



Havyard Leirvik as

6953 LEIRVIK I SOGN

Att.: Svein Engedal

096 CHS/ERP  
UT755, Garware Shipping Corp.Lt

**VEDR. VÅR ORDRE:** 85683  
(Ref our order no.)

**OVERSENDELSE AV DOKUMENTASJON:**  
(Submittance of documentation)

\* BRUKSINSTRUKSER  
(Instruction manuals) -----+ | |



\* SERTIFIKATER  
(Certificates) -----+



\* INSTALLASJONSMANUALER  
(Installation manuals) \_\_\_\_\_

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## ORDER PRESENTATION

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ALLWEILER ORDER NO: 85683 2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF.....: 096 CHS/ERP / UT755, Garware Shipping Corp.Ltd, Mum

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**Pos 1,00 FO DISCH. PUMP 2. SPEED**

NAM 80-200/230 U3.1D W80 AELD65IEC280  
Serialno.: 6037608,  
EL-MOTOR 280M-2/4 MARINE 2-SPEED

**Pos 2,00 FW DISCH. PUMP 2. SPEED**

NAM 80-200/230U3.1DW18 AELD65 IEC280  
Serialno.: 6037609,  
EL-MOTOR 280M-2/4 MARINE 2-SPEED

**Pos 3,00 LIQUID MUD DISCH. PUMP**

AEB 2N 1450-IE/0X1 P01 G 112 PA P 6230  
Serialno.: 6026674, 6026673,  
GEARMOTOR CB 9-250M/4DF SL 63 350A60

**Pos 4,00 BW/DW DISCH. PUMP 2. SPEED**

NAM 80-200/230U3.1DW3AELD65IEC280  
Serialno.: 6037610,  
EL-MOTOR 280M-2/4 MARINE 2-SPEED

**Pos 5,00 BRINE DISCH. PUMP**

AEB 2N 1450-IE/0X1 P01 G 112 PA P 6230  
Serialno.: 6026678,  
GEARMOTOR CB 9-250M/4DF SL 63 350A60

**Pos 6,00 BASE OIL DISCH. PUMP 2. SPEED**

NAM 80-200/230 U3.1D W80 AELD65IEC250  
Serialno.: 6037611,  
EL-MOTOR 250M-2 V1 IP54

**Pos 10,00 LIQUID MUD MIXER - EL. DRIVEN (NON EX-EXECUTION)**

Allmix Agitator RW570 DM A120/12  
AGITATOR EL.

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### Pos 20,00 SFI 581 - HYDROPHORE SYSTEM

SOB 222 W G2V/V.10 FOR IEC 100  
Serialno.: 6037613, 6037612,  
EL-MOTOR 100L-4 MARINE

### Pos 22,00 SEWAGE PUMP

AEB 1L 381  
Serialno.: 6026681,  
SK25F-AL-100L/4

### Pos 23,00 SEWAGE EJECTOR

GOLAR STRIPPING EJECTOR 1 1/2"-2"-2 1/2

### Pos 26,00 701 - FUEL OIL TRANSFER PUMP

TRILUB 140 R 46 U8.6 V W115 IEC 100/112  
Serialno.: 6037691, 6037690,  
EL-MOTOR 100L-2 MARINE

### Pos 30,00 SFI 711 - LUBE OIL PUMP

TRE 40-R46 U18.1 V W202 IEC 90 w/flanges  
Serialno.: 6037692,  
EL-MOTOR 90L-2 MARINE

### Pos 35,00 711 - SLUDGE PUMP

AEB 1L 101  
Serialno.: 6026683,  
GEARMOTOR SK SERIES

## ORDER PRESENTATION

ALLWEILER ORDER NO: 85683 2  
CUSTOMER.....: Havyard Leirvik as  
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Pos 40,00 721.101.10/20 - SW COOLING PUMP ME, FREQUENCY CONTROLLED

NB 125-200/01/230-U3.1D-W3 IEC 180  
Serialno.: 6037615, 6037614,  
EL-MOTOR 180M-4 V1 IP54

FWD NO: 2  
AFT NO: 1

Pos 41,00 721.102.10 - SW COOLING PUMP ME, BACK-UP

NB 125-200/01/230-U3.1D-W3 IEC 180  
Serialno.: 6037616,  
EL-MOTOR 180L-4/8 V1 IP54

Pos 55,00 BILGE- / FIRE PUMP

AEB 1E 750-ID/111PO1 G122PP 5846  
Serialno.: 6026704, 6026703,  
GEARMOTOR SK42F 160L4

Pos 60,00 EMERGENCY FIRE PUMP

NB 32-160/170-U3.1D-W3- FOR IEC 160  
Serialno.: 6037617,  
EL-MOTOR 160M-2 MARINE

Pos 65,00 722.105.10 - FW COOLING PUMP

NB 80-315/279-U3.1D-W18 IEC 160  
Serialno.: 6037618,  
EL-MOTOR 160L-4 V1 IP54

AFT  
No: 1

Pos 66,00 722.105.20 - FW COOLING PUMPS

NB 80-315/285-U3.1D-W18 IEC 160  
Serialno.: 6037619,  
EL-MOTOR 160L-4 V1 IP54

FWD  
No: 2

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## ORDER PRESENTATION

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ALLWEILER ORDER NO: 85683 2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF.....: 096 CHS/ERP / UT755, Garware Shipping Corp.Ltd, Mum

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**Pos 67,00 722.105.30 - FW COOLING PUMP, BACK-UP**

NB 80-315/285-U3.1D-W18 IEC 160  
Serialno.: 6037620,  
EL-MOTOR 160L-4 V1 IP54

**Pos 68,00 722.105.40 - FW COOLING PUMP FOR HARBOUR**

NB 50-125/128-U3.1D-W18 IEC 112  
Serialno.: 6037621,  
EL-MOTOR 112M-2 V1 IP54

*AFY*  
*NO: 1*

**Pos 69,00 722.105.50 - FW COOLING PUMP FOR HARBOUR**

NB 50-125/133-U3.1D-W18 IEC 112  
Serialno.: 6037622,  
EL-MOTOR 112M-2 V1 IP54

*FND*  
*NO: 2*

**Pos 79,00 722.140.10 - CIRC. PUMP FW GENERATOR**

NB 32-125/116 U3.1D-W18 IEC 90  
Serialno.: 6037624, 6037623,  
EL-MOTOR 90L-2 V1 IP54

**Pos 80,00 581.123.10 - HOT WATER CIRC. PUMP**

NB 20-160/153 U3.1D W18 IEC 71  
Serialno.: 6037625,  
EL-MOTOR 71-4 IP54

Reid at SCRABSTER on 05.09.12,  
& fitted in place. (PME L.O. priming pump)

Type: TRILUB 80R 46W 115  
No: 08/12038867/2012

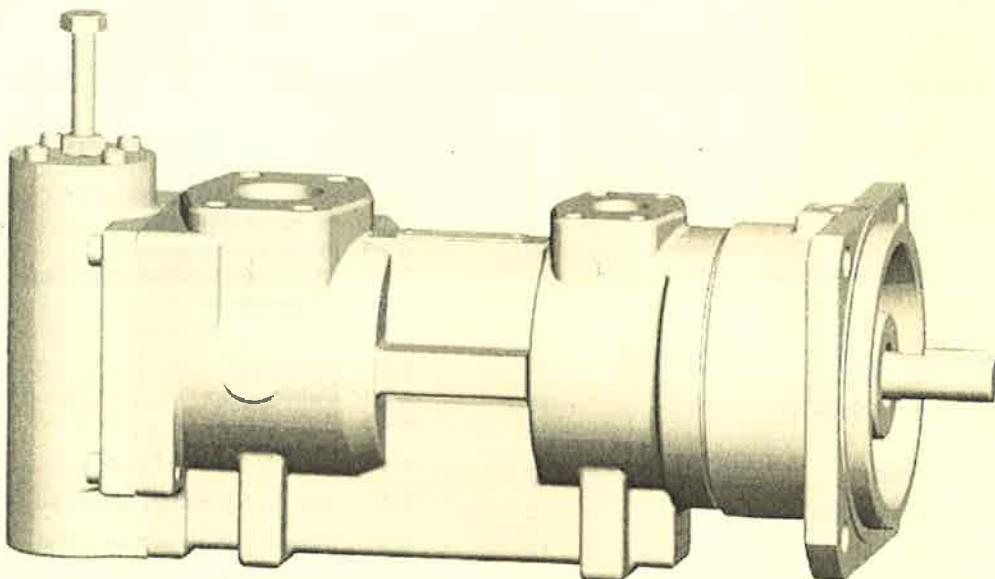
ALLWEILER



# Screw Pump

Original Operating Manual      **TRILUB TRL Series**

Pump was fitted on 05.09.12.



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Version BA-2011.11  
ID-No. 550 271  
VM-No. 652.0009 GB

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We reserve the right to make technical changes.

CE

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## 1 About this document

This manual:

- Is part of the pump
- Applies to the pump series mentioned above
- Describes safe and appropriate operation during all operating phases

### 1.1 Target groups

Target group	Duty
Operating company	<ul style="list-style-type: none"> <li>▶ Keep this manual available at the site of operation of the equipment, including for later use.</li> <li>▶ Ensure that personnel read and follow the instructions in this manual and the other applicable documents, especially all safety instructions and warnings.</li> <li>▶ Observe any additional rules and regulations referring to the system.</li> </ul>
Qualified personnel, fitter	<ul style="list-style-type: none"> <li>▶ Read, observe and follow this manual and the other applicable documents, especially all safety instructions and warnings.</li> </ul>

Tab. 1 Target groups and their duties

### 1.2 Other applicable documents

Document	Purpose
ATEX additional instructions	Operation in explosion-hazard areas
Order data sheet	Technical specifications, conditions of operation
Setup drawing	Setup dimensions, connection dimensions etc.
Technical description	Technical specifications, operating limits
Sectional drawing	Sectional drawing, part numbers, component designations
Supplier documentation	Technical documentation for parts supplied by subcontractors
Declaration of conformity	Conformity with standards, contents of the declaration of conformity (→ 9.4 Declaration of conformity according to EC machine directives, Page 34).

Tab. 2 Other applicable documents and their purpose

### 1.3 Warnings and symbols

Warning	Risk level	Consequences of disregarding the warning
<b>DANGER</b>	Immediate acute risk	Death, serious bodily harm
<b>WARNING</b>	Potential acute risk	Death, serious bodily harm
<b>CAUTION</b>	Potentially hazardous situation	Minor bodily harm
<b>NOTE</b>	Potentially hazardous situation	Material damage

Tab. 3 Warnings and consequences of disregarding them

Symbol	Meaning
⚠	Safety warning sign ► Take note of all information highlighted by the safety warning sign and follow the instructions to avoid injury or death.
▶	Instruction
1., 2., ...	Multiple-step instructions
✓	Precondition
→	Cross reference
○	Information, notes

Tab. 4 Symbols and their meaning

## 2 Safety

- The manufacturer does not accept any liability for damages caused by disregarding the entire documentation.

### 2.1 Intended use

- Only use the pump to pump the agreed pumped liquids (→ order data sheet).
- Adhere to the operating limits.
- Avoid dry running:
  - Make sure the pump is only operated with, and never without, pumped liquid.
- Avoid cavitation:
  - Fully open the suction-side fitting and do not use it to adjust the flow rate.
  - Open the pressure-side fitting completely.
- Avoid damage to the motor:
  - Note the maximum permissible number of times the motor can be switched on per hour (→ manufacturer's specifications).
- Consult the manufacturer about any other use of the pump.
- When a pump is delivered without a motor, the pump unit must be completed in accordance with the stipulations of machine directive 2006/42/EC

#### Prevention of obvious misuse (examples)

- Note the operating limits of the pump with regard to temperature, pressure, viscosity, flow rate and motor speed (→ order data sheet).
- Do not operate the pump while the pressure-side fitting is closed.
- Pumps may not be used with foodstuffs if they have not been adapted accordingly. The use of the pump for foodstuffs must be specified in the order data sheet.
- Only select the setup type according to this operating manual. For example, the following are not allowed:
  - Hanging base plate pumps in the pipe
  - Overhead installation
  - Installation in the immediate vicinity of extreme heat or cold sources
  - Installation too close to the wall

### 2.2 General safety instructions

- Observe the following regulations before carrying out any work.

#### 2.2.1 Product safety

The pump has been constructed according to the latest technology and recognized technical safety rules. Nevertheless, operation of the pump can still put the life and health of the user or third parties at risk or damage the pump or other property.

- Only operate the pump if it is in perfect technical condition and only use it as intended, remaining aware of safety and risks, and in adherence to the instructions in this manual.
- Keep this manual and all other applicable documents complete, legible and accessible to personnel at all times.
- Keep the information on the pump in a complete and legible condition.
- Refrain from any procedures and actions that would pose a risk to personnel or third parties.
- In the event of any safety-relevant malfunctions, shut down the pump immediately and have the malfunction corrected by the personnel responsible.
- In addition to the entire documentation for the product, comply with statutory or other safety and accident-prevention regulations and the applicable standards and guidelines in the country where the pump is operated.

## 2.2.2 Obligations of the operating company

### Safety-conscious operation

- Only operate the pump if it is in perfect technical condition and only use it as intended, remaining aware of safety and risks, and in adherence to the instructions in this manual.
- Ensure that the following safety aspects are observed and monitored:
  - Intended use
  - Statutory or other safety and accident-prevention regulations
  - Safety regulations governing the handling of hazardous substances
  - Applicable standards and guidelines in the country where the pump is operated
- Make personal protective equipment available.

### Qualified personnel

- Make sure all personnel tasked with work on the pump have read and understood this manual and all other applicable documents, especially the safety, maintenance and repair information, before they start any work.
- Organize responsibilities, areas of competence and the supervision of personnel.
- Ensure that all work is carried out by specialist technicians only:
  - Fitting, repair and maintenance work
  - Work on the electrical system
- Make sure that trainee personnel only work on the pump under the supervision of specialist technicians.

### Safety equipment

- Provide the following safety equipment and verify its functionality:
  - For hot, cold and moving parts: Safety guarding provided by the customer for the pump
  - For possible build up of electrostatic charge: Ensure appropriate grounding
  - If there is no pressure relief valve in the pump: Provide an appropriate safety valve on the pressure side between the pump and the first shut-off device

### Warranty

- Obtain the manufacturer's approval prior to carrying out any modifications, repairs or alterations during the warranty period.
- Only use genuine parts or parts that have been approved by the manufacturer.

## 2.2.3 Obligations of personnel

- All directions given on the pump must be followed (and kept legible), e.g. the arrow indicating the sense of rotation and the markings for fluid connections.
- Pump, coupling guard and components:
  - Do not step on them or use as a climbing aid
  - Do not use them to support boards, ramps or beams
  - Do not use them as a fixing point for winches or supports
  - Do not use them for storing paper or similar materials
  - Do not use hot pump or motor components as a heating point
  - Do not de-ice using gas burners or similar tools
- Do not remove the safety guarding for hot, cold or moving parts during operation.
- Use personal protective equipment whenever necessary.
- Only carry out work on the pump while it is not running.
- Isolate the motor from its supply voltage and secure it against being switched back on again before all assembly and maintenance work.
- Reinstall the safety equipment on the pump as required by regulations after any work on the pump.

## 2.3 Specific hazards

### 2.3.1 Explosion-hazard area

- (→ ATEX additional instructions).

### 2.3.2 Hazardous pumped liquids

- Follow the safety regulations for handling hazardous substances when handling hazardous (e.g. hot, flammable, poisonous or potentially harmful) pumped liquids.
- Use personal protective equipment when carrying out any work on the pump.

### 3 Layout and function

#### 3.1 Label

##### 3.1.1 Type plate



Fig. 1 Type plate (example)

- 1 Pump type
- 2 Pump number
- 3 Year of manufacture
- 4 Pumping pressure
- 5 Power consumption
- 6 Kinematic viscosity
- 7 Motor speed
- 8 Flow rate

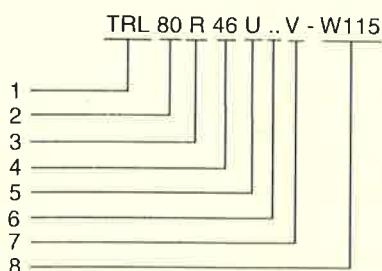
##### 3.1.2 ATEX plate



Fig. 2 ATEX plate (example)

- 1 Explosion protection mark
- 2 Reference to ATEX additional instructions

##### 3.1.3 Pump type code



Position	Meaning	
1	Series	
2	Size (theoretical flow rate in l/min at normal inclination and 1450 rpm)	
3	Spindle pitch direction	
	R	Right
4	Spindle pitch angle in degrees	
5	Design characteristic	
	U	Internal antifriction bearing; unheated, uncooled shaft seal
6	Shaft seal	
7	Design characteristic	
	V	Version with valve
8	Material key	

Tab. 5 Pump type code

## 3.2 Layout

### 3.2.1 TRL layout, internal antifriction bearing

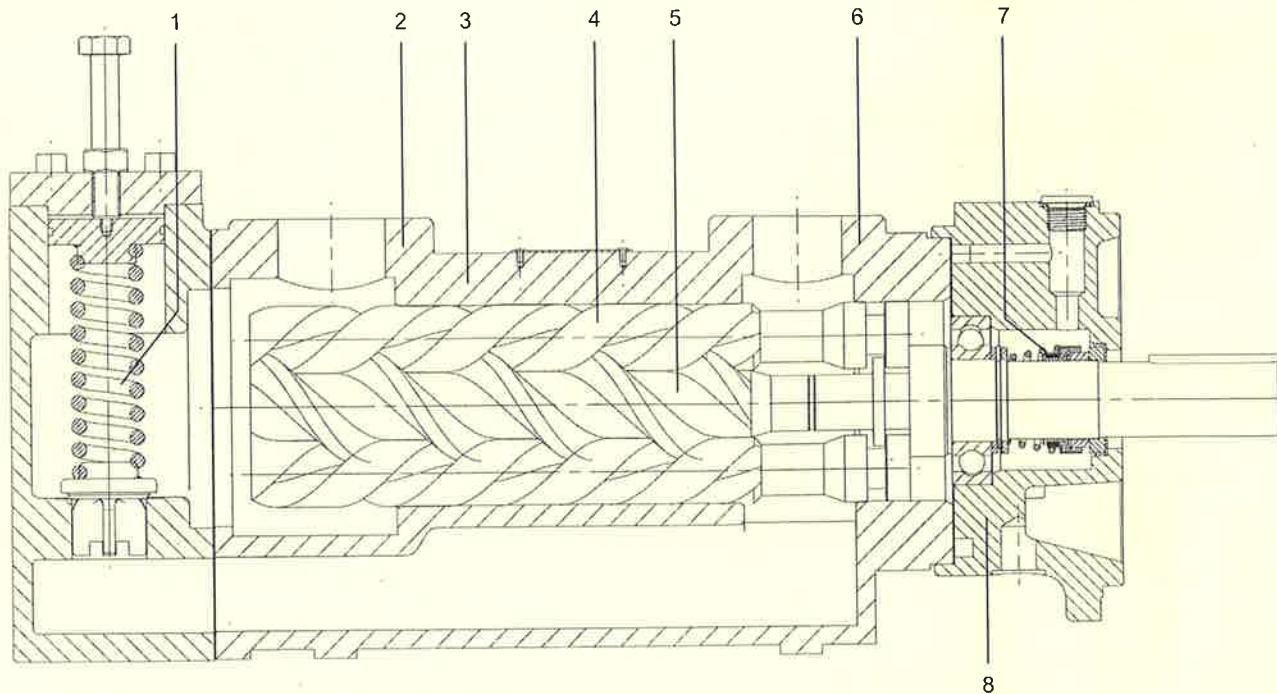


Fig. 3 TRL layout, internal antifriction bearing

- 1 Pressure relief valve
- 2 Flange, suction side
- 3 Pump casing
- 4 Drive spindle (1 x)
- 5 Idler spindle (2 x)
- 6 Flange, pressure side
- 7 Shaft seal
- 8 Pump cover

## 3.3 Shaft seals

### 3.3.1 Mechanical seals

 Mechanical seals have functional leaks.

- Mechanical seal, standard version
  - Uncooled, maintenance-free unbalanced mechanical seal construction

## 3.4 Bearings and lubrication

### 3.4.1 U version

- Internal groove ball bearing, lubricated with liquid according to DIN 625

### 3.5 Types of setup

○ The following types of setup are possible:

- Vertical, dry
- Vertical, wet
- Horizontal, dry

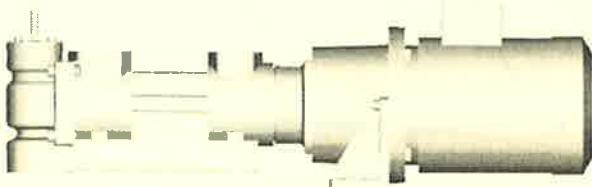


Fig. 4 Horizontal setup type



Fig. 5 Vertical setup type

## 4 Transport, storage and disposal

### 4.1 Transport

-  Weight specifications (→ order data sheet).

#### 4.1.1 Unpacking and inspection on delivery

1. Unpack the pump/unit on delivery and inspect it for transport damage.
2. Report any transport damage to the manufacturer immediately.
3. Dispose of packaging material according to local regulations.

#### 4.1.2 Lifting

 **DANGER**

**Death or crushing of limbs caused by falling or overturning loads!**

- ▶ Use lifting gear appropriate for the total weight to be transported.
  - ▶ Fasten the lifting gear as shown in the following illustrations.
  - ▶ For vertical transport: Provide a securing rope between the hook and load eyebolt of the motor.
  - ▶ Never fasten the lifting gear onto the motor eyebolt (unless used as a safety device against tipping over for units with a high center of gravity).
  - ▶ Do not stand under suspended loads.
- 
- ▶ Fasten the lifting gear to the pump unit.

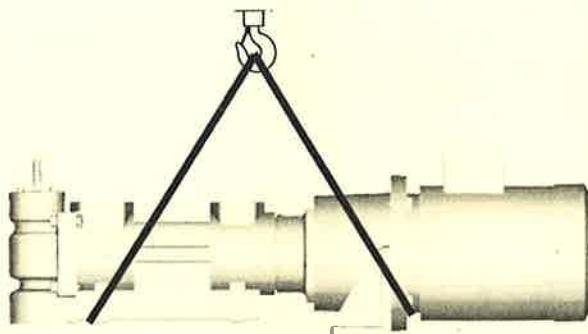


Fig. 6 Fastening the lifting gear to the pump unit (horizontal)

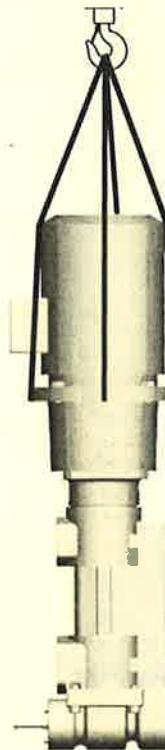


Fig. 7 Fastening the lifting gear to the pump unit (vertical)

## 4.2 Treatment for storage

-  The pump has not been treated for storage at the factory.

### NOTE

**Material damage due to inappropriate treatment for storage!**

- Treat the pump properly, inside and outside, for storage.

### 4.2.1 Applying preservative to the inside

-  Set the pump down so that the pressure-side flange is higher than the suction-side flange.

1. Close the suction-side flange with a blank flange.
2. Fill the pump with preservative (e.g. RUST-BAN 335).
3. Turn the shaft slowly against the pump's sense of rotation.
4. Continue filling and turning until preservative escapes from the pressure flange without bubbles.
5. Close the pressure-side flange with a blank flange.
6. Every 6 months:
  - Renew the preservative if necessary.

### 4.2.2 Applying preservative to the outside

- Apply preservative to all bare metal parts.

## 4.3 Storage

### NOTE

**Material damage due to inappropriate storage!**

- Treat and store the pump properly.

1. Seal all openings with blank flanges, blind plugs or plastic covers.
2. Make sure the storage room meets the following conditions:
  - Dry
  - Frost-free
  - Vibration-free
  - Dust-free
3. Turn the shaft once a month.
4. Make sure the shaft and bearing change their rotational position in the process.

## 4.4 Removing the preservative

-  Only necessary for pumps treated for storage.

### NOTE

**High water pressure or spray water can damage bearings!**

- Do not clean bearing areas with a water or steam jet.

### NOTE

**Damage to seals due to wrong cleaning agents!**

- Ensure the cleaning agent does not corrode the seals.

1. Choose the cleaning agent according to the application. (→ 9.2.5 Cleaning agents, Page 30).
2. Remove the preservative from all bare internal parts of the pump.
3. Dispose of cleaning agents in accordance with local regulations.
4. For storage times in excess of 6 months:
  - Replace the elastomer parts made of EP rubber (EPDM).
  - Check all elastomer parts (O-rings, shaft seals) for proper elasticity and replace them if necessary.

## 4.5 Disposal

-  Plastic parts can be contaminated by poisonous or radioactive pumped liquids to such an extent that cleaning will be insufficient.

### ⚠ WARNING

**Risk of poisoning and environmental damage by the pumped liquid or oil!**

- Use personal protective equipment when carrying out any work on the pump.
- Prior to the disposal of the pump:
  - Collect and dispose of any escaping pumped liquid or oil in accordance with local regulations.
  - Neutralize residues of pumped liquid in the pump.
  - Remove the preservative (→ 4.4 Removing the preservative, Page 13).
- Remove the plastic parts and dispose of them in accordance with local regulations.
- Dispose of the pump in accordance with local regulations.

## 5 Setup and connection

- For pumps in explosion-hazard areas (→ ATEX additional instructions).

### NOTE

**Material damage due to distortion or passage of electrical current in the bearing!**

- ▶ Do not make any structural modifications to the pump unit or pump casing.
- ▶ Do not carry out any welding work on the pump unit or pump casing.

### NOTE

**Material damage caused by dirt!**

- ▶ Do not remove any covers or transport and screw plugs until immediately before connecting the pipes to the pump.

### 5.1 Preparing the setup

#### 5.1.1 Checking the ambient conditions

- ▶ Make sure the required ambient conditions are fulfilled (→ 9.2.1 Ambient conditions, Page 30).

#### 5.1.2 Preparing the installation site

- ▶ Ensure the installation site meets the following conditions:
  - Pump is freely accessible from all sides
  - Sufficient space for the installation/removal of the pipes and for maintenance and repair work, especially for the removal and installation of the pump and the motor
  - Pump not exposed to external vibrations (damage to bearings)
  - Frost protection

#### 5.1.3 Preparing the surface

- ▶ Make sure the surface meets the following conditions:
  - Level
  - Clean (no oil, dust or other impurities)
  - Capable of bearing the weight of the pump unit and all operating forces
  - The pump is stable and cannot tip over

#### 5.1.4 Removing the preservative

- ▶ If the pump is to be put into operation immediately after setup and connection: Remove the preservative prior to setup (→ 4.4 Removing the preservative, Page 13).

#### 5.1.5 Installing the heat insulation (optional)

- Only necessary to maintain the temperature of the pumped liquid.

### NOTE

**Material damage on the bearing or shaft seal due to overheating!**

- ▶ Only install the heat insulation on the pump casing
- ▶ Install the heat insulation properly.

### 5.2 Setup

1. If the pump is set up in a vertical position (container layout/installation):
  - Install the pump unit with pump bracket or discharge casing on the cover of the container.
2. If the pump is set up in a horizontal position:
  - Install the pump unit with mounting feet on a level surface.
  - Ensure that the leakage bore hole / pipe points downwards.
  - Turn the pump cover on the drive side if necessary.

## 5.3 Installing the motor

- Only necessary if the pump unit is assembled on site.

### NOTE

#### Material damage caused by knocks and bumps!

- Keep the coupling halves properly aligned when slipping them on.
- Do not knock or hit any components of the pump.

1. Smear a very thin coat of molybdenum disulfide (e.g. Molykote) on the shaft ends of the pump and motor.
2. Insert the shaft keys.
3. Slip on the pump-side and motor-side coupling halves. Adhere to the prescribed axis projection (→ 9.2.6 Coupling assembly, Page 31).
  - Without a mounting fixture: Remove the rubber buffers and heat the coupling halves up to approximately 100 °C.
4. Tighten the grub screws on both coupling halves.
5. Lift the motor and position it on the pump bracket.
6. Screw in the motor screws.

## 5.4 Planning the pipes

### 5.4.1 Specifying supports and flange connections

#### NOTE

#### Material damage due to excessive forces and torques exerted by the piping on the pump!

- Do not exceed the permissible values (→ flange loads according to EN ISO 14847)

1. Calculate the pipe forces, taking every possible operating condition into account:
  - Cold/warm
  - Empty/full
  - Depressurized/pressurized
  - Positional changes of the flanges
2. Ensure the pipe supports have permanent low-friction properties and do not seize up due to corrosion.

### 5.4.2 Specifying nominal diameters

- Keep the flow resistance in the pipes as low as possible.

1. Make sure the nominal suction pipe diameter is ≥ the nominal suction branch diameter.
  - Make sure the flow rate is below 1 m/s
2. Make sure the nominal pressure pipe diameter is ≥ the nominal outlet flange diameter.
  - Make sure the flow rate is below 3 m/s

### 5.4.3 Specifying pipe lengths

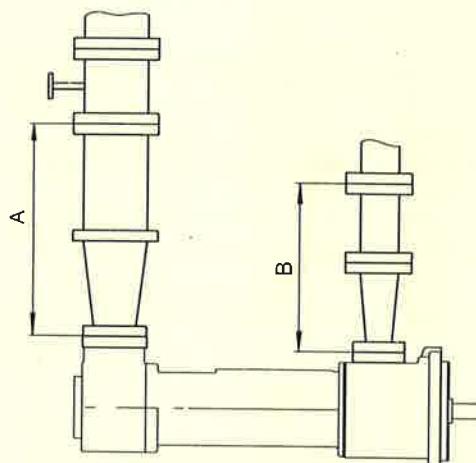


Fig. 8 Straight pipe lengths upstream and downstream of the pump (recommended)

A > 5 x nominal suction pipe diameter

B > 5 x nominal pressure pipe diameter

- Maintain the recommended minimum values when installing the pump.

- Suction side: Shorter pipes are possible but may restrict the hydraulic performance.

Pressure side: Shorter pipes are possible but can result in increased operating noise.

### 5.4.4 Optimizing changes in cross-section and direction

1. Avoid bending radii of less than 1.5 times the nominal pipe diameter.
2. Avoid abrupt changes of cross-section and direction along the piping.

#### 5.4.5 Discharging leaks

##### **WARNING**

**Risk of injury and poisoning due to hazardous pumped liquids!**

- Safely collect any leaking pumped liquid, then discharge and dispose of it in accordance with environmental regulations.
1. Provide equipment for collecting and discharging leaking liquids.
  2. Ensure the free discharge of leaking liquids.

#### 5.4.6 Avoiding excessive pressure

##### **WARNING**

**Risk of injury due to excessive pressure!**

- If there is no pressure relief valve in the pump: Provide an appropriate safety valve in the pressure line.

#### NOTE

**Material damage due to overheating of the pump!**

- If the return flow of the pressure relief valve flows directly into the pump suction side or suction line: Monitor the temperature.
1. Observe the operating instructions of the manufacturer.
  2. Make sure the factory setting of the pressure relief valve meets the requirements of the system.
  3. Do not feed the return flow of the safety valve directly back into the suction pipe.

#### 5.4.7 Providing safety and control devices (recommended)

##### Avoid impurities

1. Install a dirt trap in the suction pipe (mesh size of 0.6 mm).
2. To monitor impurities, install a differential pressure gauge with contact manometer.
3. Provide a fine filter if necessary:
  - Select the filter mesh, depending on the type, level of contamination and pumping pressure.

##### Avoiding reverse running

- Install a non-return valve between the outlet flange and the gate valve to ensure the liquid does not flow back when the pump is switched off.

##### Making provisions for isolating and shutting off pipes

- For maintenance and repair work.
- Provide shut-off devices in the suction and pressure pipes.

##### Allowing measurement of the operating conditions

1. Provide manometers for pressure measurements in the suction and pressure pipes.
2. Provide for suction-side temperature measurements.

##### Monitoring leaks

- Only necessary for hot or hazardous pumped liquids.
- 1. Provide leak monitoring equipment.
  2. Safely collect any leaking pumped liquid (e.g. following a seal malfunction) and dispose of it.

## 5.5 Connecting the pipes

### 5.5.1 Keeping the pipes clean

#### NOTE

##### Material damage due to impurities in the pump!

- Make sure no impurities can enter the pump.

1. Flush all pipe parts and fittings prior to assembly.
2. Ensure no flange seals protrude inwards.
3. Remove any blank flanges, plugs, protective foils and/or protective paint from the flanges.
4. On welded pipes: Remove the welding beads.

### 5.5.2 Installing the suction pipe

1. Remove the transport and screw plugs from the pump.
2. To avoid air pockets:
  - For supply operation: Run the pipes with a continuous downward slope to the pump.
3. Ensure no seals protrude inwards.

### 5.5.3 Installing the pressure pipe

1. Remove the transport and screw plugs from the pump.
2. Install the pressure pipe.
3. Ensure no seals protrude inwards.

### 5.5.4 Checking the stress-free pipe connections

- ✓ Piping installed and cooled down

#### NOTE

##### Material damage due to distorted pump casing

- Ensure that all pipes are stress relieved when connected to the pump.

1. Disconnect the pipe connecting flanges from the pump.
2. Check whether the pipes can be moved freely in all directions within the expected range of expansion:
  - Nominal diameter < 150 mm: by hand
  - Nominal diameter > 150 mm: with a small lever
3. Make sure the flange surfaces are parallel.
4. Reconnect the pipe connecting flanges to the pump.

## 5.6 Electrical connection

### DANGER

#### Risk of death due to electric shock!

- Have all electrical work carried out by qualified electricians only.

### 5.6.1 Connecting the motor

- 1 Follow the instructions of the motor manufacturer.

1. Connect the motor according to the connection diagram.
2. Make sure no danger arises due to electric power.
3. Install an EMERGENCY STOP switch.

## 5.7 Installing the coupling guard

### Flanged drive

1. If available, install the coupling guard (two plates) on the bell housing

## 6 Operation

- For pumps in explosion-hazard areas (→ ATEX additional instructions).

### 6.1 Putting the pump into service for the first time

#### 6.1.1 Removing the preservative

- Only necessary for pumps treated for storage.

► (→ 4.4 Removing the preservative, Page 13).

#### 6.1.2 Pressure relief valve

- Pressure relief valves supplied by the manufacturer are pre-set.
- Make sure the safety valve on the system side meets the requirements of the pump.

#### 6.1.3 Filling and bleeding

##### WARNING

##### Risk of injury and poisoning due to hazardous pumped liquids!

- Safely collect any leaking pumped liquid and dispose of it in accordance with environmental rules and requirements.

1. Open the suction-side fitting.
2. Fill the pump and suction pipe with pumped liquid until pumped liquid escapes without bubbles.
3. Fill the seal chamber with pumped liquid if necessary.
4. Open the pressure-side fitting.
5. Ensure that no pipe connections are leaking.

#### 6.1.4 Checking the sense of rotation

- ✓ Pump filled and bled

##### DANGER

##### Risk of death due to rotating parts!

- Use personal protective equipment when carrying out any work on the pump.
- Keep an adequate distance to rotating parts.

##### NOTE

##### Material damage caused by dry running!

- Make sure the pump is filled properly.

1. Switch the motor on and immediately off again.
2. Make sure the motor turns clockwise (when looking at the motor fan).
3. If the sense of rotation is different: Swap two phases.

#### 6.1.5 Switching on

- ✓ Pump set up and connected properly
- ✓ Motor set up and connected properly
- ✓ All connections stress-free and sealed
- ✓ All safety equipment installed and tested for functionality
- ✓ Pump prepared, filled and bled properly
- ✓ Sufficient filling level in the container (minimum immersion depth)

##### DANGER

##### Risk of injury due to running pump or hot pump parts!

- Do not touch the running pump.
- Ensure that the coupling guard is attached.
- Do not carry out any work on the running pump.
- Allow the pump to cool down completely before starting any work.

##### DANGER

##### Risk of injury and poisoning due to pumped liquid spraying out!

- Use personal protective equipment when carrying out any work on the pump.

##### NOTE

##### Risk of cavitation when throttling down the suction flow rate!

- Fully open the suction-side fitting and do not use it to adjust the flow rate.

##### NOTE

##### Material damage due to excessive pressure!

- Do not operate the pump while the pressure-side fitting is closed.

##### NOTE

##### Material damage caused by dry running!

- Make sure the pump is filled properly.

1. Open the pressure-side fitting.
2. Open the suction-side fitting.
3. Switch on the motor and make sure it is running smoothly.
4. Make sure the temperature rises at a rate of no more than 2 K/min.
5. Make sure the minimum pumping pressure is above 2 bar.
6. After the first load under pressure and at operating temperature, check that the pump is not leaking.

### 6.1.6 Switching off

#### **⚠ WARNING**

##### Risk of injury due to hot pump parts!

- ▶ Use personal protective equipment when carrying out any work on the pump.

1. Switch off the motor.
2. After initial start-up: Check all tie bolts and tighten them if necessary.

## 6.2 Operation

### 6.2.1 Switching on

- ✓ Pump initially put into service properly
- ✓ Pumps filled and bled

#### **⚠ DANGER**

##### Risk of injury due to running pump or hot pump parts!

- ▶ Do not touch the running pump.
- ▶ Ensure that the coupling guard is attached.
- ▶ Do not carry out any work on the running pump.
- ▶ Allow the pump to cool down completely before starting any work.

#### **⚠ DANGER**

##### Risk of injury and poisoning due to pumped liquid spraying out!

- ▶ Use personal protective equipment when carrying out any work on the pump.

### NOTE

##### Risk of cavitation when throttling down the suction flow rate!

- ▶ Fully open the suction-side fitting and do not use it to adjust the flow rate.

### NOTE

##### Material damage caused by dry running!

- ▶ Make sure the pump is filled properly.
1. Open the pressure-side fitting.
  2. Open the suction-side fitting.
  3. Switch on the motor and make sure it is running smoothly.
  4. Make sure the temperature rises at a rate of no more than 2 K/min.
  5. Make sure the minimum pumping pressure is above 2 bar.

### 6.2.3 Switching off

- ▶ Switch off the motor.

## 6.3 Shutting down the pump

#### **⚠ WARNING**

##### Risk of injury and poisoning due to hazardous pumped liquids!

- ▶ Safely collect any leaking pumped liquid and dispose of it in accordance with environmental rules and requirements.
- ▶ Take the following measures whenever the pump is shut down:

Pump is	Measure
...shut down for a prolonged period	<ul style="list-style-type: none"> <li>▶ Take measures according to the pumped liquid (→ Table 7 Measures depending on the behavior of the pumped liquid, Page 19).</li> </ul>
...emptied	<ul style="list-style-type: none"> <li>▶ Close the suction-side and pressure-side fittings.</li> </ul>
...dismounted	<ul style="list-style-type: none"> <li>▶ Isolate the motor from its power supply and secure it against unauthorized switch-on.</li> </ul>
...put into storage	<ul style="list-style-type: none"> <li>▶ Follow the storage instructions (→ 4.3 Storage, Page 13).</li> </ul>

Tab. 6 Measures to be taken if the pump is shut down

Behavior of the pumped liquid	Duration of shutdown (depending on process)	
	Short	Long
Solids sedimenting	<ul style="list-style-type: none"> <li>▶ Flush the pump.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Flush the pump.</li> </ul>
Solidifying/ freezing, non-corrosive	<ul style="list-style-type: none"> <li>▶ Heat up or empty the pump and containers.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Empty the pump and containers.</li> </ul>
Solidifying/ freezing, corrosive	<ul style="list-style-type: none"> <li>▶ Heat up or empty the pump and containers.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Empty the pump and containers.</li> <li>▶ Treat the pump and containers with preservative.</li> </ul>
Remains liquid, non-corrosive	-	-
Remains liquid, corrosive	-	<ul style="list-style-type: none"> <li>▶ Empty the pump and containers.</li> <li>▶ Treat the pump and containers with preservative.</li> </ul>

Tab. 7 Measures depending on the behavior of the pumped liquid

## 6.4 Start-up following a shutdown period

1. If the pump is shut down for over 6 months, take the following measures before starting it up again:
  - Replace the elastomer seals (O-rings, shaft seal rings).
  - Replace the antifriction bearings.
  - If necessary: Replace the motor bearing (→ operating manual of the motor manufacturer).
2. Carry out all steps as for the initial start-up (→ 6.1 Putting the pump into service for the first time, Page 18).

## 6.5 Operating the stand-by pump

- ✓ Stand-by pump filled and bled
- Operate the stand-by pump at least once a week.

## 7 Maintenance

- For pumps in explosion-hazard areas (→ ATEX additional instructions).
- Trained service technicians are available for fitting and repair work. Present a pumped liquid certificate (DIN safety data sheet or safety certificate) when requesting service.

### 7.1 Inspections

- The inspection intervals depend on the operational strain on the pump.

#### DANGER

##### Risk of injury due to running pump or hot pump parts!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Allow the pump to cool down completely before starting any work.

#### WARNING

##### Risk of injury and poisoning due to hazardous pumped liquids!

- ▶ Use personal protective equipment when carrying out any work on the pump.

##### 1. Check at appropriate intervals:

- Temperature of roller bearings < 70 °C
- Normal operating conditions unchanged
- Check whether the pressure relief valve is working

##### 2. For trouble-free operation, always ensure the following:

- No dry running
- No leaks
- No cavitation
- Suction-side gate valves open
- Unclogged and clean filters
- Sufficient pump ingress pressure
- No unusual running noises or vibrations
- No excessive leakage at the shaft seal

### 7.2 Maintenance

- Service life of the antifriction bearings for operation within the permissible operating range: > 2 years  
Intermittent operation, high temperatures and aggressive ambient and process conditions reduce the service life of antifriction bearings.
- Mechanical seals are subject to natural wear, which strongly depends on the respective operating conditions. Therefore, general statements regarding their service life cannot be made.

#### DANGER

##### Risk of injury due to running pump or hot pump parts!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Allow the pump to cool down completely before starting any work.
- ▶ Isolate the motor from its supply voltage and secure it against being switched back on again before all assembly and maintenance work.

#### DANGER

##### Risk of death due to electric shock!

- ▶ Have all electrical work carried out by qualified electricians only.

#### WARNING

##### Risk of injury and poisoning due to hazardous or hot pumped liquids!

- ▶ Use personal protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down before commencing any work.
- ▶ Make sure the pump is depressurized.
- ▶ Empty the pump and safely collect the pumped liquid. Dispose of it in accordance with environmental rules and requirements.

#### 7.2.1 Mechanical seals

- Mechanical seals have functional leaks (→ manufacturer's specifications).
- ▶ In the event of major leaks: Replace the mechanical seal and its auxiliary seals.

### 7.2.2 Cleaning the pump

#### NOTE

**High water pressure or spray water can damage bearings!**

- ▶ Do not clean bearing areas with a water or steam jet.
- ▶ Clean large-scale grime from the pump.

### 7.3 Repairs

#### DANGER

**Risk of injury due to running pump or hot pump parts!**

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Allow the pump to cool down completely before starting any work.
- ▶ Isolate the motor from its supply voltage and secure it against being switched back on again before all assembly and maintenance work.

#### DANGER

**Risk of death due to electric shock!**

- ▶ Have all electrical work carried out by qualified electricians only.

#### WARNING

**Risk of injury and poisoning due to hazardous or hot pumped liquids!**

- ▶ Use personal protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down before commencing any work.
- ▶ Make sure the pump is depressurized.
- ▶ Empty the pump, safely collect the pumped liquid and dispose of it in accordance with environmental regulations.

#### WARNING

**Risk of injury due to heavy components!**

- ▶ Pay attention to the component weight. Lift and transport heavy components using suitable lifting gear.
- ▶ Set down components safely and secure them against overturning or rolling away.

#### 7.3.1 Returning the pump to the manufacturer

- ✓ Pump depressurized
- ✓ Pump completely empty
- ✓ Electrical connections disconnected and motor secured against being switched on again
- ✓ Pump cooled down
- ✓ Coupling guard dismounted
- ✓ On couplings with spacer piece: Spacer piece removed
- ✓ Auxiliary systems shut down, depressurized and emptied
- ✓ Manometer lines, manometer and holdings dismounted
- 1. Enclose a truthfully and fully completed safety certificate when returning pumps or components to the manufacturer (→ 9.3 Safety certificate, Page 33).
- 2. Take necessary measures, depending on the required repair work, as listed in the table below when returning the pump to the manufacturer.

Repairs	Measure for return
...at the customer's premises	▶ Return the defective component to the manufacturer.
...at the manufacturer's premises	▶ Flush the pump and decontaminate it if it was used for hazardous pumped liquids.
...at the manufacturer's premises for warranty repairs	▶ Return the complete pump (not disassembled) to the manufacturer.

