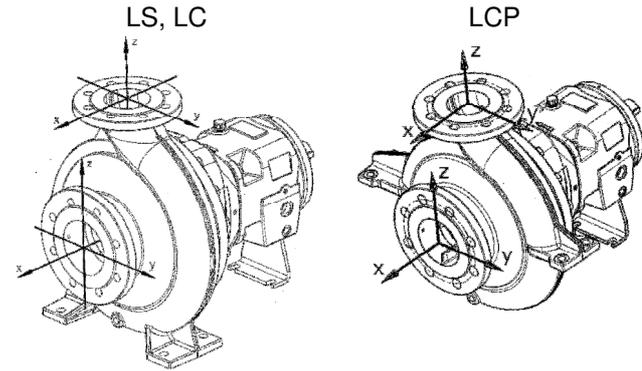
... following the Europump-Recommendation for pump acc. to ISO 5199.

The data for forces and torques are only valid for static piping loads.

The values given in the chart are valid for pump units with standard LS- or LCP-base frames (grouted).

The data for forces and torques refer to LC or LCP-standard materials 0.7040 (ductil iron) and 1.4408 (stainless steel).

For the LS-standard material 0.6025 (cast iron) the values must be multiplied with factor 0,5.



pic 1

Sizes	Suction nozzle									Discharge nozzle								
	ØDN	Forces in N				Torques in Nm				ØDN	Forces in N				Torques in Nm			
		F _x	F _y	F _z	ΣF	M _x	M _y	M _z	ΣM		F _x	F _y	F _z	ΣF	M _x	M _y	M _z	ΣM
LS, LC																		
125-330	150	4000	3600	3240	6280	2000	1400	1640	2920	125	2840	2560	3160	4960	1680	1200	1520	2440
125-500	150	4000	3600	3240	6280	2000	1400	1640	2920	125	2840	2560	3160	4960	1680	1200	1520	2440
150-500	200	5360	4800	4320	8360	2600	1840	2120	3840	150	3600	3240	4000	6280	2000	1400	1640	2920
200-260	250	6680	5960	5400	10440	3560	2520	2920	5240	200	4800	4320	5360	8360	2600	1840	2120	3840
200-350	250	6680	5960	5400	10440	3560	2520	2920	5240	200	4800	4320	5360	8360	2600	1840	2120	3840
200-400	250	6680	5960	5400	10440	3560	2520	2920	5240	200	4800	4320	5360	8360	2600	1840	2120	3840
200-500	250	6680	5960	5400	10440	3560	2520	2920	5240	200	4800	4320	5360	8360	2600	1840	2120	3840
250-315	300	8000	7160	6440	12520	4840	3440	3960	7120	250	5960	5400	6680	10440	3560	2520	2920	5240
250-350	300	8000	7160	6440	12520	4840	3440	3960	7120	250	5960	5400	6680	10440	3560	2520	2920	5240
250-400	300	8000	7160	6440	12520	4840	3440	3960	7120	250	5960	5400	6680	10440	3560	2520	2920	5240
250-500	300	8000	7160	6440	12520	4840	3440	3960	7120	250	5960	5400	6680	10440	3560	2520	2920	5240
300-400	350	9320	8360	7520	14600	6200	4400	5080	9120	300	7160	6440	8000	12520	4840	3440	3960	7120
300-450	350	9320	8360	7520	14600	6200	4400	5080	9120	300	7160	6440	8000	12520	4840	3440	3960	7120
300-500	350	9320	8360	7520	14600	6200	4400	5080	9120	300	7160	6440	8000	12520	4840	3440	3960	7120
350-450	400	10640	9560	8600	16680	7760	5520	6360	11440	350	8360	7520	9320	14600	6200	4400	5080	9120
400-400	400	10640	9560	8600	16680	7760	5520	6360	11440	400	9560	8600	10640	16680	7760	5520	6360	11440
600-600	600	15920	14360	12920	25000	16160	11520	13280	23920	600	14360	12920	15920	25000	16160	11520	13280	23920
LCP																		
125-500	150	5000	4500	4050	7850	2500	1750	2050	3650	125	3550	3200	3950	6200	2100	1500	1900	3050
150-500	200	6700	6000	5400	10450	3250	2300	2650	4800	150	4500	4050	5000	7850	2500	1750	2050	3650
200-260	250	8350	7450	6750	13050	4450	3150	3650	6550	200	6000	5400	6700	10450	3250	2300	2650	4800
200-350	250	8350	7450	6750	13050	4450	3150	3650	6550	200	6000	5400	6700	10450	3250	2300	2650	4800
200-400	250	8350	7450	6750	13050	4450	3150	3650	6550	200	6000	5400	6700	10450	3250	2300	2650	4800
200-500	250	8350	7450	6750	13050	4450	3150	3650	6550	200	6000	5400	6700	10450	3250	2300	2650	4800
250-315	300	10000	8950	8050	15650	6050	4300	4950	8900	250	7450	6750	8350	13050	4450	3150	3650	6550
250-350	300	10000	8950	8050	15650	6050	4300	4950	8900	250	7450	6750	8350	13050	4450	3150	3650	6550
250-400	300	10000	8950	8050	15650	6050	4300	4950	8900	250	7450	6750	8350	13050	4450	3150	3650	6550
250-500	300	10000	8950	8050	15650	6050	4300	4950	8900	250	7450	6750	8350	13050	4450	3150	3650	6550
300-400	350	11650	10450	9400	18250	7750	5500	6350	11400	300	8950	8050	10000	15650	6050	4300	4950	8900
300-450	350	11650	10450	9400	18250	7750	5500	6350	11400	300	8950	8050	10000	15650	6050	4300	4950	8900
300-500	350	11650	10450	9400	18250	7750	5500	6350	11400	300	8950	8050	10000	15650	6050	4300	4950	8900
350-450	400	13300	11950	10750	20850	9700	6900	7950	14300	350	10450	9400	11650	18250	7750	5500	6350	11400
400-400	400	13300	11950	10750	20850	9700	6900	7950	14300	400	11950	10750	13300	20850	9700	6900	7950	14300
600-600	600	19900	17950	16150	31250	20200	14400	16600	29900	600	17950	16150	19900	31250	20200	14400	16600	29900

4. Transport, Handling, Storage

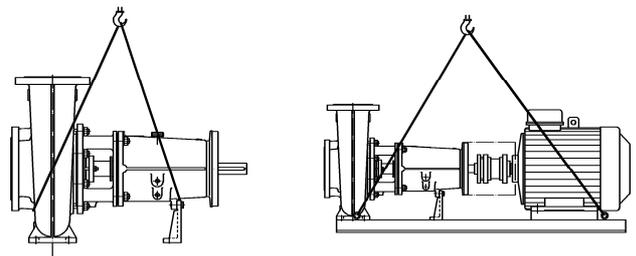
4.1 Transport, Handling

- 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 suction and discharge side of the pump must be closed with plugs during transport and storage.