Tab. 8 Measures for returning the pump

### 7.3.2 Dismounting

- ✓ Pump depressurized
- ✓ Pump completely empty, flushed and decontaminated
- ✓ Electrical connections disconnected and motor secured against being switched on again
- ✓ Pump cooled down
- ✓ Coupling guard dismounted
- ✓ On couplings with spacer piece: Spacer piece removed
- ✓ Auxiliary systems shut down, depressurized and emptied
- ✓ Manometer lines, manometer and holdings dismounted

### WARNING

#### Risk of injury during disassembly!

- Secure the pressure-side gate valve against accidental opening.
- Depressurize the blocking pressure system, if available.
- Wear protective gloves as components can become very sharp through wear or damage.
- Remove spring-loaded components carefully (e.g. mechanical seal, tensioned bearing, valves etc.), as components can be ejected by the spring tension.
- Observe the manufacturer's specifications (e.g. for the motor, coupling, mechanical seal, blocking pressure system, cardan shaft, drives, belt drive etc.).

1. Observe the following during removal:
  - Mark the precise orientation and position of all components before dismounting them.
  - Dismount components concentrically without canting.
2. Dismount the pump (→ sectional and exploded drawing).

### 7.3.3 Installing

- Install the components concentrically, without canting, in accordance with the markings made.

### NOTE

#### Material damage due to unsuitable components!

- Always replace lost or damaged screws with screws of the same strength (→ 9.2.3 Tightening torques, Page 30).
- Only replace seals with seals of the same material.

1. Observe the following during installation:
  - Replace worn parts with genuine spare parts.
  - Replace seals, inserting them in such a way that they are unable to rotate.
  - Maintain the prescribed tightening torques (→ 9.2.3 Tightening torques, Page 30).
2. Clean all parts (→ 9.2.5 Cleaning agents, Page 30). Do not remove any markings which have been applied.
3. Install the pump (→ 9.1 Sectional drawings, Page 27).
4. Install the pump in the system (→ 5 Setup and connection, Page 14).

### 7.4 Ordering spare parts

- For trouble-free replacement in the event of faults, we recommend keeping a supply of complete spare pumps available on site.

Parts which can be replaced can be found in the parts list (→ 9.1.1 Part numbers and designations, Page 27).

- Have the following information ready to hand when ordering spare parts (→ type plate):
  - Pump type
  - Pump number
  - Year of manufacture
  - Part number
  - Designation
  - Quantity

## 8 Troubleshooting

### 8.1 Pump malfunctions

If malfunctions occur which are not specified in the following table or cannot be traced back to the specified causes, please consult the manufacturer.

Possible malfunctions are identified by a number in the following table. This number identifies the respective cause and remedy in the troubleshooting list.

Malfunction	Number
Pump not pumping	1
Pumping rate insufficient	2
Pumping rate excessive	3
No pump suction	4
Pump running roughly	5
Pump jammed	6
Pump leaking	7
Excessive motor power uptake	8

Tab. 9 Malfunction/number assignment

Malfunction number								Cause	Remedy
1	2	3	4	5	6	7	8		
X	-	-	-	-	-	-	-	Transport screw plugs still in place	<ul style="list-style-type: none"> <li>▶ Remove the transport screw plugs.</li> <li>▶ Dismount the pump and inspect it for dry-running damage.</li> </ul>
X	-	-	-	-	-	-	-	Supply/suction pipe closed by fitting	<ul style="list-style-type: none"> <li>▶ Open the fitting.</li> </ul>
X	-	-	-	X	-	-	-	Supply/suction pipe not bled properly or not filled up completely	<ul style="list-style-type: none"> <li>▶ Fill up the pump and/or pipe completely and bleed them.</li> </ul>
X	-	-	-	X	-	-	-	Formation of air pockets in the supply or suction pipe	<ul style="list-style-type: none"> <li>▶ Install the fitting for bleeding.</li> <li>▶ Correct the piping layout.</li> </ul>
X	-	-	-	X	-	-	-	Pressure pipe blocked	<ul style="list-style-type: none"> <li>▶ Clean the pressure pipe.</li> </ul>
X	-	-	X	X	-	-	-	Pump running in the wrong sense of rotation	<ul style="list-style-type: none"> <li>▶ Swap any two phases on the motor (→ 6.1.4 Checking the sense of rotation, Page 18).</li> </ul>
X	-	-	X	-	X	-	-	Pump very dirty	<ul style="list-style-type: none"> <li>▶ Dismount and clean the pump.</li> </ul>
X	X	-	X	X	-	-	-	Supply/suction pipe, pump or suction strainer blocked or encrusted	<ul style="list-style-type: none"> <li>▶ Clean the supply/suction pipe, pump or suction strainer.</li> <li>▶ Clean the suction strainer.</li> </ul>
X	X	-	X	X	-	-	-	Air is sucked in	<ul style="list-style-type: none"> <li>▶ Seal the source of malfunction.</li> </ul>
X	X	-	X	X	-	-	-	Excessive amount of gas: Pump is cavitating	<ul style="list-style-type: none"> <li>▶ Check the cable gland.</li> <li>▶ Clean/enlarge the filter.</li> <li>▶ Enlarge the supply/suction pipe cross-section.</li> </ul>

Malfunction number								Cause	Remedy
1	2	3	4	5	6	7	8		
X	X	-	X	X	-	-	-	Excess play between: • Spindles • Spindles and housing	► Repair or replace any worn parts.
X	X	-	X	-	-	X	-	Shaft seal leaking	► Replace the shaft seal.
-	X	-	X	-	-	-	-	Motor speed too low	► Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary. ► Increase the motor speed if speed control is available.
-	X	-	X	-	-	-	-	Supply/suction pipe not fully opened	► Open the fitting.
-	X	-	X	X	-	-	-	Supply/suction pipe cross-section too narrow	► Enlarge the supply/suction pipe cross-section. ► Remove any encrustations from the suction pipe. ► Open the fitting completely.
-	X	-	X	X	-	-	-	Suction height excessive: $NPSH_{pump}$ larger than $NPSH_{system}$	► Increase the suction pressure. ► Consult the manufacturer.
-	X	-	X	X	-	-	-	Pumped liquid temperature too high: Pump is cavitating	► Increase the suction pressure. ► Lower the temperature. ► Consult the manufacturer.
-	X	-	X	X	-	-	-	Hydraulic parts of the pump dirty, clotted or encrusted	► Dismount the pump. ► Clean the parts.
-	X	-	X	-	-	-	X	Viscosity or specific weight of the pumped liquid outside the range specified for the pump	► Consult the manufacturer.
-	-	-	-	X	-	-	-	Pressure-side fitting not opened wide enough	► Open the pressure-side fitting.
-	X	-	X	X	X	-	-	Pump parts worn	► Replace the worn pump parts.
-	-	X	-	X	-	-	X	Motor speed too high	► Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary. ► Reduce the motor speed if speed control is available.
-	-	-	-	X	X	-	X	Antifriction bearing defective	► Replace the antifriction bearing.
-	-	-	-	-	X	-	X	Defective antifriction bearing in motor	► Replace the antifriction bearing.
-	-	-	-	-	-	X	-	Tie bolts not tightened properly	► Tighten the tie bolts (→ 9.2.3 Tightening torques, Page 30).
-	-	-	-	-	-	X	-	Mechanical seal worn	► Replace the mechanical seal.
-	-	-	-	-	-	X	-	Housing seal defective	► Replace the housing seal.

Malfunction number								Cause	Remedy
1	2	3	4	5	6	7	8		
-	-	-	-	X	X	X	X	Pump distorted	► Check the pipe connections and pump attachment.
-	-	-	-	X	-	-	-	Coupling elements worn	► Replace the coupling elements.
-	X	-	X	X	-	-	X	Motor running on 2 phases	► Check the fuse and replace it if necessary. ► Check the cable connections and insulation.

Tab. 10 Troubleshooting list

## 8.2 Pressure relief valve malfunctions

If malfunctions occur which are not specified in the following table or cannot be traced back to the specified causes, please consult the manufacturer.

Possible malfunctions are identified by a number in the following table. This number identifies the respective cause and remedy in the troubleshooting list.

Malfunction	Number
Pumping pressure drops	1
Pressure relief valve does not open	2
Pressure relief valve does not close	3
Pressure relief valve rattles	4

Tab. 11 Malfunction/number assignment

Malfunction number				Cause	Remedy
1	2	3	4		
X	-	-	-	Spring worn out	► Install a new spring.
X	-	-	-	Valve seat leaks	► Install a new valve cone.
-	X	-	-	Spring tension too high	► Relieve the pressure on the spring by turning the adjusting screw, then reset the pressure relief valve.
-	X	-	-	Foreign particles in the valve	► Remove the pressure relief valve. ► Clean the internal parts. ► Install the pressure relief valve.
-	X	-	-	Pump operating temperature too high	► Consult the manufacturer.
-	-	X	-	Spring has no or insufficient tension	► Reset the pressure relief valve.
-	-	X	-	Valve seat leaks	► Rework or replace the valve cone or valve casing.
-	-	-	X	Pressure relief valve rattles	► Measure the excess pressure with the fitting on the pressure side closed. ► Reset the pressure relief valve (opening pressure 10% higher than the operating pressure).

Tab. 12 Pressure relief valve troubleshooting list

## 9 Appendix

### 9.1 Sectional drawings

#### 9.1.1 Part numbers and designations

Part no.	Designation
1	Pump casing
3	Pump cover
7	Cover plate
12	Drive spindle
13	Idler spindle
20	Intermediate cover
23	Spacer ring
100 1)	Gasket
101 1)	Gasket
120 1)	O-ring
121 1)	O-ring
140 1)	Seal ring
186 1)	Mechanical seal
200	Socket head cap screw
201	Socket head cap screw
202	Socket head cap screw
203	Hexagon head bolt
214	Screw plug
220	Hexagon nut
250	Snap ring
251	Snap ring
260	Supporting washer
261	Adjusting washer
270	Spring dowel
280	Blind rivet
281 1)	Spring
290	Shaft key
292 1)	Groove ball bearing
331	Valve housing
332	Cover

Part no.	Designation
333	Spring retainer
334 1)	Valve cone
970	Rating plate

Tab. 13 Designation of components according to part numbers

1) Can be ordered as spare part/spare part kit

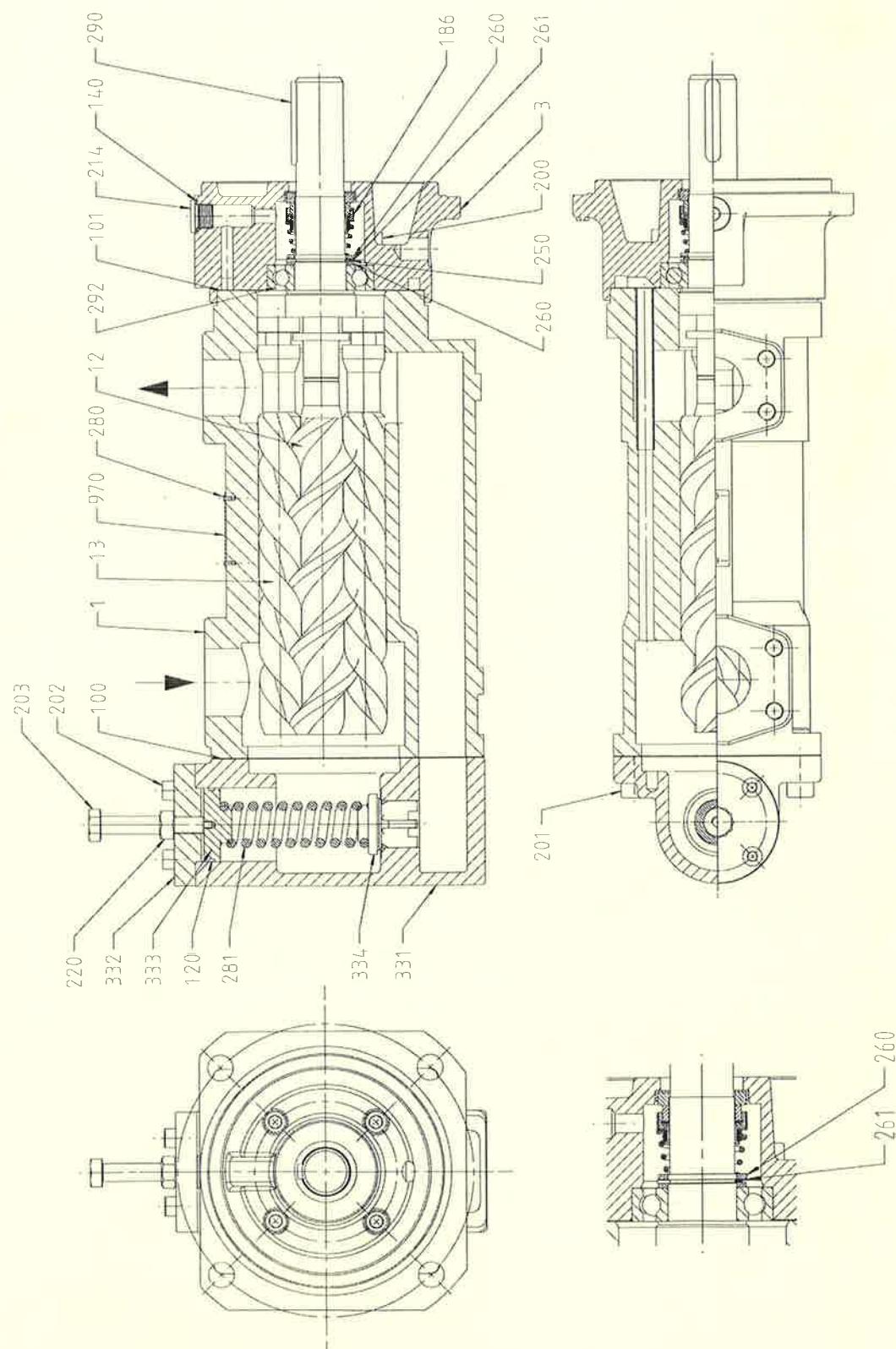
**9.1.2 TRL...U... drawings****Sectional drawings**

Fig. 9 TRL...U... sectional drawing

**Exploded drawing**

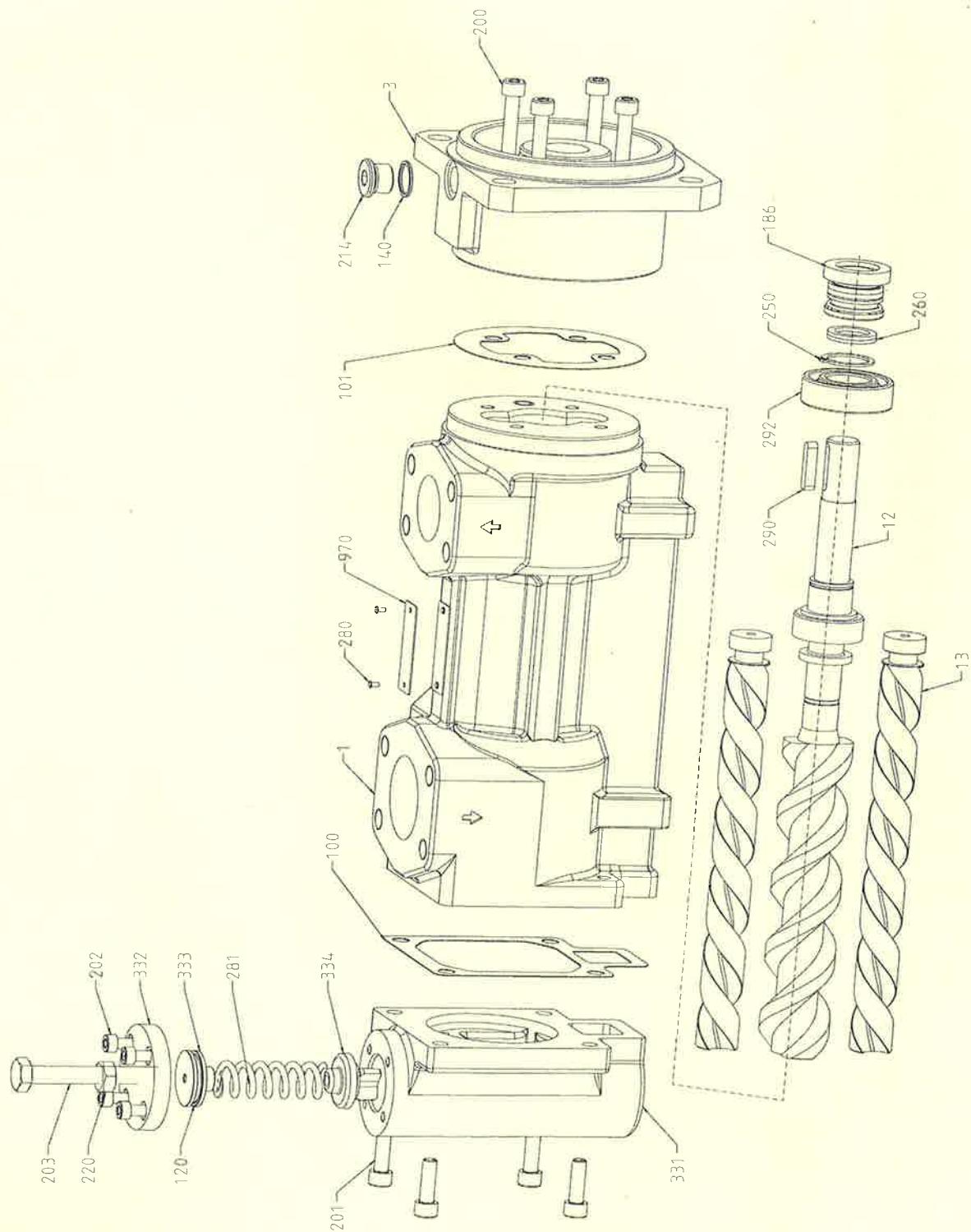


Fig. 10 TRL...U... exploded drawing

## 9.2 Technical specifications

 More technical specifications (→ order data sheet).

### 9.2.1 Ambient conditions

 Operation under any other ambient conditions should be agreed with the manufacturer.

Temperature [°C]	Relative humidity [%]		Setup height above sea level [m]
	Long-term	Short-term	
-20 to +40	≤ 85	≤ 100	≤ 1000

Tab. 14 Ambient conditions

### 9.2.2 Sound pressure level

Measuring conditions:

- Distance to the pump: 1 m
- Operation: cavitation-free
- Motor: IEC standard motor
- Tolerance ±3 dB

Lower-noise versions of the motors are available if the expected noise levels exceed the permissible limits.

Size	Sound pressure level [dB] for pump at speed [rpm]			
	1450	1750	2900	3500
40	50	52	59	61
80	52	54	61	63
140	55	57	64	66
210	58	60	67	69
280	60	62	69	71
440	63	65	72	74

Tab. 15 Sound pressure level

### 9.2.3 Tightening torques

 The following values apply to oiled screws and torque tightening processes.

Thread size	Quality	Tightening torque [Nm]
M 6		3,9
M 8		9,8
M 10		18,6
M 12		32,3
M 16		78,4
M 20		156,8
M 24		289,1
M 27		426,3
M 30		578,2
M 6		8,8
M 8		21,6
M 10		43,1
M 12		73,5
M 16		181,3
M 20		352,8
M 24		661,5
M 27		975,1
M 30		1323,0
M 6		13,2
M 8		31,8
M 10		63,0
M 12		108,0
M 16		264,0
M 20		517,0
M 24		890,0
M 27		1304,0
M 30		1775,0

Tab. 16 Tightening torques

### 9.2.4 Preservatives

 Use RUST-BAN 335 as a preservative, for example.

### 9.2.5 Cleaning agents

Application area	Cleaning agents
Other	Benzine, wax solvents, diesel, paraffin, alkaline cleaners

Tab. 17 Cleaning agents

### 9.2.6 Coupling assembly

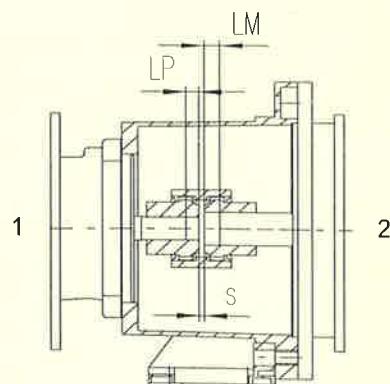


Fig. 11 Coupling assembly

1 Pump side

2 Motor side

### Mounting feet layout

Motor	Pump														
	40/80				140-210-280				440						
	LP	LM	S	[mm]	Coupling	LP	LM	S	[mm]	Coupling	LP	LM	S	[mm]	Coupling
80	23	24	4		Bowex M19	13	12	4		Bowex M32	-	-	-		-
90S/L	7	30	4		Bowex M24	8	7	4		Bowex M32	-	-	-		-
100L/112M	10	12	4		Bowex M28	16	16	4		Bowex M32	22	22	4		Bowex M38
132S/M	5	6	4		Bowex M38	0	5	4		Bowex M38	2	22	4		Bowex M38
160M/L	7	18	4		Bowex M42	5	6	4		Bowex M42	27	30	4		Bowex M65
180M/L	-	-	-		-	5	6	4		Bowex M48	27	30	4		Bowex M65
200L	-	-	-		-	5	6	4		Bowex M65	10	25	4		Bowex M65
225M-2	-	-	-		-	-	-	-		-	27	33	4		Bowex M65
225S/M-4	-	-	-		-	-	-	-		-	19	20	4		Bowex M65

Tab. 18 Dry setup with mounting feet

**Container installation or layout**

Motor	Pump															
	40/80				140-210				280				440			
	LP	LM	S	Coupling	LP	LM	S	Coupling	LP	LM	S	Coupling	LP	LM	S	Coupling
80	0	20	4	Oest AR24	-	-	-	-	-	-	-	-	-	-	-	-
90S/L	0	10	4	Oest AR24	0	10	4	Oest AR42*	-	-	-	-	-	-	-	-
100L/112M	10	12	4	Bowex M28	0	0	4	Oest AR38**	22	22	4	Bowex M38	22	22	4	Bowex M38
132S/M	5	6	4	Bowex M38	0	5	4	Bowex M38**	0	24	4	Bowex M38	2	22	4	Bowex M38
160M/L	7	18	4	Bowex M42	5	6	4	Bowex M42**	0	-1	4	Bowex M42	27	30	4	Bowex M65
180M/L	-	-	-	-	5	6	4	Bowex M48**	0	-1	4	Bowex M48	27	30	4	Bowex M65
200L	-	-	-	-	5	6	4	Bowex M65	-	-	-	-	10	25	4	Bowex M65
225M-2	-	-	-	-	-	-	-	-	-	-	-	-	27	33	4	Bowex M65
225S/M-4	-	-	-	-	-	-	-	-	-	-	-	-	19	20	4	Bowex M65

Tab. 19 Container setup without mounting feet

\*) TRL 140 only

\*\*) TRL 140 and 210 only

### 9.3 Safety certificate

- Please copy this document and send it together with the  
 pump.

The pump and accessories submitted for inspection / repairs together with the safety certificate by us, the signatory:

Type: \_\_\_\_\_ Delivery date: \_\_\_\_\_

Part no.: \_\_\_\_\_ Order no.: \_\_\_\_\_

Reason for inspection / repair: \_\_\_\_\_

Was not used with liquids that are hazardous to health or the environment.

Was used for the following application: \_\_\_\_\_

Came into contact with liquids that must be labeled for safety or are considered to be polluting.

Last pumped liquid: \_\_\_\_\_

The pump has been carefully emptied and cleaned on the outside and inside prior to delivery or provision.

Special safety precautions are not necessary for subsequent handling.

The following safety precautions regarding rinsing liquids, liquid residue and disposal are necessary:  
\_\_\_\_\_  
\_\_\_\_\_



If the pump was used with critical liquids, please make sure you enclose a **safety data sheet** in the package.

We hereby declare that the information given is correct and complete, and that the pump is being shipped in accordance with legal requirements.

Company /  
address: \_\_\_\_\_ Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Customer no.: \_\_\_\_\_

Issuer name:  
(capital letters) \_\_\_\_\_ Position: \_\_\_\_\_

Date: \_\_\_\_\_ Company stamp / signature: \_\_\_\_\_

Tab. 20 Safety certificate

## 9.4 Declaration of conformity according to EC machine directives

- The following declaration does not contain serial numbers or signatures. The original declaration is delivered with the respective pump.

### Declaration of conformity

#### EC declaration of conformity according to machine directive, appendix II A

We,

Allweiler GmbH, Postfach 1140, 78301 Radolfzell, Germany; Tel. +49 (0)7732 86-0, Fax. +49 (0)7732 86-436, hereby declare that the following machine adheres to the relevant EC directives detailed below:

ID no.

Designation      TRILUB TRL

Equipment no.

Order no.

#### EC directives:

- Machine directive (2006/42/EC)
- Low-voltage directive (2006/95/EC)
- EMC directive (2004/108/EC)

#### Applicable harmonized norms:

- EN 809:1998
- EN ISO 12100-1:2003
- EN ISO 12100-2:2003
- EN 14121-1:2007

Person authorized to compile the technical file

Allweiler GmbH  
Allweilerstraße 1  
78315 Radolfzell

Date: 10.11.2011

Company stamp / signature:

Company stamp / signature:

Head of Development/Construction

Head of Quality

Tab. 21 Declaration of conformity according to EC machine directives





# Contact us Information

**AFTER SALES, SERVICE, SPARE PARTS AND REPLACEMENT PUMPS**  
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## ORDER PROCESSING, AFTER SALE

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## NEW PUMPS AND ASSOCIATED EQUIPMENT, SALES:

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## ORDER PROCESSING, NEWSALE

<b>Ingunn Korsmo</b> Project manager	Phone                    +47 66 77 50 57 Cell phone            +47 934 21 986 E-mail <a href="mailto:ingunn.korsmo@allweiler.no">ingunn.korsmo@allweiler.no</a>
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## Allweiler AS represents:

Allweiler, IMO, Warren, Herborner, Osna, Speck.



## 2 Sikkerheit

Denne bruksanvisning inneholder grunnleggende opplysninger som man skal ta hensyn til ved montering, drift og tilsyn. Av den grunn må bruksanvisningen bli lest av såvel montøren som også av vedkommende fagpersonell før montasje og igangkjøring, og den må hele tiden være tilgjengelig ved maskinen/anlegget.

Man skal ikke bare ta hensyn til de oppførte alminnelige sikkerhetshenvisninger som er angitt under hovedpunktet Sikkerhet, men også de spesielle sikkerhetshenvisninger som gjelder f. eks. for privat bruk.

### 2.1 Henvisningstegn i bruksanvisningen

De punkter i denne sikkerhetsinstruksen som omtaler ting eller aktiviteter som kan bli til fare for personer dersom de ikke overholdes, er merket med det vanlige fare-symbolet



Sikkerhetsskilt i hht  
norm DIN 4844-W9

og ved varsel om elektrisk spenning er det merket med



Sikkerhetsskilt i hht  
norm DIN 4844-W8

De punkter i denne sikkerhetsinstruksen som omtaler ting eller aktiviteter som kan bli til fare for maskiner og deres funksionsdyktighet dersom de ikke overholdes, er merket med ordet:

## ADVARSEL

Henvisninger som er anbrakt direkte på maskinen som f. eks.:

- dreieretningspil
- kjennetegn for væsketilkobling

må ubetingt tas hensyn til og holdes i lesbar stand.

### 2.2 Produktkunnskap og opplæring

De som skal utføre betjening, tilsyn, inspeksjon og montasje må oppfylle de nødvendige kvalifikasjoner for denne type arbeid. Ansvarsområdet, kompetanse og overvåking av personalet må være nøyaktig regulert av ansvarshavende.

**Har personalet ikke de nødvendige kunnskaper må de få opplæring. Dette kan, hvis nødvendig, bli gjennomført på oppdrag for ansvarshavende for maskinen av produsenten/leverandøren av produktet. Videre må den ansvarlige for maskinen forsikre seg om at personalet helt har forstått innholdet i bruksanvisningen.**

### 2.3 Farer ved ikke å ta hensyn til sikkerhetshenvisninger

Ved ikke å ta hensyn til sikkerhetshenvisninger kan dette være en fare for det omkringliggende miljø og maskinen. Neglisjering av sikkerhetshenvisningene føre likeledes til tap av krav til skadeserstatning.

Å se bort fra bruksanvisningen kan eksempelvis føre til følgende farer:

- Svikt av viktige funksjoner i maskinen/anlegget
- Svikt av foreskrevne metoder til tilsyn og vedlikehold
- Fare for personer gjennom elektriske mekaniske og kjemiske påvirkninger
- Fare for miljøet gjennom lekkasje av farlige stoffer

### 2.4 Krav til bevissthet om sikkerhet i arbeidet

I arbeidet skal det tas hensyn til de oppførte sikkerhetshenvisninger i denne bruksanvisning, likeledes skal det tas hensyn til de eksisterende nasjonale forskrifter om forebygging av uhell og til eventuelle interne arbeids-, drifts- og sikkerhetsforskrifter hos arbeidsgiver.

### 2.5 Sikkerhetshenvisninger for eieren/brukeren

- Fører varme eller kalde maskindeler til fare, må disse sikres mot berøring.
- Berøringsbeskyttelse for bevegelige deler (f.eks. kobling) må ikke fjernes når maskinen er i drift.
- Ved drift av pumpeaggregater i støvfulle omgivelser (f.eks. mølle drift, sponplate-fabrikasjon, bakervarefabrikker osv.), må pumpenes og motorene overflater rengjøres regelmessig, avhengig av stedets støvkonsentrasijsnivå, for å opprettholde kjølevirksomheten og for å utelukke selvtenning. Se også hertil i retningslinjene for eksplosjonsbeskyttelse (BGR 104).
- Lekkasje (f.eks. akselpakning) ved farlig transportgod (f.eks. eksplosiv, giftig, varm) må reguleres slik at det ikke oppstår fare for personer og miljø. Lovmessige bestemmelser må overholdes.
- Fare gjennom elektrisk energi må utelukkes (detaljer angående dette er å se i f.eks. VDE-bestemmelserne og i den lokale energiforsyningens bedriften).

### 2.6 Sikkerhetshenvisninger for vedlikeholds-, inspeksjons- og monteringsarbeid

Eieren må sørge for, at alt vedlikeholds-, inspeksjons- og monteringsarbeid blir utført av autorisert og kvalifisert fagpersonal som har studert bruksanvisningen nøyaktig. Prinsipielt må arbeid på maskinen bare utføres når denne ikke er i drift. Framgangsmåten hvordan man setter maskinen ut av drift er beskrevet i bruksanvisningen og må absolutt overholdes.

Pumpen og pumpeaggregater som pumper sunnhetsfarlige medier må først bli renset. Umiddelbart etter avslutning av arbeidet må alle sikkerhets- og beskyttelsesinnredninger installeres igjen og settes i funksjon.

Før maskinen settes i drift igjen må oppføringene i avsnittet "6.1 Forberedelse til drift" bekates.

### 2.7 Egenmekting ombygging og reservedelstilvirkning

Ombygging eller endringer av maskinen er bare tillatt etter avtale med produsenten. Originale reservedeler og autorisert tilbehør fra produsenten tjener til egen sikkerhet. Bruk av andre deler opphever ansvaret for følgene som kan oppstå av dette.

### 2.8 Ulovlige driftsmåter

Driftssikkerheten til den leverte maskinen garanteres kun ved forskriftsmessig bruk, tilsvarende avsnitt 1 i bruksanvisningen. Grenseverdiene som er oppført i datalisten må på ingen måte overskrides.

**Dette informasjonsformularet med sikkerhetshenvisninger er et tillegg til den produktspesifikke bruks- og vedlikeholdsanvisningen og må av sikkerhetsgrunner tas særlig hensyn til.**

## Forutsetninger

Det forutsettes, at anleggets prinsipielle planarbeid og alt arbeid innen transport, montering, installasjon, drift, vedlikehold og reparasjon utføres av kvalifisert personal, hhv. kontrolleres av ansvarlige fagfolk.

## Merk derfor spesielt:

- tekniske data og henvisninger om tillatt bruk (monterings-, tilslutnings-, miljø- og driftsbestemmelser), som bl.a. er å se i den tekniske brosjuren, i ordrepapirene, i bruksanvisningen på typeskiltet og i øvrige produktdokumentasjoner,
- de generelle oppførings- og sikkerhetsbestemmelser,
- de lokale, anleggspesifikke bestemmelser og krav,
- fagmessig bruk av verktøy, heve- og transportinnretninger,
- bruk av personlig verneutstyr,
- monteringsbestemmelser for utstyr som f. eks. leveres uten tildekning: Under drift må nødvendig berøringsbeskyttelse være forhånden, hhv. må en farlig kontakt forhindres.

Bruksanvisningene kan av oversiktlige grunner ikke inneholde alle detaljinformasjoner til de mulige byggevariantene og kan heller ikke ta hensyn til alle mulige tilfeller av oppstilling, drift eller vedlikehold. Bruksanvisningene inneholder derfor primært slike henvisninger som er nødvendig for kvalifisert personal som bruker maskinene eller utstyret i industrimiljø.

## Sikkerhetshenvisninger for eieren/brukeren

- Fører varme eller kalde maskindeler til fare, må disse sikres mot berøring.
- Berøringsbeskyttelse for bevegelige deler ( f.eks. kobling) må ikke fjernes når maskinen er i drift.
- Ved drift av pumpeaggregater i støvfulle omgivelser (f.eks. mølle drift, sponplate-fabrikkasjon, bakervarefabrikker osv.), må pumpenes og motorenes overflater rengjøres

regelmessig, avhengig av stedets støvkonsentrasjon, for å opprettholde kjølevirksomheten og for å utelukke selvtenning. Se også hertil i retningslinjene for eksplosjonsbeskyttelse (ZH 1/10).

- Lekkasje (f.eks. akselpakning) ved farlig transportgod (f.eks. eksplosiv, giftig, varm) må reguleres slik, at det ikke oppstår fare for personer og miljø. Lovmessige bestemmelser må overholdes.
- Fare gjennom elektrisk energi må utelukkes (detaljer angående dette er å se i f.eks. VDE-bestemmelserne og i den lokale energiforsyningsbedriften).

## Sikkerhetshenvisninger for vedlikeholds-, inspeksjons- og monteringsarbeid

Eieren må sørge for, at alt vedlikeholds-, inspeksjons- og monteringsarbeid blir utført av autorisert og kvalifisert fagpersonal som har studert bruksanvisningen nøyaktig. Prinsipielt må arbeid på maskinen bare utføres når denne ikke er i drift. Framgangsmåten hvordan man setter maskinen ut av drift er beskrevet i bruksanvisningen og må absolutt overholdes.

Pumper og pumpeaggregater som pumper sunnhetssfarlige medier må først bli renset. Umiddelbart etter avslutning av arbeidet må alle sikkerhets- og beskyttelsesinnretninger installeres igjen og settes i funksjon. Før maskinen settes i drift igjen må oppføringene i avsnittet "Forberedelse til drift" beaktes.

## Egenmekting ombygging og reservedelstilvirkning

Ombygging eller endringer av maskinen er bare tillatt etter avtale med produsenten. Original reservedeler og autorisert tilbehør fra produsenten tjener til egen sikkerhet. Bruk av andre deler opphever ansvaret for følgene som kan oppstå av dette.

## Ulovlige driftsmåter

Driftssikkerheten til den leverte maskinen garanteres kun ved forskriftsmessig bruk, tilsvarende avsnitt 1 i bruksanvisningen. Grenseverdiene som er oppført i datalisten må på ingen måte overskrides.

## 2 Safety

These operating instructions contain basic safety instructions for installation, operation and maintenance. It is therefore essential that they are read by fitters and all specialist staff and customer personnel prior to installation and start-up. They must always be kept at hand at the place of installation.

The special safety instructions contained in the other chapters must be observed in addition to the general safety instructions in this chapter.

### 2.1 Identification of safety instructions in the operating manual

The safety instructions contained in these operating instructions which represent a danger to personnel if not complied with are specially marked by the general danger symbol:



Warning symbol  
as per DIN 4844-W9

Warning of danger from electric voltage is indicated as follows:



Warning symbol  
as per DIN 4844-W8.

Instructions which are essential to avoid endangering the machine and its operation are marked by the word

**ATTENTION**

Instructions affixed directly to the machine such as

- Directional markers
- Signs for fluid connections

must always be observed and maintained in fully legible condition at all times.

### 2.2 Personnel qualification and training

The operating, maintenance, inspection and mounting personnel must be appropriately qualified for the duties assigned to them. The scope of their responsibilities, competency and supervisory duties must be closely controlled by the customer. If the personnel do not have the required knowledge, they must be trained and instructed. If required, this may be provided by the manufacturer/supplier on behalf of the customer. The customer must additionally ensure that personnel fully understand the content of the operating instructions.

### 2.3 Dangers in the event of non-compliance with safety instructions

Failure to comply with the safety instructions may result in danger to persons, and place the environment and the machine at risk. Non-compliance with the safety instructions will lead to the loss of any claims for damages.

Non-compliance may result in the following dangers:

- Failure of important functions of the plant
- Failure of specified methods for maintenance and servicing
- Danger to persons resulting from electrical, mechanical and chemical effects
- Danger to the environment resulting from leakage of hazardous substances

### 2.4 Responsible working practices

The safety instructions contained in these operating instructions, current national accident prevention regulations, as well as internal working, operating and safety rules of the customer, must be observed.

### 2.5 Safety instructions for the user/operator

- Hot or cold machine parts representing a danger must be protected against accidental contact on site.
- Protection against accidental contact for moving parts (such as the coupling) must not be removed while the machine is in operation.
- When operating pump aggregates in a dust-laden environment (e.g. milling, chipboard manufacture, bakeries), the surfaces of the pumps and motors must be cleaned at regular intervals, depending on local conditions, in order to maintain the cooling effect and eliminate the possibility of spontaneous combustion. Please also see explosion protection regulations (BGR 104).
- Leakage (e.g. from the shaft seal) of hazardous substances being handled, such as explosive, toxic or hot materials, must be discharged in such a way that no danger to persons or the environment is created. Legal regulations must be observed.
- Dangers from electrical energy must be eliminated. For details in this regard, please refer to VDE and local power company regulations.

### 2.6 Safety instructions for maintenance, inspection and installation

The operating company must ensure that all maintenance, inspection and installation tasks are performed by authorized and qualified specialist personnel who have thoroughly studied the operating instructions.

Work on the machine is only to be carried out when the machine is at a standstill. The procedure for shutting down the machine described in the operating instructions must always be followed.

Pumps or aggregates handling fluids which are detrimental to health must be decontaminated. All safety and protective devices must immediately be refitted and made operational on completion of the work.

The instructions under Section 6.1, "Preparation for start-up", must be observed before restarting.

### 2.7 Unauthorized conversion and production of replacement parts

Conversion or modification of the machines is only permissible after consultation with the manufacturer. Original replacement parts and accessories approved by the manufacturer are intrinsic to safe operation. If other parts are used the manufacturer cannot be held liable for the consequences.

### 2.8 Unacceptable modes of operation

The operational safety of the machine supplied is only ensured when it is used in accordance with Section 1 of the operating instructions. The limit values given on the data sheet must not be exceeded under any circumstances.

**This information sheet with the warning hints applies in addition to the product-specific operating and maintenance instructions and must for safety reasons be particularly observed.**

## Prerequisites

It is assumed that the basic planning operations of the plant as well as all operations regarding transportation, assembly, installation, commissioning, maintenance and repair are performed by qualified personnel and/or controlled by responsible experts.

**With regard hereto, the following are to be particularly observed:**

- the technical data and statements on the admissible employment (assembly, connecting, ambient and operating conditions) which are, among other things, contained in technical brochures, the order documents, the operating instructions, the plate information and the other product documentation,
- the general installation and safety regulations,
- the local plant-specific stipulations and requirements,
- the proper utilization of tools, lifting and transport appliances,
- the employment of personal protective equipment,
- mounting conditions for devices which are, for example, supplied without covering: During operation, the required protection against accidental contact must be attached and/or a dangerous approach avoided.

For better clearness, the operating instructions cannot contain all detailed information for possible construction variants and can in particular not consider every possible case of installation, operation or maintenance. Correspondingly, the operating instructions mainly contain such hints only which, in case of due employment of the machines or devices in industrial fields of application, are required for qualified personnel.

## Safety hints for the user/operator

- If hot or cold machine parts lead to dangers, these parts must be protected against accidental contact at the site.
- Protection against accidental contact for moving parts (e.g. coupling) must not be removed when the machine is in operation.

• When operating pump aggregates in a dust-laden environment (e.g. mill operation, chipboard production, bakery-goods factories etc.), the surfaces of the pumps and motors, depending upon the local dust concentration, must be cleaned at regular intervals so as to maintain the cooling effect and exclude spontaneous ignitions. Please also refer to Explosion Protection Recommendations (ZH 1/10).

- Leakages (e.g. of the shaft seal) of dangerous substances to be handled (e.g. explosive, toxic, hot) must be discharged so as not to result in danger to persons and the environment. Legal stipulations are to be observed.
- Dangers by electrical energy are to be excluded (for details with regard hereto, please refer e.g. to the regulations of the VDE and the local energy supply associations).

## Safety hints for maintenance, inspection and mounting operations

The operator shall see to it that all maintenance, inspection and mounting operations are performed by authorized and qualified expert personnel who have sufficiently informed themselves by thoroughly studying the operating instructions.

Basically, operations at the machine are to be performed during standstill only. The mode of operation for stopping the machine described in the operating instructions must by all means be observed.

Pumps or aggregates handling noxious fluids must be decontaminated. Immediately upon completion of the operations, all safety and protective devices must be mounted and made operational again.

Prior to restarting, the items listed in Section „Preparation for start-up“ are to be observed.

**Independent reconstruction and spare parts production**  
Reconstruction of or changes to the machine are only admissible after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer serve safety purposes. The use of other parts may cancel the liability for the consequences resulting therefrom.

## Inadmissible modes of operation

The operating safety of the machine supplied is only ensured with due application according to Section 1 of the operating instructions. The limit values given in the data sheet must by no means be exceeded.

# **Operating and Maintenance Instructions with Dismounting and Mounting Instructions**

**Eccentric Screw Pumps  
Series AEB1L, AEB.E, AEB.N,  
AEB.H, AEDB1E, AEDB2N**

**Design IE, ZE**

VM No.: 732.0002 GB  
Edition: 03.06  
Ident No.: 174 700

**Retain  
for future  
use!**

Order No.:

Ident No. of Pump:

Machine No.:

Pump Type:

Operating data, dimensions and other additional information can be found in the order-specific part of the documentation.



These Operating and Maintenance Instructions contain information from the pump manufacturer. They may need to be supplemented by instructions of the operator company for its personnel.

These instructions do not take account of specific information relating to operation and maintenance of the process plant into which the pump is integrated. Such information can only be given by the persons responsible for construction and planning of the plant (plant manufacturer).

**Such specific instructions relating to operation and maintenance of the process plant into which the pump is integrated have priority over the instructions of the pump manufacturer. The plant manufacturer must on principle observe the limits of use!**

**Refer to the operating instructions of the plant manufacturer!**

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### **Important note:**

This operating manual is to be supplemented by the order-related information.

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## 1. General

### 1.1 Application and range of utilization

The eccentric screw pumps are self-priming, rotary positive-displacement pumps for handling and dosing low to high-viscosity, neutral or aggressive, pure or abrasive, gaseous liquids or liquids which tend to froth, even with fibre and solids contents.

**ATTENTION** The range of utilization is to be taken from the order data sheet.

### 1.2 Performance data

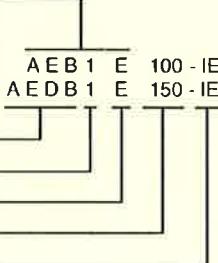
The exact performance data applying to the pump are to be taken from the order data sheet and are engraved on the name plate.

### 1.3 Abbreviation

The abbreviation of the eccentric screw pumps is set up according to the following scheme:

#### Example:

Series —————



This abbreviation is embossed on the type plate.

### 1.4 Warranty

Our liability for shortcomings in the supply is laid down in our delivery conditions. No liability will be undertaken for any damages caused by non-compliance with the operating instructions and service conditions. If at any later date the operating conditions happen to change (e.g. different liquid pumped, speed, viscosity, temperature or pressure conditions), it must be checked by us from case to case and confirmed, if necessary, whether the pump is suited for these purposes. In case no special agreements were made, pumps supplied by us may, during the warranty period, be opened or varied only by us or our authorized contractual service stations; otherwise, our liability for any defects will cease.

### 1.5 Testing

Prior to leaving our factory, all pumps are subjected to a leakage and performance test. Only properly operating pumps leave the factory achieving the performances assured by us. Thus, compliance with the following operating instructions ensures proper operation.

## 2. Safety

These operating instructions contain basic hints to be observed in case of installation, operation and maintenance. Therefore, prior to mounting and commissioning, these operating instructions must by all means be read by the fitter as well as the pertinent expert personnel/customer and must always be available at the place of installation of the machine/ plant. Not only are the general safety hints listed under this main item „Safety“ to be observed, but also the spe-

cial safety hints such as for private use added to the other main items.

### 2.1

#### Marking of hints in the operating instructions

The safety hints contained in these operating instructions which, in case of non-compliance, may cause danger to personnel, are particularly marked with the general danger symbol



Safety sign  
according to DIN 4844-W9

in case of warning against electric voltage with



Safety sign  
according to DIN 4844-W8

For safety hints, non-compliance with which may cause dangers to the machine and its functions, the word

### ATTENTION

is inserted.

Hints directly attached to the machine such as

- directional marker
- signs for fluid connections

must by all means be observed and maintained in completely legible condition.

### 2.2

#### Personnel qualification and personnel training

The personnel for operation, maintenance, inspection and mounting must have the corresponding qualification for these operations. Range of liability, competence and the supervision of the personnel must be exactly controlled by the customer. If the personnel do not have the required knowledge, same must be trained and instructed. If required, this may be effected by the manufacturer/ supplier on behalf of the machine customer. In addition, it must be ensured by the customer that the contents of the operating instructions are fully understood by the personnel.

### 2.3

#### Dangers in case of non-compliance with the safety hints

Non-compliance with the safety hints may result in danger not only to persons, but also to environment and machine. Non-compliance with the safety hints may lead to the loss of any claims for damages. In detail, non-compliance may, **for example**, entail the following dangers:

- failure of important functions of the machine/plant
- failure of specified methods for maintenance and servicing
- danger to persons by electrical, mechanical and chemical influences
- danger to the environment by leakage of dangerous substances

### 2.4 Responsible working

The safety hints mentioned in these operating instructions, the current national rules for the prevention of accidents as well as any internal working, operating and safety regulations of the owner must be observed.

### 2.5 Safety hints for the user/operator

- If hot or cold machine parts lead to dangers, these parts must be protected against accidental contact at the site.
- Protection against accidental contact for moving parts must not be removed when the machine is in operation.
- When operating pump aggregates in a dust-laden environment (e.g. milling, chipboard manufacture, bakeries), the surface of the pumps and motors must be cleaned at regular intervals, depending on local conditions, in order to maintain the cooling effect and eliminate the possibility of spontaneous combustion. Please also see explosion protection regulations (BGR 104)
- Leakages (e.g. of the shaft seal) of dangerous materials to be handled (e.g. explosive, toxic, hot) must be discharged so as not to result in danger to persons and the environment. Legal stipulations are to be observed.
- Dangers by electrical energy are to be excluded (for details with regard hereto, please refer e.g. to the regulations of the VDE and the local energy supply associations).

### 2.6 Safety hints for maintenance, inspection and mounting operations

The customer shall see to it that all maintenance, inspection and mounting operations are performed by authorized and qualified expert personnel who have sufficiently informed themselves by thoroughly studying the operating instructions.

Basically, operations at the machine must be performed during standstill only. The mode of operation for stopping the machine described in the operating instructions must by all means be observed.

Pumps or aggregates handling noxious liquids must be decontaminated.

Immediately upon completion of the operations, all safety and protective devices must be mounted and made operational again.

Prior to restarting, the items listed in Chapter "Preparation for start-up" are to be observed.

### 2.7 Independent reconstruction and spare parts production

Reconstruction of or changes to the machine are only admissible after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer serve safety purposes. The use of other parts may cancel the liability for the consequences resulting therefrom.

### 2.8 Inadmissible modes of operation

The operating safety of the machine supplied is only ensured with due application according to Chapter 1 "General" of the operating instructions. The limit values given in the data sheet must by no means be exceeded.

### 2.9 Operation in potentially explosive environments

 Observe the instructions of the ATEX additional operating manual when operating the pump respectively aggregate in potentially explosive environments.

### 3. Transport and intermediate storage

#### 3.1 Packing

The symbols applied to the packing must be observed.  
During transportation and storage, suction and outlet side and auxiliary connections of the pump must be closed with plugs. During installation of the pump aggregate, the plugs must be removed.

#### 3.2 Transportation

The pump or pump aggregate is to be safely transported to the place of installation, if required by means of lifting gear.

 Observe the general regulations on the lifting of loads. Cranes and stopper ropes may not be attached to the suspension brackets of motors.

When transporting the pump by crane, place the stopper ropes safely around the suction casing. With complete pump aggregates, an additional rope must be slung around the drive engine.

The stopper ropes have to be slung around the pump respectively pump aggregate so that these are exactly balanced when lifted.

**ATTENTION** During transportation toppling of the aggregate due to nose-heaviness has to be ruled out.

#### Transport damages

**ATTENTION** Check the pump for damage on receipt. Any damage detected must be notified immediately.

#### 3.3 Preservation and storage of eccentric screw pumps

See our document VM 2102/ ...

### 4. Description

#### 4.1 Structural design

Self-priming, one or two-stage eccentric screw pump. The conveyor elements are rotor and stator. The input torque is transmitted via the drive shaft and the joint shaft to the rotor.

Pressure casing, stator and suction casing are held together by external casing connection screws (clamp bolts).

The stuffing box or mechanical seal housing is located between the suction casing and the bearing bracket.

#### 4.1.1 Bearing and lubrication

Joint shaft with liquid-proof clad bolt joints. Greasing with joint oil.

Bearing of the drive shaft/plug-in shaft in the reinforced bearings of the drive.

#### 4.1.2 Shaft seal

Through uncooled or cooled stuffing box or cooled or uncooled, maintenance-free, non-released, singular or double-action mechanical seal.

#### 4.1.3 Dimensions/branch position/flanges

The dimensions of the pump respectively the pump aggregate, the branch position and flange dimensions are to be taken from the tables of dimensions.

#### 4.2 Sound pressure level

The sound pressure level of the pump is below 70 dB (A).

#### 4.3 Mode of operation

Self-priming, rotating positive-displacement pump. Conveyor elements are the rotating helical rotor and the static stator. Both touch in transection with series AEB.E, AEB.N, AEB.H in two points each and with series AEB1L, AEDB.E, AEDB.N in three points each, which form two sealing lines seen across the length of the conveyor elements with series AEB.E, AEB.N, AEB.H and three sealing lines with series AEB1L, AEDB.E, AEDB.N. The content of the sealed chambers that form with the rotation of the rotor is shifted axially and totally continuously from the suction to the outlet side of the pump. No turbulence occurs despite the rotation of the rotor. The unvarying chamber volume rules out crushing forces and thus guarantees very gentle, low-pulsation conveyance.

#### 4.4 Aggregate construction

##### 4.4.1 Drive

By means of non-explosion-protected or explosion-protected electric motors, geared motors or variable speed gear motors.

##### 4.4.2 Base plate

Horizontal pumps are generally mounted on a joint base plate with the drive. The base plates are made of steel.

#### 5. Installation/Mounting

##### 5.1 Installation

The pumps can be installed horizontally or vertically with bearing upwards.

##### 5.2 Foundation

The foundation design depends on the size of the pump and/or the pump aggregate and the local installation conditions.

For exact data on the pump and aggregate dimensions, please refer to our tables of dimensions.

The foundation may be designed as concrete foundation or load-carrying foundation frame, for example of the steel type.

All foundation designs are subject to the following: The foundation must be designed so that it can take the weight of the pump aggregate on the entire surface.

##### 5.2.1 Arrangement of a steel foundation plate

A steel foundation plate must be designed in such a way that the base plate makes full contact and can be secured with bolts or by welding.

**ATTENTION** If only some of the areas of the base plate are supported, the plate sags in

the center or the pump aggregate can be twisted. This influences the alignment of the pump aggregate can cause high noise emission and damage.

##### 5.2.2 Arrangement of concrete foundations

Concrete foundations must be horizontal, straight and clean and must fully absorb the load exerted on the foundations. Concrete foundations must be designed in such a way that the base plate makes full contact and can be secured with suitable bolts (see our aggregate drawing).

**ATTENTION** If only some of the areas of the base plate are supported, the plate sags in the center or the pump aggregate can be twisted. This influences the alignment of the pump aggregate and can cause high noise emission and damage.

##### 5.2.3 Fastening of the pump aggregate on the concrete foundations

After aligning the pump aggregate on the concrete foundations the securing bolts are diagonally and evenly tightened.

##### 5.2.4 Arrangement of concrete foundations for poured base plates

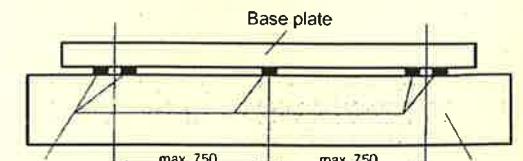
When shuttering the concrete foundations it must be observed that a gap for aligning the pump aggregate and applying the mortar compound remains between the top of the finished foundation block and the bottom of the base plate.

The set concrete foundations must be straight, even and clean. Any traces of oil must be removed from the foundations. The recessed anchor holes for the foundation bolts must be cleaned and removed and cleaned out with air. Prior to the installation of the pump aggregate the surface of the concrete foundations must be roughened and cleaned to ensure a good bonding between the foundation block and the mortar compound.

##### 5.2.5 Alignment of the pump aggregate

The pump aggregate must be aligned to the defined height and system dimensions. This is done by means of suitable steel inlays that are placed directly next to each fixing screw. The total height of the steel inlays is defined by the fixed system dimensions of the plant. The steel inlays and the base plate must lie flush.

If the attachment holes are more than 750 mm apart, we recommend additional steel inlays at a distance of 750 mm each.



Alignment with steel shims

##### 5.2.6 Pouring of base plate

After alignment on the concrete foundations, a low-shrinkage mortar compound must be poured over the entire length of the base plate, covering also the anchor holes with the connected foundation bolts.

Once the mortar compound has set on the base plate and in the anchor holes, the foundation bolts must be diagonally and evenly tightened.

**Note:** When pouring or adding the mortar compound it must be observed that the base plate makes full contact. Tap the plate to ensure that no cavities have formed underneath.

### 5.3 Base plate

The base-plate has to be attached tension-free to the base.

### 5.4 Space requirements for maintenance and servicing

**ATTENTION** The pump must be accessible from all sides in order to be able to perform the required sight inspections.

There must be enough room for maintenance and service work, especially for the exchange of the conveyor elements. The stator and rotor dismantling dimensions are listed in the pump respectively pump aggregate dimension sheet. Also make sure that all pipelines can be attached/detached without obstacles.

### 5.5 Mounting the pipelines

#### 5.5.1 Nominal widths

The nominal widths of the suction and pressure pipes should be designed according to the nominal widths of the pipe connections. Gross deviations, especially on the suction side, require consultation with the factory.

#### 5.5.2 Supports and flange connections

The pipelines must be connected tension-free to the pump via the flange connectors. They have to be supported near the pipe and should be easy to screw on in order to avoid strains. After loosening the screws, the flanges may neither be slanted nor springy and also not rest on each other under pressure. Possible thermal stress on the pipelines has to be kept away from the pump by means of suitable measures, e.g. the installation of compensators.

#### 5.5.3 Cleaning the pipelines prior to attachment

The pipelines, sliders and valves on the suction side must be rinsed respectively cleaned under all circumstances before mounting the pump.

Leftover assembly parts like screws, nuts, welding beads, pieces of steel, etc. destroy the inside parts of the pump. Any warranty claim is void when damages are caused by such leftover materials. Flange seals may not protrude to the inside. Blind flanges, stoppers protective foils and/or lacquers on flanges and sealing strips have to be completely removed.

### 5.6 Mounting of auxiliary pipelines for additional facilities

All auxiliary pipelines for supplying the shaft seal and the possible double-jacket casing for heating and cooling the pump have to be connected tension-free and sealing.

The pipes for the quenching liquid with single-acting mechanical seals with quench (design: G0Q) and the sealing liquid with double-action mechanical seal (design: G0D) should be installed with a large flowtrough profile. The quenching respectively sealing liquid discharge takes place at the highest connection of the mechanical seal housing.

The flow direction of the flushing, sealing and quenching liquid is indicated with arrows in the section drawings.

In order to ensure self-deairing, the pipes must be installed continuously rising, short and favorable for the flow.

The formation of air pockets and gas bubbles has to be prevented, install deairing connections if required. The heating/cooling liquid discharge must be connected to the highest connection of the possible double-jacket casing.

### 5.7 Safety and control devices

#### 5.7.1 Manometer and vacuometer

A manometer and vacuometer have to be connected to the pressure and suction pipe.

#### 5.7.2 Safety devices in the discharge pipeline

If there is a shut-off device in the pressure pipe or if there is the possibility that the pressure pipe may become clogged, a safety device must be provided, e.g. a bypass with integrated pressure relief valve, space membrane, motor protection switch, etc.



**Eccentric screw pumps are positive-displacement pumps and can theoretically generate an infinitely high pressure.**

**In case of a closed pressure pipe, e.g. because of clogging or accidental closing of the valve, the pressure generated by the pump may reach a multiple of the admissible plant pressure. This may cause pipes to burst, which must be especially prevented when handling dangerous conveyor substances. Therefore, the corresponding safety equipment (e.g. pressure switches) also has be installed in the plant.**

### 5.8 Electrical connections



Only an expert may attach the power cables of the coupled drive engine in accordance with the circuit diagram of the engine manufacturer. The valid guidelines of the Electrician's Association and the public power companies have to be observed.

Danger through electric energy must be ruled out.

## 6. Start-up/Shutdown

### 6.1 Preparations for start-up

#### 6.1.1 Filling the pump with liquid

**ATTENTION** The pump may not run dry! For initial start-up and after longer periods of standstill, the pump must be filled with liquid.

Even a few rotations without liquid may damage the stator. For that reason, the suction casing must be filled with water or conveyor liquid prior to start-up for lubricating the stator and rotor. After long periods of standstill, meaning when it must be assumed that the residual liquid in the pump has evaporated or after repairs, you have to repeat the filling process.

After filling, the pump works in self-priming mode. Deairing is not necessary, as the pump can convey a liquid-gas mixture.

#### 6.1.2 Turning on the additional facilities for shaft seals (if provided)

If the pumps are charged with a flushing/sealing or quenching liquid, the available shut-off slides must be opened before putting the pump into operation for the first time and set to the following pressure values:

- **Supply of the stuffing box with flushing or sealing liquid** (Design P02, P03, and P04).

**Note:** Stuffing box with flushing or sealing chamber ring require a flushing respectively sealing liquid for maintaining the function.

The required flushing respectively sealing liquid pressure for pumps with stuffing box is

P02 = 0.1 to 0.5 bar

(above inner pressure of the suction casing)

P03 = 0.5 bar

(above inner pressure of the suction casing)

P04 = 0 to 0.5 bar

(Flushing and sealing liquid see Chapter 6.1.3.).

- **Supply of single-acting, non-relieving mechanical seal with choke ring** (Design G0S and G0T).

**Note:** These mechanical seals require a flushing liquid in order to maintain their function, which carries off the emerging friction heat and limits the penetration of the conveyor liquid into the sealing chamber.

The required flushing liquid pressure is 0.1 to 0.5 bar above the inner pressure of the suction casing. The required flushing liquid flow for carrying off the dissipation of the mechanical seal is listed in the table in Chapter 7.1.2.4 (flushing liquid see Chapter 6.1.3).

- **Supply of double-action, non-relieving mechanical seal** (Design G0D).

**Note:** These mechanical seals require a sealing liquid in order to maintain their function, which carries off the emerging friction heat and limits the penetration of the conveyor liquid into the sealing gap.

**ATTENTION** The circulation of the sealing liquid must be secured prior to each start-up.

The sealing liquid pressure must be approx. 1.5 to 2 bar above the pressure on the inside of the suction casing. The flowthrough quantity must be regulated in such a way that the exit temperature does not exceed approx. 60°C and is at least 30 K below the boiling temperature at operating pressure. The temperature difference between input and output may amount to at most 15 K. (Sealing liquid see Chapter 6.1.3).

- **Supply of the single-acting mechanical seal with quench** (Design G0Q).

The space between the mechanical seal counter-ring and the shaft seal ring must be charged with quenching liquid. The max. admissible pressure difference between the quenching liquid pressure and the pressure in the suction casing is  $p = 0,5$  bar. The max. quenching liquid pressure is 3 bar. (Quenching liquid see Chapter 6.1.3).

**6.1.3 Quality and property of flushing/sealing and quenching liquid**

**ATTENTION** Any liquid may be used as sealing/flushing or quenching liquid under consideration of the corrosion resistance of all touching parts and the compatibility with the medium to be sealed. The liquid must be free from solid substances, may not be prone to deposits, should have a high boiling point as well as a good heat conductivity and low viscosity. Clean and soft water fulfills these requirements to a high degree.

**6.1.4 Activating the additional facility for heating or cooling the stuffing box casing and/or the suction casing (double-jacket casing)**

If the pumps are equipped with these additional features, all shut-off devices for heating or cooling systems must be opened. The following pressure and temperature limits must be observed.

- **Supply of the cooled or heated stuffing box and/or suction casing (double-jacket casing) with suitable liquid media**



**Only liquid media** may be used as heating or cooling liquid under consideration of the corrosion resistance of all touching parts.

The maximum heating or cooling liquid pressure is 6 bar. The maximum heating temperature may not exceed 150°C and the cooling temperature may not be below -40°C.

**Note:** The design temperature is listed in the order data sheet.

**6.1.5 Breaking away of the pump**

When initially starting the pump or after longer periods of standstill, you have to make sure that the drive engine turns the pump effortlessly. Should this not be easily possible due to the high adhesion between the rotor and the stator in new state, use suitable tools at the plug-in shaft behind the shaft seal to free the pump.

**ATTENTION** The plug-in shaft may not be damaged here.

**6.1.6 Control of the sense of rotation**

The normal rotation direction of the pump seen from the drive against the drive shaft is to the left. Here the suction connection is located on the side of the shaft seal so that the shaft seal is relieved. In special cases, e.g. when sucking from a vacuum or conveying media that do not tolerate gas cavities, the pump rotates to the right. This switches the suction and the outlet side around.

**ATTENTION** The rotation direction of the pump must correspond to the rotation direction arrow "n" on the pump's type plate. A wrong rotation direction may cause damages to the pump. In order to control the rotation direction, briefly press the on/off switch of the engine.

**6.2 Start-up**

**6.2.1 Start-up**

Prior to starting the pump, all shut-off devices on the suction and outlet side have to be opened.

**6.2.2 Drive**

Turn the motor on.

**ATTENTION** Observe the product-specific peculiarities of the drive. See operating instructions by the drive manufacturer.

### 6.2.3 Checking the delivery values

Once the drive has reached its operating speed, check the intake pressure and the pump end pressure via the vacuometer and the manometer.

The motor may not be overloaded. The power intake can be monitored with an ammeter. Check the temperature and the viscosity of the conveyor liquid in this context. The resulting values must be compared with the order data sheet respectively acceptance protocol.

### 6.2.4 Protection against running dry

When no more conveyor media is sucked in by the pump, the thermal energy emerging in the conveyor elements of the eccentric screw pump through dry friction and milling work is no longer carried off in a sufficient quantity, which thermally destroys the stator elastomer after a short time already. There are different protectors against running dry for protecting the conveyor elements that are adapted to the respective operating conditions (consultation with the factory).

## 6.3 Shutdown

### 6.3.1 Shutoff

Turn the motor off.

### 6.3.2 Measures in case of longer periods of standstill

If longer operational breaks are intended and if there is danger of frost, the pump must be emptied. To do so, unscrew the screw plug (502) from the suction casing (505) and afterwards conserve the pump (see Chapter 3.3).

## 7. Maintenance/Repair

### 7.1 Maintenance

- For service and maintenance work, observe the details in Chapter 2 "Safety".
- Regular monitoring and maintenance work on the pump and the drive extends the service life.

#### 7.1.1 General monitoring

1. The pump may not run dry.
2. The drive engine may not be overloaded.
3. Check the suction and pressure pipes for tightness.
4. An installed stuffing box must drip slightly during operation. An installed mechanical seal may not have any strong leaks.
5. Observe pressure and temperature monitoring devices and compare them with the order data sheet respectively acceptance protocol.
6. Additional installations like flushing, sealing and quenching of the shaft seal must be monitored if provided.
7. Additional equipment for heating or cooling the stuffing box casing and/or suction casing must be monitored, if provided.

#### 7.1.2 Maintenance of components

##### 7.1.2.1 Joints of the joint shaft

The joints of the joint shaft are lubricated with ALLWEILER special joint oil type B or oil ET1510 ISO 460 by Tribol Lubricants GmbH, Mönchengladbach, if the pumps are deployed in the food industry, with ALLWEILER special joint oil type BL or oil 1810/460 by Tribol Lubricants GmbH, Mönchengladbach.

**ATTENTION** Other lubricants were not tested by us and can therefore not be recommended!

The joints are lubricated for life. We do however recommend checking the joint sleeve for tightness when opening the pump for other reasons and exchanging the joint oil after 8,000 operating hours. The table in Chapter 7.1.2.6 shows the allocation of the pump size to the oil quantity in cubic centimeters. For changing the joint oil, refer to the disassembly and assembly instructions.

#### 7.1.2.2 Shaft sealing

Shaft sealing either takes place via a stuffing box or a mechanical seal.

##### • Stuffing box

Possibly increased leaks on the stuffing box during the first operating hours normally decrease on their own during the warm-up time.

If necessary, slightly tighten the hexagon nuts (202) on the gland (203).

Please observe that there has to be a slight leak on the stuffing box. This dissipates the friction heat that forms on the sealing surface.

If the leaking losses increase disproportionately and if this cannot be reduced by slightly tightening the hexagon nuts (202) several times, the packing rings have lost their shape elasticity and must be replaced.

##### - Dismounting the old packing rings and cleaning the stuffing box casing

After relieving the pump from pressure and removing the stuffing box casing, you can take out the old packing rings. Use a packing puller with elastic shaft. Afterwards, carefully clean the stuffing box space and the drive shaft in the area of the packing rings. Used-up drive shafts respectively shaft protection casings must be renewed (see disassembly and assembly instructions).

##### - Mounting the packing rings

**ATTENTION** As a rule, you may only install packing rings that correspond to the required operating conditions of the pump.

The dimensions and required number of pre-pressed packing rings and ring cuts respectively cut lengths are listed in the table in Chapter 7.1.2.4.

**With cuts** we recommend the straight vertical cut to the shaft. In order to achieve a gap-free, parallel position of the cutting ends when closing the packing ring, the cutting angle should be approx. 20° to both cut ends (see figure 1).

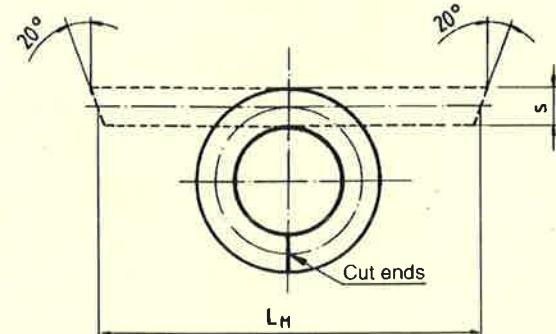


Figure 1: Cutting packing rings

**Pre-pressed packing rings or ring cuts** have to be carefully turned open axial and radial so that they can just about be slid across the shaft. Bending the rings may lead to damages.

When mounting in the packing space, carefully re-bend the packing rings to ring shape. The cutting joints have to be shifted by 90° here. Each ring has to be slid into the stuffing box space individually with the cutting ends facing forward by means of the gland. The sealing chamber ring or flushing ring have to be installed sequentially.

**ATTENTION** You may never use pointed objects for this work. Danger of damaging the shaft and deforming the packing material!

- **Start-up the stuffing box after re-packaging**

The stuffing box may only be tightened slightly prior to start-up. When starting the pump, 50 to 200 drops per minute are an admissible leakage quantity.

During the warm-up process of approx. 30 minutes, adjust a minimum leakage of 2 to 20 drops per minute by evenly tightening the gland (203) step by step via the hexagon nuts (202).

**ATTENTION** The stuffing box temperature may not rise abnormally during this process. Approx. 20° to 60°C above the conveyor liquid temperature are admissible. In case of a rapid rise in temperature, the gland must be loosened immediately and the warm-up process repeated. The leakage can be carried off via the threaded boring located in the strip tank in the bearing socket.

Rule out damages to persons and the environment through leakage of dangerous substances!



• **Mechanical seal**

Non-relieved mechanical seals in all material pairings and designs are applied. The mechanical seal is maintenance-free.

In case of heavy leaks due to wear and tear, you have to exchange the mechanical seal (see disassembly and assembly instructions).

**ATTENTION** As the running dry of the mechanical seals must be avoided, the pump may only be operated in filled state and, if provided, with activated additional installations (see Chapter 6.1.2).

**7.1.2.3 Drive engines and (variable speed gear) drive**

See the operating and maintenance instructions by the manufacturers.

**7.1.2.4 Packing ring dimensions (for Chapter 7.1.2.2), lubricant quantities for joints (for Chapter 7.1.2.1) and flushing liquid flows (for Chapter 6.1.2)**

	Pump size							
Pump series	AEB1E	50	100	200	380 550	750 1000	1450	2700
	AEDB1E	75	150	300	560	1200	2300	4250
	AEB2E	50	100	200	380	750	1450	2700
	AEB1N	25	50	100	200	380	750	1450
	→ AEB2N	25	50	100	200	380	750	1450 ✓
	AEDB2N	38	75	150	300	560	1200	2300
	AEB1L	51 101	201	381	551 751	1001 1451	2701	5001
	AEB H	12	25	50	-	-	-	-
	Number of packing rings for design P01①	6	6	6	6	6	6	6
	Dimensions of packing rings for cut rings	Ø 37 / 25 x 6	Ø 42 / 30 x 6	Ø 51 / 35 x 8	Ø 59 / 43 x 8	Ø 73 / 53 x 10	Ø 80 / 60 x 10	Ø 99 / 75 x 12
	Dimensions of packing rings for cut rings L <sub>M</sub> x S	104,2 x 6	121 x 6	144,5 x 8	171,4 x 8	211,8 x 10	235,3 x 10	292,5 x 12
	Oil quantity in cm <sup>3</sup> per joint	10	18	37	52	87	169	290
	Flushing liquid flow water l/min	0,05	0,07	0,09	0,11	0,11	0,15	0,21

① With shaft seal designs P02, P03 and P04, the quantity reduces by 1.

## 7.2 Repair (dismounting and mounting instructions)

### General

Qualified customer service fitters are available for assembly and repair work upon request.



Prior to repairs performed by your own personnel or our expert fitters, make sure that the pump is completely empty and clean.

This especially applies to pumps, which are sent to our factory or one of our authorized repair shops for repair.

We will not accept repair orders for pumps filled with conveyor media for reasons of protecting our employees and the environment. Otherwise we will charge the customer/operator the costs for environmentally-conform disposal.

In case of pumps operated with dangerous substances ① and/or conveyor media that are dangerous to the environment, the customer/operator has to inform his own respectively our fitters on-site in case of repairs or our factory respectively authorized workshop in case of returning the pump about this circumstance. In these cases, you need to submit a conveyor media certificate, e.g. in the shape of a DIN safety data sheet together with your request for a fitter.

### ① Dangerous substances are:

- toxic substances
- substances detrimental to health
- caustic substances
- irritating substances
- explosive materials
- fire-promoting, highly, easily and normally inflammable materials
- carcinogenic substances
- embryo-damaging substances
- substances that damage the genetic material
- substances which are dangerous for human beings in any other way

With all work on-site, the owner's own respectively our fitters have to be informed about dangers that may arise in connection with repairs.

These instructions contain the most important disassembly and assembly work. The assembly steps described in the individual chapters have to be observed under all circumstances.

### 7.2.1 Dismounting of the eccentric screw pump

The following work steps have to be performed prior to disassembly:

- Detach the power supply cables to the motor. It must not be possible to turn the motor on.
  - All shut-off devices in the feed and pressure pipes have to be closed.
  - Drain the conveyor liquid from the suction casing. Unscrew the screw plug for that purpose (502).
- Note:** Use a receiver.
- Deinstall all feed and pressure pipes as well as all auxiliary pipelines.
  - Loosen the screws on the pump feet and take them off.

### 7.2.1.1 Dismounting the stator

- Remove the hexagon nuts (609) and washers (610) from the clamp bolts (611).
  - Pull off the pressure casing (504).
  - Remove the clamp bolts (611) and supports (612), if provided.
  - Pull the stator (402) off the rotor (401).
- Note:** In case of difficulties with dismounting, turn the stator (402) with pliers at the same time. To do so, arrest the plug-in shaft (125).
- In case of stators made of plastic or metal, take off the stator seals (403) and (404).

### 7.2.1.2 Dismounting the rotor and rotor-side joint

Dismounting the rotor and the rotor-side joint takes place after dismounting the stator (402). See Chapter 7.2.1.1.

- Remove the hexagon nuts (607) and serrated lock washers (608) as well as the hexagon screws (606).
- Pull the suction casing (505) across the rotor (401). Make sure that the finely crafted rotor is not damaged.
- Take off the gasket for suction casing (501).
- Saw open the lock on the joint clamp (306) with a metal saw and press it out on both sides with a screwdriver.
- Take the joint clamp (306) off the joint sleeve (308) (see figure 2).

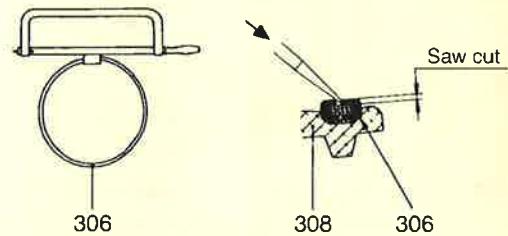


Figure 2: Removing the joint clamp

- !
- Lift the joint sleeve (308) with a screwdriver and pull it off axially towards the joint shaft (307).
  - Catch the oil filling in a container.
  - Drive the joint sleeve (304) across the collar of the joint shaft (307). Do not deflect the joint shaft (307) (see figure 3).

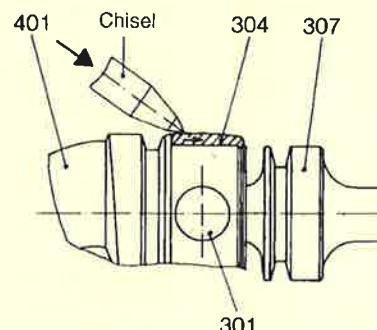


Figure 3: Dismounting the joint sleeve

- Push out the joint bolt (301).
- With a brass driver, drive out the two sleeves for the joint bolts halfway (303). Slant the joint shaft (307) for that purpose (see figure 4).

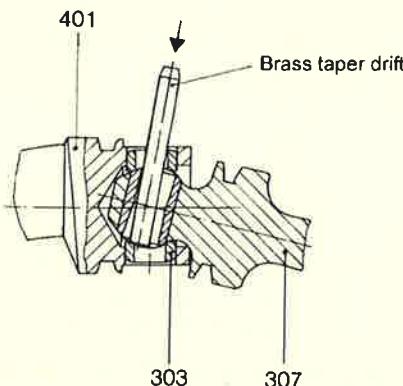


Figure 4: Dismounting the sleeves for joint bolts

- Pull the rotor (401) off the joint shaft (307).
- Press out the joint bush (302) from the joint shaft (307) (n/a with AEB1L 51, AEB1L 101, AEB1E 50, AEB2E 50, AEB1N 25, AEB2N 25, AEDB1E 75, AEDB2N 38, AEB4H 12).
- Drive out the sleeve for the joint bolt (303) all the way out of the rotor (401) with the brass spike.

#### 7.2.1.3 Dismounting the joint shaft and drive side joint

Disassembly of the joint shaft and the joint of the drive side takes place after dismounting the stator (402) and the rotor (401). See Chapter 7.2.1.1 and 7.2.1.2.

- Dismount the joint on the drive side as described in Chapter 7.2.1.2.
- Pull the joint shaft (307) off the plug-in shaft (125).
- Press the joint bush (302) out of the joint shaft (307).
- Completely drive the sleeve for the joint bolt (303) out of the plug-in shaft (125) with the brass spike.

#### 7.2.1.4 Dismounting the shaft seal and plug-in shaft

**Note:** In case of pumps with shaft sealing by means of stuffing box, you can change the packing rings as described in Chapter 7.1.2.2 without dismounting the plug-in shaft. Dismounting the plug-in shaft is required when the pump is equipped with a mechanical seal. In case of damages to the plug-in shaft in the area of the shaft seal, the pump must also be dismounted as described in the following.

- Dismount the stator (402) (see Chapter 7.2.1.1).
- Remove the hexagon nuts (607) and serrated lock washers (608) as well as the hexagon screws (606).
- Pull the suction casing (505) across the rotor (401). Make sure that the finely crafted rotor is not damaged.
- Take off the gasket for suction casing (501).
- Pull the thrower (123) off the clamp set (123).
- Loosen the clamp bolts of the clamp set (123) evenly and **in sequence**.
- To do so, turn the plug-in shaft (125), if required. Should the outer ring of the clamp set not come off the inner ring on its own, you can unscrew some of the clamp bolts and screw them into the neighboring removing thread. Then untightening is effortless.



Never pull out the clamp bolts all the way (danger of accidents).

- Pull the plug-in shaft (125) with all parts of the shaft seal and the clamp set (123) out of the lantern socket.
- Pull the clamp set (123) off the plug-in shaft (125).

- **Dismounting the stuffing box**

- Remove the self-locking hexagon nut (202) and take off the gland halves (203).
- Pull the stuffing box casing (204) off the drive shaft (118).
- Take off the stuffing box packing (207) with design P02 including the flushing ring (208) and with designs P03 and P04 including the sealing chamber ring (209) from the stuffing box casing (204).

- For the design with shaft protection sleeve, pull off the shaft protection sleeve (206) and the O sealing ring (115) from the drive shaft (118).

- **Dismounting the single-acting mechanical seal**

- Pull off the mechanical seal housing (214) with the counter-ring of the mechanical seal (219) (atmosphere side) off the plug-in shaft (125).

**Note:** Make sure that you pull off the casing with the mechanical seal counter-ring concentric and that it doesn't get jammed in order to prevent damage to the counter-ring.

- Press the mechanical seal counter-ring and the O-ring out of the mechanical seal housing (214). Exert pressure evenly.
- Drive out the retaining pin (220).
- Loosen the grub screws in the rotating part of the mechanical seal if provided (219) and pull the mechanical seal off the drive shaft (118).

**ATTENTION** Prior to loosening the grub screws, mark respectively measure the position of the mechanical seal on the shaft protection sleeve or the drive shaft. Do not slide the O-ring across the pressure spot of the screw!

- **Dismounting the mechanical seal, single-acting with throttle ring**

- Remove the hexagon screws (245).
- Pull the mechanical seal housing (214) with the counter-ring of the mechanical seal (atmosphere side) (219) off the plug-in shaft (125).

**Note:** Make sure that you pull off the casing with the mechanical seal counter-ring concentric and that it doesn't get jammed in order to prevent damage to the counter-ring.

- Pull off the O-ring (218).
- Press the mechanical seal counter-ring and the O-ring out of the mechanical seal housing (214). Exert pressure evenly.
- Drive out the retaining pin (220).
- Loosen the grub screws in the rotating part of the mechanical seal (219) and pull the mechanical seal off the plug-in shaft (125).

**ATTENTION** Prior to loosening the grub screws, mark respectively measure the position of the mechanical seal on the shaft protection sleeve or the drive shaft. Do not slide the O-ring across the pressure spot of the screw!

- Pull the mechanical seal cover (215) with the throttle ring (234) off the plug-in shaft (125).
- Open the throttle ring (234) and remove it with the O-ring (235).
- Pull the retaining pins (236) out of the mechanical seal cover (215).

**• Dismounting the mechanical seal, single-acting with quench**

- Pull the mechanical seal housing (214) with the counter-ring of the mechanical seal (atmosphere side) (219) off the plug-in shaft (125).

**Note:** Make sure that you pull off the casing with the mechanical seal counter-ring concentric and that it doesn't get jammed in order to prevent damage to the counter-ring.

- Press the mechanical seal counter-ring and the O-ring out of the mechanical seal housing (214). Exert pressure evenly.
- Drive out the retaining pin (220).
- Loosen the grub screws in the rotating part of the mechanical seal if provided (219) and pull the mechanical seal off the plug-in shaft (125).

**ATTENTION** Prior to loosening the grub screws, mark respectively measure the position of the mechanical seal on the shaft protection sleeve or the drive shaft. Do not slide the O-ring across the pressure spot of the screw!

- Press the shaft seal ring (232) out.

**• Dismounting the mechanical seal, double-action**

- Remove the hexagon screws (245).
- Pull the mechanical seal housing (214) with the counter-ring of the mechanical seal (atmosphere side) (219) off the plug-in shaft (125).

**Note:** Make sure that you pull off the casing with the mechanical seal counter-ring concentric and that it doesn't get jammed in order to prevent damage to the counter-ring.

- Pull off the O-ring (218).
- Loosen the grub screws in the rotating part of the mechanical seal (219) and pull the mechanical seal off the plug-in shaft (125).

**ATTENTION** Prior to loosening the grub screws, mark respectively measure the position of the mechanical seal on the shaft protection sleeve or the drive shaft. Do not slide the O-ring across the pressure spot of the screw!

- Pull the mechanical seal cover (215) with the counter-ring of the mechanical seal (product side) (219) from the drive shaft (118).

**Note:** Make sure that you pull off the casing with the mechanical seal counter-ring concentric and that it doesn't get jammed in order to prevent damage to the counter-ring.

- Press the mechanical seal counter-rings and O-rings out of the mechanical seal housing (214)

and the mechanical seal cover (215). Exert pressure evenly.

- Remove the retaining pins (220) and (236).

**7.2.2 Assembly of the eccentric screw pump**

**General**

Assembly of the individual pump components after careful cleaning takes place in reverse direction.

**7.2.2.1 Mounting the shaft seal and plug-in shaft**

**• Mounting the stuffing box**

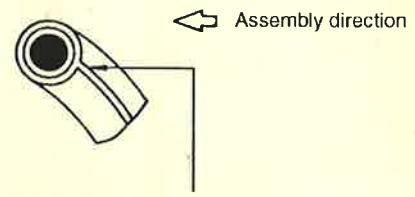
- Slide the stuffing box casing (204) onto the plug-in shaft (125).
- Install the stuffing box (207) with design P02 including flushing ring (208) and with designs P03 and P04 including sealing chamber ring (209) into the stuffing box casing (204). Also see Chapter 7.1.2.2 "Mounting new packing rings".

**• Installation of the mechanical seal, general**

Mechanical seals are high-quality precision parts. The assembly instructions of the mechanical seal manufacturers must be observed. During installation, gentle treatment and utmost cleanliness are prerequisites for trouble-free functioning. To ease assembly, you may lubricate the surfaces across which the O-rings glide with lubricants like for example silicon oil, polydiol or soft soap.

**ATTENTION** Do not use any normal oil.

**Note:** Make sure that parts that glide on top of each other are always exchanged in pairs. When using double PTFE-coated O-rings, make sure that the seam of the outer coating points away from the assembly direction. Otherwise the coating may open respectively strip off (see figure 5).



Seam of the outer teflon coating

Figure 5: Seam of the outer coating points away from the assembly direction

**• Mounting the single-acting mechanical seal**

- Drive the retaining pin (220) into the mechanical seal housing (214).
- Press the mechanical seal counter-ring (219) with the O-ring into the cleaned mechanical seal housing (214) concentrically.

**Note:** Ensure even distribution of pressure and observe the retaining pin. The retaining pin (220) may not protrude on the inside.

- Slide the rotating part of the mechanical seal (219) onto the plug-in shaft (125).

**Note:** Observe the fitting dimension respectively position of the mechanical seal exactly as marked during disassembly.

- Insert grub screws, if provided, into the rotating part of the mechanical seal (219) with the screw fitting agent Loctite No. 241 or similar and tighten.

- Slide the mechanical seal housing (214) with the mechanical seal counter-ring (219) across the plug-in shaft (125).

**Note:** When sliding the mechanical seal housing onto the drive shaft, make sure that the mechanical seal housing is not jammed in order to avoid damage to the mechanical seal counter-ring.

- **Installation of the mechanical seal, single-acting with throttle ring**

- Press the throttle ring (234) with the O-ring (235) concentrically into the mechanical seal cover (215).

**Note:** Observe even pressure distribution.

- Drive in the retaining pin (236) with a spike into the mechanical seal cover (215). The retaining pin may not protrude on the inside.

- Slide the mechanical seal cover (215) across the plug-in shaft (125).

- The subsequent installation of the mechanical seal takes place as described in Chapter "Installation of the single-acting mechanical seal".

- Pull the O-ring (218) onto the mechanical seal housing (214).

Slide the mechanical seal housing (214) with the mechanical seal counter-ring (219) across the mechanical seal counter-ring (219) across the drive shaft (118) and attach with the hexagon screws (245) on the mechanical seal cover (215).

- **Installation of the mechanical seal, single-acting with quench**

- Installation of the mechanical seal takes place as described in the Chapter "Mounting the single-acting mechanical seal".

- Drive in the retaining pin (220) with sealing agent (251) Loctite No. 640 or similar.

- Press the shaft seal ring (232) into the cleaned mechanical seal housing (214). Do not grease the sealing lip.

**Note:** The sealing lip of the shaft seal must always point towards the side to be sealed (inwards).

Press the ring in with a suitable pressing stamp. Make sure that the pressure force is exerted as close as possible on the outer diameter of the shaft seal ring.

**ATTENTION** In order to widen the sealing lip of the shaft seal ring, the mechanical seal housing (214) with the integrated shaft seal ring (232) must initially be slid onto the plug-in shaft (125) in reverse direction with the shaft seal ring forward.

After widening, pull off the mechanical seal housing (214) off the plug-in shaft (125) and reinsert it quickly with the flange side pointing forward onto the plug-in shaft in the correct position.

- **Mounting the double-action mechanical seal**

- Drive the retaining pin (236) into the mechanical seal cover (215).
- Press the mechanical seal counter-ring (219) with the O-ring concentrically into the mechanical seal cover (215).

**Note:** Observe even pressure distribution and the retaining pin. The retaining pin may not protrude on the inside.

- Slide the mechanical seal cover (215) across the plug-in shaft (125).

- The subsequent installation of the mechanical seal takes place as described in the Chapter "Installation of the single-acting mechanical seal".
- Pull the O-ring (218) onto the mechanical seal housing (214).
- Slide the mechanical seal housing (214) with the mechanical seal counter-ring (219) across the plug-in shaft (125) and attach with the hexagon screws (245) on the mechanical seal cover (215).

- **Mounting the plug-in shaft**

- The clamp sets (123) are delivered ready for installation. Therefore, they should not be dismounted prior to initial tensioning.
- Deinstalled clamp sets (123) do not need to be taken apart and relubricated prior to renewed tensioning.
- Only clean and relubricate the clamp set (123) when it is dirty.
- Use a solid-substance lubricant with a friction value of  $\mu = 0.04$ .

Lubricant	Retail form/ manufacturer
Molykote 321 R (sliding lacquer)	Spray/ Dow Corning
Molykote Spray (powder spray)	Spray/ Dow Corning
Molykote G Rapid	Spray or paste/ Dow Corning
Aemasol MO 19 R	Spray or paste/ A.C. Matthes
Molykombin UMFT 1	Spray/ Klüber Lubric.
Unimoly P 5	Powder/ Klüber Lubric.

- In case of damaged cone surfaces, the clamp set must be replaced.
- Grease the clamp bolt threads and head support with Molykote and screw in the clamp bolts manually until the heads of the clamp bolts come to rest at the inner ring of the clamp set.

**ATTENTION** Do not tighten the clamp bolts before sliding the plug-in shaft (125) onto the drive shaft.

**ATTENTION** Clean and **degrease** the shaft of the drive and the boring of the plug-in shaft (125).

- Slide the thrower (123) onto the plug-in shaft (125).
- Slightly grease the seat of the clamp set (123) on the plug-in shaft (125) and slide the clamp set (123) all the way onto the plug-in shaft (125).
- Slide the plug-in shaft (125) all the way onto the drive shaft.
- Tighten the clamp bolts of the clamp set (123) in sequence. To do so, turn the plug-in shaft if necessary.

**ATTENTION** All clamp bolts have to be tightened until the front surfaces of the outer and inner ring are plane and the screw pick-up increases strongly (see function state in figure 6). The admissible screw pick-ups [Nm] are engraved in the clamp set (123).

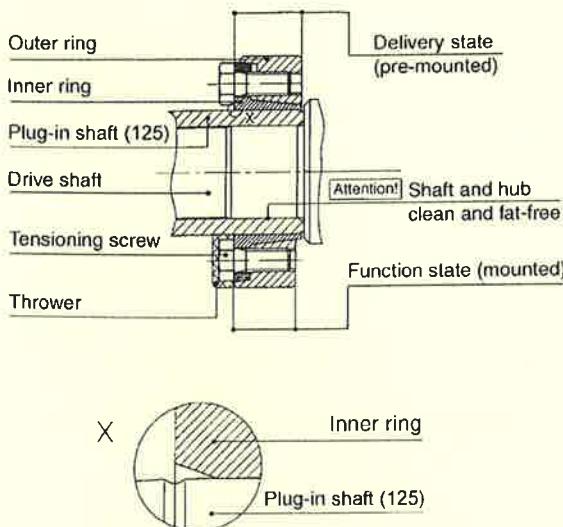


Figure 6: Clamp sets in the inner collar

- Check the right position of the clamp set (123) on the plug-in shaft (125) in accordance with figure 6, detail X.
- Pull the thrower (123) onto the clamp set (123).

#### 7.2.2.2 Mounting the rotor and joints

- Drive the sleeve for the joint bolt (303) halfway into the rotor (401) and the plug-in shaft with the brass spike.
- Press the joint bush (302) into the joint shaft (307) in such a way that the longitudinal axis of the oval boring (marked by 2 notches) aligns with the longitudinal axis of the joint shaft and that the joint sleeve protrudes evenly on both sides of the joint shaft. Not available with AEB1L 51, AEB1L 101, AEB1E 50, AEB2E 50, AEB1N 25, AEB2N 25, AEDB1E 75, AEDB 2N 38, AEB4H 12 (see figure 7).