! 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 and must only be used by authorized persons. 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.

Picture 2 shows the correct method of carrying by crane.



pic 2



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.



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



Slipping out of the pump / pump unit of the transport lifting device can cause damages to persons and things.

4.2 Storage / Conservation

Pumps or units, which are stored over a longer period before start-up (max. 6 months), must be protected from moisture, vibrations and dirt (e.g. by wrapping in

oil paper or plastic). Pumps must basically be stored in a place where they are protected from the weather, e.g. under dry cover. During this time, all suction and discharge branches and all other intakes and outlets must be closed with dummy flanges or plugs.

For longer periods of storage conservation measurements at machined surfaces and packing with moisture protection can be necessary!

5. Mounting / Installation

5.1 Mounting of Pump / Unit

5.1.1 Mounting of pump on a base frame

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 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.

5.1.2. Mounting the unit to a foundation

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. Its 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 0,2 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 0,2 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 LS- resp. LCP-base frames are designed solidly, the grouting of the adjusted base frames is absolutely necessary.

- 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.

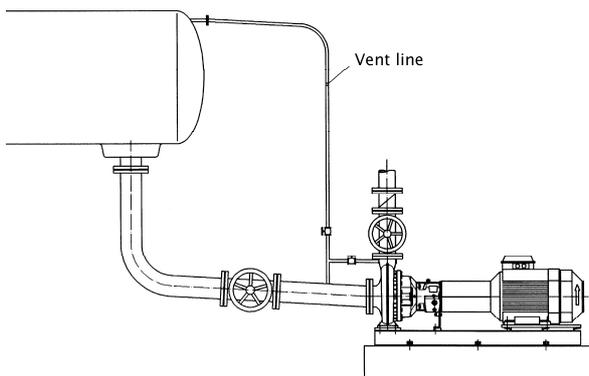
5.2 Connection of Piping to the Pump



The pump must not be used as fixed point for the piping. The permitted piping loads must not be exceeded, refer to chapter 3.5.

5.2.1 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. Under suction lift condition lay the suction pipe in the horizontal section towards the pump so that it is slightly inclined upwards so that no air traps occur. Under positive suction head condition install the suction pipe work slightly declined towards the pump. Do not install fittings or elbows right before the suction nozzle.
- If the suction supply is under vacuum and entrained gas may be present in the liquid, it is recommended that a vent line be considered upstream of the pump suction with 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-up (pic 3).



pic 3

- When laying the pipes, make sure that the pump is accessible for maintenance, installation and disassembly.
- Notice "Permitted Forces on Flanges" (chapter 3.5).
- If expansion joints are used in the pipes, they have to be supported in such a way that the pump is not loaded unduly high because of the pressure in the pipes.
- 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 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.
- To protect the shaft sealing (especially mechanical seals) against foreign impurities, it is recommended that a sieve, 800 micron, is installed in the suction/intake pipe when the motor is being started up.

- 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).

5.2.2 Additional connections

Any required sealing, flushing or cooling pipe connections must be installed. Please consult the data sheet to see which pipes, pressures and amounts are necessary. The position and size of connections to the pump are given in the appendix, "Connections".



These connections are essential for the function!

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

5.3 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.



On operation in zone 1 and 2 a coupling with valid Atex-certification must be used.

The Operating Instructions of the manufacturer must be followed.

5.3.1 Alignment of coupling



The alignment of the coupling 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!

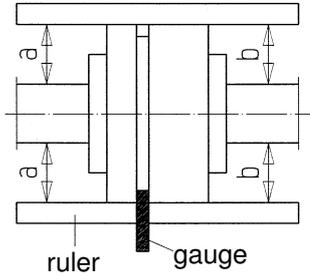


After mounting onto the foundation and the connection of the piping the coupling must be adjusted again, even, if the unit was delivered completely mounted on the frame.

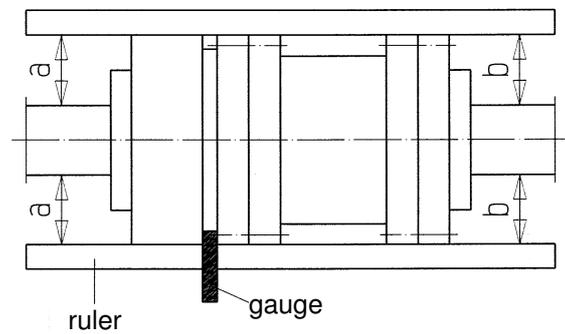
- Before starting installation, carefully clean shaft ends and coupling components.
- Before adjusting the coupling unfasten screws (S7) between bearing bracket (10) and casing foot (80/F) and only fasten again after the adjustment. Repeat measurement after fastening of screws (S7).
- The unit is properly aligned, when a ruler, which is laid axially over both coupling halves, has the same distance to the particular shaft everywhere on the circumference. Further, both coupling halves must have the same distance to one another on every of the circumference. This must

be checked by means of a tracer, gauge or dial gage; refer to pic. 4 and 5.

- The permitted tolerances for your coupling are shown in the operating instructions of the coupling. For the exact characterization of your coupling refer to data sheet and / or order confirmation.



pic 4 - Alignment of coupling with gauge and ruler



pic 5 - Alignment of coupling with spacer

! Control alignment of coupling again in operation warm condition and on system pressure (if available) and correct, if necessary. Pay attention to chapter 6 beforehand! It must be possible to turn the unit easily and harmoniously by hand.

! Improper alignment of the unit can lead to damages at coupling and unit!

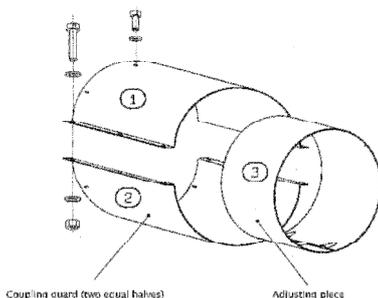
! Mount coupling guard after alignment and before start-up.

5.3.2 Coupling Guard

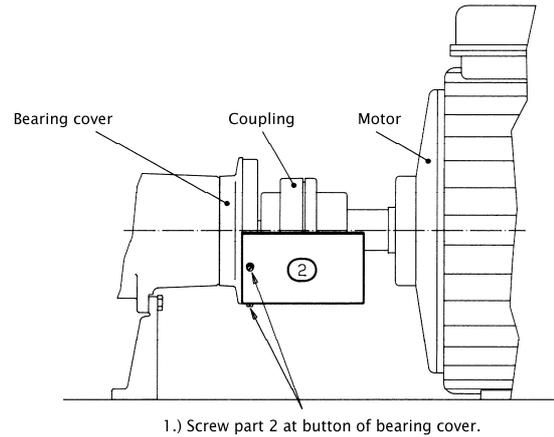
Ex Acc. to accident prevention regulations the pump must only be operated with coupling guard.

Ex Care has to be taken, that the used coupling guard consists of non-sparking material.

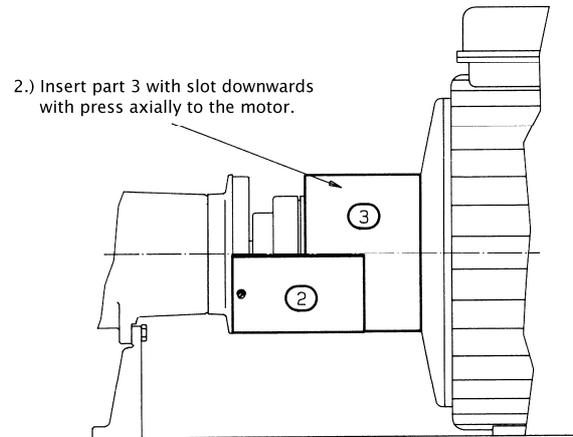
Parts:



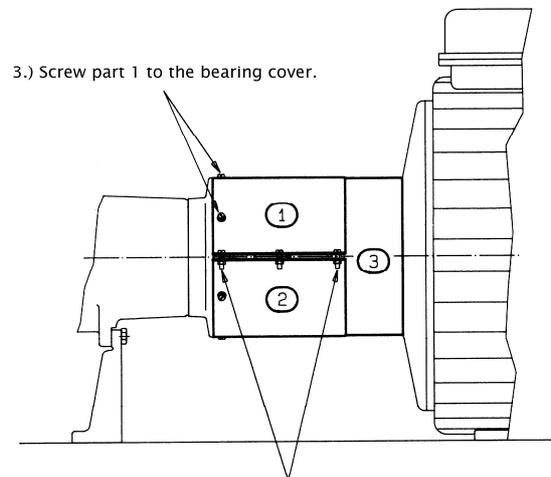
Assembly:



1.) Screw part 2 at button of bearing cover.



2.) Insert part 3 with slot downwards with press axially to the motor.



3.) Screw part 1 to the bearing cover.

4.) Screw part 1 and part 2 together, which fixes the adjusting piece.

5.4 Drive

On selecting the motor size care has to be taken, that the requirements acc. to ISO 5199 are fulfilled. **Note the Operating Instructions of the motor manufacturer.**

Ex On application in zone 1 and 2 a motor with valid Atex-certification must be used.

5.5 Electric 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 name 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 must be provided.



In areas endangered to explosion IEC 60079-14 must additionally be noticed for the electric installation.



Care must be taken that the base frame (2x M10-thread available for earthing screws) is earthed by means of corresponding measures.



The direction of rotation must only be checked when the pump is full. Dry running will cause damage to the pump.

5.6 Final Control

Check alignment of coupling acc. to chapter 5.3.1 again. It must be possible to turn the unit easily by hand at the coupling.

6. Start-up, Operation, Shut down



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).

6.1 Initial start-up

Before starting up the pump, check, if the following points were controlled and carried out:

- If pump is oil lubricated, first open oil drain (AS) and drain off any liquid that may have collected (e.g. condensation). Close oil drain (AS) and fill oil as described in chapter 6.5.1.
- For pumps with grease lubrication, no further lubrication is needed before initial start-up.
- Pump and suction pipe must be filled completely with liquid when starting up.
- 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.
- Open valve in suction /intake pipe.
- Set discharge side valve to approx. 25% of rated flow quantity. With pumps with a discharge branch rated width less than 200, the valve can remain closed when starting up.
- Secure, that unit is electrically connected acc. to all regulations and with all safety devices.
- Check direction of rotation by switching on and off briefly. It must be the same as the directional arrow on the bearing frame.

6.2 Switch on drive

- Immediately (max. 20 seconds on 50 Hz resp. max. 11 seconds on 60 Hz currency feed) after reaching normal operating speed open discharge valve adjust the required operating point. The pumping data shown at the type plate resp. in the data sheet and / or the order confirmation must be

met. Every change is only permitted after talking with the manufacturer!



Operation with closed valve in the suction and / or discharge piping is not permitted.



On starting-up without back-pressure, the back-pressure must be produced through throttling at the discharge side. After reaching full back-pressure open valve



In order that the shaft sealing can be monitored and maintained unhindered, no protection cover is provided in this area. Therefore special attention is required when pump is working (no long hair, loose clothes, a.s.o.).