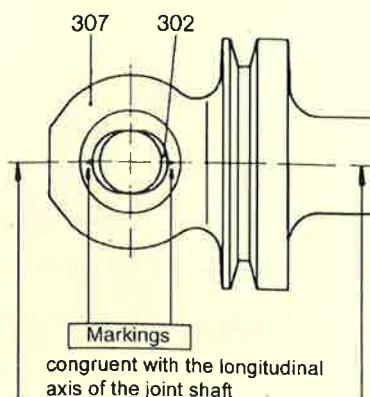


Figure 7: Pressing in the joint sleeve

- Slide the joint clamps (306), the joint collar (308) and the joint sleeve (304) onto the shaft of the joint shaft (307).
- Slide the joint shaft (307) into the head of the rotor (401) respectively the plug-in shaft (125).
- Slide the joint bolt (301) into the joint bush (302) and completely drive in the sleeves for the joint bolts (303).
- Emery the joint sleeve (304) until smooth at the outer diameter if required and pull onto the head of the rotor (401) respectively the plug-in shaft.
- After pulling on the joint sleeve (304), secure this against axial shifting on the head of the rotor (401) respectively the plug-in shaft (125).

**ATTENTION** To do so, drive the end of the joint sleeve (304) with a puncher blow into the groove at the head of the rotor (401) respectively the plug-in shaft (125) (see figure 8).

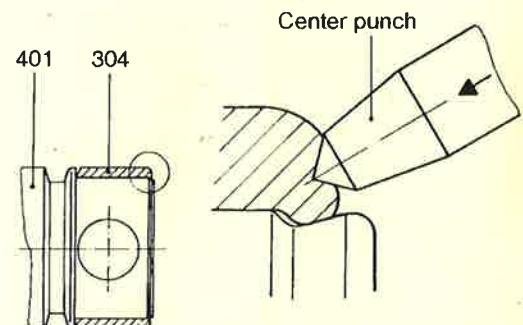


Figure 8: Securing the joint sleeve

- ✓ - Pull on the joint collar (308) with a screwdriver, lift on top with a screwdriver, guide the spray pipe of the oil bottle underneath the collar and fill the joint cavity with ALLWEILER special joint oil type B or oil ET 1510 ISO 460 by Tribol Lubricants GmbH, Mönchengladbach. For application in the food industry with ALLWEILER special joint oil type BL or oil 1810/460 by Tribol Lubricants GmbH, Mönchengladbach. For the filling quantity, see the table in Chapter 7.1.2.4.
- Check, whether the bent loop of the joint clamp (306) is attached to the joint clamp lock. If not, press down with a common pair of flat-nosed pliers (see figure 9).

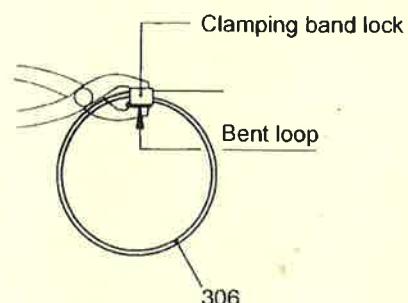


Figure 9: Press down joint clamp loop onto joint clamp lock

- Insert the joint clamps (306) into the circumferential grooves of the joint collar (308) and tighten.

**Note:** Use the following clamping tools for this purpose:

**For pump sizes smaller/equal**

AEB1N 200, AEB2N 200, AEDB2N 300  
 AEB1E 380, AEB2E 380, AEDB1E 560  
 AEB1L 751, AEB.H 100  
 AE.H 100 the clamping tool with the name PoK-It II.

**For pump sizes larger/equal**

AEB1N 380, AEB2N 380, AEDB2N 560  
 AEB1E 750, AEB2E 750, AEDB1E 1200  
 AEB1L 1001, AEB.H 200 the clamping tool with the name Band-It together with the adapter J050.

You can purchase the above named tools from us.

When clamping the joint clamps, proceed as follows:

- **Clamping with clamping tool Band-It and adapter J050.**
- Insert the band end of the joint clamp (306) into the clamping tool with adapter up to the joint clamp lock.
- Hold down the clamp end with the eccentric lever of the clamping tool and tighten the joint clamp (306) by turning the crank (figure 12).

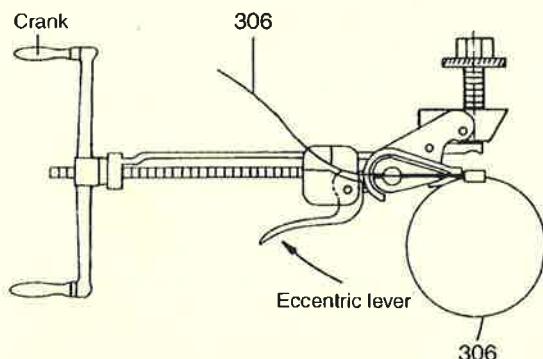


Figure 12: Tighten the joint clamp with the clamping tool Band-It and adapter J050

**Note:** The right tightening of the joint clamps (306) is portrayed in figure 14.

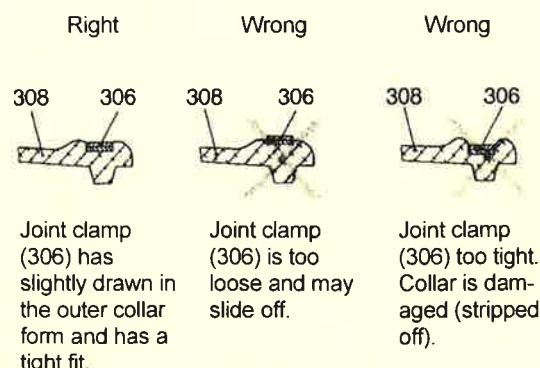


Figure 11: Tightening the joint clamps

- Check that the joint clamp (306) is positioned in the joint collar (308) across the entire circumference in the collar groove.

- Slowly turn the clamping tool by approx. 60° upwards until the shear hook reaches behind the joint clamp lock (see figure 12).
- Tighten the pressure screws by hand until the joint clamp has a tight fit.

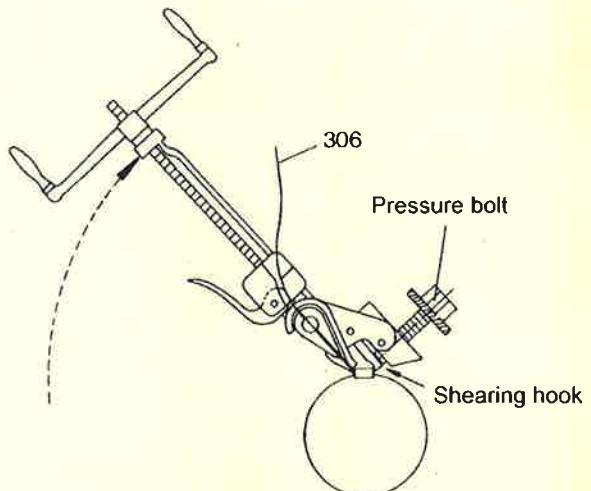


Figure 12: Shearing the joint clamp

- Turn the pressure screw with a spanner or ratchet clockwise until the joint clamp is sheared off.

**ATTENTION** If the joint clamp is lifted up slightly on the sheared off side, adjust this by careful realignment. Do not hammer or hit on the joint clamp lock, otherwise you may damage the collar.

**Note:** Joint clamps made of hastelloy cannot be sheared off with the clamping tool. After canting at the joint clamp lock, shear off the joint clamp with a pair of metal shears and deburr the cutting edges (see figure 16).

**• Clamping with the clamping tool PoK-It II**

- When using the clamping tool PoK-It II, cant the joint clamp (306) after tightening on the joint clamp lock by swiveling the clamping tool in such a way that the clamp cannot slide back through the lock. After canting at the joint clamp lock, shear off the joint clamp with a pair of metal shears and deburr the cutting edges (see figure 13).

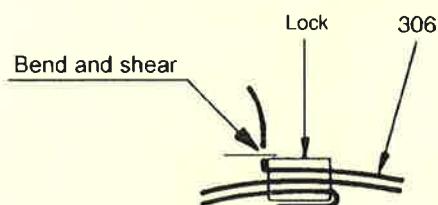


Figure 13: Canting and shearing the joint clamp

**ATTENTION** Check whether the joint clamp is bent in such a way that it cannot slide back through the joint clamp lock (see figure 16). If this is not the case, remove the joint clamp and replace it with a new one.

#### 7.2.2.3 Mounting the stator

- Prior to pulling on, grease the stator (402) and rotor (401) with lubricant (silicone oil, polydiol, soft soap or similar).  
**ATTENTION** Do not use any normal oil.
- With stators made of plastic or metal, insert stator seals (403) and (404).  
**Note:** With stators made of plastic, the stator seal (403) with the O-ring must always lie on the outlet side.
- Pull the stator onto the rotor (401).  
**Note:** In case of difficulty, turn the stator (402) with pliers at the same time. To do so, arrest the plug-in shaft (125).
- Screw the pressure casing (504), support (612), if provided, stator (402) and suction casing (505) together with the clamp bolts (611) and the hexagon nuts (609). Tighten the hexagon screws evenly.

#### 7.3 Replacement parts/spare parts

All stated pumps with the different shaft seal and bearing designs are portrayed in the following sectional drawings with parts list. The replacement parts/spare parts are listed in the parts list.

Recommended replacement parts/spare parts:

R = large repair set

r = small repair set



For reasons of operational safety, you may only stock and install original replacement parts supplied by us. In this context, we refer to the statements in Chapter 2.7.

When ordering replacement parts/spare parts, state the following:

**Machine number**

**Abbreviation of the pump**

**Part number**

**Denomination and part quantity**

or **Ident No. and quantity**

**Note:** The machine number and abbreviation of the pump is embossed on the type plate.

The identity number and quantity are indicated in the enclosed separate replacement parts list.

**Series AEB1L, AEB.E, AEB.N, AEB.H, AEDB1E, AEDB2N**  
**Design IE, ZE**

**ALLWEILER** 

Part No.	Denomination	Pcs.
122	Lantern socket	1
123	Clamp set	1
125	Plug-in shaft	R 1
201	T-head bolt	2
202	Self locking nut	2
203	Gland	1
204	Stuffing box casing	1
207	Stuffing box packing	R, r ①
208	Flushing ring	1
209	Sealing ring	1
212	Screw plug	1
213	Sealing tape	1
214	Mechanical seal housing	1
215	Mechanical seal cover	1
218	O-ring	R 1
219	Mechanical seal	R 1
220	Retaining pin	1
232	Shaft seal ring	R 1
234	Throttle ring	R 1
235	O-ring	R 1
236	Retaining pin	R 2
245	Hexagon nut	3
251	Sealing material	1
301	Joint bolt	R, r 2
302	Joint sleeve	R, r 2 ⑤
303	Sleeve for joint bolt	R, r 4
304	Joint collar	R, r 2
305	Joint oil	R, r ①
306	Joint clamp	R, r 4
307	Joint shaft	R, r 1
308	Joint bush	R, r 2
401	Rotor	R, r 1
402	Stator	R, r 1
403	Stator gasket, outlet-side	R, r 1
404	Stator gasket, suction-side	R, r 1
501	Gasket for suction casing	R, r 1
502	Screw plug	1
503	Seal ring	R 1 ③
504	Pressure casing	1 ③
505	Suction casing	1
506	Suction casing cover	2
507	Gasket	R 2
508	Tap bolt	8
509	Nut	8
512	Reducing flange	1
513	O-ring	R 1
525	Washer	8
601	Type plate	1
602	Half-round head grooved pin	4
603	Information plate "Start-up"	1
604	Information plate "Suction"	1
605	Information plate "Pressure"	1
606	Hexagon screw	4
607	Hexagon nut	4
608	Serrated lock washer	4
609	Hexagon nut	4
610	Washer	4
611	Clamp bolt	4
612	Support	1 ②
613	Hexagon nut	2 ④

Recommended spare parts:

R = large repair set

r = small repair set

① see Chapter 7.1.2.4

② 2 pcs. with AEB4H 100-IE, AEB4H 200-IE

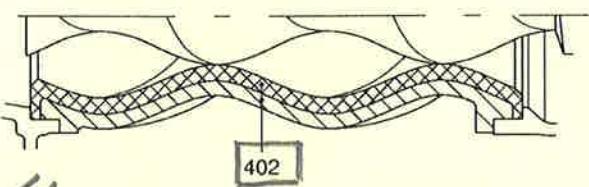
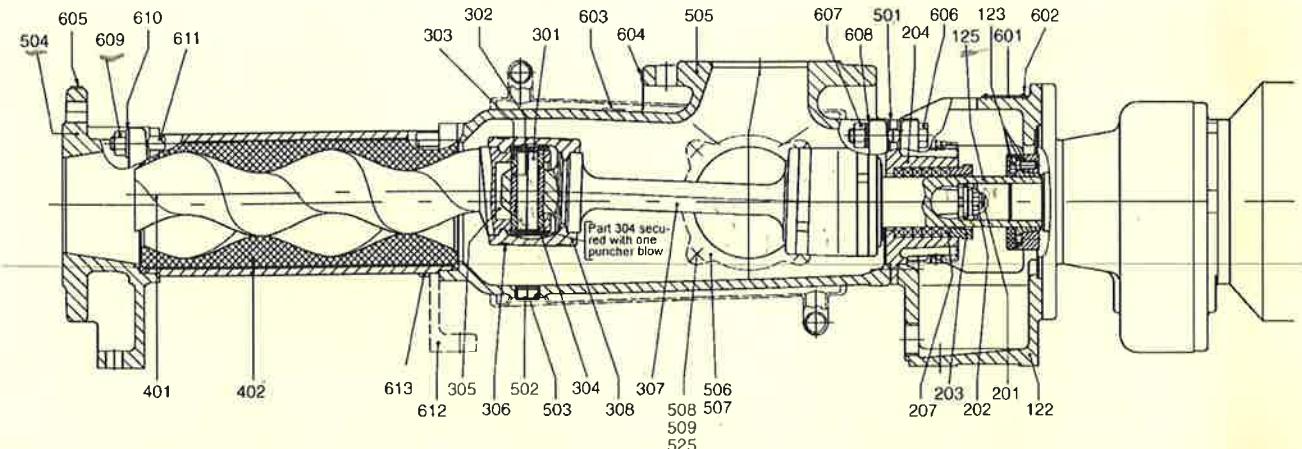
③ 2 pcs. with connection piece position 2 and 4

④ 4 pcs. with AEB4H 100-IE, AEB4H 200-IE

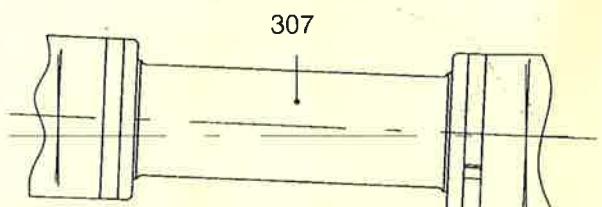
⑤ n/a with AEB1L 51, AEB1L 101, AEB1E 50, AEB2E 50,  
 AEB1N 25, AEB2N 25, AEDB1E 75, AEDB2N 38, AEB4H 12

**7.4 Sectional drawings with spare parts list and recommended replacement parts/spare parts for series AEB1L, AEB.E, AEB.N, AEB.H, AEDB1E, AEDB2N; Designs IE, ZE**

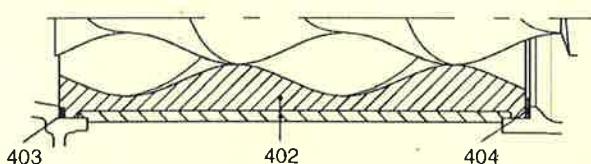
**Sectional drawing for series AEB1L, AEB.N, AEDB1E, AEDB2N; Design IE**



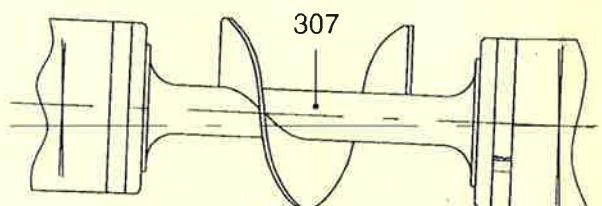
✓ Stator with even elastomer wall thickness



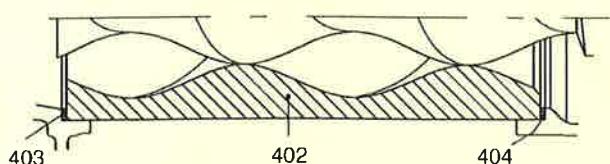
Winding protection on joint shaft



Stator of plastic material

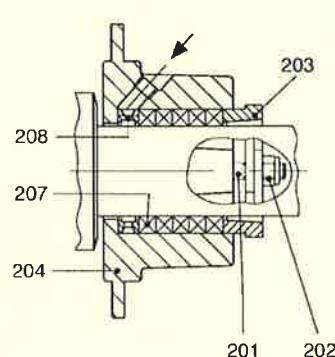
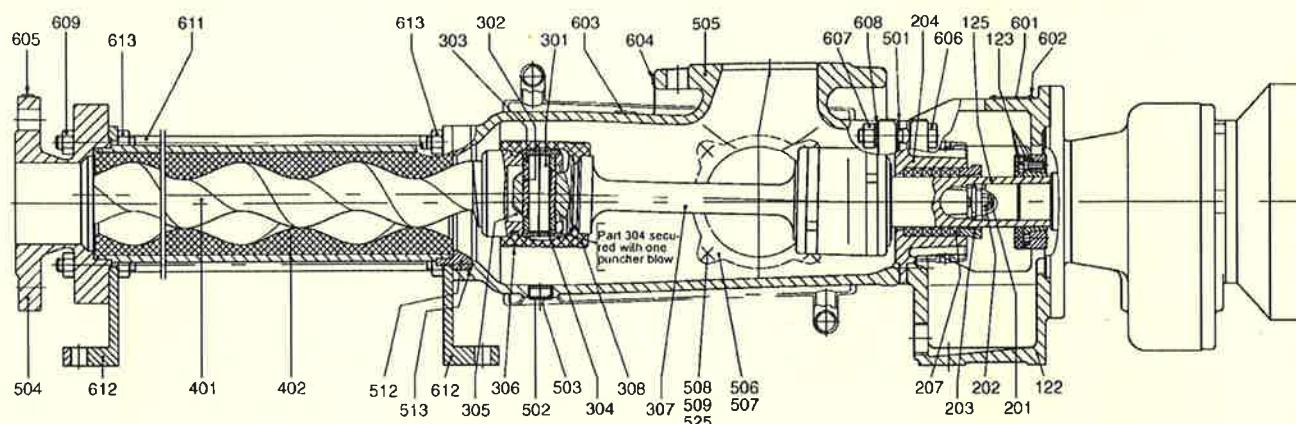


Worm on joint shaft

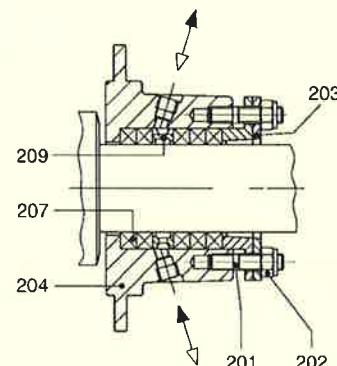


Stator of metal

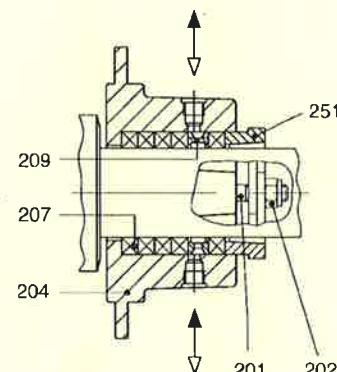
**Sectional drawing for series AEB.H; Design IE**



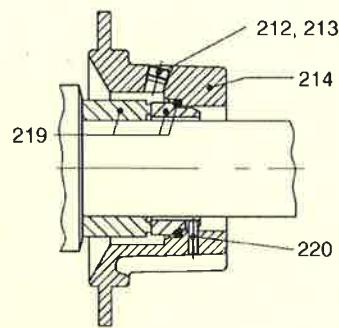
**P02** Stuffing box with flushing ring



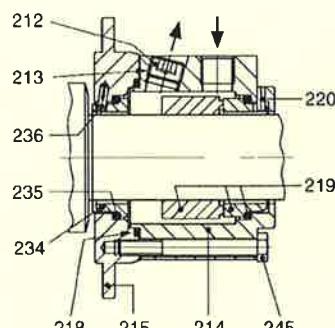
**P03** Stuffing box with internal sealing chamber ring



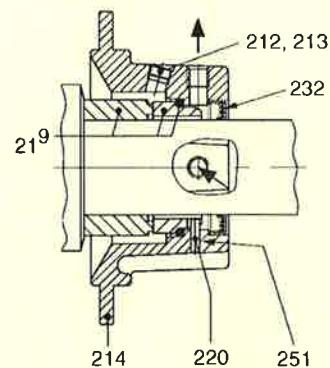
**P04** Stuffing box with external sealing chamber ring



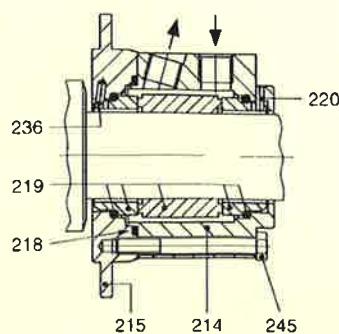
**G0K** and **G0N**, mechanical seal, single-acting



**G0S** and **G0T**, mechanical seal, single-acting with throttle ring



**G0Q** mechanical seal, single-acting with quench



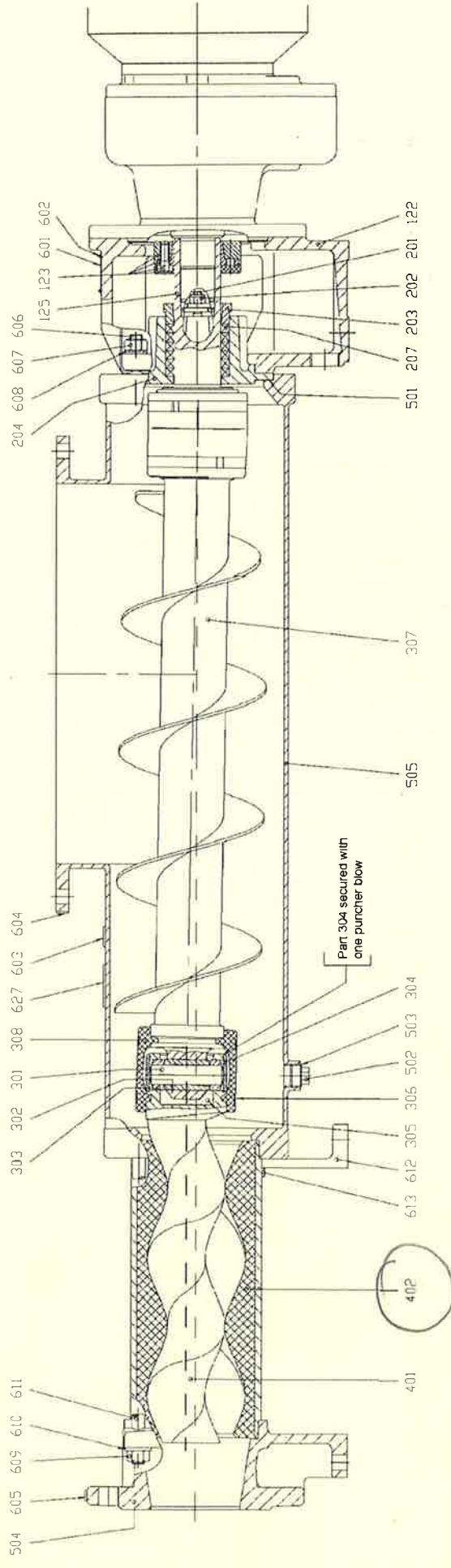
**G0D** mechanical seal, double-acting

*sludge pump*

**Series AEB1L, AEB.E, AEB.N, AEB.H, AEDB1E, AEDB2N  
Design IE, ZE**

**ALLWEILER**

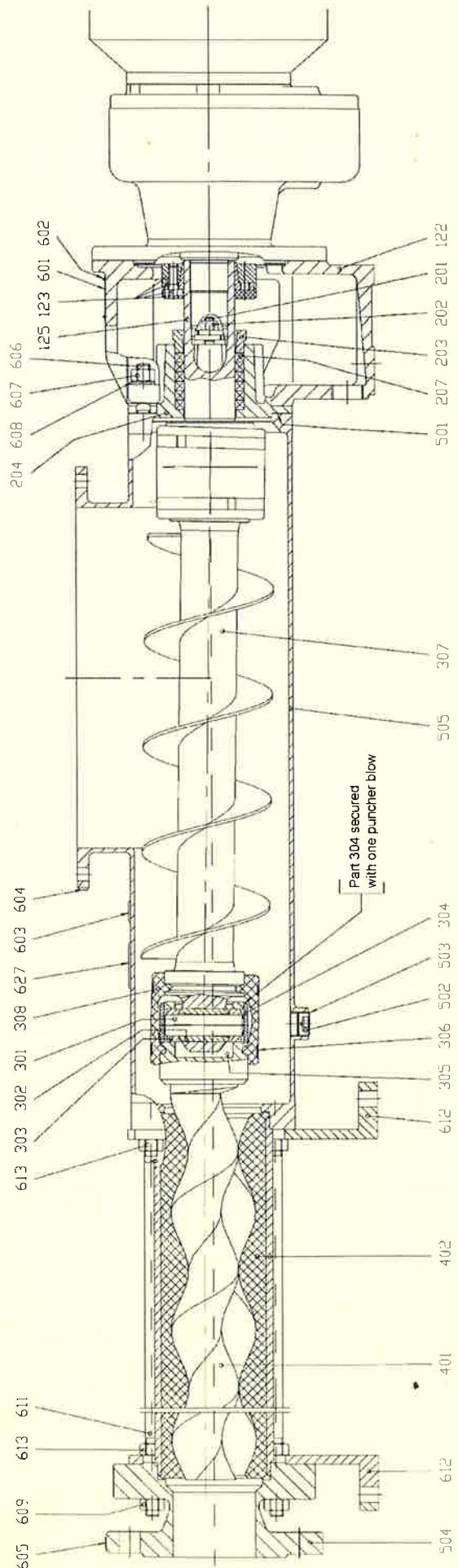
**Sectional drawing for series AEB.N; Design ZE**





**Series AEB1L, AEB.E, AEB.N, AEB.H, AEDB1E, AEDB2N**  
**Design IE, ZE**

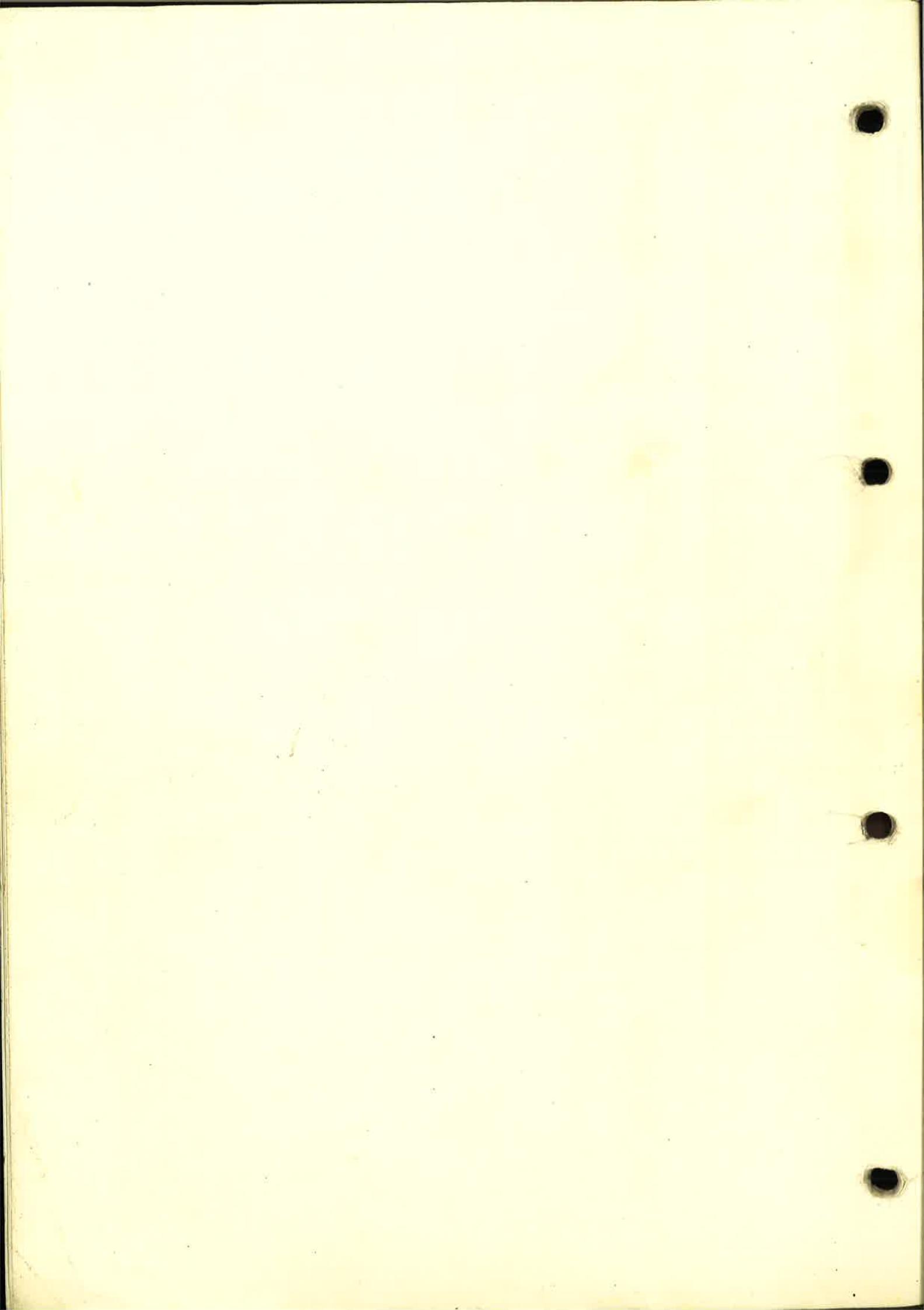
Sectional drawing for series AEB.H; Design ZE



**8. Operating faults, causes and remedial action**

No.	Operating troubles										Cause and remedial action
	Pump does not start	Pump does not draw	Discharge not achieved	Pressure height not achieved	Pump discharges unevenly	Pump emits noises	Pump is stuck or no longer discharges	Motor gets too warm	Stator wears down prematurely	Leaking shaft seal	
	a	b	c	d	e	f	g	h	i	k	
1	•							•			ALLWEILER eccentric screw pumps work disruption-free at all times when they are deployed in accordance with the operating conditions stated in our order confirmation and when the operating instructions are observed.
2			•								High adhesion between the rotor and stator in a new state after longer periods of standstill. Turn pump by hand with auxiliary tools.
3		•	•		•	•	•				Check the rotation direction with the arrow on the pump. In case of wrong direction, reverse the polarity on the motor.
4		•	•		•	•					Check suction pipe and shaft seal for tightness.
5		•	•		•						Check suction height – poss. increase suction pipe diameter – install larger filters – open suction valve all the way.
6	•		•					•			Check viscosity of the conveyor media.
7			•		•						Check the rotation speed of the pump – check rotation speed and power consumption of the drive motor – check voltage and frequency.
8	•		•				•	•	•		Avoid air bubbles in the conveyor medium.
9		•	•		•		•		•		Check pressure height – open slider in the pressure pipe all the way, remove congestion in the pressure pipe.
10		•	•								Pump runs partially or completely dry.
11		•			•	•					Check whether there is sufficient conveyor media on the suction side.
12						•					Increase the rotation speed with thin media and large suction volume
13	•	•	•				•		•		Reduce rotation speed with viscous media – danger of cavitation.
14		•	•	•	•		•				Check longitudinal clearance of the joint bolts, poss. joint bush wrongly mounted.
15		•	•				•	•			Check for foreign objects in the pump, dismount pump, remove foreign objects, replace defect parts.
16		•	•				•		•		Stator and rotor worn out. Dismount pump, replace defect parts.
17	•	•					•	•	•		Joint parts (f, g) and/or drive shaft resp. shaft protector sleeve (b, c) worn out: dismount pump, replace defect parts.
18	•	•	•					•		•	Suction pipe partially or completely obstructed.
19	•	•					•		•		Check the temperature of the conveyor media – stator expansion too large – stator stuck on the rotor – stator poss. burnt or swollen.
20	•	•							•	•	Stuffing box: exchange obsolete rings (b,c,k), loosen gland (a,h), tighten gland (b,c,k)
21	•	•					•		•	•	Solid substance content and/or graining too large – reduce rotation speed: install a sieve with admissible mesh width in front of the pump.
											Solid substances sediment when the pump stands still and harden. Rinse pump immediately, if necessary dismount and clean.
											Medium hardens when undercutting a certain temperature limit – heat pump.

Technical alterations reserved.



---

**ORDER SPECIFICATION**

---

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as	Date of issue:	
CUSTOMER REF.....:	096 CHS/ERP		30/10-07

---

**FO DISCH. PUMP 2. SPEED**

\*\*\*\*\*

1,00	NAM 80-200/230 U3.1D W80 AELD65IEC280	Number:	1,00
------	---------------------------------------	---------	------

Allweiler vertical single-stage centrifugal pump with flexible coupling and el-motor. Spacer-coupling allows easy dismantling of bearing unit, impeller, seal etc, without removing the volute casing, pipelines and driving motor. Pump has axial suction flange, radial delivery flange.  
Bulkhead mounting.

**NOTE: MOTOR SHAFT Ø75**

Technical specification: Centrifugal pump

Serialno.:	6037608,
Capacity.....	....m3/h: 200 - 100
Diff. pressure.....	....bar: 9 - 2,2
Delivery head.....	.....m: 90 - 22,5
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 9 - 2,2
Speed.....	... rpm: 3500 - 1750
NPSHr.....	.....m: 6,8 - 4,0
Power absorbed.....	.....Kw: 66,4 - 8,3
Medium.....	.....: FW
Temperature.....	.....C: amb.
Viscosity.....	...mm2/s: 1
Specific gravity....	...kg/m3: 1000
Pump casing.....	material: Nod.C.I.
Impeller.....	material: NiAlBz
Shaft.....	material: 1.4571
Shaft seal.....	....type: Mech.seal

1,01	AELD 65 AUTOMATIC ASPIRATOR	Number:	1,00
------	-----------------------------	---------	------

Automatic air driven priming ejector mounted.

1,10	EL-MOTOR 280M-2/4 MARINE 2-SPEED	Number:	1,00
------	----------------------------------	---------	------

Technical specification: El-motor

Rated power.....	....KW: 77/20,7
RPM.....	...Rpm.: 3500/1750
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: 122/32
Starting method....	....type: DOL/DOL
Construction method.	....type: V1
Protection.....	.....: IP55
Vikling.....	.....: Dahlander
Isolation.....	.....: F
Temp.rise.....	.....K: 90K
Heating element....	.....: 230V 98W
Test certificate....	.....: DNV

---

**ORDER SPECIFICATION**

---

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

---

1,20 CERTIFICATE DNV, PUMP Number: 1,00

1,90 Mano/Vac.set fluid w/sep.transm.on panel Number: 1,00

The set contains as follows:

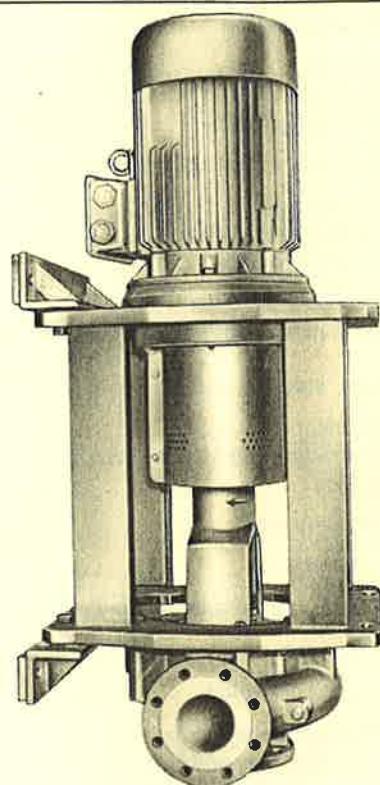
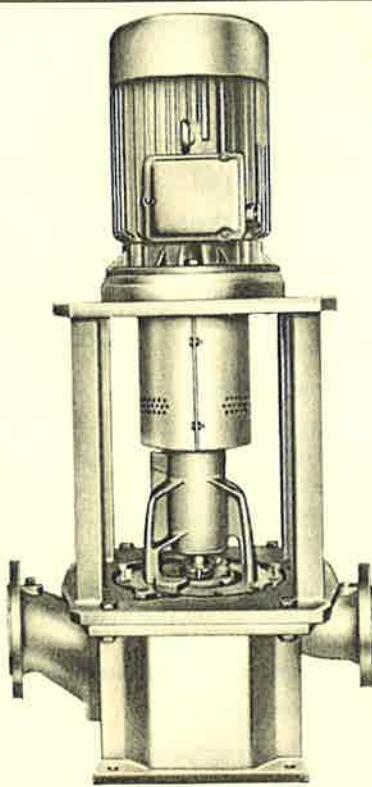
- 2 off 100 mm. liquid filled instruments for local reading. -1 to 5 and 0 - 16 bar.
- 2 off pressure transmitter, 4-20 mA.
- 2 off 3 way ball valve with over mentioned mounted.  
All mounted on a panel plate.

For FO pump.

# • Centrifugal Pump with Volute Casing

Operating manual

NIM / NAM series



Version BA-2006.03  
Print-No. 550 018  
VM-No. 467.0001 GB

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Email: [info@allweiler.com](mailto:info@allweiler.com)  
Internet: <http://www.allweiler.com>

We reserve the right to make technical changes.

CE

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## 1 About this document

This manual

- Is part of the pump
- Applies to the afore-mentioned pump series
- Describes safe and appropriate operation during all operating phases

### 1.1 Target groups

Target group	Duty
Operating company	<ul style="list-style-type: none"> <li>▶ Keep this manual available at the site of operation of the system, including for later use.</li> <li>▶ Ensure that personnel read and follow the instructions in this manual and the other applicable documents, especially all safety instructions and warnings.</li> <li>▶ Observe any additional rules and regulations referring to the system.</li> </ul>
Qualified personnel, fitter	<ul style="list-style-type: none"> <li>▶ Read, observe and follow this manual and the other applicable documents, especially all safety instructions and warnings.</li> </ul>

Tab. 1 Target groups and their duties

### 1.2 Other applicable documents

Document	Purpose
Order data sheet	Technical specifications, conditions of operation
Setup drawing	Setup dimensions, connection dimensions etc.
Technical description	Technical specifications, operating limits
Sectional drawing	Sectional drawing, part numbers, component designations
Automatic aspirator operating manual	Technical documentation
Supplier documentation	Technical documentation for parts supplied by subcontractors
Spare parts list	Ordering spare parts
Safety certificate	Returning the pump to the manufacturer
Declaration of conformity	Conformity of the pump with standards

Tab. 2 Other applicable documents and their purpose

### 1.3 Warnings and symbols

Warning	Risk level	Consequences of disregard
 <b>DANGER</b>	Immediate acute risk	Death, grievous bodily harm
 <b>WARNING</b>	Potentially acute risk	Death, grievous bodily harm
 <b>CAUTION</b>	Potentially hazardous situation	Minor bodily harm
<b>CAUTION</b>	Potentially hazardous situation	Material damage

Tab. 3 Warnings and consequences of disregarding them

Symbol	Meaning
	Safety warning sign ► Take note of all information highlighted by the safety warning sign and follow the instructions to avoid injury or death.
►	Instruction
1. , 2. , ...	Multiple-step instructions
✓	Precondition
→	Cross reference
	Information, advice

Tab. 4 Symbols and their meaning

### 1.4 Technical terms

Term	Meaning
Sealing medium	Medium as seal barrier/buffer fluid or for quenching of shaft seals
Auxiliary systems	Systems for operating the pump

Tab. 5 Technical terms and their meaning

## 2 Safety

- o The manufacturer does not accept any liability for damage resulting from disregard of the entire documentation.

### 2.1 Intended use

- Only use the pump for pumping the agreed pumped media (→ order data sheet).
- Adhere to the operating limits and size-dependent minimum flow rate.
- Avoid dry running:  
Initial damage, such as destruction of the mechanical seal and plastic parts, will occur within only a few seconds.
  - Make sure the pump is only operated with, and never without, a pumped medium.
- Avoid cavitation:
  - Fully open the suction-side armature and do not use it to adjust the flow rate.
  - Do not open the pressure-side armature beyond the agreed operating point.
- Avoid overheating:
  - Do not operate the pump while the pressure-side armature is closed.
  - Observe the minimum flow rate (→ order data sheet).
- Avoid damage to the motor:
  - Do not open the pressure-side armature beyond the agreed operating point.
  - Note the maximum permissible number of times the motor can be switched on per hour (→ manufacturer's specifications).
- Consult the manufacturer about any other use of the pump.

#### Prevention of obvious misuse (examples)

- Note the operating limits of the pump concerning temperature, pressure, flow rate and motor speed (→ order data sheet).
- The power consumed by the pump will increase with increasing density of the pumped medium. To avoid overloading the pump, coupling or motor, stay within the agreed density (→ order data sheet).  
Lower densities are allowed. Adapt the auxiliary systems accordingly.
- When pumping liquids containing solids, ensure that the limits for the proportion of solids and the grain size are maintained (→ order data sheet, technical description).
- When using auxiliary systems, ensure that there is a continuous supply of the appropriate medium.

### 2.2 General safety instructions

- o Take note of the following regulations before carrying out any work.

#### 2.2.1 Product safety

The pump has been constructed according to the latest technology and recognized technical safety rules. Nevertheless, operation of the pump can involve risks to life and health of the user or third parties and risk of damage to the pump and other property.

- Only operate the pump if it is in perfect technical condition and only use it as intended, staying aware of safety and risks, and in adherence to the instructions in this manual.
- Keep this manual and all other applicable documents complete, legible and accessible to personnel at all times.
- Refrain from any procedures and actions that would expose personnel or third parties to any risk.
- Should there be any safety-relevant fault, shut down the pump immediately and have the fault corrected by appropriate personnel.
- In addition to the entire documentation for the product, always comply with statutory or other safety and accident-prevention regulations and with the applicable standards and guidelines in the country where the pump is operated.

## 2.2.2 Obligations of the operating company

### Safety-conscious operation

- Only operate the pump if it is in perfect technical condition and only use it as intended, staying aware of safety and risks, and in adherence to the instructions in this manual.
- Ensure that the following safety aspects are observed and monitored:
  - Adherence to intended use
  - Statutory or other safety and accident-prevention regulations
  - Safety regulations governing the handling of hazardous substances
  - Applicable standards and guidelines in the country where the pump is operated
- Make protective equipment available.

### Qualified personnel

- Make sure all personnel tasked with work on the pump have read and understood this manual and all other applicable documents, especially the safety, maintenance and repair information, before they start work.
- Organize responsibilities, who is in charge of any specific duty and how personnel is supervised.
- Ensure that all work is carried out by specialist technicians only:
  - Fitting, repair and maintenance work
  - Work on the electrical system
- Make sure trainee personnel is supervised by a specialist technician when working on the pump.

### Safety equipment

- Provide the following safety equipment and verify their functionality:
  - For hot, cold and moving parts: guard provided by the customer to prevent contact with the pump
  - For possible build up of electrostatic charge: ensure appropriate grounding

### Warranty

- Obtain the manufacturer's approval prior to carrying out any modifications, repairs or alterations during the warranty period.
- Only use original parts or parts that have been approved by the manufacturer.

## 2.2.3 Duties of the personnel

- All directions given on the pump must be followed (and kept legible), e.g. the arrow indicating the direction of rotation and the markings for fluid connections.
- Do not remove the guards to prevent contact with hot, cold or moving parts during operation.
- Use protective equipment if necessary.
- Only carry out work on the pump while it is not running.
- Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.
- Reinstall the safety equipment on the pump as required by regulations after any work on the pump.

## 2.3 Special hazards

### 2.3.1 Hazardous pumped media

- Follow the safety regulations for handling hazardous substances when pumping hazardous media (e.g. hot, flammable, poisonous or potentially harmful).
- Use protective equipment when carrying out any work on the pump.