- Packing:
Packing needs leakage for trouble free function (drop wise outlet of the pumped medium). Adjust ample leakage in the beginning. Reduce that slowly during the first operating hours by continuously fastening of gland (see position "69" and "M2" in sectional drawing) when pump is running. Assume 30-100 drops / minute as approx. value.



Dry running packing harden and destroy the shaft sealing resp. the shaft.



If pump does not reach attended head or if atypical sounds or vibrations do occur: Switch off pump (see chapter 6.7) and seek for causes (see chapter 10).

6.3 Restarting

Basically, the same procedure should be followed as for starting up for the first time. However, there is no need to check the direction of rotation and the accessibility of the pump unit.

The pump should only be automatically restarted if it has been made sure that the pump has remained filled whilst stand by.

 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.

6.4 Limits of Operation

 The operating limits of the pump / unit regarding pressure, temperature, performance and speed are shown in the data sheet and / or order confirmation and must be observed under any circumstances!

- Do not exceed the output given on the motor name plate.
- Avoid sudden changes in temperature (temperature shocks).
- The pump and motor should run evenly and without vibrations; check at least once a week.

6.4.1 Flow min. / max.

If no other data are given in the curves or data sheets, the following is valid:

$$Q_{min} = 0,1 \times Q_{BEP} \text{ for short time operation}$$

$$Q_{min} = 0,3 \times Q_{BEP} \text{ for continuous operation}$$

$$Q_{max} = 1,2 \times Q_{BEP} \text{ for continuous operation *)}$$

Q_{BEP} = Flow in efficiency optimum

*) on condition that $NPSH_{facility} > (NPSH_{pump} + 0,5 \text{ m})$

6.4.2 Abrasive Media

 On pumping liquids with abrasive components an increased wear at hydraulic and shaft sealing must be expected. The intervals of inspection should be reduced compared to the usual times.

6.4.3 Permitted number of starts

The permitted number of starts of the pump must not be exceeded, see diagram 6.

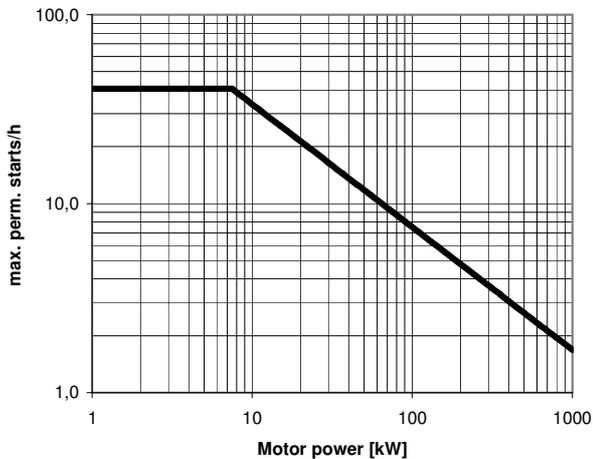


Diagram 6

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.

6.5 Lubrication of Bearings

6.5.1 Oil lubrication

 The bearing bracket must be filled up with oil. For quality of oil refer to chapter 7.4.1. For quantity of oil refer to chapter 7.4.1. The pumps are delivered without oil filling!

Oil level sight glass (standard design)

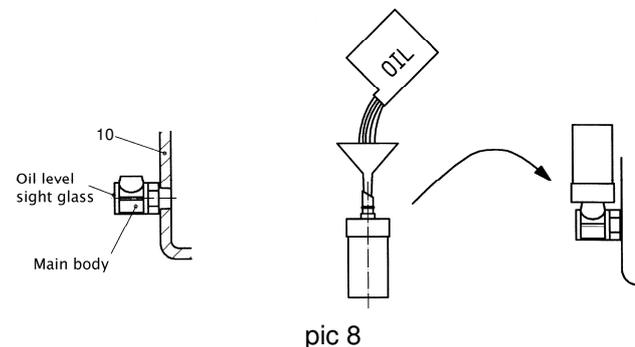
Remove oil filling plug (FS) and fill oil into the connection opening.

Fill in oil up to the middle of the oil level sight glass (ÖA) (pic 7). Keep level exactly. Overfilling leads to increased bearing temperature and possibly oil leakage. If oil level is too low this can cause shortcoming of lubrication.



Constant level oiler (special design)

- Supplied loose.
- Unscrew the reservoir from the main body (right threaded) and set aside.
- Seal the main body into the bearing bracket (10), through a PTFE sealing tape, at connection for constant level oiler (ÖK). Tighten until threaded boss is in vertical position (picture 8).
- Remove the oil filling plug (FS) (upper side of bearing bracket) and fill in oil through the connection opening (GF1), until the oil level reaches almost the middle of the oil level sight glass in the main body.
- Using a funnel, fill the reservoir (picture 8).
- Make sure that o-ring is on reservoir spout.
- Place thumb over reservoir spout, invert, and insert the spout into the internal threaded boss on the main body. Tighten reservoir (picture 8).
- Now the oil is flowing from the reservoir into the bearing chamber.
- Repeat filling till the reservoir stays full to 2/3rd.
- Refill oil as soon as the oil level falls below 1/3rd.



6.5.2 Grease lubrication

 For quality of grease refer to chapter 7.4.2. For quantity of grease refer to chapter 7.4.2.

- The bearings are already filled with lithium based grease at the factory and are thus ready for use.
- The grease provided is suitable for a temperature range from -30° to +90°C (measured at surface of bearing bracket).

- Re-lubrication via the two grease nipples (SN).

6.5.3 Bearing temperature

- Bearing temperature (measured at bearing bracket) should lie max. 50°C over ambient temperature and must not exceed 90°C, control weekly at least. On grease lubrication the bearing temperature can temporarily be higher by 5-10°C after regreasing, till a possible surplus of grease in the bearings is cut.

6.6 Monitoring



In areas endangered to explosion it is recommended to monitor the temperature of the bearings and the vibrations of the bearing bracket.



Regular monitoring and maintenance will extend the life of your pump or pump system.

- Check oil level at least once a week and top up if necessary.
- Check pump for leaks at least once a week.
- On packing, check quantity of leakage at least once a week (see chapter 6.2 section "Packing").
- Check the regulating and monitoring devices of any sealing, flushing or cooling systems once a week to ensure that they function properly. Outgoing cooling water should be hand warm.
- With double mechanical seals, monitor pressure and flow rate in mechanical seal area; check at least once a week.
- 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.

6.7 Shutting down

- Close the valve in discharge pipe right before (max. 30 seconds) switching off the motor. This is not necessary if there is a spring-loaded check valve.
- Switch off motor (make sure it runs down quietly).
- Close the 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.

7. Servicing, Maintenance

7.1 General remarks



Work should only be carried out on the pump or pump unit when it is not in operation. You must observe chapter 2.

- If the pump also remains under operating conditions (pressure and temperature) when stationary, leave all sealing, flushing and cooling systems switched on.
- The shaft sealing must remain sealed if there is a risk of air being sucked in (in the event of supply from vacuum systems or parallel operation with shared suction pipe).

6.8 Storage / longer periods of non-operation

6.8.1 Storage of new pumps

If the putting into operation shall happen a longer period after the delivery, we recommend the following measures for the storage of the pump:

- Store pump at a dry place.
- Rotate pump by hand at least once a month.

6.8.2 Measures for longer putting out of operation

Pump remains installed and in ready for operation:

- Test runs of 5 min. duration must be made in regular intervals. The span between the test runs is depending on the plant. However, it should be made once a week, at least.

6.8.3 Longer periods of non-operation



After long stationary periods, packing may have hardened; these must be replaced before start-up.

When starting up, follow the instructions for starting up for the first time (see chapter 6)!

a) Filled pumps

- Switch stand-by pumps on and immediately off again once a week. Possibly use as main pump.
- If the stand-by pump is at operating pressure and temperature, leave all sealing, flushing and cooling systems switched on.
- Replace oil or grease after 2 years.
- Stuffing box must be adjusted to maintain lubrication of the packing (e.g. do not over tighten).

b) Drained pumps

- Turn shaft at least 1x week (do not switch on because of dry running).
- Replace oil or grease after 2 years.



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.

7.2 Mechanical seals

 Before opening the pump, it is essential that you note chapter 2 and chapter 8.

If the liquid being handled leaks out at the mechanical seal, it is damaged and must be replaced.

Replacement of the mech. seal according to accompanying "Mounting Instructions for Shaft Sealing".

7.3 Stuffing boxes

Stuffing boxes require constant maintenance, see chapter 6.2 section "Stuffing box". 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 sleeve). Replacement of stuffing boxes acc. to attached "Mounting Instructions for Shaft Sealing".

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

7.4 Lubrication and Change of Lubricant

7.4.1 Oil lubrication

Temperature at bearing	First oil change after operating hours	All further oil changes after operating hours
bis 60°C	300	8760 *)
60°C - 80°C	300	4000 *)
80°C - 90°C	200	3000 *)

*) at least 1x year

 In plants endangered to explosion the oil change intervals must be kept under any circumstances!

Oil change

- After the first operating hours, drain oil (oil drain "AS" with drain plug and flush with fresh oil. Clean oil drain plug and close oil drain again.
- Fill in new oil according to chapter 6.5.
- If the pump is left idle for a longer time, the oil should be changed after two years.

 Old oil must be disposed of in accordance with the valid national environmental regulations.

Oil quality

Name	Lubricating oil CLP46 DIN 51517 or HD 20W/20 SAE
Symbol acc. DIN 51502	
Cinematic viscosity at 40°C	46 ±4 mm ² /s
Flash point (acc. to Cleveland)	+175°C
Setting point (Pour point)	-15°C
Application temperature *)	higher than permitted bearing temperature

*) For ambient temperatures under -10°C another suitable type of lubrication oil must be used. Request required.

Oil quantity

Bearing bracket	Oil quantity in l
42 S	1,9
55 S	3,7
75 S, 90 S	7,5
100 S	18,0

7.4.2 Grease lubrication

Re-greasing

- Grease lubricated bearings with the possibility of re-greasing must be re-lubricated all 4000 operating hours, but at least 1x year. Clean lubricating nipples (SN) first.

Quality of grease lubricant ...

... corresponding to NLGI GRADE 2

Quantity of re-greasing (approx. value)

Bearing bracket	bearing at pump side	bearing at drive side
42 S	20 g / 22 cm ³	35 g / 39 cm ³
55 S	30 g / 33 cm ³	60 g / 66 cm ³
75 S, 90 S	50 g / 55 cm ³	100 g / 110 cm ³
100 S	75 g / 83 cm ³	145 g / 160 cm ³

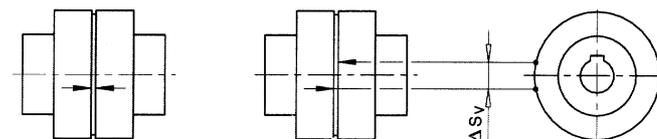
- If the pump is left non-operational for a longer time, the grease in the bearings should be changed after 2 years.

7.5 Coupling

Check the clearance in the coupling components regularly approx. every 1000 operating hours, but at least 1x year, the radial clearance in the coupling parts must be checked.

For couplings with rubber pads the following applies:

Unless a clearance in the couplings is necessary, the coupling pads may wear out to approximately ¼ of their usual thickness, before they have to be changed. For the measurement of the clearance in the coupling place a mark on the O.D. of each coupling hub (see following pic). Then fix one hub, turn the opposite hub as far as possible. Then measure the distance (ΔS_V) between the marks of the coupling. If this measure exceeds the value given in the chart, the packing must be replaced. It must be replaced in sets.



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

 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 chapter 5.3.

7.6 Cleaning of pump



The pump must not be cleaned with pressurised water - water will get into the bearings.



- 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).

- Radial-Shaft sealing (WD1 and WD2) are not completely free from leakage. Impurities could cause leakage at the shaft sealing area of the frame. Therefore wipe off impurities with a rag from time to time.
- Replace dirty oil level sight glass (ÖA).

8. Dismantling and repair of pump

8.1 General remarks



Repair to the pump or pump system may only be carried out by authorised skilled personnel or by the manufacturer's specialist staff.