### 3 Layout and function

#### 3.1 Labels

##### 3.1.1 Type plate

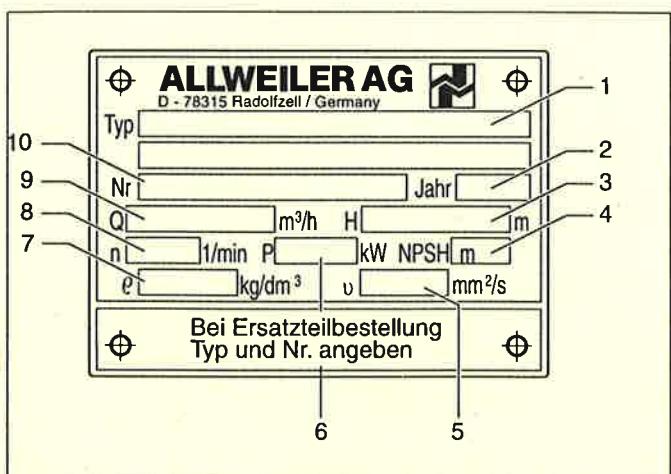


Fig. 1 Type plate (example)

- 1 Pump type
- 2 Year of manufacture
- 3 Differential head
- 4 Pump NPSH value
- 5 Kinematic viscosity
- 6 Power consumption
- 7 Density
- 8 Motor speed
- 9 Flow rate
- 10 Serial number

##### 3.1.2 Pump type code

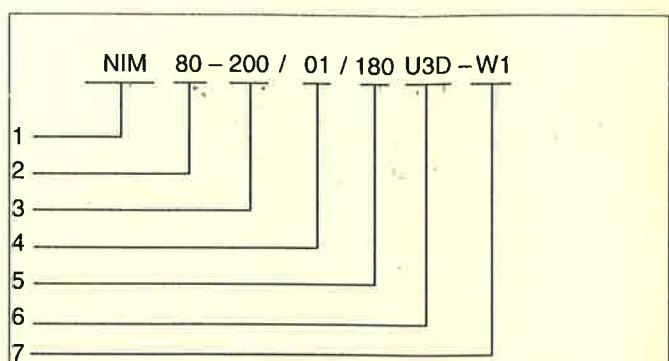


Fig. 2 Pump type code (example)

- 1 NIM or NAM series
- 2 Pressure flange DN [mm]
- 3 Nominal impeller diameter [mm]
- 4 Hydraulic no.
- 5 Actual impeller diameter [mm]
- 6 Shaft seal
- 7 Material key

### 3.2 Layout

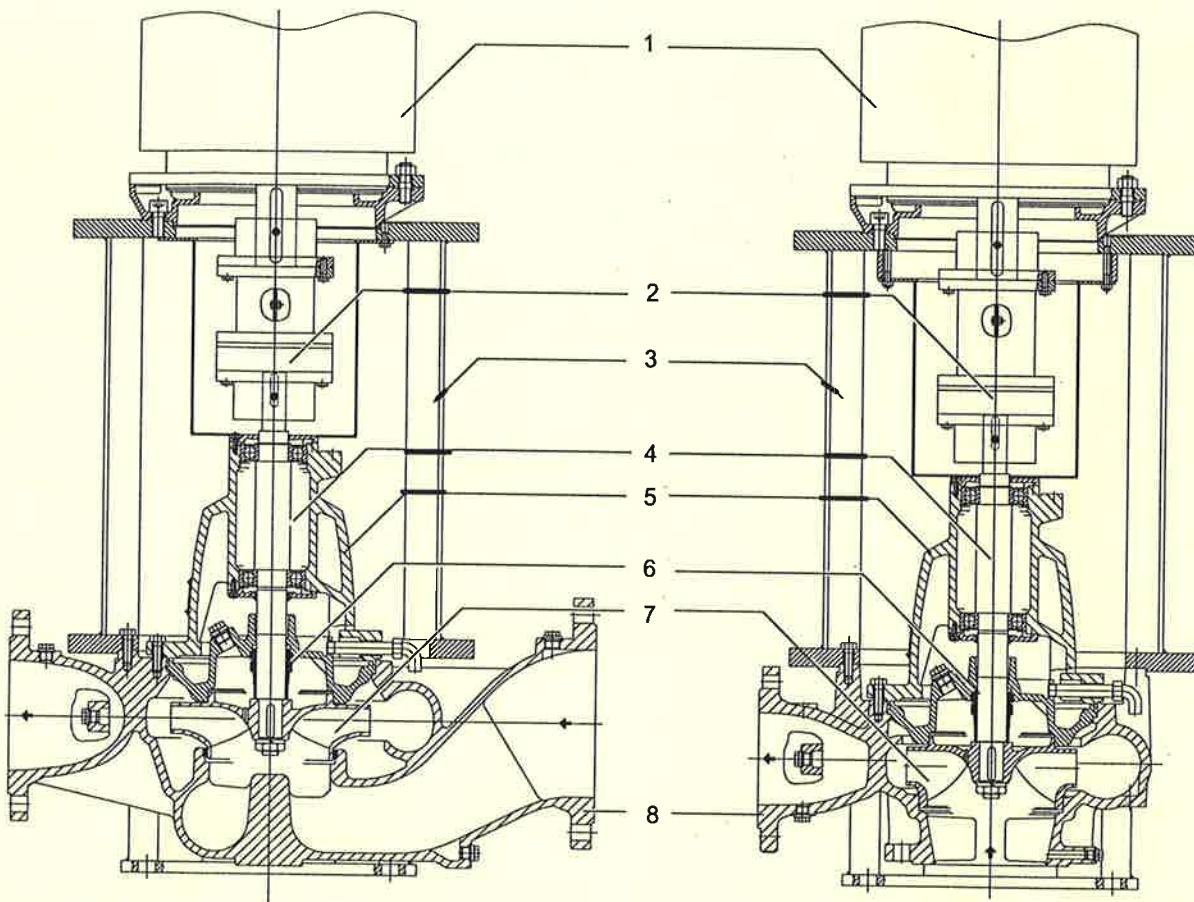


Fig. 3 Layout of NIM (left) – NAM (right)

- |                                 |                   |                 |
|---------------------------------|-------------------|-----------------|
| 1 Motor                         | 4 Shaft           | 7 Impeller      |
| 2 Coupling with extension piece | 5 Bearing bracket | 8 Volute casing |
| 3 Bell housing                  | 6 Shaft seal      |                 |

### 3.3 Shaft seals

 Only one of the following shaft seals can be used.

#### 3.3.2 Packing gland

 The packing gland must always leak slightly to carry the frictional heat away.

##### 3.3.1 Mechanical seals

 Mechanical seals have functional leaks.

- Single mechanical seal
- Single mechanical seal with quenching

### 3.4 Auxiliary systems

#### 3.4.1 Automatic aspirator (if available)

- Information on the material, functional description and electrical connection (→ A25 automatic aspirator operating manual).

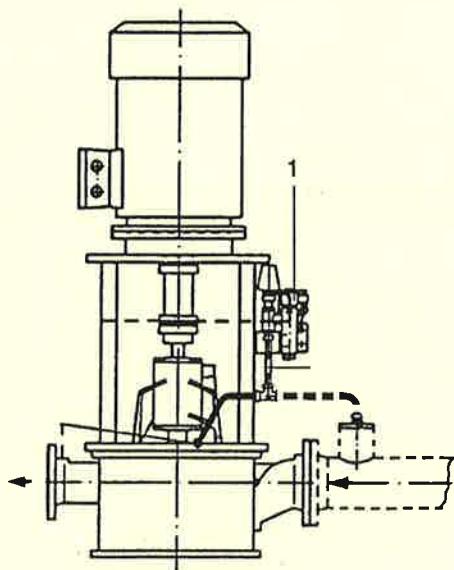


Fig. 4 Automatic aspirator – extension example

1 Automatic aspirator

The maintenance-free A25 automatic aspirator:

- Used for automatic bleeding of pumps and suction pipes
- Operates according to the ejector principle with pressure-dependent control
- Suitable for clean, chemically neutral water

## 4 Transport, storage and disposal

### 4.1 Transport

- For details of weight (→ documents for the particular order).

#### 4.1.1 Unpacking and inspection on delivery

1. Unpack the pump/aggregate on delivery and inspect it for damage.
2. Report any damage to the manufacturer immediately.
3. Dispose of packaging material according to local regulations.

#### 4.1.2 Lifting



**Death or crushing of limbs caused by falling or overturning loads!**

- Use lifting gear appropriate for the total weight to be transported.
- Fasten the lifting gear as illustrated below.
- Do not stand under suspended loads.
- Set the load down on a level surface.

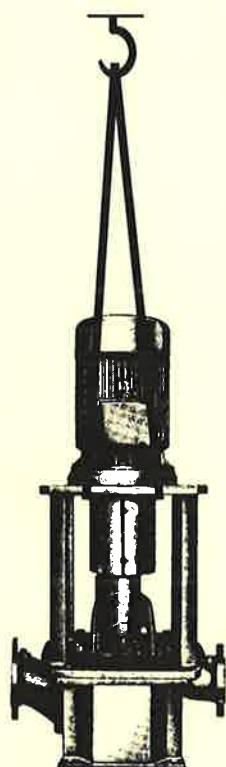


Fig. 5 Fastening the lifting gear to the pump aggregate

- Lift the pump/aggregate properly.

### 4.2 Preservation

- Not necessary for non-rusting materials

#### CAUTION

**Material damage due to inappropriate treatment for storage!**

- Treat the pump properly, inside and outside, for storage.

1. Choose a preservative appropriate for the type and duration of storage (→ 9.2.2 Preservatives, Page 36).
2. Use the preservative specified by the manufacturer.
3. All bare metal parts should be treated, inside and outside.

### 4.3 Storage

#### CAUTION

**Material damage due to inappropriate storage!**

- Treat and store the pump properly.

1. Seal all openings with blind flanges, blind plugs or plastic covers.
2. Make sure the storage room meets the following conditions:
  - Dry
  - Frost-free
  - Vibration-free
3. Turn the shaft once a month.
4. Make sure the shaft and bearing change their rotational position in the process.

#### 4.4 Removing the preservative

- Only necessary for pumps treated with preservative
- 1 Only necessary for pumps treated with preservative

##### WARNING

**Risk of poisoning from preservatives and cleaning agents in the foodstuffs and drinking water sector!**

- ▶ Only use cleaning agents which are compatible with the pumped medium (→ 9.2.5 Cleaning agents, Page 37).
- ▶ Completely remove all preservative.

##### **CAUTION**

**High water pressure or spray water can damage bearings!**

- ▶ Do not clean the bearing areas with a water or steam jet.

##### **CAUTION**

**Damage to seals due to incorrect cleaning agent!**

- ▶ Ensure the cleaning agent does not corrode the seals.

- 1 Choose a suitable cleaning agent for the application.  
(→ 9.2.5 Cleaning agents, Page 37).

- With Tectyl 506 EH: allow benzine to soak in for 10 minutes  
1 (recommended).

- 2 Dispose of preservatives according to local regulations.
- 3 For storage times in excess of 6 months:
  - Replace the elastomer parts made of EP rubber (EPDM).
  - Check all elastomer parts (O-rings, shaft seals) for proper elasticity and replace them if necessary.

#### 4.5 Disposal

- Plastic parts can be contaminated by poisonous or radioactive pumped media to such an extent that cleaning is insufficient.

##### WARNING

**Risk of poisoning and environmental damage caused by pumped medium or oil!**

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Prior to disposal of the pump:
  - Catch and dispose of any escaping pumped medium or oil in accordance with local regulations.
  - Neutralize residues of pumped medium in the pump.
  - Remove any preservative (→ 4.4 Removing the preservative , Page 13).
- ▶ Remove and dispose of any plastic parts in accordance with local regulations.

- ▶ Dispose of the pump in accordance with local regulations.

## 5 Setup and connection

### CAUTION

**Material damage caused by dirt!**

- ▶ Do not remove the transport seals until immediately before setting up the pump.
- ▶ Do not remove any covers and transport and sealing covers until immediately before connecting the piping to the pump.

### 5.1 Preparing the setup

#### 5.1.1 Checking the ambient conditions

1. Make sure the required ambient conditions are fulfilled (→ 9.2.1 Ambient conditions, Page 36).
2. For setup heights > 1000 m above sea level, consult the manufacturer.

#### 5.1.2 Preparing the installation site

- ▶ Ensure the installation site meets the following conditions:
  - Pump is freely accessible from all sides
  - Sufficient space for installation/removal of the pipes and for maintenance and repair work, especially for the removal and installation of the pump and the motor
  - Pump not exposed to external vibrations (damage to bearings)
  - Frost protection

#### 5.1.3 Installing the heat insulation

- Only necessary to maintain the temperature of the pumped medium

### CAUTION

**Material damage caused by overheating!**

- ▶ Only install the heat insulation on the volute casing.
- ▶ Install the heat insulation properly.

#### 5.1.4 Removing the preservative

- ▶ If the pump is to be put into operation immediately after setup and connection: remove the preservative prior to setup (→ 4.4 Removing the preservative, Page 13).

#### 5.1.5 Fastening the pump

- The pump can also be attached to the wall with angles.
- ▶ Install and fasten the pump (→ setup drawing).

### 5.2 Installing the motor

- Only necessary if the pump aggregate is assembled on site.

### CAUTION

**Material damage caused by knocks and bumps!**

- ▶ Keep the coupling halves properly aligned when pushing on the motor.
- ▶ Do not knock or hit any components of the pump.

1. Smear a very thin coat of molybdenum disulfide (e.g. Molykote) on the shaft ends of the pump and motor.

2. Insert shaft keys.

3. Without a mounting rig: remove the rubber buffers and warm up both halves of the coupling to approx. 100 °C.

4. Slide on the pump-side and motor-side coupling halves until the shaft ends are flush with the center of the coupling. When doing this, ensure the prescribed spacing between the two halves of the coupling is maintained (→ assembly instructions for the coupling).

5. Tighten the grub screws on both halves of the coupling.

6. Screw in the motor bolts and tighten them.

### 5.3 Planning the piping

#### 5.3.1 Keeping the piping clean

### CAUTION

**Material damage due to impurities in the pump!**

- ▶ Make sure no impurities can get into the pump.

1. Clean all piping parts and armatures prior to assembly.

2. Ensure no flange seals protrude inwards.

3. Remove any blind flanges, plugs, protective foils and/or protective paint from flanges.

#### 5.3.2 Specifying supports and flange connections

### CAUTION

**Material damage due to excessive forces and torques exerted by the piping on the pump!**

- ▶ Do not exceed permissible limits.

1. Calculate the pipe forces taking every possible operating condition into account:
  - Cold/warm
  - Empty/full
  - Unpressurized/pressurized
  - Shift in position of flanges

2. Ensure the pipe supports have permanent low-friction properties and do not seize up due to corrosion.

### 5.3.3 Specifying nominal diameters

- Keep the flow resistance in the pipes as low as possible.

1. Specify the nominal suction pipe diameter  $\geq$  nominal suction flange diameter.
2. Specify the nominal pressure pipe diameter  $\geq$  nominal pressure flange diameter.

### 5.3.4 Specifying pipe lengths

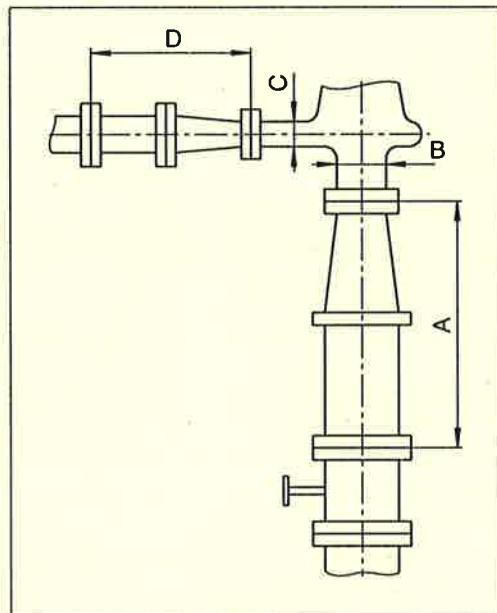


Fig. 6 Straight pipe lengths upstream and downstream of the pump (recommended)

- A  $> 5 \times$  nominal suction pipe diameter
- B Nominal suction pipe diameter
- C Nominal pressure pipe diameter
- D  $> 5 \times$  nominal pressure pipe diameter

- Maintain the recommended minimum values when installing the pump.

- Suction side: shorter pipes are possible but may restrict the hydraulic performance.

Pressure side: shorter pipes are possible but can result in increased operating noise.

### 5.3.6 Optimizing cross-section and direction changes

1. Avoid radii of curvature of less than 1.5 times the nominal pipe diameter.
2. Avoid abrupt changes of cross-section along the piping system.

### 5.3.7 Provide safety and control devices (recommended)

#### Avoid impurities

1. Integrate a filter into the suction pipe.
2. To monitor impurities, install a differential pressure gauge with a contact manometer.

#### Avoid reverse running

- Install a non-return valve between the pressure flange and the gate valve to ensure the medium does not flow back when the pump is switched off.

#### Make provisions for isolating and shutting off the pipes

- For maintenance and repair work.

- Provide shut-off devices in the suction and pressure pipes.

#### Allow the measurement of the operating conditions

1. Provide manometers for pressure measurements in suction and pressure pipes.
2. Provide for motor-side torque measurements.
3. Provide for pump-side temperature measurements.

## 5.4 Connecting the pipes

### 5.4.1 Installing auxiliary pipes (if available)

- Follow the manufacturers' specifications for any existing auxiliary systems.
- 1. Connect the auxiliary pipes to the auxiliary connections so that they are stress-free and do not leak (→ setup drawing).
- 2. To avoid air pockets, run the pipes with a continuous slope up to the pump.

### 5.4.2 Installing the suction pipe

1. Remove the transport and sealing covers from the pump.
2. To avoid air pockets, run the pipes with a continuous slope up to the pump.
3. Ensure no seals protrude inwards.
4. For suction operation: install a foot valve in the suction pipe to prevent the pump and suction pipe from running empty during downtimes.

### 5.4.3 Installing the pressure pipe

1. Remove the transport and sealing covers from the pump.
2. Install the pressure pipe.
3. Ensure no seals protrude inwards.

### 5.4.4 Inspection for stress-free pipe connections

- ✓ Piping installed and cooled down
- 1. Separate the pipe connecting flanges from the pump.
- 2. Check whether the pipes can be moved freely in all directions within the expected range of expansion:
  - Nominal diameter < 150 mm: by hand
  - Nominal diameter > 150 mm: with small lever
- 3. Make sure the flange surfaces are parallel.
- 4. Reconnect the pipe connecting flanges to the pump.

## 5.5 Electrical connection



### Risk of death due to electric shock!

- Have all electrical work carried out by qualified electricians only.



### Risk of death due to rotating parts!

- Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.

### 5.5.1 Connecting the motor

- Follow the instructions of the motor manufacturer.

1. Connect the motor according to the connection diagram.
2. Make sure that no danger arises due to electrical energy.
3. Install an EMERGENCY STOP switch.

### 5.5.2 Checking the direction of rotation



### Risk of death due to rotating parts!

- Use protective equipment when carrying out any work on the pump.
- Secure the shaft key from being thrown out when checking the direction of rotation.
- Keep an adequate distance to rotating parts.

## CAUTION

### Material damage caused by running dry or wrong direction of rotation!

- Uncouple the motor from the pump.

1. Switch the motor on and immediately off again.
2. Check whether the direction of rotation of the motor corresponds to the rotational direction arrow on the pump.
3. If the direction of rotation is different: swap two phases.
4. Couple the motor to the pump again.

## 5.6 Checking the alignment of the coupling

- ! The motor and pump can be aligned precisely only at the factory.



### Risk of death due to rotating parts!

- ▶ Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.

### CAUTION

#### Material damage due to incorrect alignment of the coupling!

- ▶ If there is any lateral or angular displacement, align the motor exactly with the pump.
- ▶ For detailed information and special couplings: (→ manufacturer's specifications).

### Checking the alignment of the coupling

#### ✓ Implements, tools and materials:

- Dial gage (can be used for couplings with a spacer piece)
- Other suitable tools, e.g. laser alignment instrument

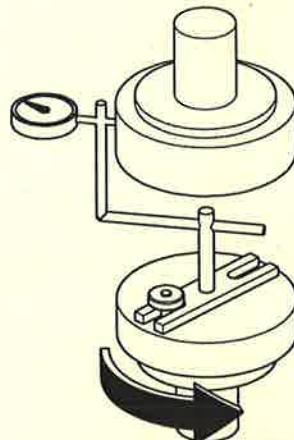


Fig. 7 Checking the lateral displacement

#### 1. Check the lateral displacement with a dial gage:

- Carry out the measurement as illustrated.
- Permissible radial deviation, measured at the coupling circumference: < 0.2 mm

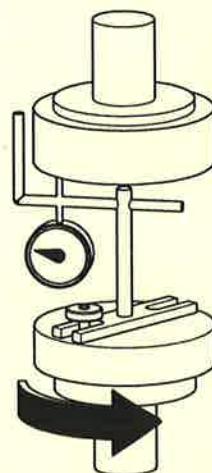


Fig. 8 Checking the angular displacement

#### 2. Check the angular displacement with a dial gage:

- Carry out the measurement as illustrated.

#### 3. Send the pump to the factory for inspection and alignment in the event of impermissible lateral or angular displacement.

## 6 Operation

### 6.1 Preparations for the initial start-up

#### 6.1.1 Identifying the pump type

- Identify the pump type (→ order data sheet).
- Pump types vary e.g. with regard to bearing lubrication, bearing bracket size, type of shaft seal and auxiliary systems.

#### 6.1.2 Removing the preservative

- Only necessary for pumps treated with preservative
- (→ 4.4 Removing the preservative , Page 13).

#### 6.1.3 Lubricating the bearings

- Pumps with grease-lubricated roller bearings are ready for operation upon delivery.

#### 6.1.4 Preparing auxiliary systems (if available)

- The manufacturer does not accept any liability for damage arising from the installation or use of a third-party or unapproved auxiliary system.

#### 6.1.5 Filling and bleeding

#### WARNING

Risk of injury and poisoning due to hazardous pumped media!

- Safely collect any leaking pumped medium and dispose of it in accordance with environmental rules and requirements.

#### CAUTION

Material damage caused by dry running!

- Make sure the pump is filled properly.

#### Without automatic aspirator (supply operation)

1. Fill the pump and the suction pipe with pumped medium.
2. Open the suction-side armature.
3. Open the pressure-side armature.
4. If available: open the auxiliary systems and check the flow rate.
5. Verify that no pipe connections are leaking.

#### With automatic aspirator (suction operation)

1. Fill the pump and the suction pipe with pumped medium.
2. Open the suction-side armature.
3. Close the pressure-side armature.
4. If available: open the auxiliary systems and check the flow rate.
5. Verify that no pipe connections are leaking.
6. Start suction operation (→ A25 operating manual manufacturer instructions).

## 6.2 Start-up

### 6.2.1 Switching on

- ✓ Pump set up and connected properly
- ✓ Motor set up and connected properly
- ✓ Motor exactly aligned with the pump
- ✓ All connections stress-free and sealed
- ✓ Any existing auxiliary systems are ready for operation
- ✓ All safety equipment installed and tested for functionality
- ✓ Pump prepared, filled and bled properly



#### Risk of injury due to running pump!

- Do not touch the running pump.
- Do not carry out any work on the running pump.
- Allow the pump to cool down completely before starting any work.



#### Risk of injury and poisoning caused by pumped medium spraying out!

- Use protective equipment when carrying out any work on the pump.

### CAUTION

#### Material damage caused by dry running!

- Make sure the pump is filled properly.

### CAUTION

#### Risk of cavitation when throttling down the suction flow rate!

- Fully open the suction-side armature and do not use it to adjust the flow rate.
- Do not open the pressure-side armature beyond the operating point.

### CAUTION

#### Material damage caused by overheating!

- Do not operate the pump while the pressure-side armature is closed.
- Observe the minimum flow rate (→ order data sheet).

1. Open the suction-side armature.
2. Close the pressure-side armature.
3. Switch on the motor and check it for smooth running.
4. Once the motor has reached its nominal speed, slowly open the pressure-side armature until the operating point is reached.
5. For pumps with hot pumped media, make sure any temperature changes do not exceed 50 °C/h.

6. After the initial stress caused by pressure and operating temperature, check that the pump is not leaking.

7. If the pumped media is hot, briefly switch off the pump at operating temperature and check the alignment of the coupling (→ 5.6 Checking the alignment of the coupling, Page 17).

8. If present, set a slight leak on the packing gland.

### 6.2.2 Switching off

- ✓ Pressure-side armature closed (recommended)

### ⚠ WARNING

#### Risk of injury due to hot pump parts!

- Use protective equipment when carrying out any work on the pump.

1. Switch off the motor.

2. Check all connecting bolts and tighten them if necessary.

## 6.3 Shutting down

### ⚠ WARNING

#### Risk of injury and poisoning due to hazardous pumped media!

- Safely collect any leaking pumped medium and dispose of it in accordance with environmental rules and requirements.

- Take the following measures whenever the pump is shut down:

Pump is	Measure
...shut down for a prolonged period	► Take any measures depending on the pumped medium (→ Table 7 Measures depending on the behavior of the pumped medium, Page 20).
...emptied	► Close the suction-side and pressure-side armatures.
...dismounted	► Isolate the motor from its power supply and secure it against unauthorized switch-on.
...put into storage	► Follow the storage instructions (→ 4.3 Storage, Page 12).

Tab. 6 Measures to be taken if the pump is shut down

Behavior of pumped medium	Duration of shutdown (depending on process)	
	Short	Long
Solids sediment	► Flush the pump.	► Flush the pump.
Solidifies/ freezes, non-corrosive	► Heat up or empty the pump and containers.	► Empty the pump and containers.
Solidifies/ freezes, corrosive	► Heat up or empty the pump and containers.	► Empty the pump and containers. ► Treat the pump and containers with preservative.
Remains liquid, non-corrosive	-	-
Remains liquid, corrosive	-	► Empty the pump and containers. ► Treat the pump and containers with preservative.

Tab. 7 Measures depending on the behavior of the pumped medium

## 6.4 Start-up following a shutdown period

1. If the pump is shut down for > 1 year, take the following measures before starting it up again:

Shutdown period	Measure
> 1 year	► For versions with roller bearings without lifetime lubrication: relubricate
> 2 years	► Replace elastomer seals (O-rings, shaft sealing rings). ► Replace antifriction bearings.

Tab. 8 Measures to be taken after prolonged shutdown periods

2. Carry out all steps as for the initial start-up (→ 6.2 Start-up, Page 19).

## 6.5 Operating the stand-by pump

- ✓ Stand-by pump filled and bled
  - Operate the stand-by pump at least once a week.
1. Completely open the suction-side armature.
  2. Open the pressure-side armature to an extent that the stand-by pump reaches its operating temperature and is heated through evenly (→ 6.2.1 Switching on, Page 19).

## 7 Maintenance

- For pumps in explosion hazard areas (→ ATEX additional instructions).
- Trained service technicians are available for fitting and repair jobs. Present a pumped medium certificate (DIN safety data sheet or safety certificate) when requesting service.

### 7.1 Inspections



#### Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.

#### ⚠ WARNING

#### Risk of injury and poisoning due to hazardous pumped media!

- ▶ Use protective equipment when carrying out any work on the pump.

1. Check at appropriate intervals:
  - Maintenance of minimum flow rate
  - Temperature of roller bearings < 120 °C
  - Normal operating conditions unchanged
  - Coupling alignment and condition of elastic parts
2. For trouble-free operation, always ensure the following:
  - No dry running
  - No leaks
  - No cavitation
  - Suction-side gate valves open
  - Unobstructed and clean filters
  - Sufficient supply pressure
  - No unusual running noises or vibrations
  - No excessive leakage at the shaft seal
  - Proper functioning of auxiliary systems
  - Put the installed stand-by pump into operation at least once a week

### 7.2 Maintenance

- Service life of the antifriction bearings for operation within the permissible operating range: > 2 years  
Intermittent operation, high temperatures, low viscosities and aggressive ambient and process conditions reduce the service life of antifriction bearings.
- Mechanical seals are subject to natural wear, which strongly depends on the actual operating conditions. Therefore, general statements regarding their service life cannot be made.



#### Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.



#### Risk of death due to electric shock!

- ▶ Have all electrical work carried out by qualified electricians only.

#### ⚠ WARNING

#### Risk of injury and poisoning due to hazardous or hot pumped media!

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down completely before commencing any work.
- ▶ Make sure the pump is unpressurized.
- ▶ Empty the pump, safely collect the pumped medium and dispose of the medium in accordance with environmental rules and requirements.

#### 7.2.1 Antifriction bearings lubricated with grease

1. As a precaution, replace antifriction bearings with lifetime lubrication every 2 years (recommended).
2. Fill any open antifriction bearings without guard disks with grease (→ 9.2.6 Lubricants, Page 37).

### 7.2.2 Mechanical seals

- Due to their function, mechanical seals always leak a bit (→ manufacturer's specifications).

Single mechanical seals with quenching: any drastic rise in the level of the quenching system indicates a major leak at the product-side mechanical seal.

- ▶ In the event of a larger leak: replace the mechanical seal and its auxiliary seals and check the integrity of the auxiliary systems.

### 7.2.3 Packing gland

- The packing gland must always leak slightly to carry the frictional heat away.

Larger leaks in the initial hours of operation lessen during the running-in period.

- ▶ If there is increased leakage: gently tighten the hexagon nuts on the gland.

## 7.3 Dismounting



### Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.



### Risk of death due to electric shock!

- ▶ Have all electrical work carried out by qualified electricians only.

### **WARNING**

### Risk of injury and poisoning due to hazardous or hot pumped media!

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down completely before commencing any work.
- ▶ Make sure the pump is unpressurized.
- ▶ Empty the pump, safely collect the pumped medium and dispose of the medium in accordance with environmental rules and requirements.

### 7.3.1 Returning the pump to the manufacturer

- ✓ Pump unpressurized
  - ✓ Pump completely empty
  - ✓ Electrical connections isolated and motor secured against switch-on
  - ✓ Pump cooled down
  - ✓ Coupling guard dismounted
  - ✓ With couplings with a spacer piece: spacer piece removed
  - ✓ Auxiliary systems shut down, unpressurized and emptied
  - ✓ Manometer connections, manometer and fixtures dismounted
1. Always enclose a truthfully (fully) completed safety certificate when returning pumps or individual parts to the manufacturer. Order a safety certificate from the manufacturer if necessary.
  2. Take necessary measures, depending on the required repair work, as listed in the table below when returning the pump to the manufacturer.

Repair carried out	Measure for return
...at the customer's premises	<ul style="list-style-type: none"> <li>▶ Return the defective component to the manufacturer.</li> </ul>
...at the manufacturer's premises	<ul style="list-style-type: none"> <li>▶ Flush the pump and decontaminate it if it was used to pump hazardous media.</li> <li>▶ Return the complete pump (not disassembled) to the manufacturer.</li> </ul>
...at the manufacturer's premises for warranty repairs	<ul style="list-style-type: none"> <li>▶ Only if the pumped media is hazardous: flush and decontaminate the pump.</li> <li>▶ Return the complete pump (not disassembled) to the manufacturer.</li> </ul>

Tab. 9 Measures for return

### 7.3.2 Preparations for dismounting

- ✓ Pump unpressurized
- ✓ Pump completely empty, flushed and decontaminated
- ✓ Electrical connections isolated and motor secured against switch-on
- ✓ Pump cooled down
- ✓ Coupling guard dismounted
- ✓ With couplings with a spacer piece: spacer piece removed
- ✓ Auxiliary systems shut down, unpressurized and emptied
- ✓ Manometer connections, manometer and fixtures dismounted

○ In production, the pumps are constructed to a standard process. The slide-in unit can be removed without removing the volute casing and piping.

- When dismounting, observe the following:
- Precisely mark the assembly orientation and position of all components before dismounting.
  - Dismantle components concentrically without canting.
  - Dismount the pump (→ sectional drawing).

### 7.4 Installing

○ Reinstall the components concentrically, without canting, following the markings made.

1. When installing, observe the following:
  - Replace worn parts with genuine spare parts.
  - Replace seals, inserting them so that they cannot rotate.
  - Maintain the specified tightening torques (→ 9.2.4 Tightening torques, Page 37).
2. Clean all parts (→ 9.2.5 Cleaning agents, Page 37). Do not remove the prepared markings.
3. Install the pump (→ sectional drawing).
4. Replace the antifriction bearings. Fill any open antifriction bearings without guard disks with grease:
  - Make sure you use the correct type and minimum amount of grease when filling the bearing (→ 9.2.6 Lubricants, Page 37).
  - Fill the cavities between the rolling elements up to 40 % with grease.
  - Wipe off any excess grease with a soft object.
5. Install the pump in the system (→ 5 Setup and connection, Page 14).

### 7.5 Ordering spare parts

○ For trouble-free replacement in the event of any faults, we recommend keeping complete slide-in units or spare pumps available on site.

The application guidelines conforming to DIN 24296 recommend provisioning for two years of continuous use (→ 9.3 Spare parts for two years of continuous operation according to DIN 24296, Page 38).

- Have the following information ready to hand when ordering spare parts (→ type plate):
- Short designation of the pump
  - Pump number
  - Year of manufacture
  - Part number
  - Designation
  - Quantity

## 8 Troubleshooting

For faults which are not specified in the following table or cannot be traced back to the specified causes, please consult the manufacturer.

Possible faults are identified by a fault number in the table below. This number identifies the respective cause and remedy in the troubleshooting list.

Fault	Number
Pump not pumping	1
Pumping rate insufficient	2
Pumping rate excessive	3
Pumping pressure insufficient	4
Pumping pressure excessive	5
Pump running roughly	6
Antifriction bearing temperatures too high	7
Pump leaking	8
Motor power uptake excessive	9

Tab. 10 Fault number assignment

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
X	-	-	-	-	-	-	-	-	Supply/suction pipe and/or pressure pipe closed by armature	► Open the armature.
x	-	-	-	-	-	-	-	-	Automatic aspirator defective	► (→ A25 automatic aspirator operating manual).
-	X	-	X	-	-	-	-	-	Supply/suction pipe not fully opened	► Open the armature.
X	X	-	X	-	X	-	-	-	Supply/suction pipe, pump or suction screen blocked or encrusted	► Clean the supply/suction pipe, pump or suction screen.
-	X	-	X	-	X	-	-	-	Supply/suction pipe cross-section too narrow	► Increase the cross-section. ► Remove any encrustations from the suction pipe. ► Open the armature completely.
X	-	-	-	-	-	-	-	-	Transport and sealing cover still in place	► Remove the transport and sealing cover. ► Dismount the pump and inspect it for dry-running damage.
-	X	-	X	-	X	-	-	-	Differential head excessive: $NPSH_{pump}$ larger than $NPSH_{system}$	► Increase the supply pressure. ► Consult the manufacturer.
X	-	-	-	-	X	-	-	-	Supply/suction pipe not bled properly or not filled up completely	► Fill up the pump and/or piping completely and bleed them.
X	-	-	-	-	X	-	-	-	Supply/suction pipe contains air pockets	► Install the armature for bleeding. ► Correct the piping layout.
X	X	-	X	-	X	-	-	-	Air is sucked in	► Seal the source of malfunction.
X	X	-	X	-	X	-	-	-	Excessive amount of gas: pump is cavitating	► Consult the manufacturer.

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
-	X	-	X	-	X	-	-	-	Pumped medium temperature too high: pump is cavitating	<ul style="list-style-type: none"> <li>▶ Increase the supply pressure.</li> <li>▶ Lower the temperature.</li> <li>▶ Consult the manufacturer.</li> </ul>
-	X	-	X	-	-	-	-	X	Viscosity or specific gravity of the pumped medium outside the range specified for the pump	<ul style="list-style-type: none"> <li>▶ Consult the manufacturer.</li> </ul>
-	X	-	X	-	-	-	-	-	Geodetic differential head and/or pipe flow resistances too high	<ul style="list-style-type: none"> <li>▶ Remove sediments from the pump and/or pressure pipe.</li> <li>▶ Install a larger impeller and consult the manufacturer.</li> </ul>
-	X	-	-	X	X	-	-	-	Pressure-side armature not opened sufficiently	<ul style="list-style-type: none"> <li>▶ Open the pressure-side armature.</li> </ul>
X	X	-	-	X	X	-	-	-	Pressure pipe blocked	<ul style="list-style-type: none"> <li>▶ Clean the pressure pipe.</li> </ul>
X	X	-	X	-	X	-	-	-	Pump running in the wrong direction	<ul style="list-style-type: none"> <li>▶ Swap any two phases on the motor.</li> </ul>
X	X	-	X	-	-	-	-	-	Motor speed insufficient	<ul style="list-style-type: none"> <li>▶ Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary.</li> <li>▶ Increase the motor speed if speed control is available.</li> </ul>
-	X	-	X	-	X	X	-	-	Pump parts worn	<ul style="list-style-type: none"> <li>▶ Replace the worn pump parts.</li> </ul>
-	-	X	X	-	X	-	-	X	Pressure-side armature opened too wide	<ul style="list-style-type: none"> <li>▶ Throttle down at the pressure-side armature.</li> <li>▶ Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.</li> </ul>
-	-	X	-	-	X	-	-	X	Geodetic differential head, pipe flow resistances and/or other resistances lower than specified	<ul style="list-style-type: none"> <li>▶ Throttle down the flow rate at the pressure-side armature. Observe the minimum flow rate.</li> <li>▶ Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.</li> </ul>
-	-	X	-	X	-	-	-	-	Viscosity lower than expected	<ul style="list-style-type: none"> <li>▶ Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.</li> </ul>
-	-	X	-	X	X	X	-	X	Motor speed too high	<ul style="list-style-type: none"> <li>▶ Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary.</li> <li>▶ Reduce the motor speed if speed control is available.</li> </ul>
-	-	X	-	X	X	-	-	X	Impeller diameter too large	<ul style="list-style-type: none"> <li>▶ Throttle down the flow rate at the pressure-side armature. Observe the minimum flow rate.</li> <li>▶ Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.</li> </ul>
X	X	-	X	-	X	-	-	-	Impeller out of balance or blocked	<ul style="list-style-type: none"> <li>▶ Dismount the pump and inspect it for dry-running damage.</li> <li>▶ Clean the impeller.</li> </ul>

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
-	X	-	X	-	X	-	-	-	Hydraulic parts of the pump dirty, clotted or encrusted	► Dismount the pump. ► Clean the parts.
-	-	-	-	-	X	X	-	X	Defective antifriction bearing in bearing bracket	► Replace the antifriction bearing.
-	-	-	-	-	-	X	-	X	Defective antifriction bearing in motor	► Replace the antifriction bearing.
-	-	-	-	-	-	X	-	-	Lubricant: too much, not enough or unsuitable	► Reduce, top up or replace the lubricant.
-	-	-	-	-	-	-	X	-	Connecting bolts not tightened correctly	► Tighten the connecting bolts.
-	-	-	-	-	-	-	X	-	Mechanical seal worn	► Replace the mechanical seal.
-	-	-	-	-	-	-	X	-	Housing seal defective	► Replace the housing seal.
-	-	-	-	-	-	-	X	-	Shaft sleeve is penetrated	► Replace the shaft sleeve and/or O-ring.
-	-	-	-	-	X	X	X	X	Pump distorted	► Check the pipe connections and pump fixings. ► Check the coupling alignment. ► Check the fixing of the support foot.
-	-	-	-	-	X	X	-	-	Coupling not properly aligned	► Align the coupling.
-	-	-	-	-	X	-	-	-	Coupling units worn	► Replace the coupling units and realign them.
-	X	-	X	-	X	-	-	X	Motor running on 2 phases	► Check the fuse and replace it if necessary. ► Check the cable connections and insulation.