When disassembling the pump pay attention to chapter 2 and chapter 4.1.

For mounting and repair you can order specialized personnel if you want.



If dangerous liquids are pumped the appropriate disposal of the handled liquid is necessary before the disassembly of the pump. Pay attention to the fact, that even in drained pumps there are remainders of the handled liquid. If necessary the pump must be flushed or decontaminated. Laws must be observed, otherwise danger to health is existing!

- Before the disassembly the pump has to be secured in such a way, that it can't be started.
- The pump casing must be drained and without pressure.
- All locking devices in the suction- and discharge-pipe must be closed.
- All parts must have taken on the temperature of the environment.



Secure disassembled pumps, units or single parts against tipping over or rolling off.



While disassembling the pump use of an open flame (blowlamp, etc.) only, when there is no danger of setting fire, cause an explosion or cause injurious vapours.

Never apply heat to remove the impeller nut. Use of heat may result in severe physical injury and property damage.



Use original spare parts only. Pay attention to the right materials and the matching design.

8.2 General



Works, which require shocks (hammer), must only be performed outside the explosive atmosphere or only non-sparking tools must be used.

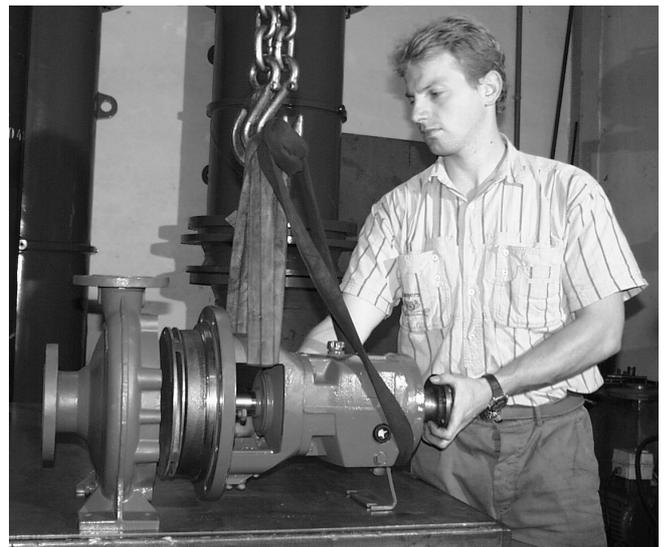
Carry out disassembly and mounting according to the appropriate sectional drawing. You will only need common tools.

Before disassembly check if required parts are ready. Disassemble the pump only so far, as required for the replacement of the repair part.

8.3 Disassembly of Back Pull Out Assembly

The Back Pull Out Assembly includes all parts of the pump except the volute casing (4). As the pumps are constructed for process design the volute casing (4) can stay on the base frame and in the pipes, unless the volute casing itself must be repaired.

- Drain volute casing (4) through the drain plug (E).
- Unscrew all auxiliary piping (flush, cooling, quench, a.s.o.) and drain lubrication oil from bearing bracket (10) via the screwed oil plug (AS).
- Remove coupling guard.
- Remove spacer of the spacer type coupling (if available). Remove motor at standard coupling.
- Loosen screws for support foot (80/F) from the base frame.
- Hang the Back Pull Out Assembly onto a lifting device, so that it won't sink down or press into the volute casing during the dismantling. Example see picture 9 for lifting recommendations.



pic 9

- Loosen casing screws (hexagon nuts "M1").
- Using the possibly available jack screws, separate the Back Pull Out Assembly from the casing.

8.4 Removal of Impeller

! Note attached "Mounting Instruction for Shaft Sealing".

- Loosen impeller nut (28) (right threaded) by fixing the rotor at the coupling end.
- Draw off the impeller (1) with two screw drivers or pry bars (picture 10). Remove key (PF1).



pic 10

! Be sure to locate pry bars under impeller vanes to prevent damage to the impeller.

- For further dismantling the Back Pull Out Assembly should be placed in the vertical position (with vertical shaft, see picture 11). Attention: Precautions should be taken to prevent the Back Pull Out Assembly from tipping!



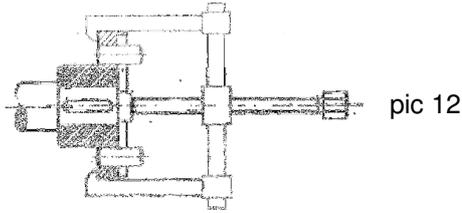
pic 11

8.5 Removal of Shaft Sealing

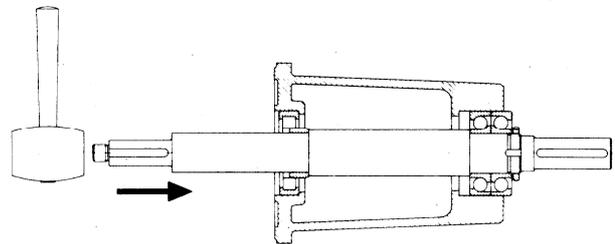
- Before you remove the casing cover (18..) notice "Mounting Instructions for Shaft Sealing".

8.6 Removal of Bearing

- Remove coupling with a coupling puller (picture 12), remove coupling key (PF2).



- Remove the flinger (73).
- Loosen and remove hexagon screws (S5) resp. hexagon nuts (M5), remove the lantern (11).
- Only for bearing bracket 100S: Unscrew the hexagon nuts (M8) and demount the bearing cover (12/P).
- Loosen and remove the hexagon screws (S6), remove the bearing cover (12).
- Move the shaft (24) with the pair of angular contact bearings (K2) and the inner ring of the roller bearing (K1) with haps by a wood or plastic hammer with caution to the drive end (picture 13).



picture 13

- Demount the roller bearing (K1) (cage) off the bearing bracket (10).
- Bend up the lock washer (SB), unscrew the bearing nut (50) (right threaded), remove the lock washer (SB).
- Heat up the angular contact bearings (K2) and the inner ring of the roller bearing (K1) and remove it with qualified tools (e.g. with hook proof-puller) from the shaft (24).