Tab. 11 Troubleshooting list

## 9 Appendix

### 9.1 Sectional drawings

#### 9.1.1 Auxiliary connections

Abbreviation	Connection
FD	Pumped medium / emptying
FF	Filling
LO	Leak / egress
PM1/PM2	Pressure gauge
FV	Bleeding

Tab. 12 Abbreviations of the connection designations

#### 9.1.2 Part numbers and designations

Part no.	Designation
102.01	Volute casing
106.01	Suction casing
161.01	Housing cover
161.05	Housing cover
182.01	Foot
210.01	Shaft
230.01	Impeller
321.01	Radial ball bearing      6308 ZZ
321.02	Radial ball bearing      6308 ZZ
321.03	Radial ball bearing
321.04	Radial ball bearing
322.01	Cylindrical roller bearing
330.01	Bearing bracket
346.01	Bell housing
360.01	Bearing cover
360.02	Bearing cover
400.01	Gasket
400.02	Gasket
411.01	Seal ring
411.02	Seal ring
411.03	Seal ring
411.04	Seal ring
411.05	Seal ring
411.06	Seal ring
411.37	Seal ring
412.01	O-ring

Part no.	Designation
412.10	O-ring
412.11	O-ring
424.01	V-ring
424.02	V-ring
433.01	Mechanical seal
441.01	Shaft seal housing
452.01	Gland
458.01	Retaining ring
461.01	Gland packing
502.01	Split ring
502.02	Split ring
504.01	Spacer ring
507.01	Oil thrower
509.01	Intermediate ring
509.02	Intermediate ring
516.01	Nilos ring
516.02	Nilos ring
525.01	Spacer sleeve
551.01	Spacing washer
551.10	Spacing washer
551.12	Spacing washer
557.01	Balance disk
565.01	Rivet
571.01	Clamp
575.01	Strap
672.01	Vent
681.01	Coupling guard
710.01	Pipe
710.02	Pipe
731.02	Pipe fitting
801.01	Flanged motor
855.01	Coupling with spacer piece
894.01	Console
901.01	Hexagon head bolt
901.02	Hexagon head bolt
901.03	Hexagon head bolt
901.04	Hexagon head bolt

<b>Part no.</b>	<b>Designation</b>
901.08	Hexagon head bolt
901.09	Hexagon head bolt
902.01	Stud bolt
902.03	Stud bolt
902.05	Stud bolt
902.06	Stud bolt
902.08	Stud bolt
902.10	Stud bolt
903.01	Screw plug
903.02	Screw plug
903.03	Screw plug
903.04	Screw plug
903.05	Screw plug
903.06	Screw plug
903.26	Screw plug
904.02	Grub screw
904.03	Grub screw
908.01	Jacking screw
908.02	Jacking screw
908.10	Jacking screw
914.01	Cheese head screw
914.04	Cheese head screw
914.05	Cheese head screw
914.10	Cheese head screw
920.03	Hexagon nut
920.04	Hexagon nut
920.05	Hexagon nut
920.06	Hexagon nut
920.08	Hexagon nut
920.10	Hexagon nut
922.01	Impeller nut
932.01	Circlip
932.04	Circlip
932.10	Circlip
934.01	Spring washer
936.01	Spring ring
940.01	Shaft key

<b>Part no.</b>	<b>Designation</b>
940.02	Shaft key
951.01	Cup spring
971.01	Name plate

Tab. 13 Designations of components according to part numbers

9.1.3 Sectional drawings of the NIM series

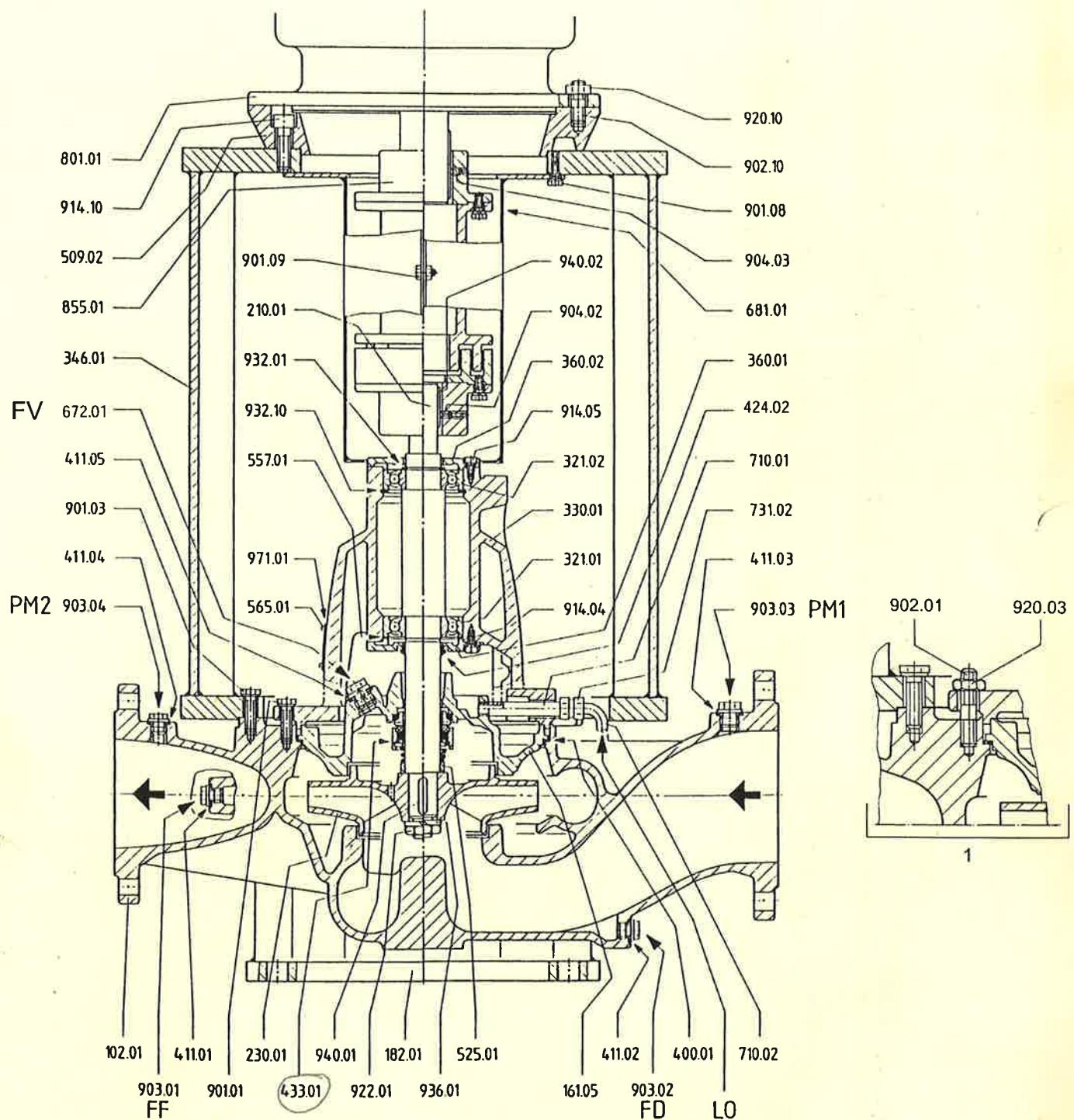


Fig. 9 U3...D Unbalanced mechanical seal  
Base installation

1 Attachment to size-585 bearing  
bracket

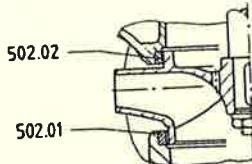


Fig. 10 Version with split rings

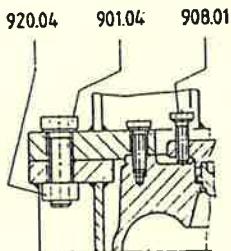


Fig. 11 Attachment of the pump feet to the bell housing

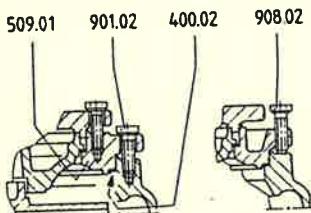


Fig. 12 Version with intermediate ring

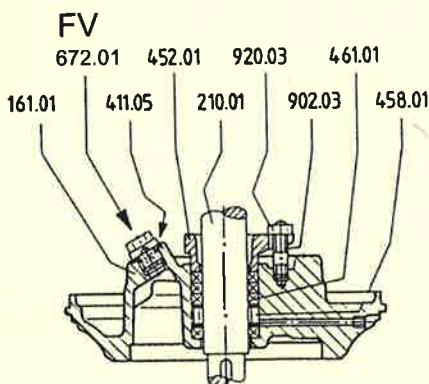


Fig. 13 U1B – Packing gland with self-locking

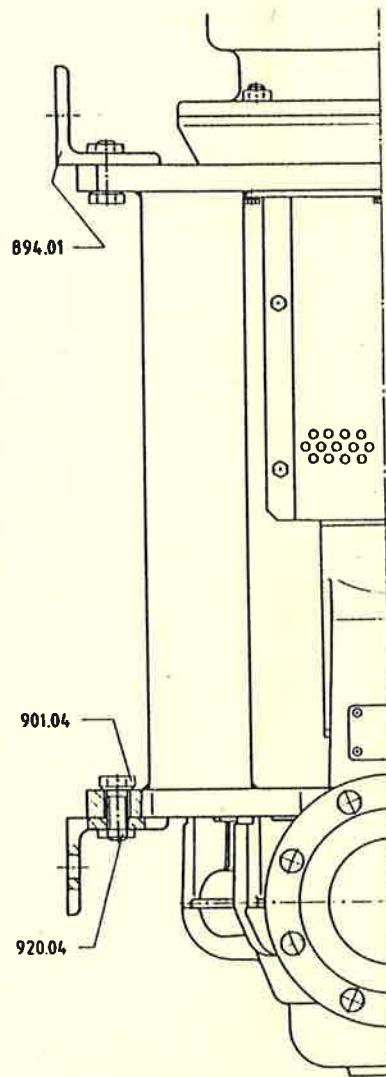


Fig. 14 Wall attachment version

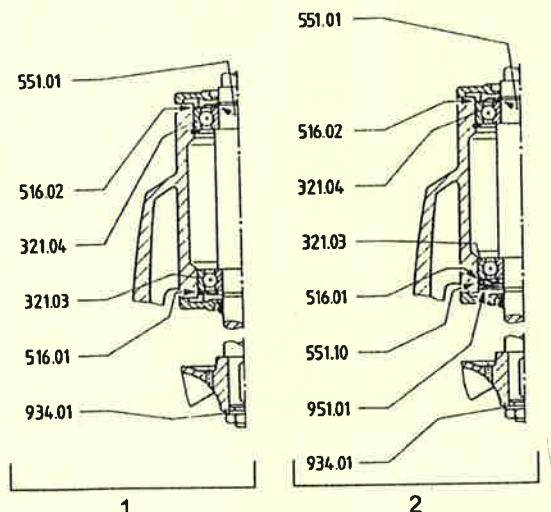


Fig. 15 Bearing and impeller retention version

1 Bearing bracket size 530

2 Bearing bracket size 585

Sizes 300–315 and 300–400 at bearing bracket 585

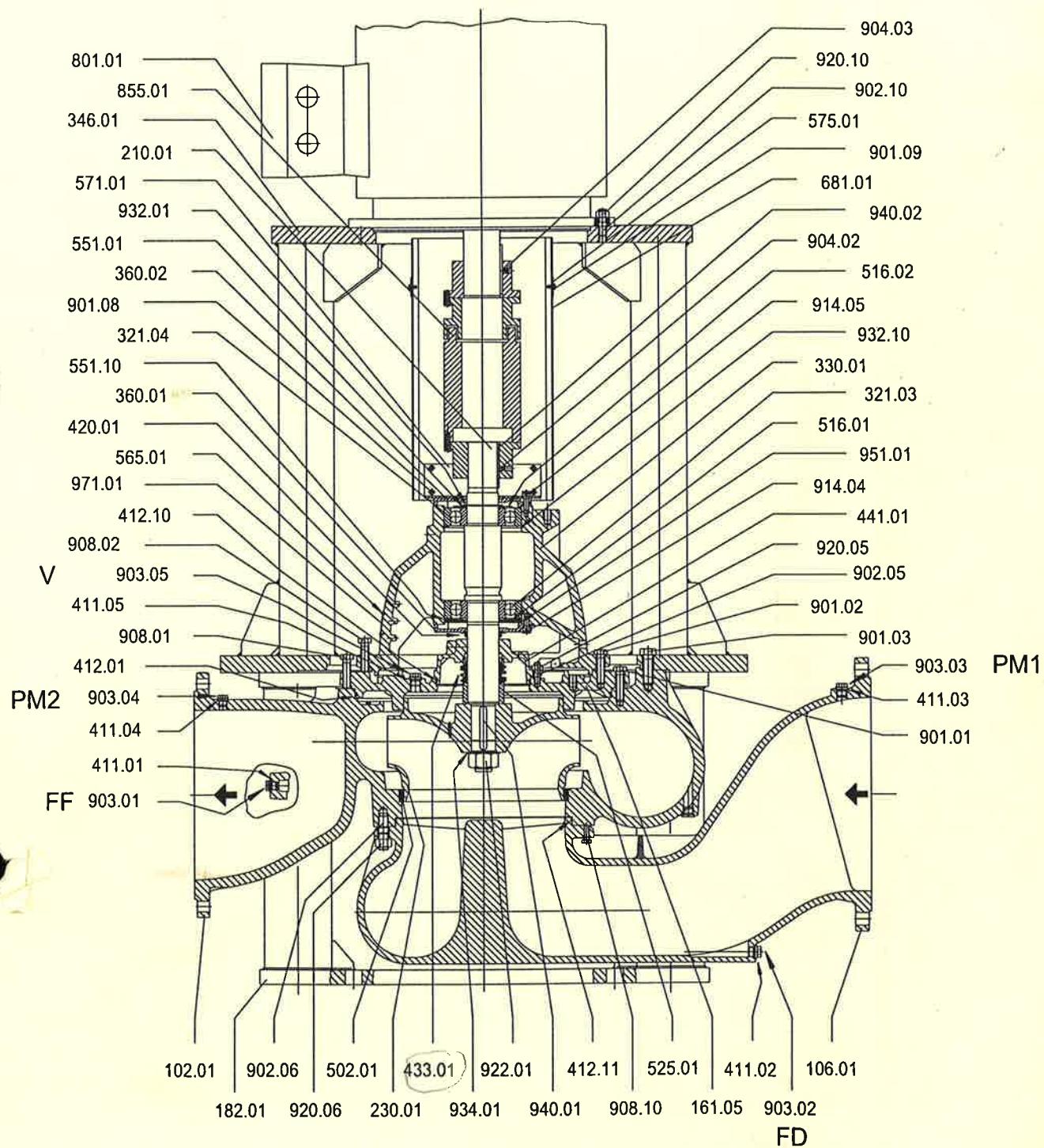


Fig. 16 U3...D Unbalanced mechanical seal  
Base installation

## Sizes 300–315 and 300–400 at bearing bracket 700

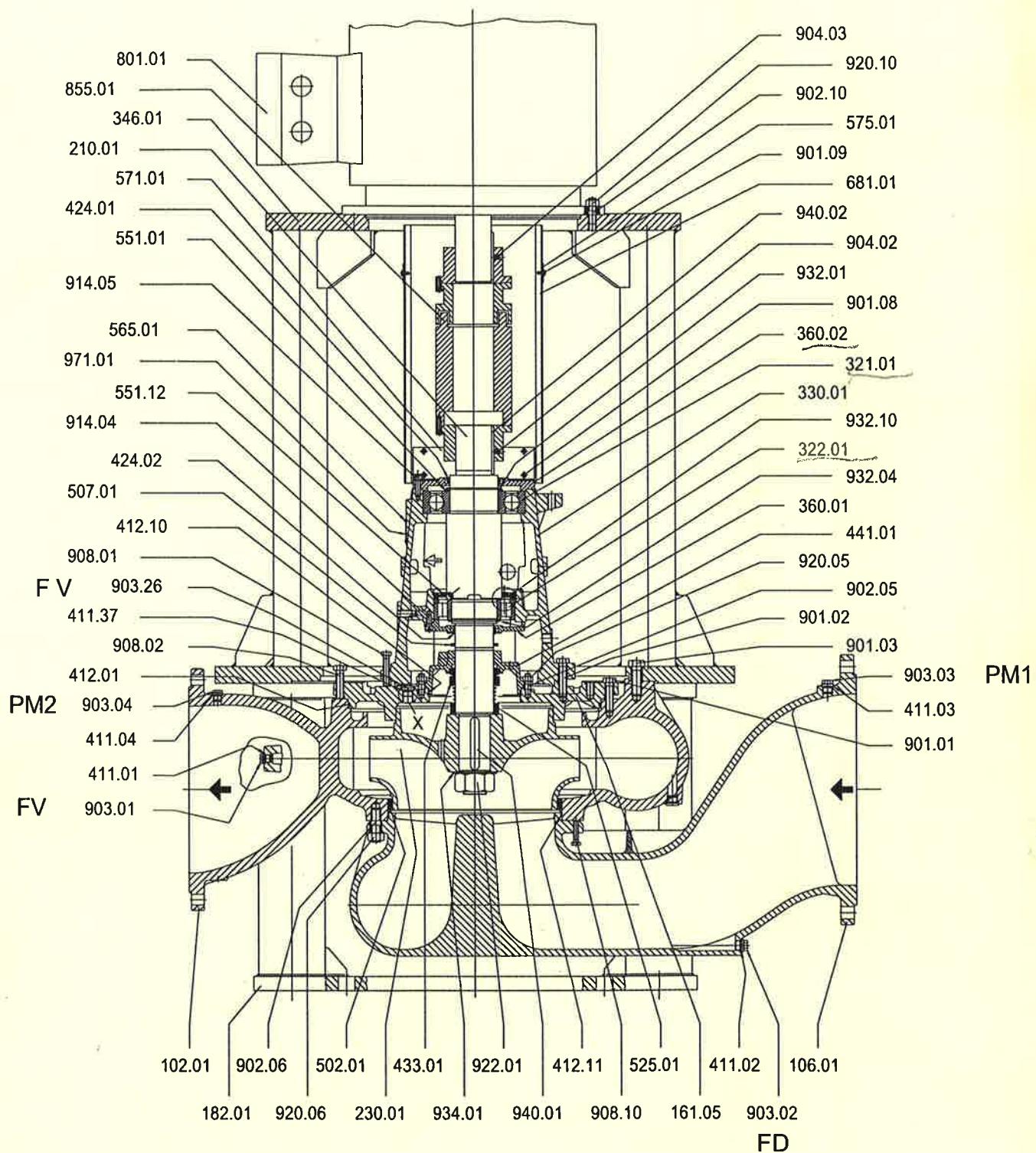


Fig. 17 U3...D Unbalanced mechanical seal  
Base installation

**Variants for 300–315 and 300–400 sizes**

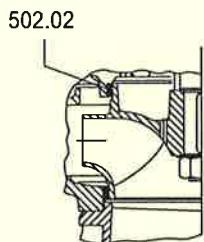


Fig. 18 Version with V2 split ring

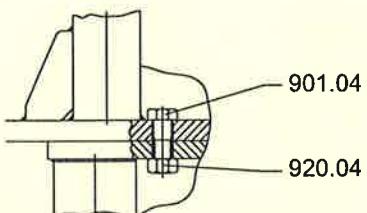


Fig. 19 Attachment of the pump feet to the bell housing

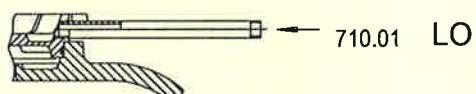


Fig. 20 Leak/egress on housing cover

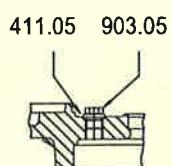


Fig. 21 X detail on housing cover

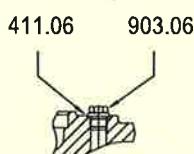


Fig. 22 C01 connection on volute casing

9.1.4 Sectional drawings of the NAM series

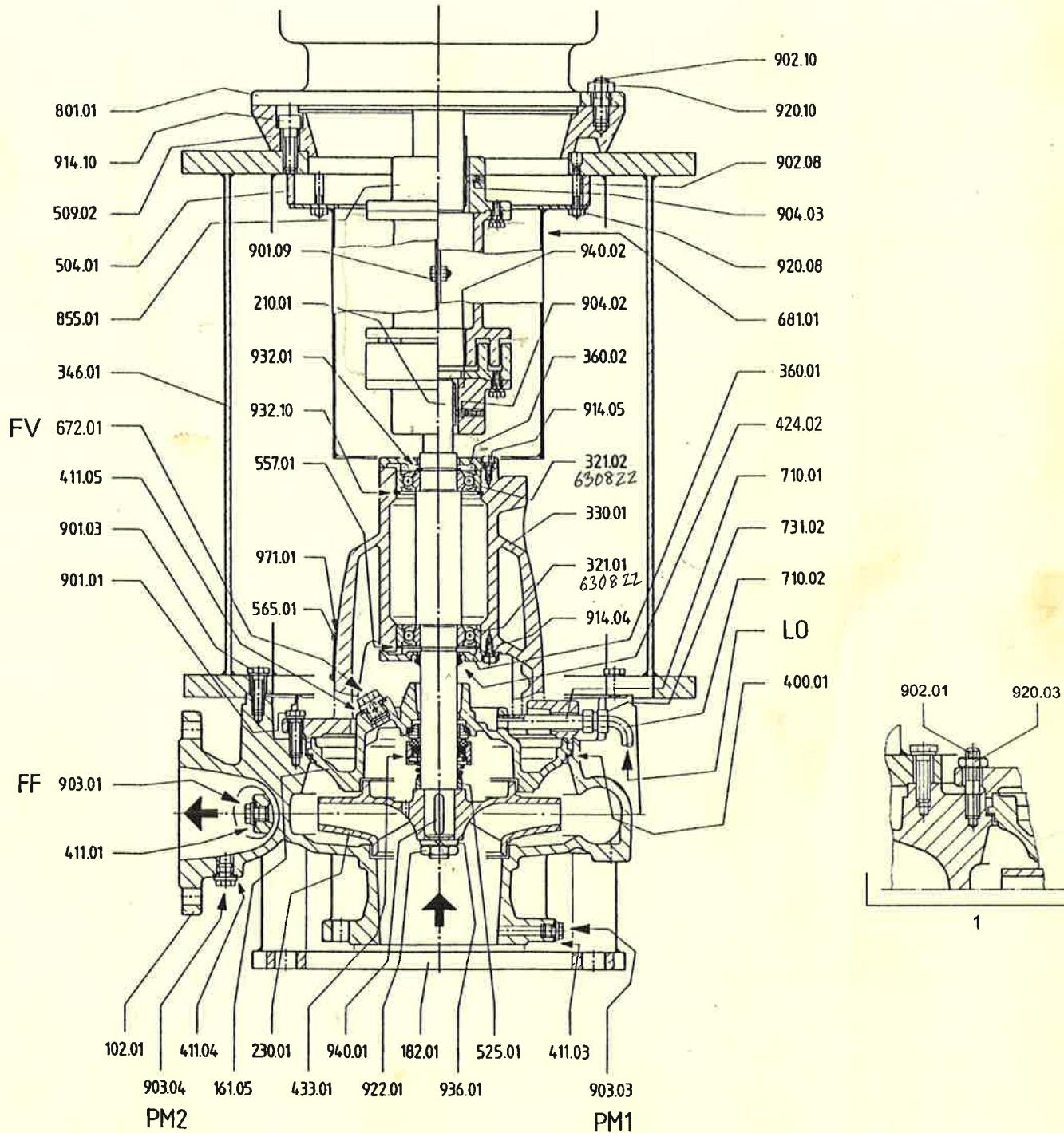


Fig. 23 U3...D Unbalanced mechanical seal  
Base installation

1 Attachment to size-585 bearing  
bracket

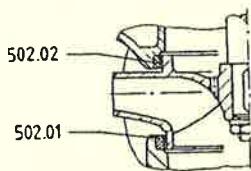


Fig. 24 Version with split rings

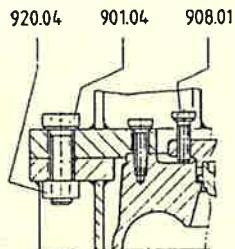


Fig. 25 Attachment of the pump feet to the bell housing

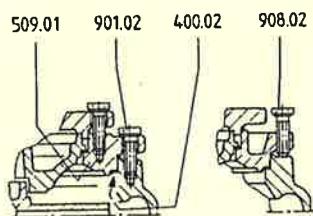


Fig. 26 Version with intermediate ring

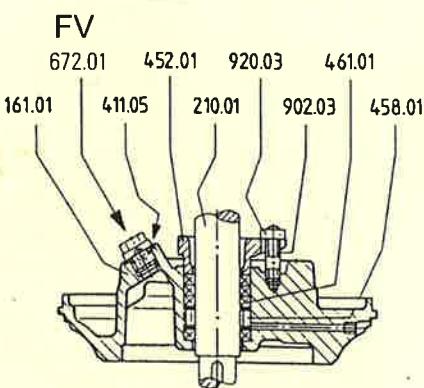


Fig. 27 U1B – Packing gland with self-locking

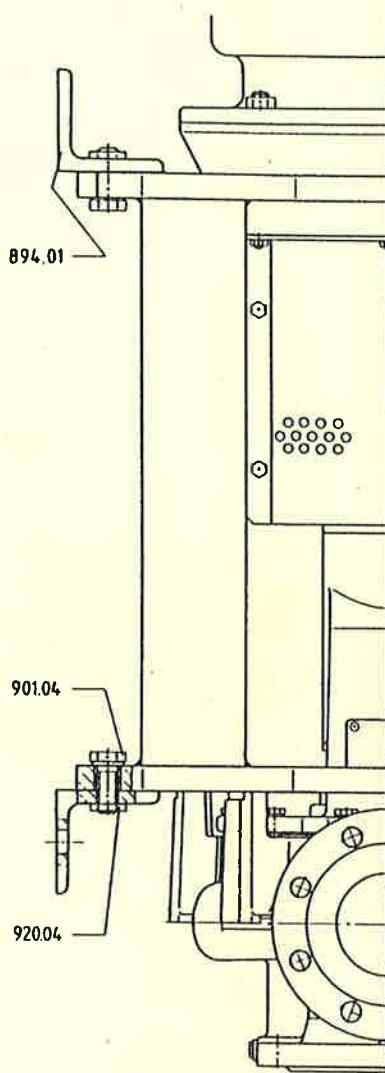


Fig. 28 Wall attachment version

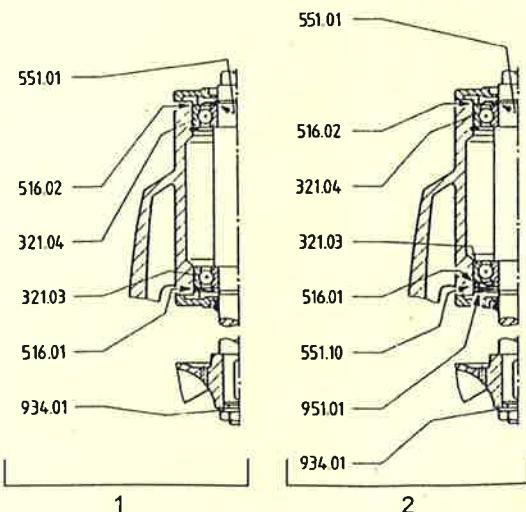


Fig. 29 Bearing and impeller retention version

1 Bearing bracket size 530

2 Bearing bracket size 585

## 9.2 Technical specifications

More technical specifications (→ order data sheet).

### 9.2.1 Ambient conditions

Operation under other ambient conditions to be agreed with the manufacturer

Temperature [°C]	Relative humidity [%]		Setup height above sea level [m]
	Long-term	Short-term	
-20 to +40	≤ 85	≤ 100	≤ 1000

Tab. 14 Ambient conditions

### 9.2.2 Preservatives

Use a Valvoline preservative or similar (recommended).

Type of storage	Storage duration [months]	Preservative inside/ outside	Renew [months] inside/ outside
In closed, dry and dust-free room	6–12	Tectyl 511 M	–
	> 12	Tectyl 506 EH	48/48
In open air, central European climate	6–12	Tectyl 542	–
	> 12	Tectyl 506 EH	48/18
In open air, tropical climate, aggressive industrial atmosphere or close to sea	6–12	Tectyl 542/ Tectyl 506 EH	–
	> 12	Tectyl 506 EH	48/12

Tab. 15 Valvoline preservatives

### 9.2.3 Sound pressure levels

Measuring conditions:

- Distance to the pump: 1 m
- Operation: cavitation-free
- Motor: IEC standard motor
- Tolerance ±3 dB

Lower-noise versions of the motors are available if the expected noise levels exceed the permissible limits.

Nominal motor power PM [kW]	Sound pressure level [dB] for pump with motor at speed [min⁻¹]			
	1450	1750	2900	3500
1.5	58	58.5	63	64
2.2	60	60.5	66	67
3.0	62	62.5	68	69
4.0	63	63.5	69	70
5.5	65	65.5	71	72
7.5	66	66.5	72	73
11.0	68	68.5	74	75
15.0	69	69.5	75	76
18.5	70	70.5	76	77
22.0	71	71.5	77	78
30.0	72	72.5	78	79
37.0	73	73.5	79	80
45.0	74	74.5	80	81
55.0	75	75.5	80	81
75.0	76	76.5	81	82
90.0	76	76.5	82	83
110.0	77	77.5	82	83
132.0	78	78.5	83	84
160.0	79	79.5	84	85
200.0	80	80.5	85	86

Tab. 16 Sound pressure levels

### 9.2.4 Tightening torques

Part no.	Thread gage	Quality	Tightening torque [Nm]
901.01	M12 M16	A4-70	45 110
901.02	M12 M16	A4-70	45 110
901.03	M12 M16 M20	8.8	70 170 330
901.04	M20 M24 M30	8.8	330 560 1100
901.08 901.09	M8	4.6	10
902.01	M16	A4-70	110
914.04 914.05	M6 M8 M10	8.8	10 20 40
914.10	M16	8.8	180
920.03 <sup>1)</sup>	M16	A4-70	110
920.04	M20 M24 M30	8.8	330 560 1100
920.05 920.06 920.08	M12 M20 M8	A4-70 A4-70 5.8	45 210 12
920.10	M12 M16 M20	5.8	35 80 160
922.01	M24 x 1.5 M30 x 1.5 M36 x 1.5 M48 x 1.5	A4/1.44 A4/1.44 A4/1.44 A4/1.40	175 310 630 1700

Tab. 17 Tightening torques

1) applies only to bearing bracket 585

### 9.2.5 Cleaning agents

Application area	Cleaning agents
Foodstuffs and drinking water sector	E.g. spirit, Ritzol 155, strong alkaline soapy solution, steam jet (for individual parts only)
Other	Benzine, wax solvents, diesel, paraffin, alkaline cleaners

Tab. 18 Cleaning agents

### 9.2.6 Lubricants

Manufacturer	Brand name	Name according to DIN 51825
Agip	Agip GR MU3	K3K-20
ARAL	Aralub HL3	K3K-20
BP	BP Energearse LS3	K3K-20
ESSO	BEACON 3	K3K-20
Fuchs	RENOLIT FWA 220	K3K-20
Klüber	MICROLUBE GL 263	K3K-20
Mobil-Öl	Mobilux 3	K3K-20
Shell	Shell Alvania Fett R3	K3K-20
SKF	SKF-Fett LGMT3	K3K-20

Tab. 19 Grease types

Size of the bearing bracket	Short designation of the antifriction bearing	Approx. amount of grease [g]
530	6410 J C3	35
585	6413 J C3	65
700	NU 2219 ECJ	50

Tab. 20 Minimum amounts for grease lubrication

$D = 50 \text{ MM}$

$OD = 130 \text{ MM}$

$Th = 31 \text{ mm}$

$D = 65 \text{ MM}$

$OD = 160 \text{ MM}$

$Th = 37 \text{ MM}$

As per IMPA code

Correct Bearing - 6308 ZZ

Two in No

226/19

**9.3 Spare parts for two years of continuous operation according to DIN 24296**

Part no.	Part designation	Number of identical pumps (including stand-by pumps)						
		2	3	4	5	6 or 7	8 or 9	> 9
<b>Set/quantity of spare parts</b>								
230.01	Impeller	1	1	1	2	2	3	30 %
210.01 922.01 934.01 936.01	Shaft Impeller nut Spring washer or Spring ring	1 <sup>1)</sup>	1	1	2	2	2	30 %
321.01 321.02 321.03 321.04 322.01	Groove ball bearing Groove ball bearing Groove ball bearing Groove ball bearing Cylindrical roller bearing	2 <sup>2)</sup>	1	1	2	2	3	4
_ 1)	Bearing bracket, complete, consisting of: Shaft, bearing, bearing cover etc.	-	-	-	-	-	1	2
433...	Mechanical seal	2	3	4	5	6	7	90 %
461.01	Gland packing rings (set)	4	4	6	6	6	8	40 %
502.01 502.02	Split ring Split ring	2	2	2	3	3	4	50 %
Various <sup>1)</sup>	Seals for pump housing (set) Other seals (set)	4	6	8	8	9	12	150 %

Tab. 21 Spare parts for two years of continuous operation

1) Delivered as a mechanical unit (BG) or sales unit (VG)

2) Depending on the size of the bearing bracket





*Ref pos 1.*

## ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2  
 CUSTOMER.....: Havyard Leirvik as  
 CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
 Date of issue: 30/10-07

*F.W.*

### FW DISCH. PUMP 2. SPEED

2,00 NAM 80-200/230U3.1DW18 AELD65 IEC280

Number: 1,00

Allweiler vertical single-stage centrifugal pump with flexible coupling and el-motor. Spacer-coupling allows easy dismantling of bearing unit, impeller, seal etc, without removing the volute casing, pipelines and driving motor. Pump has axial suction flange, radial delivery flange.  
 Bulkhead mounting.

NOTE: MOTOR SHAFT Ø75

Technical specification: Centrifugal pump

Serialno.:	6037609,
Capacity.....	....m3/h: 200 - 100
Diff. pressure.....	....bar: 9 - 2,2
Delivery head.....	....m: 90 - 22,5
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 9 - 2,2
Speed.....	... rpm: 3500 - 1750
NPSHr.....	....m: 6,8 - 4,0
Power absorbed.....	....Kw: 66,4 - 8,3
Medium.....	.....: FW
Temperature.....	.....C: amb.
Viscosity.....	...mm <sup>2</sup> /s: 1
Specific gravity....	...kg/m <sup>3</sup> : 1000
Pump casing.....	material: Nod.C.I.
Impeller.....	material: NiAlBz
Shaft.....	material: 1.4571
Shaft seal.....	....type: Mech.seal

2,01 AELD 65 AUTOMATIC ASPIRATOR Number: 1,00

Automatic air driven priming ejector mounted.

2,10 EL-MOTOR 280M-2/4 MARINE 2-SPEED Number: 1,00

Technical specification: El-motor

Rated power.....	.....KW: 77/20,7
RPM.....	....Rpm.: 3500/1750
Voltage.....	....Volt: 3*440
Frequency.....	....Hz: 60
Ampere In.....	....A: 122/32
Starting method....	....type: DOL/DOL
Construction method.	....type: V1
Protection.....	.....: IP55
Vikling.....	.....: Dahlander
Isolation.....	.....: F
Temp.rise.....	....K: 90K
Heating element....	....: 230V 98W

---

**ORDER SPECIFICATION**

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ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10-07

---

Test certificate.... ....: DNV

2,20 CERTIFICATE DNV, PUMP Number: 1,00

2,90 Mano/Vac.set fluid w/sep.transm.on panel Number: 1,00

The set contains as follows:

- 2 off 100 mm. liquid filled instruments for local reading. -1 to 5 and 0 - 16 bar.
- 2 off pressure transmitter, 4-20 mA.
- 2 off 3 way ball valve with over mentioned mounted.  
All mounted on a panel plate.

For FW pump.

## ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2 Rev.no.: 2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP Date of issue: 30/10/07

### LIQUID MUD DISCH. PUMP

\*\*\*\*\*

3,00 AEB 2N 1450-IE/0X1 P01 G 112 PA P 6230 Number: 2,00

Allweiler self-priming eccentric screw-pump with gearmotor flanged on. Horizontal execution. Safety valve and dry running protection is included.

Suct.flange position: one right (pos 2) one left (pos 4) viewed from driver.

Technical specification: Eccentric screw pump

Serialno.: 6026674, 6026673,  
Capacity..... ....m3/h: 75  
Diff.pressure..... ....bar: 18  
Rpm..... ....rpm.: 350  
Power absorbed..... ....Kw: 50  
Direction..... ..cw/ccw: ccw  
Medium..... .....: Liquid mud  
Viscosity..... ....mm2/s: - 200  
Casing..... material: Cast Iron  
Rotor..... material: St.St.  
Stator..... material: Special Perbunan  
Stator..... ....type: Equal wallthickness  
Shaft sealing..... ....type: Stuffing box

3,10 GEARMOTOR CB 9-250M/4DF SL 63 350A60 Number: 2,00

Technical specification: El-motor

Rated power..... ....KW: 63  
RPM..... ....Rpm.: 350  
Voltage..... ....Volt: 3 x,440  
Frequency..... ....Hz: 60  
Ampere In..... ....A: 105  
Ampere Is..... ....A: -  
Starting method.... ....type: Frequency controlled  
Construction method. ....type: Flanged on  
Protection..... .....: IP55  
Isolation..... .....: F  
Temp.rise..... ....K: 90  
PTC Yes/NO..... .....: mounted

3,18 CERTIFICATE DNV, PUMP Number: 2,00

3,19 TEST REPORT DNV EL-MOTOR Number: 2,00

3,20 VEGASWING 61 R 1" Number: 2,00

Dryrunningprotection. Registration of liquid / no liquid.

Mounted on suction pipe.

Power supply: 20-250VAC, 20-60VDC.

Output: DPDT (relay on/off\*) to be connected to a time relay function, 2-10 sec., supplied by yard.

---

## ORDER SPECIFICATION

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ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havard Leirvik as  
CUSTOMER REF.....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

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\* max 750VA AC, 54 W DC

3,45 SAFETYVALVE 40X65 MUD PN 40 Number: 2,00

Set point: 18,5 bar

Inlet & Outlet with flanges.

3,50 MANO/VACUMETER W. PRESS.TR. 2M/ Mud Number: 2,00

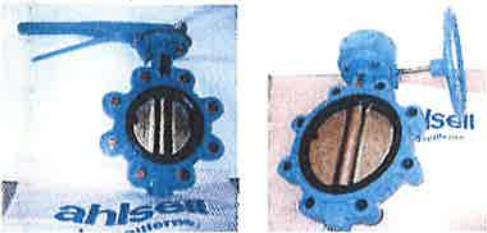
Mano / vacumeter for mud.

Remote and local reading. 4-20 ma.  
-1 to 5 bar & 0 - 25 bar

Delived with membran to avid contact with media.

**Material:**

Hus/Body: ..... Seigjern/Ductile iron (DI) GGG-40.3  
 Spjeld/Disc: ..... AlBr (2.0975.01)  
 Spindel/Stem: ..... 316SS, (1.4408)  
 Pakning/Sealing: ..... NBR  
 Foringer/Bearings: .... PTFE  
**FARGE/COLOUR:... Grønn / Green**



**DREIESPJELDVENTIL**

**Butterfly Valve**

**SIP - 13LT - Lug type**

**Anbefalt bruksområde/Recommended usage:**

Bunn- og overbord ventil for skip og ellers på utsatte plasser. Min. 12% el. for 3.1.C sertifikat. For temperaturer under 80°C.

For use on ships, for bottom and hull, and under other special working conditions. Min. 12% el. for 3.1.C certificate. For temp. below 80°C.

**Lug-type:**

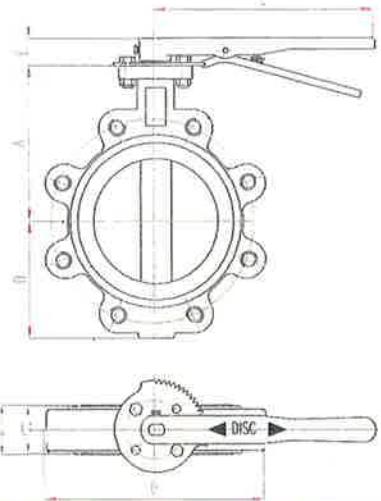
- Ventil med gjengede boltehull
- Valve with threaded bolt holes

**Ventil med spak - Valve with lever**

Dim.DN Inch.	Varenr. NRF	D mm.	L1 mm.	L2 mm.	A mm.	B mm.	E mm.	L mm.	Mv Nm	Vekt Kg
<b>DN 40</b> 1,5"	<b>5534097</b>	110	33	35	120	81	32	267	12	4.2
<b>50</b> 2"	<b>5534098</b>	120	43	46,5	124	81	32	267	13	5.0
<b>DN 65</b> 2,5"	<b>5534099</b>	140	46	47,5	134	91	32	267	21	6.0
<b>DN 80</b> 3"	<b>5534101</b>	145	46	47,5	141	97	32	267	28	7.0
<b>DN 100</b> 4"	<b>5534102</b>	160	52	54,5	156	115	32	267	35	9.3
<b>DN 125</b> 5"	<b>5534103</b>	190	56	58,5	168	128	32	267	50	12.6
<b>DN 150</b> 6"	<b>5534104</b>	215	56	58,0	184	140	32	267	108	13.0

Trykklasse/Pressure class: PN 16

Flenseborring/Flange drilling: PN 16

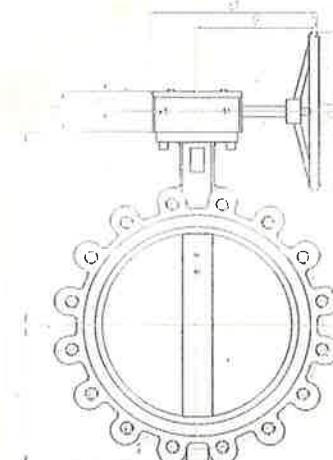


**Ventil med gir - Valve with gearbox**

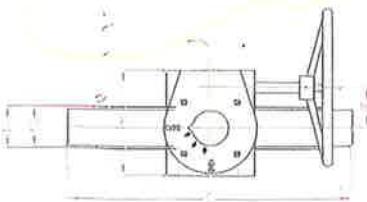
Dim.DN Inch.	Varenr. NRF	D mm.	L1 mm.	L2 mm.	A mm.	B mm.	C1 mm.	E1 mm.	Mv Nm	Vekt Kg
<b>DN 200</b> 8"	<b>5534105</b>	330	60	62,5	213	174	77	310	195	31
<b>DN 250</b> 10"	<b>5534106</b>	395	68	70,5	244	220	77	308	300	42,3
<b>DN 300</b> 12"	<b>5534107</b>	465	78	80,5	283	254	77	308	455	65,5
<b>DN 350</b> 12"	<b>5534108</b>	515	78	80,5	368	272	77	308	624	81,9
<b>DN 400</b> 12"	<b>5534109</b>	580	102	104,5	400	320	103	430	845	122,5
<b>DN 450</b> 12"	<b>5534111</b>	630	114	116,5	422	348	103	430	1130	132,9
<b>DN 500</b> 12"	<b>5534112</b>	700	127	129,5	479	372	147	480	1430	228,3
<b>DN 600</b> 12"	<b>5534113</b>	823	154	156,5	562	470	147	480	1846	327,3

Trykklasse/Pressure class: PN 10

Flenseborring/Flange drilling: PN 10



Dim.DN	G	J	L1	Ho	øF1	K
DN 200	236	35	314	63	290	181
DN 250-350	227	38	310	78	290	201
DN 400-450	260	51	394	120	290	291
DN 500-600	348	71	478	120	290	310



Kan leveres med 3.1.B sertifikat.

Forbehold om trykkfeil og endring av produktet  
No responsibility for any errors.

**ahlsell**

*Ref pos 1.*

## ORDER SPECIFICATION

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10/07

### BW/DW DISCH. PUMP 2. SPEED

\*\*\*\*\*

4,00	NAM 80-200/230U3.1DW3AELD65IEC280	Number:	1,00
------	-----------------------------------	---------	------

Allweiler vertical single-stage centrifugal pump with flexible coupling and el-motor. Spacer-coupling allows easy dismantling of bearing unit, impeller, seal etc, without removing the volute casing, pipelines and driving motor. Pump has axial suction flange, radial delivery flange.  
Bulkhead mounting.

NOTE: MOTOR SHAFT Ø75

Technical specification:	Centrifugal pump
--------------------------	------------------

Serialno.:	6037610,
Capacity.....	....m3/h: 200 - 100
Delivery head.....	.....m: 90 - 22
Inlet pressure.....	.....bar: 0
Outlet pressure.....	.....bar: 9 - 2,2
Speed.....	... rpm: 3500 - 1750
NPSHr.....	.....m: 6,8 - 4,0
Power absorbed.....	.....Kw: 68 - 8,5
Medium.....	.....: SW
Temperature.....	.....C: amb.
Viscosity.....	....mm <sup>2</sup> /s: 1
Specific gravity.....	...kg/m <sup>3</sup> : 1025
Pump casing.....	material: NiAlBz
Impeller.....	material: NiAlBz
Shaft.....	material: 1.4571
Shaft seal.....	....type: Mech.seal

4,01	AELD 65 AUTOMATIC ASPIRATOR	Number:	1,00
------	-----------------------------	---------	------

Automatic air driven priming ejector mounted.

4,10	EL-MOTOR 280M-2/4 MARINE 2-SPEED	Number:	1,00
------	----------------------------------	---------	------

Technical specification:	El-motor
--------------------------	----------

Rated power.....	....KW: 77/20,7
RPM.....	...Rpm.: 3500/1750
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: 122-32
Starting method.....	....type: DOL/DOL
Construction method.....	....type: V1
Protection.....	.....: IP55
Vikling.....	.....: Dahlander
Isolation.....	.....: F
Temp.rise.....	.....K: 90K
Heating element.....	.....: 230V 98W
Test certificate....	.....: DNV

---

## ORDER SPECIFICATION

---

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

---

4,20 CERTIFICATE DNV, PUMP Number: 1,00

4,90 Mano/Vac.set fluid w/sep.transm.on panel Number: 1,00

The set contains as follows:

- 2 off 100 mm. liquid filled instruments for local reading. -1 to 5 and 0 - 16 bar.
- 2 off pressure transmitter, 4-20 mA.
- 2 off 3 way ball valve with over mentioned mounted.  
All mounted on a panel plate.

For BW/DW pump.

Ref pos 3.

ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

BRINE DISCH. PUMP

\*\*\*\*\*

5,00 AEB 2N 1450-IE/0X1 P01 G 112 PA P 6230 Number: 1,00

Allweiler self-priming eccentric screw-pump with gearmotor flanged on. Horizontal execution. Safety valve and dry running protection is included.

Suct.flange: pointing left viewed from driver (Pos 4)

) Technical specification: Eccentric screw pump

Serialno.: 6026678,  
Capacity..... ....m<sup>3</sup>/h: 75  
Diff.pressure..... ....bar: 18  
Rpm..... ....rpm.: 350  
Power absorbed..... ....Kw: 50  
Direction..... ..cw/ccw: ccw  
Medium..... .....: Brine  
Viscosity..... ...mm<sup>2</sup>/s: - 200  
Casing..... material: Cast Iron  
Rotor..... material: St.St.  
Stator..... material: Special Perbunan  
Stator..... ....type: Equal wallthickness  
Shaft sealing..... ....type: Stuffing box

5,10 GEARMOTOR CB 9-250M/4DF SL 63 350A60 Number: 1,00

Technical specification: El-motor

Rated power..... ....KW: 63  
RPM..... ....Rpm.: 350  
Voltage..... ....Volt: 3 x 440  
Frequency..... ....Hz: 60  
Ampere In..... ....A: 105  
Ampere Is..... ....A: -  
Starting method.... ....type: Frequency controlled  
Construction method. ....type: Flanged on  
Protection..... .....: IP55  
Isolation..... .....: F  
Temp.rise..... ....K: 90  
PTC Yes/NO..... .....: mounted

5,20 VEGASWING 61 R 1" Number: 1,00

Dryrunningprotection. Registration of liquid / no liquid.

Mounted on suction pipe.

Power supply: 20-250VAC, 20-60VDC.

Output: DPDT (relay on/off\*) to be connected to a time relay function, 2-10 sec., supplied by yard.

\* max 750VA AC, 54 W DC

5,45 SAFETYVALVE 40X65 MUD PN 40 Number: 1,00

Set point: 18,5 bar

---

## ORDER SPECIFICATION

---

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

---

Inlet & Outlet with flanges.

5,50 MANO/VACUMETER W. PRESS.TR. 2M/ Mud Number: 1,00

Mano / vacumeter for mud.

Remote and local reading. 4-20 ma.  
-1 to 5 bar & 0 - 25 bar

Delived with membran to avid contact with media.

*Ref pos 1.*

## ORDER SPECIFICATION

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10/07

### BASE OIL DISCH. PUMP 2. SPEED

\*\*\*\*\*

6,00 NAM 80-200/230 U3.1D W80 AELED65IEC250 Number: 1,00

Allweiler vertical single-stage centrifugal pump with flexible coupling and el-motor. Spacer-coupling allows easy dismantling of bearing unit, impeller, seal etc, without removing the volute casing, pipelines and driving motor. Pump has axial suction flange, radial delivery flange.  
Bulkhead mounting.

#### NOTE: MOTOR SHAFT Ø65

Technical specification: Centrifugal pump

Serialno.:	6037611,
Capacity.....	....m3/h: 150 - 75
Diff. pressure.....	....bar: 9 - 2,2
Delivery head.....	....m: 90 - 22,5
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 9 - 2,2 (s.g.1,0)
Speed.....	... rpm: 3500 - 1750
NPSHr.....	....m: 6,0 - 3,5
Power absorbed.....	....Kw: 47,2 - 5,9(s.g.0,87)
Medium.....	.....: Base
Temperature.....	.....C: amb.
Viscosity.....	...mm2/s: 1
Specific gravity....	...kg/m3: 870
Pump casing.....	material: Cast iron
Impeller.....	material: Cast iron
Shaft.....	material: 1.4021
Shaft seal.....	....type: Mech.seal

6,01 AELED 65 AUTOMATIC ASPIRATOR Number: 1,00

Automatic air driven priming ejector mounted.

6,10 EL-MOTOR 250M-2 V1 IP54 Number: 1,00

Technical specification: El-motor

Rated power.....	.....KW: 63/17,2
RPM.....	...Rpm.: 3500/1750
Voltage.....	....Volt: 3*440
Frequency.....	....Hz: 60
Ampere In.....	.....A: ?/?
Starting method....	....type: DOL/DOL
Construction method.	....type: V1
Protection.....	.....: IP55
Vikling.....	.....: Dahlander
Isolation.....	.....: F
Temp.rise.....	.....K: 90K
Heating element....	.....: 230V 98W
Test certificate....	.....: DNV

---

## ORDER SPECIFICATION

---

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

---

6,20 CERTIFICATE DNV, PUMP Number: 1,00

6,90 Mano/Vac.set fluid w/sep.transm.on panel Number: 1,00

The set contains as follows:

- 2 off 100 mm. liquid filled instruments for local reading. -1 to 5 and 0 - 16 bar.
- 2 off pressure transmitter, 4-20 mA.
- 2 off 3 way ball valve with over mentioned mounted.  
All mounted on a panel plate.

For BASE pump.

## ORDER SPECIFICATION

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havard Leirvik as	Date of issue:	
CUSTOMER REF.....:	096 CHS/ERP		30/10-07

### LIQUID MUD MIXER - EL. DRIVEN (NON EX-EXECUTION)

10,00 Allmix Agitator RW570 DM A120/12  Number: 10,00

Allweiler/ABS submersible el-driven agitator for mixing of liquid mud/brine/slop. Mechanical seal protection by means of the "Solid Deflection Ring. 15 m. cable length included.

Temp guard for el. motor built in: TCS System  
Leackage detector in oilchamber built in: DI System

TCS- and DI system to be connected startercabinet and give alarm- / stop signal. Relay for integration of these signals is included in scope of supply.

Cable gland specially designed for cable protection hose to be clamped on.

Minimum tanklevel for operation of agitator to be 600 mm above upper wing tip.

Technical specification: Agitator - el. drive

Speed.....	.....rpm: 590
Power absorbed.....	.....kw: 11,2
Specific gravity....	..kg/dm3: max 2,8
Propeller diameter..	.....mm: 550
Wing angle.....	..grader: 5
Cable.....	....matr: CSM, Hypalon
Fixing plate.....	....matr: 1.4571 316Ti
Oil housing.....	....matr: 1.4571 316Ti
Propeller.....	....matr: 1.4571 316Ti
Cooling Jacket.....	....matr: 1.4571 316Ti
Shaft.....	....matr: 1.4404 316L
Shaft seal.....	....type: Mech. CiC/Ci
Tank, hight.....	.....mm: To be given
Tank, diam.....	.....mm: l x b x h
Tank form.....	.....
Drive.....	.....: electrical, IP68

10,10 AGITATOR EL. Number: 10,00

Temp. guard, el. motor: TCS System  
Leackage detector, oilcamber: DI System

Both to be connected to starter.

Technical specification: El-motor

Rated power.....	.....KW: 12 / 15,3
RPM.....	...Rpm.: 590
Voltage.....	....Volt: 3*450

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**ORDER SPESIFICATION**

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ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF....:	096 CHS/ERP	Date of issue:	30/10-07

---

Frequency..... ....Hz: 60  
Ampere In..... ....A: 32,1  
Ampere Is..... ....A: 89,8  
Starting method.... ....type: DOL  
Protection..... ....: IP 68  
Isolation..... ....: F, 155 degr. C

10,11 TDM - module for starter Number: 10,00

Relay w/amplifier for connection of leakage monitoring electrode  
in agitator and temp.switch.

10,20 BULKHEAD PENETRATION WELDING PIPE Number: 10,00

10,30 BULKHEAD PENETRATION UNIT H1-50/20/60 Number: 10,00



Allweiler AS  
1395 HVALSTAD

Att.:

Hvalstad, 28.08.2003

Your ref.:

Our ref.:

## Subject: Important information reg. Allweiler / ABS el. agitators

Allweiler AS has for years delivered Allweiler / ABS el. driven agitators, type: RW 5531, RW 570, RW 6522 and RW 650. These agitators are equal, but designed for different densities.

This letter is meant as a basic reminder and control to secure proper operation of your agitators. It is important to read operation manual before mounting and operating the agitators.

### Alarms:

- The agitator is provided with a seal monitor system (DI). A DI electrode indicates if leakage occurs in seal chamber. The cable from the electrode must be connected to a DI module in the control cabinet and give an alarm signal which can be acted upon.
- The agitator is provided with high temp. sensor (TCS). The cable from the sensor must be connected to a relay and an alarm in the control cabinet.

Module (relay) for integration of these signals is available from Allweiler AS. This module is standard in starter cabinets for agitators delivered from Allweiler AS

### Cable:

- Advised info is labelled on end of the electrical cable:

*"IMPORTANT: This cable end is sealed to prevent moisture entering the cable. Please do not open or interfere with seal until a permanent electrical connection above possible water level is being made. Connect all cable leads. 10 leads: 7, 8 Thermal overload protection, 9 Sealing monitor electrode. 7 leads. 4, 5 Thermal overload protection, 6 sealing monitor electrode. Check direction of rotation. Please read attached operating instructions."*

Page 1



## Installation:

- Protection hose must cover the cable. It is important that the hose / cable is properly clamped to avoid damage due to rapid movement.
- We advise in general the agitators to be mounted parallel with bottom.
- The agitator needs at least 500 mm free space behind the agitator. This to provide good suction capability.
- The agitator should have min. 500 mm. free space from lower wing tip to tank bottom.

## Operation:

- The agitators are not to be started more than 10 times / hour. This to avoid over-heating.
- The agitators are not to operate with lower mud level than apr. 600 mm over the highest propeller wing tip.  
It is important for trouble free operation that the propeller always is covered complete by the agitated liquid.

**We kindly ask you to control your installed agitators based on this information. Please contact us if further assistance is required.**

Best regards,  
Allweiler AS

Geir Olimb  
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**ABS**



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Ph. +47 66 77 50 50 Fax +47 66 84 79 10  
E-mail firmapost@allweiler.no Internett www.allweiler.no

**RW**

**300 / 400 / 650 / 900**

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## **Einbau - und Betriebsanweisung Installation and Operating Instructions**

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Änderungen im Sinne der technischen Weiterentwicklung vorbehalten !  
We reserve the right to make modifications in the furtherance of technical development !

EBA (2) 1 597 0403 D/GB 07.97

ABS Pump Center GmbH • Scheiderhöher Str. 30-38 • D-53797 Lohmar • Tel. Int.+49.2246.13-0 • Telefax +49.2246.13-200

**"SICHERHEITSHINWEISE"**  
für Pumpen und Rührwerke

**"SAFETY INSTRUCTIONS"**  
for Pumps and mixers

---

**Sicherheitshinweise  
Safety instructions**

---

Änderungen im Sinne der technischen Weiterentwicklung vorbehalten !  
We reserve the right to make modifications in the furtherance of technical development !

**D****Inhaltsverzeichnis** Sicherheitshinweise "Pumpen und Rührwerke"**GB****Contents** Safety instructions "Pumps and Mixers"

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**D****Sicherheitshinweise "Pumpen und Rührwerke"****GB****Safety Instructions "Pumps and Mixers"****1. ALLGEMEINE SICHERHEITSHINWEISE**

Die Unfallverhütungsvorschriften sowie die allgemeinen Regeln der Technik sind zu beachten!



Mit diesen Tauchmotorpumpen bzw. Rührwerken dürfen keine brennbaren oder explosiven Medien gefördert bzw. bewegt werden!



In explosionsgefährdeten Bereichen dürfen nur Pumpen und Rührwerke in explosionsgeschützter-Ausführung (Ex) verwendet werden!

**ACHTUNG**

Bei Ex-geschützten Pumpen wird auf die sichere Anwendung hingewiesen, sofern in der Ex-Bescheinigung unter "besondere Bedingungen" bezug genommen wird.

**2. TRANSPORT UND AUFSTELLUNG**

Die Tauchmotorpumpen und Rührwerke dürfen nicht am Elektroanschlußkabel angehoben werden.

**ACHTUNG**

Gesamtgewicht der Tauchmotorpumpen und Rührwerke beachten (siehe Typenschild).



Die Pumpen und Rührwerke sind zum Transport auf eine ausreichend feste, in allen Richtungen waagerechte Fläche abzustellen und gegen Kippen zu sichern.



Die Hebevorrichtung muß für das Gesamtgewicht der Tauchmotorpumpen und Rührwerke ausreichend groß bemessen sein und den jeweils geltenden Sicherheitsbestimmungen entsprechen.



Nicht im Schwenkbereich von schwelbenden Lasten aufhalten oder arbeiten!



Die Lasthakenhöhe muß die Gesamthöhe der Tauchmotorpumpen und Rührwerke sowie die Länge der Anschlagkette berücksichtigen!

**3. ELEKTRISCHER ANSCHLUß UND INBETRIEBNAHME**

Vor Inbetriebnahme ist durch fachmännische Prüfung sicherzustellen, daß eine der notwendigen elektrischen Schutzmaßnahmen vorhanden ist. Erdung, Nullung, Fehlerstromschutzschaltung ect. müssen den Vorschriften des örtlichen Energieversorgungsunternehmens (EVU) entsprechen und laut Prüfung der Elektrofachkraft einwandfrei funktionieren.



Die Anlage ist mit einer entsprechenden Vorsicherung (gemäß Nennstrom des Motors) abzusichern.



In Pumpstationen / Behältern ist ein Potentialausgleich gemäß VDE 0190 (Bestimmun-

**1. GENERAL SAFETY INSTRUCTIONS**

The safety regulations and the general rules of good technical practice must be observed!



These submersible pumps respectively mixers may not be used for the pumping or mixing of flammable or explosive liquids.



In explosive zones only Explosion-proof pumps and mixers (EX) may be used.

**ATTENTION**

If reference is made to "special requirements" in the Ex-certification of explosion proof pumps, in the necessity to ensure safe operation is indicated.

**2. TRANSPORT AND INSTALLATION**

The submersible pumps and mixers should never be raised by the electric cable.

**ATTENTION**

Note the entire weight of the submersible pumps and mixers (see name-plate).



The pumps and mixers are prepared for transport by placing it adequately strong completely on a horizontal surface.



The hoist must be adequately dimensioned for the weight of the pumps and mixers and must comply with all safety regulations and must comply with all safety regulations.



Do not stay or work in the swivel area of a suspended load.



The lifting hook height must take into consideration the entire height of the pumps and mixers as well as the length of the connecting chain !

**3. ELECTRICAL CONNECTION AND COMMISSIONING**

Prior to starting the unit a qualified person must ensure that one of the required electrical protective measures has been provided. Grounding, neutral line; earth leakage circuit breakers, etc. must comply with the regulations of the local Power Supply Authority and must be checked by a qualified person to ensure that they are functioning correctly.



The system must be protected by a suitable fuse (in accordance with the rated current of the motor).



In pump stations / tanks potential bonding must be carried out in accordance with VDE

**D****Sicherheitshinweise "Pumpen und Rührwerke"****GB****Safety Instructions "Pumps and Mixers"**

gen für das Einbeziehen von Rohrleitungen, Schutzmaßnahmen von Starkstromanlagen) durchzuführen.



Tauchmotorpumpen bei der Drehrichtungskontrolle so absichern, daß keine Personenschäden durch das sich drehende Laufrad und den dadurch entstehenden Luftstrom entstehen können. **Nicht in die Hydraulik greifen.**



Rührwerke dürfen nur getaucht und komplett mit der Halterung am Vierkantleitrohr montiert betrieben werden. Diese Anweisung gilt auch bei der Durchführung der Drehrichtungskontrolle !  
**Der Propeller muß gefahrenfrei drehen können !**



Die Drehrichtungsänderung darf nur von einer Elektrofachkraft durchgeführt werden.



Bei der Drehrichtungskontrolle bzw. beim Einschalten der Pumpen und Rührwerke ist der **ANLAUFRUCK** zu beachten. Dieser kann mit erheblicher Kraft erfolgen !

**ACHTUNG**

Die bauseits vorhandenen stromführenden Systeme müssen nach Querschnitt und maximalem Spannungsabfall mit den örtlichen Vorschriften (z.B. VDE) übereinstimmen. Die auf dem Typenschild der Tauchmotorpumpe / des Rührwerkes angegebene Spannung muß der vorhandenen Netzspannung entsprechen.



Der Elektroanschuß der Tauchmotorpumpen und Rührwerke darf nur von einer Elektrofachkraft durchgeführt werden.



Der Elektroanschuß bzw. das Anklemmen der Zuleitung sowie der Motoranschußkabel an die Klemmen der Steueranlage ist entsprechend dem Schaltplan der Steueranlage sowie der Motoranschußschaltbilder von einer Elektrofachkraft durchzuführen.

**ACHTUNG**

**Tauchmotorpumpe nur mit Motorschutzschalter und angeschlossenen Temperaturwächtern betreiben.**



Die elektrischen Steuereinrichtungen (Steueranlage, Kabelübergangskästen) sind vor Nässe zu schützen und im überflutungssicheren Bereich zu montieren.



Rührwerke dürfen nur getaucht und komplett im Becken installiert betrieben werden!



ABS-Rührwerke haben einen rotierenden Propeller der nicht geschützt werden kann, da dies die Funktion beeinträchtigen würde !

**4. WARTUNG**

Vor Beginn der Wartungsarbeiten sind die Pumpen und Rührwerke von einer Elektrofachkraft allpolig vom elektrischen Netz zu

0190 (Regulations for installation of pipe lines, protective measures in power plants).



When checking the direction of rotation, the submersible pump should be secured in such a manner that no danger to personnel is caused by the rotating impeller, or by the resulting air flow. **Do not place your hand into the hydraulic system.**



Mixers may only be operated when submerged and installed complete in the square guide tube with the bracket. This instruction must also be observed when checking the direction of rotation of the mixer.

**The propeller must be able to rotate free of any danger !**



The direction of rotation should only be altered by a qualified person.



Observe the **START REACTION** when switching on the pumps and mixers or checking of the direction of rotation. The START REACTION can happen with a great force !

**ATTENTION**

The power supply system on site must comply with VDE or other local regulations with regard to cross-sectional area and maximum voltage drop. The voltage stated on the name-plate of the pump or mixer must correspond to the voltage identification of the mains supply.



The submersible pumps and mixers may only be connected up by a qualified person.



The incoming power supply as well as the connection of the pump itself to the terminals on the control panel must comply with the circuit diagram of the control panel as well as the motor connection diagrams and must be carried out by a qualified person.

**ATTENTION**

The submersible pump should only be operated with the overload relay and thermal sensors connected.



The electrical control devices (control panel, junction boxes) should be protected from dampness and mounted in a flood-proof area.



Mixers may only be operated when submerged and completely installed in the tank!



The ABS mixer range has a rotating propeller which cannot be protected or covered as it would obstruct functioning !

**4. MAINTENANCE**

Before commencing any maintenance work the pumps and mixers should be completely disconnected from the mains by a qualified

**D****Sicherheitshinweise "Pumpen und Rührwerke"****GB****Safety Instructions "Pumps and Mixers"**

trennen und gegen Wiedereinschalten zu sichern.



Bei Wartungs- und Instandsetzungsarbeiten sind die Sicherheitsregeln für Arbeiten in umschlossenen Räumen von abwassertechnischen Anlagen sowie die allgemein anerkannten "Regeln der Technik" zu beachten !



**WARNUNG**  
**Lebensgefährliche Gase**  
**Unfallverhütungsvorschriften beachten !**

Beim Einstiegen in den Behälter Gurtzeug und Rettungsleine gebrauchen und mit einer Aufsichtsperson arbeiten.  
Ausreichend belüften !

**ACHTUNG**

Eingriffe an explosionsgeschützten Motoren dürfen nur in / von dafür ermächtigten Werkstätten / Personen ausgeführt werden. Bei Reparaturen dürfen nur Originalteile des Herstellers verwendet werden.

**ACHTUNG**

Die Anschlagmittel wie Ketten und Schäkel müssen in regelmäßigen Abständen (ca. alle 3 Monate) einer optischen Kontrolle auf Verschleiß, Korrosion, Durchscheuerung ect. unterzogen und im Bedarfsfall ausgetauscht werden !



Drehrichtungsänderungen an Schaltanlagen ohne Drehrichtungsumschalter dürfen nur von einer Elektrofachkraft durchgeführt werden und sind daher zum Säubern von Pumpenteilen bzw. Propellern nicht zulässig !



Die Ölkammern und Getriebe der Pumpen und Rührwerke können unter Druck stehen. Vor öffnen der Öl-Ablaßschrauben immer einen Lappen über die Öl-Einfüllschraube legen, diese kurz lösen und wieder einschrauben !



Die Vorschriften im Umgang mit Ölen und Schmierstoffen sind zu beachten. Diese Stoffe sind vorschriftsmäßig zu entsorgen !



Bei Verwendung der Pumpen und Rührwerke in Brauch- oder Rohwasser sind physiologisch unbedenkliche Öle und Fette zu verwenden !

5. **Sicherheit** (In Anlehnung an VDMA-Einheitsblatt 24292)

Diese Betriebsanweisung enthält grundlegende Hinweise, die bei Aufstellung, Betrieb und Wartung zu beachten sind. Daher ist diese Betriebsanweisung unbedingt vor Montage und Inbetriebnahme vom Monteur sowie dem zuständigen Fachpersonal/ Betreiber zu lesen und

person and care should be taken that they cannot be inadvertently switched back on.



When carrying out any repair or maintenance work, the safety regulations covering the working in enclosed areas of sewage installations, as well as "good technical practice" must be observed !



**WARNING**  
**Dangerous gases**  
**Observe all accident prevention and regulations!**

When entering into the tank make use of harness and safety line and always work with another person in attendance.  
Ensure adequate venting !

**ATTENTION**

Repair on explosion-proof motors may only be carried out by workshops or persons authorized for this. During repair work only original parts supplied by the manufacturer must be used !

**ATTENTION**

The hoists like chains and shackles should be visual checked in regular intervals (approx. every 3 month) for wear and corrosion. These parts should be replaced if required !



Changing the direction of rotation on control panels not fitted with a direction of rotation change over switch may only be carried out by a qualified person, and for this reason this procedure is not approved as a method of cleaning hydraulics or propellers.



The oil in the oilchambers and gearboxes of the pumps and mixers may be under pressure. Before beginning any work carefully loosen the oil filler screw with a cloth and close again !



The regulations covering oil and grease handling must be observed. Any waste oil or grease stuff should be correctly disposed off !



When using the pumps or mixers in process or raw water a non-toxic oil (physiologically safe) should be used !

5. **Safety** (Based on VDMA-Instruction sheet 24295)

These Operating Instructions contain basic information on the erection, operating and maintenance and should be followed carefully. For this reason it is essential that these instructions are read carefully before erection or commissioning by both the installation crew, as well as

**D**

## Sicherheitshinweise "Pumpen und Rührwerke"

**GB**

## Safety Instructions "Pumps and Mixers"

muß ständig am Einsatzort des Aggregats/Anlage verfügbar sein.

Es sind nicht nur die unter diesem Hauptpunkt Sicherheit aufgeführten, allgemeinen Sicherheitshinweise zu beachten, sondern auch die unter den anderen Hauptpunkten eingefügten speziellen Sicherheitshinweise.

### 5.1 Kennzeichnung von Hinweisen in der Betriebsanleitung



Die in dieser Betriebsanweisung enthaltenen Sicherheitshinweise, die bei Nichtbeachtung Gefährdungen für Personen hervorrufen können, sind mit einem allgemeinen Gefahrensymbol, Sicherheitszeichen nach DIN 4844-W 9 gekennzeichnet.



Bei Warnung vor elektrischer Spannung erfolgt Kennzeichnung mit Sicherheitszeichen nach DIN 4844-W 8.

**ACHTUNG** Steht bei Sicherheitshinweisen, deren Nichtbeachtung Gefahren für das Aggregat und dessen Funktionen hervorrufen können.

Direkt an das Aggregat angebrachte Hinweise wie z.B.:

- Drehrichtungspfeil
- Typenschild

müssen unbedingt beachtet und in vollständig lesbarem Zustand gehalten werden.

### 5.2 Personalqualifikation und -schulung

Das Personal für Bedienung, Wartung, Inspektion und Montage muß die entsprechende Qualifikation für diese Arbeiten aufweisen. Verantwortungsbereich, Zuständigkeit und die Überwachung des Personals müssen durch den Betreiber genau geregelt sein. Liegen bei dem Personal nicht die notwendigen Kenntnisse vor, so ist dieses zu schulen und zu unterweisen. Dies kann, falls erforderlich, im Auftrag des Betreibers des Aggregats durch den Hersteller/Lieferer erfolgen. Weiterhin ist durch den Betreiber sicherzustellen, daß der Inhalt der Betriebsanweisung durch das Personal voll verstanden wird.

### 5.3 Gefahren bei Nichtbeachtung der Sicherheitshinweise

Die Nichtbeachtung der Sicherheitshinweise kann sowohl eine Gefährdung für Personen als auch für Umwelt und Aggregat zur Folge haben. Die Nichtbeachtung der Sicherheitshinweise kann zum Verlust jeglicher Schadensatzansprüche führen.

Im einzelnen kann Nichtbeachtung beispielsweise folgende Gefährdung nach sich ziehen :

- Versagen wichtiger Funktionen des Aggregats / Anlage.
- Gefährdung von Personen durch elektrische, mechanische und chemische Einwirkungen.
- Gefährdung der Umwelt durch Leckage von gefährlichen Stoffen.

### 5.4 Sicherheitsbewußtes Arbeiten

Die in dieser Betriebsanweisung aufgeführten Sicherheitshinweise, die bestehenden nationalen Vorschriften zur Unfallverhütung sowie eventuelle interne Arbeits-, Betriebs- und Sicherheitsvorschriften des Betreibers sind zu beachten.

by those responsible for operation or maintenance. The Operating Instructions should always be readily available at the location of the unit.

In addition to following the Safety Regulations of a general nature listed under these main headings, it is also essential that the special Safety Instructions given under other headings are also observed.

### 5.1 Reference to hints in the Operating Instructions



Safety Instructions given in this Operating Manual the non-observance of which could cause danger to life have been specifically highlighted with the general danger symbol, as given for safety signs in accordance with DIN 4844-W 9.



The presence of a dangerous voltage is identified with the safety symbol in accordance with DIN 4844-W 8.

**ATTENTION** Applies to Safety Instructions, the non-observance of which could damage the unit or affect its functioning.

Symbols directly on the unit itself, i.e.

- Direction of rotation arrow
- Name-plate

must be carefully observed and must be maintained in a legible condition.

### 5.2 Qualifications of personnel and their training

The personnel for operating, maintenance, inspection and erection must possess the required qualifications for the work. Area of responsibility, duties and supervision of personnel must be carefully controlled by the user. If the personnel involved do not have the required knowledge then they must be trained or directed. Where necessary this can be carried out on behalf of the operator of the unit by the manufacturer/supplier. In addition, the user must ensure that the contents of the Operating Instructions are fully understood by these personnel.

### 5.3 Dangers which could arise due to non-observance of the Safety Instructions

The non-observance of the Safety Instructions can lead both to danger to personnel and also possible damage to the environment or the unit itself. Non-observance of the Safety Instructions can invalidate the rights of the user to any compensation or recompense.

In detail, non-observance can, for example, result in the following dangers :

- Failure of important functions of the unit/installation.
- Danger to personnel by electrical, mechanical or chemical influences.
- Danger to the environment by leakage of dangerous substances.

### 5.4 Carrying out work in a safety conscious manner

The Safety Instructions listed in this Operating Manual, the existing National Regulations for Safety, as well as any internal operating or safety regulations which apply in the users own premises must be observed.

**D****Sicherheitshinweise "Pumpen und Rührwerke"****GB****Safety Instructions "Pumps and Mixers"****5.5 Sicherheitshinweise für den Betreiber / Bediener**

- Berührungsschutz für sich bewegende Teile (z.B. Kupplung) darf bei sich in Betrieb befindlichem Aggregat nicht entfernt werden.
- Gefährdungen durch elektrische Energie sind auszuschließen (Einzelheiten hierzu siehe z.B. in den Vorschriften des VDE und der örtlichen Energieversorgungsunternehmen).

**5.6 Sicherheitshinweise für Wartungs-, Inspektions- und Montagearbeiten**

Der Betreiber hat dafür zu sorgen, daß alle Wartungs-, Inspektions- und Montagearbeiten von autorisiertem und qualifiziertem Fachpersonal ausgeführt werden, das sich durch eingehendes Studium der Betriebsanweisung ausreichend informiert hat.

Grundsätzlich sind Arbeiten an dem Aggregat nur im Stillstand durchzuführen. Die in der Betriebsanweisung beschriebene Vorgehensweise zum Stillsetzen des Aggregats muß unbedingt eingehalten werden.

Pumpen oder Aggregate, die gesundheitsgefährdende Medien fördern, müssen dekontaminiert werden.

Unmittelbar nach Abschluß der Arbeiten müssen alle Sicherheits- und Schutzeinrichtungen wieder angebracht bzw. in Funktion gesetzt werden.

Vor der Wiederinbetriebnahme sind die im Abschnitt Inbetriebnahme aufgeführten Punkte zu beachten.

**5.7 Eigenmächtiger Umbau und Ersatzteilherstellung**

Umbau oder Veränderungen des Aggregats / Anlage sind nur nach Absprache mit dem Hersteller zulässig. Originalersatzteile und vom Hersteller autorisiertes Zubehör dienen der Sicherheit. Die Verwendung anderer Teile kann die Haftung für die daraus entstehenden Folgen aufheben.

**5.8 Unzulässige Betriebsweisen**

Die Betriebssicherheit des gelieferten Aggregats ist nur bei bestimmungsgemäßer Verwendung entsprechend Abschnitt 2 - Sicherheit - der Betriebsanweisung gewährleistet. Die im Datenblatt angegebenen Grenzwerte dürfen auf keinen Fall überschritten werden.

Mit diesen Sicherheitshinweisen werden hier nicht genannte allgemeine Vorschriften und Normen nicht außer Kraft gesetzt.

**5.5 Safety Regulations for the owner/operator**

- Guards on moving parts (e.g. couplings) should not be removed while the unit is in operation.
- All dangers due to electricity must be avoided. For details consult the VDE Regulations or the regulations of your local Electricity Supply Company.

**5.6 Safety Regulations for maintenance, inspection and installation work**

The user of the unit must ensure that all maintenance, inspection or installation work is carried out by authorized and qualified skilled personnel. The user must also make certain that they have carefully studied the Operating Instructions.

In principle all work on the unit should only be carried out while it is stationary. The method described in the Operating Instructions for making the unit inoperable must be complied with.

Pumps or units used for pumping of liquids which could be injurious to health must be decontaminated.

After completion of the work all safety and protective devices must be refitted and a check made that they are fully functional.

Before starting up again the points listed under the section First Commissioning must be complied with.

**5.7 Unilateral modifications and spare parts ordering**

Modifications or changes to the unit may only be carried out after consultations with the manufacturer. Original spare parts and accessories authorized by the manufacturer are essential for compliance with Safety Regulations. The use of other parts can invalidate any claims for warranty or compensation.

**5.8 Unapproved usage**

The operating safety of the unit is only guaranteed provided that the unit is used in accordance with the Safety and Operating Instructions in Section 2. The limit values given in the Data Sheet should under no circumstances be exceeded.

The use of this safety instructions does not invalidate or render inoperative general regulations and standards which are not specifically mentioned in it.

## Inhaltsverzeichnis Einbau - und Betriebsanweisung

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## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

### 1. Allgemeines

#### 1.1 Verwendungszweck

Die ABS Rührwerke RW 300 bis 900 mit druckwasserdicht gekapseltem Tauchmotor sind hochwertige Qualitätsprodukte mit folgenden Anwendungsbereichen :

Sie eignen sich zum Mischen, Rühren und Umwälzen in kommunalen Kläranlagen, in der Industrie und in der Landwirtschaft.

#### 1.1.1 Typenbezeichnung RW 300 bis 900

**RW 4021 A 30 / 8 - 42. Ex**

### 1. General

#### 1.1 Application areas

The ABS submersible mixers of the RW 300 to 900 series fitted with water-tight encapsulated submersible motors are highly efficient quality products designed for the following application areas :

They are suitable for mixing, agitating and circulating in municipal treatment plants, in industry, and in agriculture.

#### 1.1.1 Identification code RW 300 to 900

Ex-Ausführung / Ex-Version

Motorbaugröße / Motor size

Polzahl des Motors / No. of poles

Motorleistung / Rated motor power  $P_2$  [kW] x 10

Rührwerksmotor (50 und 60 Hz) / Mixer-Motor (50 and 60 Hz)

Hydraulik- Nr. für Propellerwinkel / Hydraulics- No. (Propeller Angle)

Propellertyp / Propeller Type

- 1 Misch-Propeller (ohne Strömungsring) / Mixing Propeller (Without Flowring)
- 2 2-Blatt-Schubpropeller / 2-Blade Thrust Propeller
- 3 3-Blatt-Schubpropeller / 3-Blade Thrust Propeller
- 4 2-Blatt-Schubpropeller mit Strömungsring / 2-Blade Thrust Propeller with Flowring
- 5 3-Blatt-Schubpropeller mit Strömungsring / 3-Blade Thrust Propeller with Flowring

Propellerdurchmesser/Propeller Diameter [cm]

Rührwerk / Mixer range

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

### 1.2 Technische Motor - Daten

Der max. Schalldruckpegel aller Aggregate der RW 300 - 900 Baureihe beträgt  $\leq 70$  db(A). Je nach Installationsaufbau kann der Schalldruckpegelmaximalwert von 70 db(A), bzw. der gemessene Schalldruckpegel überschritten werden.

**HINWEIS** Weitere Motor- Hydraulikkombinationen sind auf Anfrage möglich.

**ACHTUNG** Maximale Mediumtemperatur bei Dauerbetrieb =  $40^{\circ}$  C bei getauchtem Aggregat

**HINWEIS** Die technischen Daten auf den folgenden Seiten gelten auch für die Versionen mit Strömungsring (siehe Typenbezeichnung / Seite 1)

### 1.2 Technical Motor Data

The maximum noise level of all aggregats of the RW 300 to 900 ranges is  $\leq 70$  db(A). Depending on the type of installation and at certain operating points on the curve it is possible that the noise level maximum value of 70 db(A), or the measured noise level will be exceeded.

**NOTE** Further motor / hydraulic cobinations on request.

**ATTENTION** Maximum medium temperature for continuous operation =  $40^{\circ}$  C with unit submerged

**NOTE** The technical data on the next two pages are also valid for the versions with flow ring. (See identification code on page 1)

10 m cable with free cable ends are supplied as standard  
10 m Kabel mit freiem Kabelende sind Standardlieferumfang

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

Rührwerkstyp Mixer designation	Propeller			Motor 50Hz						Installation	Gewicht Weight						
	Durchmesser [mm]	Drehzahl [1/min] Speed	Version mit Strömungsring Version with flow ring	Leistungsaufnahme P <sub>1</sub> Motor power P <sub>1</sub> [kW]	Leistungsabgabe P <sub>2</sub> Motor power P <sub>2</sub> [kW]	Startart: Direkt Type of start: Direct	Startart: Stern/Dreieck Type of start: Star/Delta	Betriebsstrom bei 400V Rated current at 400V [A]	Anlaufstrom bei 400V Starting current at 400V [A]	Kabel (Ex+Standard) Cable (Ex+Standard)	Stator Temperaturüberwachung Thermal stator protection	Dichtungsüberwachung Seal monitor	E Ex d II BT 4	Führungsrohr □60 Guide tube □60	Führungsrohr □100 Guide tube □100	Gesamtgewicht ohne Strömungsring Total weight without flow ring [kg]	Gesamtgewicht mit Strömungsring Total weight with flow ring [kg]
RW 3021	300	904	○	2,2	1,5	●		4,6	14,4	1	●	●	○	●		48	54
RW 3022	300	904	○	2,2	1,5	●		4,6	14,4	1	●	●	○	●		48	54
RW 3031	300	904	○	2,2	1,5	●		4,6	14,4	1	●	●	○	●		48	54
RW 3032	300	894	○	4,1	2,8	●		8,4	33,6	1	●	●	○	●		51	57
RW 3033	300	894	○	4,1	2,8	●		8,4	33,6	1	●	●	○	●		51	57
RW 3034	300	894	○	4,1	2,8	●		8,4	33,6	1	●	●	○	●		51	57
RW 4021	400	702	○	4,2	3,0	●		9,3	37	1	●	●	○	●	○	87	95
RW 4022	400	702	○	4,2	3,0	●		9,3	37	1	●	●	○	●	○	87	95
RW 4023	400	702	○	4,2	3,0	●		9,3	37	1	●	●	○	●	○	87	95
RW 4024	400	702	○	4,2	3,0	●		9,3	37	1	●	●	○	●	○	87	95
RW 4031	400	680	○	5,6	4,0		●	10,9	37	2	●	●	○	●	○	88	97
RW 4032	400	680	○	5,6	4,0		●	10,9	37	2	●	●	○	●	○	88	97
RW 4033	400	680	○	5,6	4,0		●	10,9	37	2	●	●	○	●	○	88	97
RW 6521	580	470	○	7,1	5,0		●	18,2	52	2	●	●	○		●	160	184
RW 6522	580	470	○	7,1	5,0		●	18,2	52	2	●	●	○		●	160	184
RW 6523	650	470	○	7,1	5,0		●	18,2	52	2	●	●	○		●	160	184
RW 6524	650	470	○	7,1	5,0		●	18,2	52	2	●	●	○		●	160	184
RW 6525	650	470	○	7,1	5,0		●	18,2	52	2	●	●	○		●	160	184
RW 6531	650	462	○	10,3	7,5		●	24,5	54	3	●	●	○		●	188	212
RW 6532	650	470	○	13,3	10,0		●	31,9	91	3	●	●	○		●	205	229
RW 6533	650	470	○	13,3	10,0		●	31,9	91	3	●	●	○		●	205	229
RW 9031	900	238 <sup>1</sup>	○	13,2	11,0		●	22,1	114	2	●	●	○		●	178	253
RW 9032	900	238 <sup>1</sup>	○	13,2	11,0		●	22,1	114	2	●	●	○		●	178	253
RW 9033	900	238 <sup>1</sup>	○	13,2	11,0		●	22,1	114	2	●	●	○		●	178	253
RW 9034	900	238 <sup>1</sup>	○	13,2	11,0		●	22,1	114	2	●	●	○		●	178	253
RW 9035	900	238 <sup>1</sup>	○	17,8	15,0		●	31,3	172	3	●	●	○		●	185	260
RW 9031	900	286 <sup>2</sup>	○	13,2	11,0		●	22,1	114	2	●	●	○		●	178	253
RW 9032	900	286 <sup>2</sup>	○	13,2	11,0		●	22,1	114	2	●	●	○		●	178	253
RW 9033	900	286 <sup>2</sup>	○	17,8	15,0		●	31,3	172	3	●	●	○		●	185	260
RW 9034	900	286 <sup>2</sup>	○	25,8	22,0		●	43,9	242	4	●	●	○		●	210	283
RW 9035	900	286 <sup>2</sup>	○	25,8	22,0		●	43,9	242	4	●	●	○		●	210	283

P<sub>2</sub> = Leistungsabgabe  
Power at motor shaft

<sup>1</sup> = Propeller-Drehzahl mit Getriebeunterersetzung i=6  
Propeller Speed with gearing i=6

● = Standard  
Standard

P<sub>1</sub> = Leistungsaufnahme  
Power taken from mains

<sup>2</sup> = Propeller-Drehzahl mit Getriebeunterersetzung i=5  
Propeller Speed with gearing i=5

○ = Option  
Option

Kabeltyp/Cable typ: 1 = A07RN - F7 G1.5; 2 = A07RN - F10 G1.5; 3 = A07RN - F10 G2.5; 4 = 2xA07RN - F4 G4 + 2x0,75

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

Rührwerkstyp Mixer designation	Propeller			Motor 60Hz								Installation	Gewicht Weight				
	Durchmesser Diameter [mm]	Drehzahl Speed [1/min]	Version mit Strömungsring Version with flow ring	Leistungsaufnahme $P_1$ Motor power $P_1$ [kW]	Leistungsabgabe $P_2$ Motor power $P_2$ [kW]	Startart: Direkt Type of start: Direct	Type of start: Star/Dreieck Type of Start: Star/Delta	Betriebsstrom bei 460V Rated current at 460V [A]	Anlaufstrom bei 400V Starting current at 400V [A]	Kabel (Ex+Standard) Cable (Ex+Standard)	Stator Temperaturüberwachung Thermal stator protection	Dichtungsüberwachung Seal monitor	E Ex d II BT 4	Führungsrohr □60 Guide tube □60	Führungsrohr □100 Guide tube □100		
RW 3021	300	1111	○	2,4	1,7	●		4,3	16,0	1	●	●	○	●		48	54
RW 3022	300	1111	○	2,4	1,7	●		4,3	16,0	1	●	●	○	●		48	54
RW 3031	300	1097	○	4,4	3,2	●		8,0	34,0	1	●	●	○	●		51	57
RW 3032	300	1097	○	4,4	3,2	●		8,0	34,0	1	●	●	○	●		51	57
RW 4021	400	858	○	4,6	3,5	●		8,8	39,5	1	●	●	○	●	○	87	95
RW 4022	400	858	○	4,6	3,5	●		8,8	39,5	1	●	●	○	●	○	87	95
RW 4023	400	858	○	4,6	3,5	●		8,8	39,5	1	●	●	○	●	○	87	95
RW 4024	400	858	○	6	4,6	●		10,3	39,5	2	●	●	○	●	○	88	97
RW 4031	400	841	○	6	4,6		●	10,3	39,5	2	●	●	○	●	○	88	97
RW 6521	650	571	○	8	6,0		●	17,5	49,8	2	●	●	○		●	160	184
RW 6522	650	571	○	8	6,0		●	17,5	49,8	2	●	●	○		●	160	184
RW 6523	650	567	○	11,5	9,0		●	23,9	52	2	●	●	○		●	188	212
RW 6524	650	569	○	15,3	12,0		●	31,4	87,8	3	●	●	○		●	205	229
RW 6525	650	569	○	15,3	12,0		●	31,4	87,8	3	●	●	○		●	205	229
RW 6531	650	569	○	15,3	12,0		●	31,4	87,8	3	●	●	○		●	205	229
RW 6532	650	569	○	15,3	12,0		●	31,4	87,8	3	●	●	○		●	205	229
RW 9031	900	244 <sup>1</sup>	○	15,3	13,0		●	21,8	109	2	●	●	○		●	178	253
RW 9032	900	244 <sup>1</sup>	○	15,3	13,0		●	21,8	109	2	●	●	○		●	178	253
RW 9033	900	244 <sup>1</sup>	○	15,3	13,0		●	21,8	109	2	●	●	○		●	178	253
RW 9034	900	244 <sup>1</sup>	○	15,3	13,0		●	21,8	109	2	●	●	○		●	178	253
RW 9035	900	244 <sup>1</sup>	○	19,8	17,0		●	29,4	165	3	●	●	○		●	185	260
RW 9031	900	286 <sup>2</sup>	○	15,3	13,0		●	21,8	109	2	●	●	○		●	178	253
RW 9032	900	286 <sup>2</sup>	○	15,3	13,0		●	21,8	109	2	●	●	○		●	178	253
RW 9033	900	286 <sup>2</sup>	○	19,8	17,0		●	29,4	165	3	●	●	○		●	185	260
RW 9034	900	286 <sup>2</sup>	○	28,8	25,0		●	41,7	229	4	●	●	○		●	210	283
RW 9035	900	286 <sup>2</sup>	○	28,8	25,0		●	41,7	229	4	●	●	○		●	210	283

$P_2$  = Leistungsabgabe  
Power at motor shaft

' = Propeller-Drehzahl mit Getriebeuntersetzung i=7  
Propeller Speed with gearing i=7

● = Standard  
Standard

$P_1$  = Leistungsaufnahme  
Power taken from mains

^ = Propeller-Drehzahl mit Getriebeuntersetzung i=6  
Propeller Speed with gearing i=6

○ = Option  
Option

Kabeltyp/Cable typ: 1 = A07RN - F7 G1.5; 2 = A07RN - F10 G1.5; 3 = A07RN - F10 G2.5; 4 = 2xA07RN - F4 G4 + 2x0,75

10 m Kabel mit freiem Kabelende sind Standardlieferumfang

10 m cable with free cable ends are supplied as standard

**HINWEIS** Diese technischen Daten gelten auch für die Versionen mit Strömungsring.  
(Siehe Typenbezeichnung / Seite 1)

**NOTE** The technical data are also valid for the versions with flow ring. (See identification code on page 1)

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

### 1.2.1 Baumaße

### 1.2.1 Dimensions

Maß Dimension	RW 300 A15/28 (50 Hz) A17/32 (60Hz)	RW 400 A30/40 (50 Hz) A35/46 (60 Hz)	RW 650 A50 (50 Hz) A60 (60 Hz)	RW 650 A75 (50 Hz) A90 (60 Hz)	RW 650 A100 (50 Hz) A120 (60 Hz)	RW 900 A110/150 (50 Hz) A130/170 (60 Hz)	RW 900 A220 (50 Hz) A250 (60 Hz)
a	190	190	190	190	190	190	190
D <sub>1</sub>	Ø 300	Ø 400	Ø 650	Ø 650	Ø 650	Ø 900	Ø 900
D <sub>2</sub>	Ø 460	Ø 560	Ø 810	Ø 810	Ø 810	Ø 1040	Ø 1040
d <sub>1</sub>	Ø 158	Ø 222,5	Ø 262,5	Ø 262,5	Ø 262,5	Ø 222,5	Ø 222,5
H □ 60	262	262	—	—	—	—	—
H □ 100	—	306	306	306	306	306	306
h <sub>1</sub>	500	700	1100	1100	1100	1500	1500
h <sub>2</sub>	50	50	50	50	50	50	50
L <sub>1</sub> □ 60	608	643	—	—	—	—	—
L <sub>1</sub> □ 100	—	673	820	960	960	1060	1160
L <sub>2</sub> □ 60	610	645	—	—	—	—	—
L <sub>2</sub> □ 100	—	675	830	970	970	1070	1170
I <sub>1</sub>	725	750	915	1055	1055	1155	1255
I <sub>2</sub> □ 60	—	465	—	—	—	—	—
I <sub>2</sub> □ 100	—	482	550	600	600	650	680
X <sub>1</sub> □ 60	229	229	—	—	—	—	—
X <sub>1</sub> □ 100	—	245	340	380	395	470	500
X <sub>2</sub> □ 60	264	264	—	—	—	—	—
X <sub>2</sub> □ 100	—	280	380	420	435	520	550

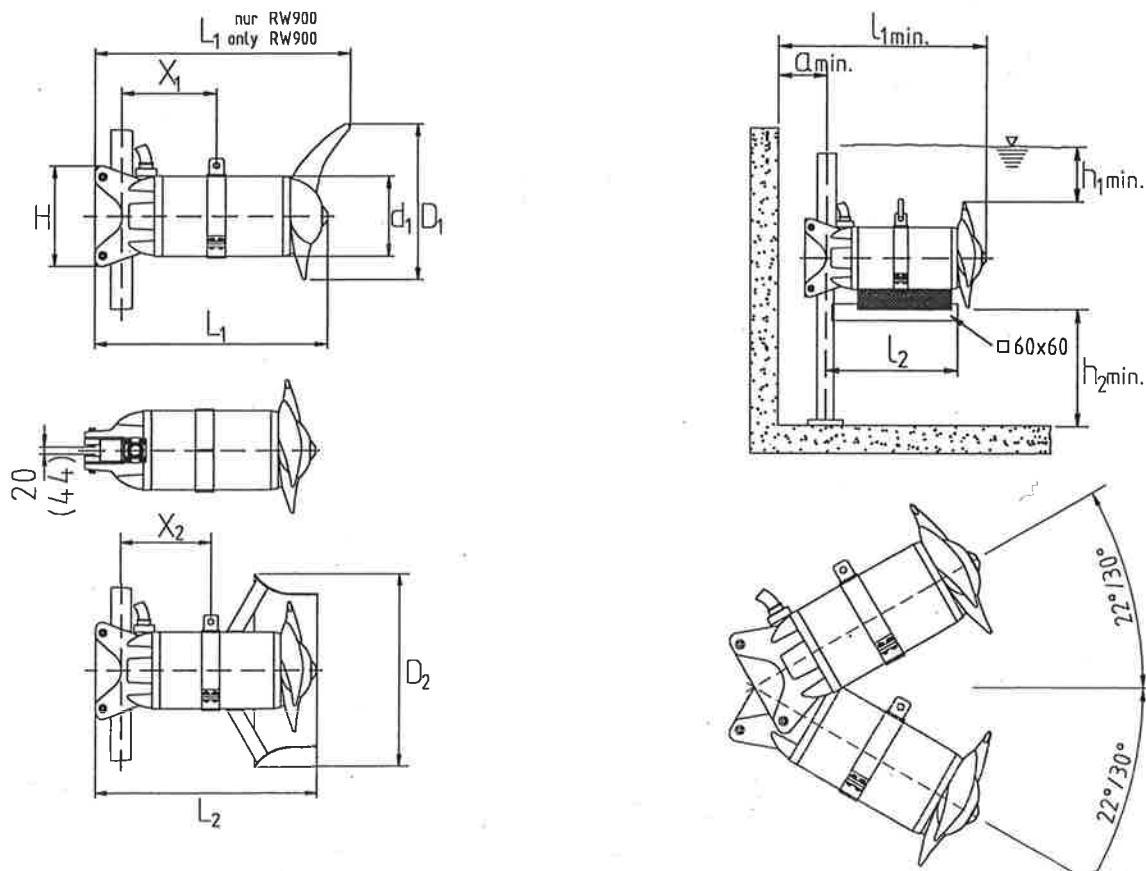


Bild 1

Fig. 1

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

### 1.2.2 Typenschild

Wir empfehlen, die Daten des gelieferten Rührwerkes anhand des Original-Typenschildes in untenstehende Abbildung einzutragen, so daß Sie jederzeit zusammen mit dem Kaufbeleg einen Nachweis der Daten führen können.

Bei Rückfragen ist unbedingt der Rührwerks-Typ, sowie die im Feld "Nr." angegebene Nummer (Artikel- und Pumpen-Nummer) anzugeben.