8.7 Reconditioning

After disassembly all parts must be cleaned and checked for wear carefully. Worn or damaged parts must be replaced by new parts (spare parts). When reassembling the pump it is recommended to replace all seals (flat gaskets, o-rings and radial shaft seal rings).

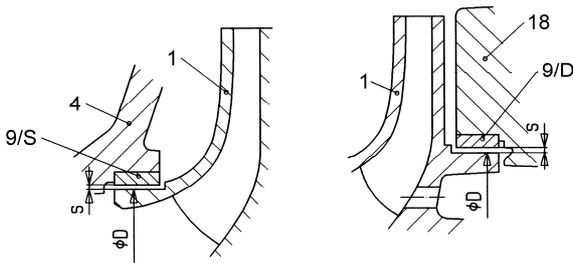
! All sealing materials of PTFE resp. Graphite are intended for being used only once.

In most cases it make sense, if damaged absolutely necessary, to renew the mechanical seal and the bearings.

Deposits on the impeller (1), on the volute casing (4) or on the casing cover (18) must be removed.

8.7.1 Clearance at impeller

Suction side of impeller Drive side of impeller



Pump size	Suction side			Drive side				
	D *) (mm)	Radial clearance s (mm)		D *) (mm)	Radial clearance s (mm)			
		new min.	max. wear limit		new min.	max. wear limit		
125-330	200	0,20 (0,45)	0,24 (0,50)	1,15 (1,40)	200	0,20 (0,45)	0,24 (0,50)	1,15 (1,40)
125-500	220	0,20 (0,45)	0,24 (0,50)	1,15 (1,40)	250	0,20 (0,50)	0,24 (0,55)	1,20 (1,50)
150-500	250	0,20 (0,45)	0,24 (0,50)	1,20 (1,45)	250	0,20 (0,50)	0,24 (0,55)	1,20 (1,50)
200-260	220	0,23 (0,50)	0,28 (0,55)	1,15 (1,45)	220	0,23 (0,50)	0,28 (0,55)	1,15 (1,45)
200-350	250	0,23 (0,75)	0,28 (0,80)	1,20 (1,75)	250	0,23 (0,75)	0,28 (0,80)	1,20 (1,75)
200-400	270	0,23 (0,60)	0,28 (0,65)	1,25 (1,65)	270	0,23 (0,60)	0,28 (0,65)	1,25 (1,65)
200-500	250	0,23 (0,50)	0,28 (0,55)	1,20 (1,50)	250	0,23 (0,50)	0,28 (0,55)	1,20 (1,50)
250-315	250	0,23 (0,75)	0,28 (0,80)	1,20 (1,75)	250	0,23 (0,75)	0,28 (0,80)	1,20 (1,75)
250-350	270	0,23 (0,60)	0,28 (0,65)	1,25 (1,65)	270	0,23 (0,60)	0,28 (0,65)	1,25 (1,65)
250-400	280	0,23 (0,75)	0,28 (0,80)	1,25 (1,80)	280	0,23 (0,75)	0,28 (0,80)	1,25 (1,80)
250-500	280	0,23 (0,70)	0,28 (0,75)	1,25 (1,75)	280	0,23 (0,70)	0,28 (0,75)	1,25 (1,75)
300-400	315	0,23 (0,68)	0,28 (0,73)	1,33 (1,80)	315	0,23 (0,68)	0,28 (0,73)	1,33 (1,80)
300-450	315	0,23 (0,68)	0,28 (0,73)	1,33 (1,80)	315	0,23 (0,68)	0,28 (0,73)	1,33 (1,80)
300-500	330	0,23 (1,00)	0,28 (1,05)	1,40 (2,20)	330	0,23 (0,70)	0,28 (0,75)	1,40 (1,90)
350-450	380	0,25 (0,68)	0,29 (0,73)	1,45 (1,90)	350	0,25 (0,68)	0,29 (0,73)	1,45 (1,90)
400-400	370	0,25 (0,65)	0,29 (0,75)	1,45 (1,90)	250	0,20 (0,45)	0,24 (0,50)	1,45 (1,70)
600-600	515	0,25 (0,65)	0,30 (0,75)	1,60 (2,05)	515	0,25 (0,65)	0,30 (0,75)	1,60 (2,05)

Values in parenthesis are valid for code VV and WW.
*) nominal diameter

When the wear limits has been reached or exceeded, the worn parts must be replaced.

There are the following possibilities to restore the correct clearances:

- a) Renew impeller(1) and wear rings (9/S und 9/D). Then the original measures are restored.
- b) A customized wear ring (bored to fit) can be supplied to avoid replacement of the impeller. Please contact factory for details.

8.8 Mounting

Re-assemble the pumps using the reverse order of steps as completed for pump disassembly. However the following observations should be considered:

- Pay attention to the utmost cleanliness when reassembling the pump.

- For tight tolerances, e.g. between shaft sleeve (44) and shaft (24) or impeller (1) and shaft (24), as well as thread, use a suitable anti-galling compound (e.g. Molykote/Never-Seeze), so that the assembly and the next disassembly will be easier.

Anti-galling compound must be compatible with the pumpage.

- Screws should be tightened, with the following torque:

Location	Screw Size	Screw torque in Nm	
		Lubricated thread	Dry thread
Casing screws	M16	75	110
	M20	165 (255)	255 (385)
	M24	325 (440)	495 (665)
	M30	575	870
All other screws	M12	40	60
	M16	100	150
	M20	190	290
	M24	330	500

Values in parenthesis are valid for:
- size M20 for pump size LS 400-400 and model LC & LCP
- size M24 for pump size LS 608-600 and LS 606-600

- It is only allowed to use the prescribed bearings according chapter 3.3.1.

It is only allowed to mount a pair of angular bearings from one manufacturer.

- Heat the angular contact bearings (K2) and the inner ring of the roller bearing (K1) in an oil bath or inductive up to 80 C, slide the bearings until the contact surface on the shaft (24) and press it as long as it fits tightly on the shaft.

The angular contact bearings (K2) must be mounted in X-arrangement resp. in O-arrangement at bearing bracket 100S.

- Don the lock washer (SB) and fasten the bearing nut (50) with a hook wrench.
- Cool down to ambient temperature the angular contact bearings.
- Refasten the bearing nut (50) and bend the lock washer (SB) of the bearing nut.
- Pay attention at the mounting of the shaft (24), with assembled angular contact bearings (K2) and inner ring of the roller bearing (K1) into the bearing bracket (10) that the running surface of the roller bearing does not get damaged by the edges of the rolls.
- At the assemble pay attention of the bearing bracket (10) with the lantern (11) and from the lantern (11) with the volute casing (4) that the screws are positioned in the centre of the clearance holes. Otherwise the bearing bracket (10) tilts against the volute casing (4) and then exact adjustment of the oil level is affected.
- For mounting of the shaft sealing (packing or mechanical sealing) see separate description "Mounting Instruction of Shaft Sealing" and chapter 8.5.

- After the mounting of the back pull out assembly, and its assembly into the volute casing, turn the shaft and control the free moving of the pump in this way. The shaft sealing will cause slightly resistance when turning, but there must not be any contact between metal parts.
- Before starting the pump check alignment of the coupling. This can be dropped on pumps with

spacer coupling, if pump casing and motor were not disassembled.



Before starting the pump do not forget to fill in oil!



Before starting the pump do not forget to install and connect all security devices.

9. Recommended Spare Parts, Spare Pumps

9.1 Spare Parts

Spare parts should be selected to last for two-year continuous operation. If no other guidelines are applicable, we recommend that you stock the number of parts listed below (in accordance with DIN 24296).

Spare Parts	Number of pumps (incl. stand-by pumps)							
	2	3	4	5	6/7	8/9	10/+	
	Number of Spare Parts							
Impeller	1	1	1	2	2	2	20%	
Wear ring	2	2	2	3	3	4	50%	
Shaft with key and nuts	1	1	1	2	2	2	20%	
Ball Bearing set	1	1	2	2	2	3	25%	
Shaft sleeve	2	2	2	3	3	4	50%	
Lantern ring	1	1	2	2	2	3	30%	
Packing ring	16	16	24	24	24	32	100%	
Joints for pump casing sets	4	6	8	8	9	12	150%	
other joints sets	4	6	8	8	9	10	100%	
Mech. Seals set	1	1	2	2	2	3	25%	
Bearing (lantern with bearing bracket, complete with shaft, bearings, aso.)	-	-	-	-	-	-	2	



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.

Spare Parts Order

When ordering spare parts, please supply the following information:

- Type: _____
- S/N (Order No.): _____
- Part name: _____
- Sectional Drawing _____

All the information is given in the data sheet and the relevant sectional drawing.



Store spare parts in dry and clean rooms!

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 chapter 6.8).



Store stand-by pumps according to chapter 6.8.

10. 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 chapter 2 of these Operating Instructions should be particularly taken into account. If necessary, the written agreement of the manufacturer must be obtained.

Discharge too low	Discharge stops after a time	Head too low	Head too high	Drive mechanism overloaded	Pump not running quietly	Temperature in pump too high	Temperature in shaft sealing too high	Temperature at the bearing too high	Pump leaking	Leakage rate at shaft sealing too high	Cause	Solution
■											Back-pressure too high	check facility for pollution, open discharge valve reduce resistance in discharge pipe (e.g. clean filter if necessary) use larger impeller (note available motor power)
		■		■				■			Back-pressure too low, discharge too low	throttle discharge valve
			■	■							Speed too high	reduce speed compare speed of motor with specified pump speed (rating plate) when adjusting speed (frequency transformer) check reference value setting
■	■										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
	■	■		■	■						Flow too little	increase min. flow (open discharge valve, bypass)
								■			Flow too big	reduce flow (throttle discharge valve)
			■	■							Impeller diameter too big	use smaller impeller
■	■	■									Impeller diameter too small	use larger impeller (check available motor power)
■	■	■		■	■						Pump and/or pipes not completely filled with liquid	fill vent
■	■	■									Pump or suction/intake pipe blocked	clean
■	■	■									Air pocket in pipeline	vent improve course of pipe
■	■	■		■	■						Suction height too big / NPSH of system too small	increase liquid level and admission pressure reduce resistance in the intake/suction pipe (change course and rated width, open shut-off valves, clean filters)
■	■	■									Air being sucked in	increase liquid level check if suction pipe is vacuum-tight
■	■	■									Air being sucked in through shaft sealing	clean sealing pipe increase sealing pressure replace shaft sealing
■	■	■									Direction of rotation is wrong	swap over two phases of power supply (to be done by an electrician)
■	■	■		■				■			Inner components suffering from wear	replace worn parts
■	■	■		■							Density and/or viscosity of liquid handled is too high	seek assistance
				■						■	Stuffing box not straight	tighten evenly
						■					Stuffing box is fastened too tight resp. shaft sealing is worn	loosen stuffing box replace packing and/or mechanical seal check sealing, flushing and cooling pipes (pressure) avoid dry running
						■				■	Lines and roughness on shaft or shaft sleeve	replace parts
						■				■	Unsuitable packing material	use suitable material (check shaft or shaft sleeve for damage beforehand)
						■				■	Deposits on mechanical seal	clean replace mechanical seal if necessary if necessary provide additional rinsing or quench
				■						■	Impeller out of balance	remove blocks/deposits replace impeller if broken or unevenly worn check shafts to ensure that they are running true
				■				■		■	Coupling not aligned	align pump unit better
				■				■		■	Coupling distance too small	change
				■	■			■	■	■	Forces in pipeline too high (pump unit under strain)	change (support pipes, use compensators, etc.) is foundation plate/frame properly cast in place?
								■			Too much, too little or the wrong type of lubricant	change
				■							Electricity supply not right (2-phase running)	check voltage of all phases check cable connections and fuses
										■	Sealing insufficient	tighten screws replace sealing
				■				■			Bearing damaged	replace check lubricant and bearing space for pollutants (rinse oil area)
								■			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
				■							System-related vibrations (resonance)	seek assistance