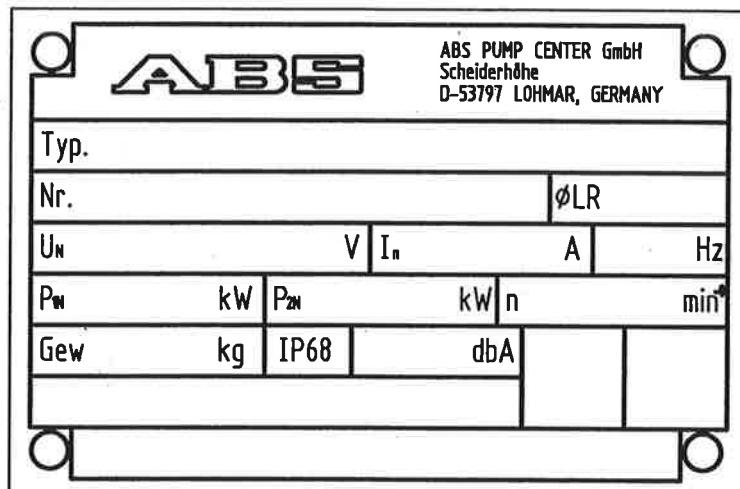


Bild 2

Legende		
Typ	Rührwerk-Typ	
Nr.	Art.-Nr. / Rührwerks-Nr.	
U <sub>N</sub>	Betriebsspannung u. Schaltung der Phasen ( $\wedge$ oder $\Delta$ für DOL)	V
I <sub>N</sub>	Nennstrom	A
	Frequenz	Hz
P <sub>1N</sub>	Leistungsaufnahme	kW
P <sub>2N</sub>	Leistungsabgabe	kW
n	Propeller-Drehzahl	min <sup>-1</sup>
LRØ	Propeller-Durchmesser	mm
Gew.	Gewicht	kg
IP 68	Schutzart	

### 1.2.2 Nameplate

We strongly recommend that the data on the mixer name-plate be written into the name-plate illustration below, so that this information together with the purchase invoice is readily available.

In the case of any queries, the mixer type, part number, and serial number should be given.

Fig. 2

Legend		
Typ	Mixer type	
Nr.	Part No. / Mixer No.	
U <sub>N</sub>	Operating voltage and connecting phases ( $\wedge$ or $\Delta$ for DOL)	V
I <sub>N</sub>	Rated current	A
	Frequency	Hz
P <sub>1N</sub>	Power input	kW
P <sub>2N</sub>	Power output	kW
n	Propeller speed	min <sup>-1</sup>
LRØ	Propeller diameter	mm
Gew.	Weight	kg
IP 68	Protection class	

### 2. Safety

### 2. Safety

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

Siehe "SICHERHEITSHINWEISE" auf den ersten Seiten dieser Einbau-und Betriebsanweisung.

**ACHTUNG** Vor Transport, Aufstellung und Installation der Pumpen sind die "SICHERHEITS-HINWEISE" sorgfältig zu studieren !

Mit dieser Einbau-und Betriebsanweisung werden hier nicht genannte allgemeine Vorschriften und Normen nicht außer Kraft gesetzt.

Unfallverhütungsvorschriften sowie allgemein anerkannte Regeln der Technik sind zu beachten!

-  Die ABS Rührwerke haben einen rotierenden Propeller der nicht geschützt werden kann, da dies die Funktion beeinträchtigen würde.
-  Das Rührwerk darf nur getaucht betrieben werden.

### 3. Transport und Lagerung

-  Rührwerk beim Transport nicht werfen oder stürzen.
-  Das Rührwerk darf nicht an der elektrischen Zuflußleitung angehoben werden.
-  Das Rührwerk ist mit einer Tragöse und Schäkel ausgerüstet, an dem zum Transport eine Kette angeschlagen werden kann.
-  Die Hebevorrichtung muß für das Gewicht des Rührwerkes ausreichend bemessen sein! (Siehe Tabelle Seite 4 und 5)

#### 3.1 Feuchtigkeitsschutz der Motoranschlußkabel

Die Motoranschlußkabel sind an den Enden werkseitig mit Schrumpfschlauch-Schutzkappen gegen in Längsrichtung eindringende Feuchtigkeit geschützt. Die Schutzkappen sind erst unmittelbar vor dem Elektroanschluß des Rührwerkes zu entfernen.

Besonders bei Installationen oder Lagerung der Rührwerke in Bauwerken, die vor Verlegung und Elektroanschluß des Motoranschlußkabels mit Wasser vollaufen können, ist darauf zu achten, daß das Kabellende, bzw. die Schutzkappe des Motoranschlußkabels nicht überflutet werden kann!

**ACHTUNG** Diese Schutzkappe ist nur ein Spritzwasserschutz und somit nicht druck-wasserdicht!  
Das Ende des Motoranschlußkabels

See the "SAFETY INSTRUCTIONS" on the first pages of this installation and instruction booklet.

**ATTENTION** The "SAFETY INSTRUCTIONS" must be studied with care before transport, set-up, installation and commissioning of the pumps !

The use of this Installation and Operating Instructions does not invalidate or render inoperative general regulations and standards which are not specifically mentioned in it.

All safety regulations and the the general rules of good technical practice must be observed !

 The ABS mixer range has a rotating propeller which cannot be protected or covered as it would obstruct functioning.

 The mixer may only be operated when submerged.

### 3. Transport and storage

-  During transport the mixer must not be thrown or dropped.
-  The mixer must never be raised by the power cable.
-  The mixer has been fitted with eyelets to which a chain can be connected by means of a shackle for transport purposes.
-  The hoist used must be suitable for the weight of the mixer! (See table on page 4 and 5)

#### 3.1 Protection of motor connection cable against moisture ingress

The ends of the motor connection cables have been protected at the Works against the ingress of moisture along the cable by the provision of shrink hose protective covers. These protective covers should only be removed immediately before electrical connection of the pump.

Particular attention is necessary during storage or installation of pumps in locations which could fill with water prior to laying and connection of the power cable of the motor. Please note that the cable end, even where fitted with protective sleeves, should not be immersed in water.

**ATTENTION** These protective covers only provide protection against water spray or similar and are not a water tight seal. The ends of the cables should not

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

*darf nicht getaucht werden, da sonst Feuchtigkeit in den Anschlußraum des Motors eindringen kann!*

**HINWEIS** Das Ende des Motoranschlußkabels ist in solchen Fällen an einer entsprechend überflutungssicheren Stelle zu fixieren.

**ACHTUNG** Kabel- und Aderisolierungen dabei nicht beschädigen!

### 4. Beschreibung

Der druckwasserdicht gekapselte, voll überflutbare Motor und die Hydraulik bilden ein kompaktes Blockaggregat.

Die Motoren sind für den Spannungsbereich von 380V - 420 V Drehstrom, Schutzart IP 68, Statorwicklung mit Isolation der Klasse F für 155 °C ausgelegt.

**HINWEIS** Weitere Spannungen auf Anfrage möglich.

Alle Motoren der Rührwerke RW 300 bis 900 sind mit Temperaturwächtern ausgestattet, die bei Überhitzung den Tauchmotor abschalten. Hierzu sind die Temperaturwächter entsprechend in der Schaltanlage anzuschließen.

 Je nach Auslegung der Schaltanlage schaltet der Tauchmotor nach dem Abkühlen automatisch wieder ein.

Die DI-Elektrode übernimmt die Dichtungsüberwachung und meldet über eine spezielle Elektronik das Eindringen von Feuchtigkeit in den Motor.

Die Lagerung der Motorwelle erfolgt durch dauergetrimmte und wartungsfreie Wälzlager.

Die Wellenabdichtung erfolgt mediumseitig durch eine hochwertige Gleitringdichtung.

Alle Rührwerke sind bei **entsprechender Auslegung** für den Betrieb an Frequenzumformern geeignet. Die **EMV-Richtlinie sowie die Einbau- und Betriebsanweisung des Frequenzumformer-Herstellers** ist dabei zu beachten !

*be immersed in water, otherwise moisture could enter the connection chamber of the motor!*

**NOTE** If there is a possibility of water ingress then the cable should be secured so that the end is above the maximum possible flood level.

**ATTENTION** Take care not to damage the cable or its insulation when doing this !

### 4. Description

The water pressure-tight encapsulated, fully flood-proof motor and hydraulics section form a compact unit construction.

The motors are available for a range of voltages, Protection Type IP 68, stator winding Insulation Class F for 155° C.

**NOTE** Other voltages on request.

All motors of the mixer series RW 300 to 900 are fitted with thermal sensors in the stator which switch off the motor in the event of excessive temperatures being reached. It is essential that the thermal sensors are correctly connected in the control panel.

 Depending on the layout of the control panel the submersible motor may be automatically switched back on after it has cooled down.

The DI-electrode carry out the seal monitoring function and signal the ingress of moisture into the motor by means of a special electronic device.

The motor shaft is supported in lubricated-for-life maintenance free ball bearings.

The shaft sealing on the medium side is by means of a high quality mechanical seal.

Depending on selection, all mixers are suitable for use with frequency inverters.

Observe the EMC-Directive and the Installation and operating instructions of the manufacturer of the frequency inverters !

#### Legende

- 1 Halterung
- 2 Kableinführung
- 3 Anschlußraum
- 4 Abdichtung zum Motorraum
- 5 Motorwicklung
- 6 Halterung mit Schäkel

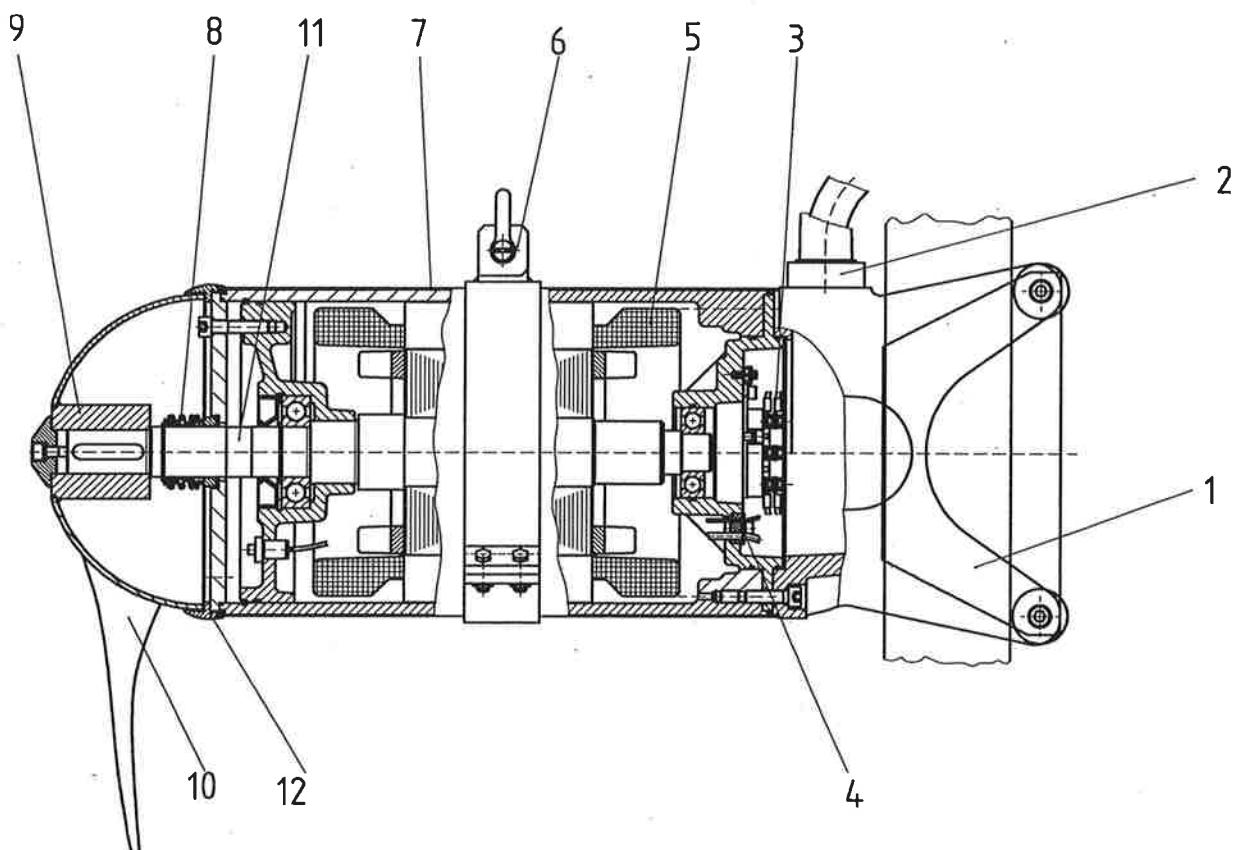
#### Legend

- 1 Bracket
- 2 Cable entree
- 3 Junction room
- 4 Seal to monitor room
- 5 Stator
- 6 Lifting ring with shackle

**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900**

7	Edelstahlummantelung (Option)
8	Gleitringdichtung
9	Propellernabe
10	Propeller
11	Welleneinheit mit Rotor und Lagern
12	SD - Ring

7	Stainless steel cover (option)
8	Mechanical seal
9	Propeller hub
10	Propeller
11	Motor shaft with rotor and bearings
12	SD-Ring

**Bild 3 RW 300 / 400 / 650****Fig. 3 RW 300 / 400 / 650**

Legende	
1	Halterung
2	Kableinführung
3	Anschlußraum
4	Abdichtung zum Motorraum
5	Motorwicklung
6	Halterung mit Schäkel
7	Edelstahlummantelung (Option)
8	Gleitringdichtung

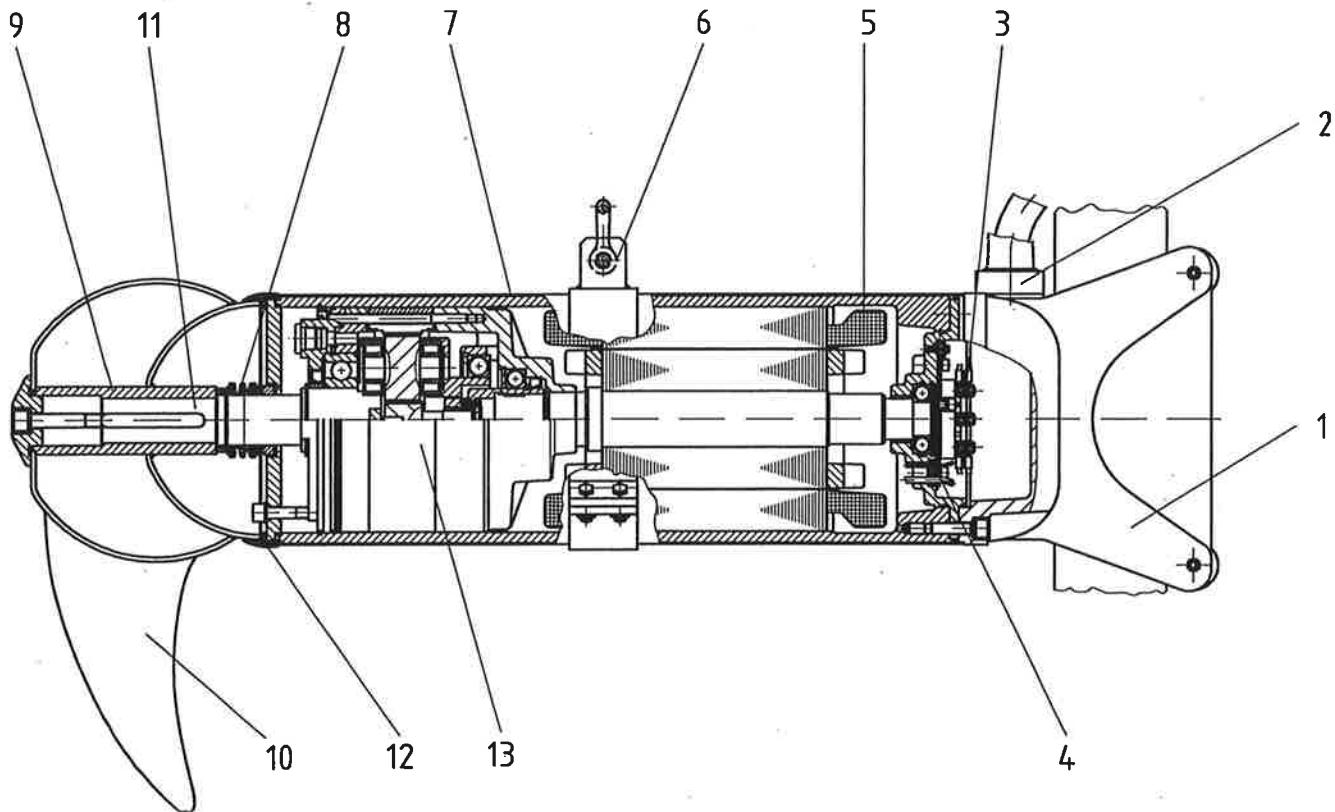
Legend	
1	Bracket
2	Cable entree
3	Junction room
4	Seal to monitor room
5	Stator
6	Lifting ring with shackle
7	Stainless steel cover (option)
8	Mechanical seal

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**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900**

9	Propellernabe
10	Propeller
11	Welleneinheit mit Rotor und Lagern
12	SD - Ring
13	Getriebe

9	Propeller hub
10	Propeller
11	Motor shaft with rotor and bearings
12	SD-Ring
13	Gear box

**Bild 4 RW 900****Fig. 4 RW 900****4.1 Spülsystem für Gleitringdichtung (Option)**

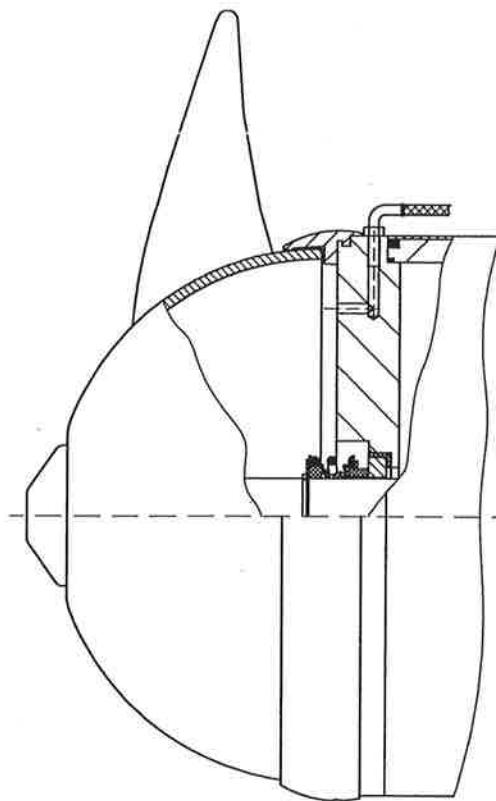
Durch die Anschlußmöglichkeit einer Brauchwasserleitung kann die Gleitringdichtung auch während des Betriebes gespült bzw. gereinigt werden. Dies kann schädliche Ablagerungen verhindern und vorzeitigem Verschleiß, z.B. durch chemische Reaktionen vorbeugen.

Es ist möglich, das Spülsystem durch Austausch des Motordeckels nachzurüsten.

**4.1 Flushing system for the mechanical seal chamber (option)**

The mixer can be equipped with a flushing system for the mechanical seal when the liquid to be mixed is e.g. sludge where chemical reactions are possible and mixing liquids in which the danger of blockage is given.

It is possible to add the flushing system by replacing the oil chamber lid.

**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900****Bild 5****5. Aufstellung und Einbau**

**HINWEIS** Wir empfehlen für die Aufstellung und den Einbau der Rührwerke die Verwendung des ABS Installationszubehörs.

**Fig. 5****5. Mounting and installation**

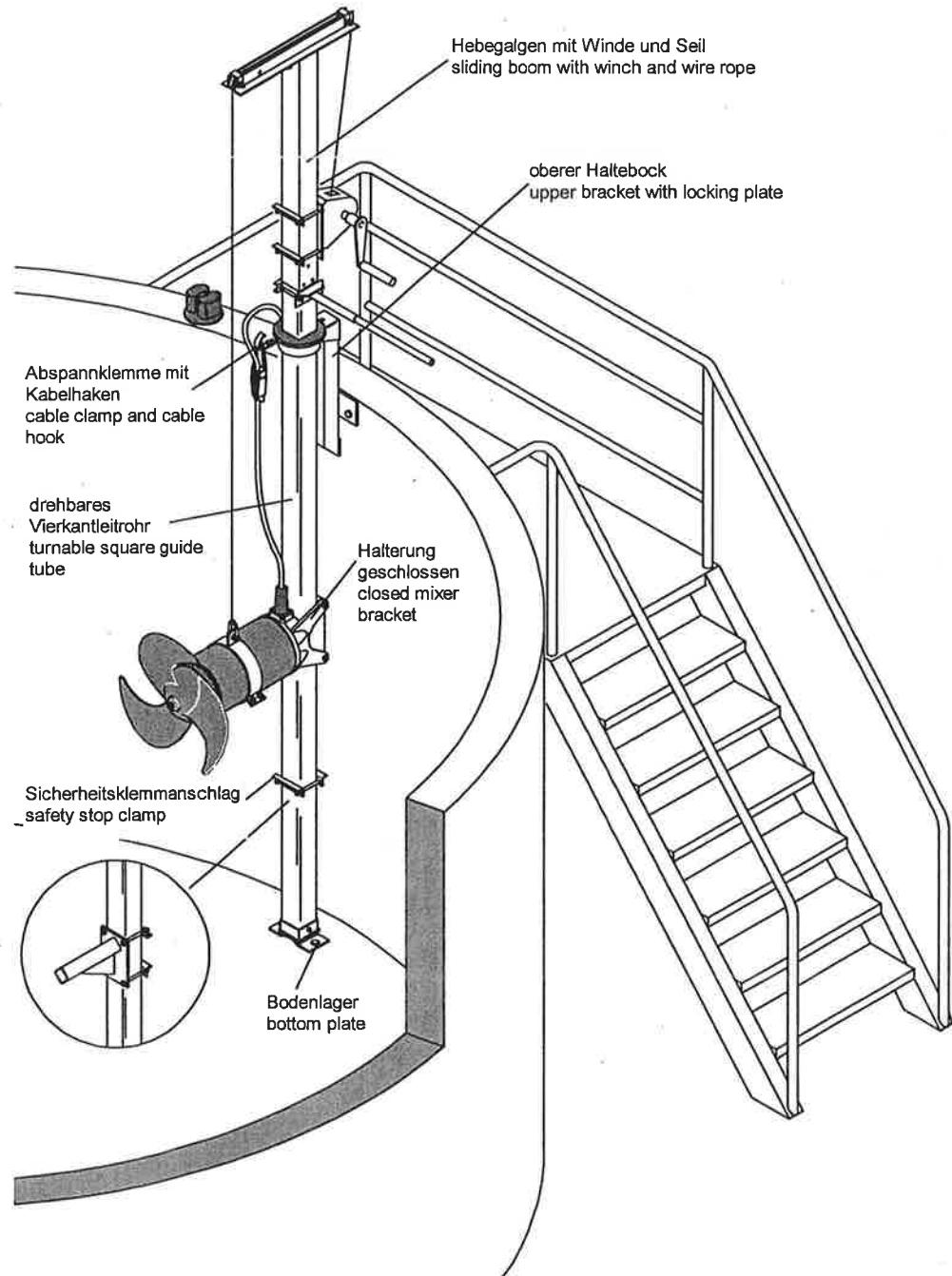
**NOTE** We recommend that ABS installation accessories be used for mounting and installation of the mixer.

**5.1 Installationsbeispiele**

Installationsbeispiel - mit vorhandenen Zubehörkomponenten- Für diese Art der Installation wird empfohlen, die geschlossene Halterung zu verwenden. (siehe Bild 11).

**5.1 Installation examples**

**Installation example** - with present components - Closed mixer bracket should be used.  
(see Fig. 11)

**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900****Bild 6****Fig. 6**

**Installationsbeispiel** mit weiteren Befestigungsmöglichkeiten. Bei dieser Installation wird empfohlen, die offene Halterung zu verwenden.  
(Siehe Bild 10).

**Installation example** - with the possibility of additional wall fixing - Open mixer bracket should be used.  
(See Fig. 10)

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

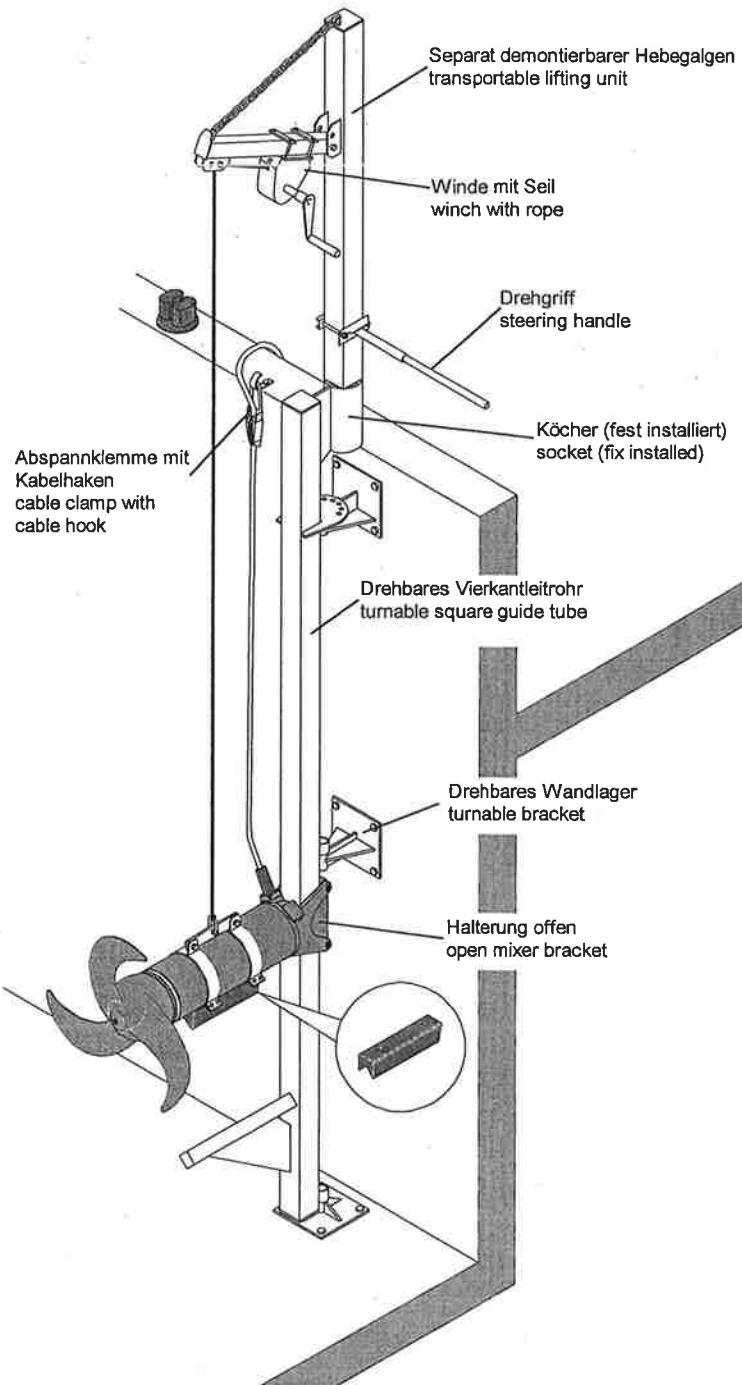
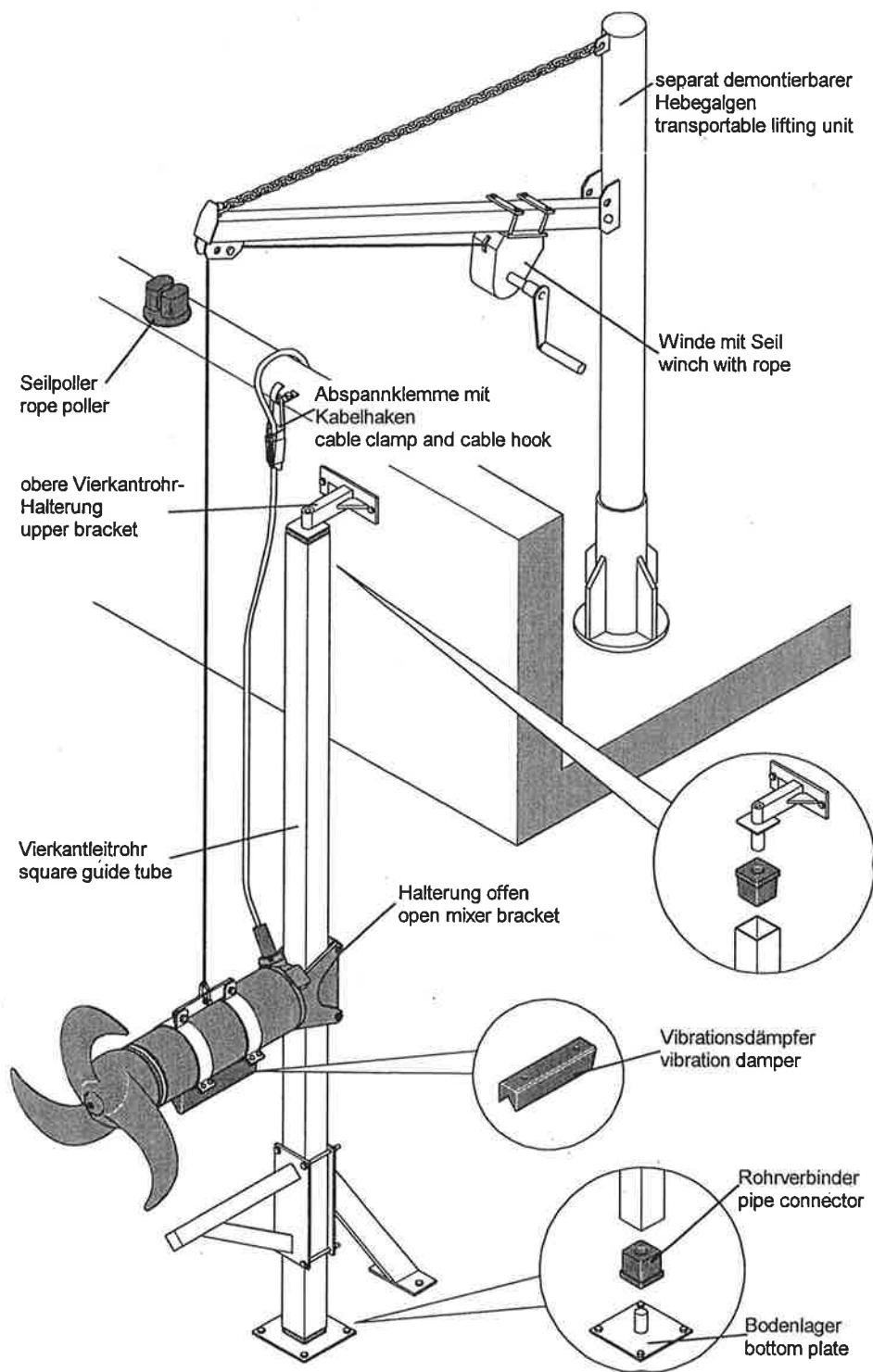


Bild 7

Fig. 7

**Installationsbeispiel** mit fester Installation als Strömungsbeschleuniger. Für diese Installation wird empfohlen, die offene Halterung zu verwenden. (Siehe Bild 10).

**Installation example** - Fix installation as a Flow Booster - Open mixer bracket should be used. (See Fig. 10)

**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900****Bild 8****Feste Installation mit Vibrationsdämpfer**

Wenn das Rührwerk an einem festen Punkt im Becken installiert werden soll, empfehlen wir die Konsole mit dem Vibrationsdämpfer zu verwenden.

In diesem Fall muß ein weiteres Vierkantrohr als

**Fig. 8****Fix installation with elastic support**

If the mixer can be installed in a fix position in the tank, we recommend to also install the elastic support (vibration damper). In this case an additional square guide tube (□ 60

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

konsole am Führungsrohr angebracht werden.

Der **Vibrationsdämpfer** für das jeweilige Rührwerk kann geordert werden. (Art. Nr. siehe nachstehende Tabelle).

x 60 mm) should be installed on the guide tube.

The **elastic support** for the mixers can be ordered separately. (Part no. see table below).

Rührwerk / Mixer range	Art.Nr. / Part no.
RW 300	-----
RW 400	6 162 0019
RW 650	6 162 0020
RW 900	6 162 0021

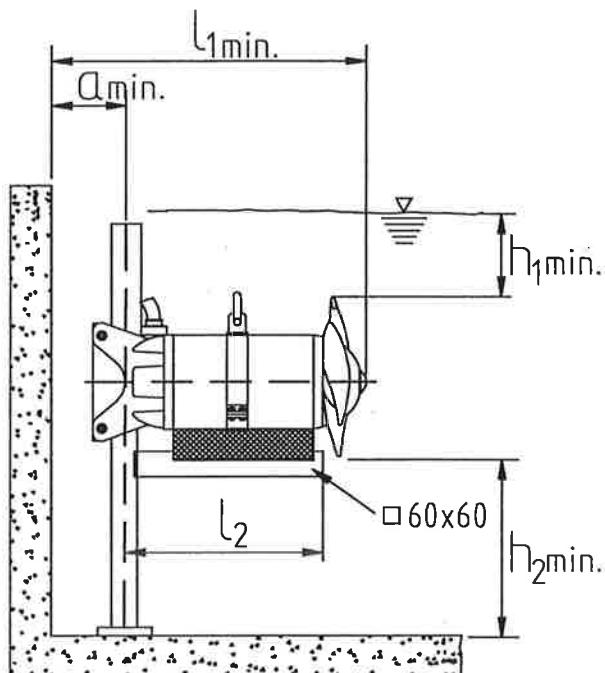


Bild 9 (Maße siehe Tabelle auf Seite 4)

Fig. 9 (For dimensions see table on page 4)

### 5.1.1 Halterungen

Bei den Rührwerken der Baureihe RW 300 bis 900 stehen beide Halterungsvarianten (offen und ge-

### 5.1.1 Guide rail bracket

The RW 300 to 900 offers the opportunity of using both bracket versions. (Open and closed bracket).

**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900**

schlossen)

Offene Halterung  
Open bracket

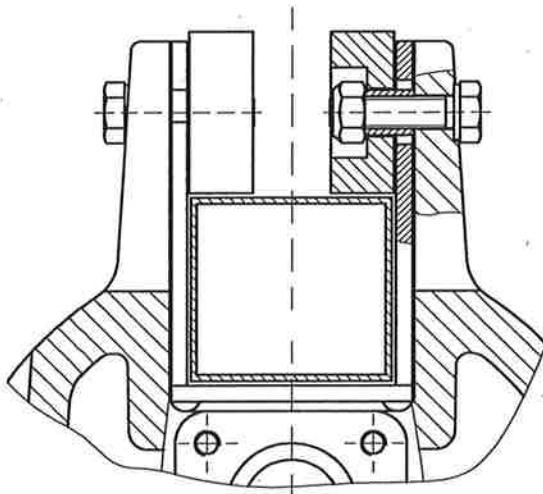


Bild 10 / Fig. 10

Geschlossene Halterung  
Closed bracket

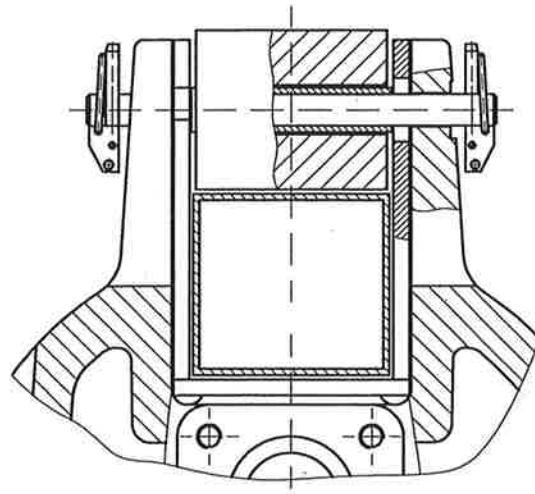


Bild 11 / Fig. 11

**Zuordnung der Führungsrohrabmessungen :**

- 60 RW 300 und RW 400
  - 100 RW 400 / RW 650 und RW 900
- (Siehe auch Abschnitt 5.1.2 / Führungsrohrlängen)

**Assign to the square guide tube dimensions :**

- 60 RW 300 und RW 400
  - 100 RW 400 / RW 650 und RW 900
- (See also Section 5.1.2 / guide tube length)

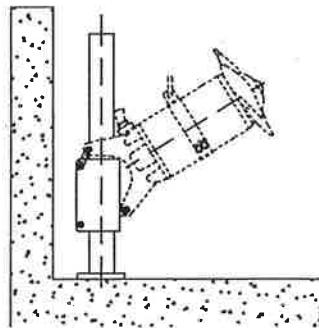
**Weitere Option : Neigungsverstellbare Halterung****Further option : Swingable bracket**

Bild 12

**5.1.2 Führungsrohrlängen (Vierkantleitrohr)**

Die nachstehende Tabelle zeigt die maximale Länge der Führungsrohre, basierend auf der maximal zulässigen Durchbiegung von 1/300 der Länge des Führungsrohres. Diese Werte sind mit der maximalen Schubkraft der stärksten RW's jeder Baureihe in Reinwasser einer Dichte von 1000 kg/m<sup>3</sup> ermittelt worden.

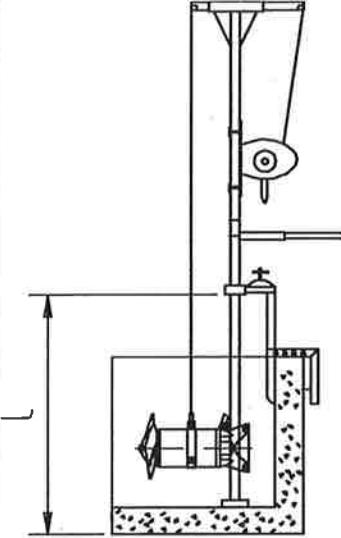
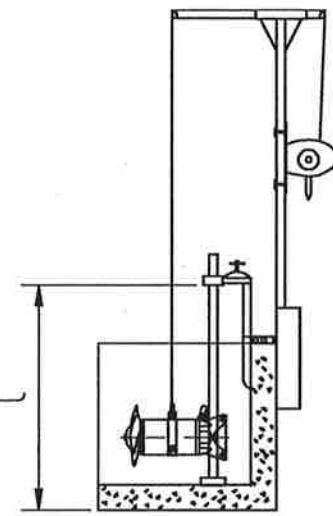
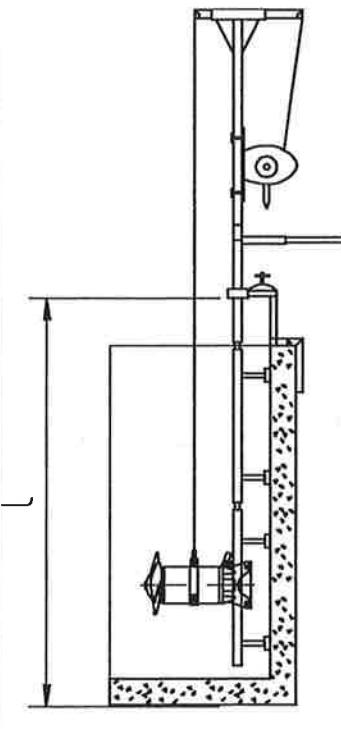
Fig. 12

**5.1.2 Guide tube length**

The following table recommends the max. length of the guide tube based on a max. flexion of approx. 1/300 of the length. This result is based on calculations of the max. thrust of the strongest of each RW range in clean water. (Density 1000 kg/m<sup>3</sup>)

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Maximale Führungsrohrlänge (l) bei der Installation der Vierkantleitrohre Maximum guide tube legth (l) of installation of square guide tube			
Rührwerk Mixer type	mit steckbarerem Hebegalgen Lifting unit (push in type)	mit separatem Hebegalgen with separat lifting unit	Führungsrohr mit zusätzlicher Wandinstallation square guide tube with additional wall fixing
			
RW 300	<input type="checkbox"/> 60 x 60 x 4 l ≤ 5 m	<input type="checkbox"/> 60 x 60 x 4 l ≤ 5 m	<input type="checkbox"/> 60 x 60 x 4 l ≤ 5 m
RW 400	<input type="checkbox"/> 60 x 60 x 4 l ≤ 4 m <input type="checkbox"/> 100 x 100 x 4 l ≤ 9 m	<input type="checkbox"/> 60 x 60 x 4 l ≤ 5 m <input type="checkbox"/> 100 x 100 x 4 l ≤ 10 m	<input type="checkbox"/> 60 x 60 x 4 l ≤ 5 m <input type="checkbox"/> 100 x 100 x 4 l ≤ 10 m
RW 650	<input type="checkbox"/> 100 x 100 x 4 l ≤ 5 m <input type="checkbox"/> 100 x 100 x 6 l ≤ 6 m <input type="checkbox"/> 100 x 100 x 8 l ≤ 7 m	<input type="checkbox"/> 100 x 100 x 4 l ≤ 6 m <input type="checkbox"/> 100 x 100 x 6 l ≤ 7 m <input type="checkbox"/> 100 x 100 x 8 l ≤ 8 m	<input type="checkbox"/> 100 x 100 x 4 l ≤ 6 m <input type="checkbox"/> 100 x 100 x 6 l ≤ 6 m <input type="checkbox"/> 100 x 100 x 8 l ≤ 8 m
RW 900 ≤ 15 kW	<input type="checkbox"/> 100 x 100 x 6 l ≤ 5 m <input type="checkbox"/> 100 x 100 x 10 l ≤ 7 m	<input type="checkbox"/> 100 x 100 x 6 l ≤ 6 m <input type="checkbox"/> 100 x 100 x 10 l ≤ 7 m	<input type="checkbox"/> 100 x 100 x 6 l ≤ 6 m <input type="checkbox"/> 100 x 100 x 6 l ≤ 6 m
RW 900 < 15 kW	Einbau nur mit Sonderinstallation! Only with special installation!		

### 5.2 Elektrischer Anschluß



Vor Inbetriebnahme ist durch fachmännische Prüfung sicherzustellen, daß eine der notwendigen elektrischen Schutzmaßnahmen vorhanden ist. Erdung, Nullung, Fehlerstromschutzschaltung etc. müssen den Vorschriften des örtlichen Energie-Versorgungs-

### 5.2 Electrical connection



Prior to starting the unit a qualified person must ensure that one of the required electrical protective measures has been provided. Grounding, neutral line, earth leakage circuit breakers, etc. must comply with the regulations of the local Power Supply Authority and

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unternehmens (EVU) entsprechen und laut Prüfung der Elektrofachkraft einwandfrei funktionieren.

Wir empfehlen die Verwendung eines empfindlichen Fehlerstrom-Schutzschalters (gemäß VDE 0700, Teil 41 "Sicherheit elektrischer Geräte für den Hausgebrauch und ähnliche Zwecke", Ausgabe Juni '92).

**ACHTUNG** Querschnitt und Spannungsabfall der Netzzuleitung müssen mit den einschlägigen Vorschriften, zum Beispiel VDE, ÖVE übereinstimmen

Die auf dem Typenschild der Pumpe angegebene Spannung muß der vorhandenen Netzspannung entsprechen



Die Anlage ist mit einer entsprechenden Vorsicherung (gemäß Nennleistung des Motors) abzusichern.



In Pumpstationen/Behältern ist ein Potentialausgleich gemäß VDE 0190 (Bestimmungen für das Einbeziehen von Rohrleitungen, Schutzmaßnahmen von Starkstromanlagen) durchzuführen.



Bei Rührwerken mit serienmäßiger Steueranlage ist die Steueranlage vor Nässe zu schützen und im überflutungssicherem Bereich in Verbindung mit einer vorschrefts-mäßig installierten CEE-Schutzkontakt-steckdose zu installieren.

**ACHTUNG** Die Rührwerke dürfen nur in der **Startart** angeschlossen werden, die in den Tabellen auf Seite 3 u. 4 angegeben ist. Abweichungen bedürfen der Rücksprache mit dem Hersteller. Zusätzlich empfehlen wir für Rührwerke > 15 kW einen Sanftanlauf.

Für Rührwerke ohne serienmäßige Schaltanlage gilt:



Das Anklemmen der Zuleitungs- und Pumpenkabel an die Klemmen der Steueranlage ist entsprechend den Kennzeichnungen von einer Elektrofachkraft gemäß den jeweils örtlich geltenden Vorschriften vorzunehmen. Der Einbau eines Motorschutzschalters ist vorzusehen.

**ACHTUNG** Für den Betrieb im Freien gilt nach VDE:



"Tauchmotorpumpen/Tauchmotorrührwerke

must be checked by a qualified person to ensure that they are functioning correctly.

We recommend the use of a sensitive earth leakage circuit breaker (in accordance with VDE 0700, Part 41 "Safety of Electrical Appliances for Household use and similar purposes", Issue June '92), or your relevant local regulations.

**ATTENTION** The cross-section and voltage drop of the power supply cable must comply with the relevant regulations, e.g. VDE, etc.

The voltage specified on the pump name-plate must be the same as the supply voltage.



The system must be protected by a suitable fuse (in accordance with the rated power of the motor).



In pump stations/tanks potential bonding must be carried out in accordance with VDE 0190 (Regulations for the installation of pipe lines, protective measures in power plants).



In the case of mixers supplied with a standard control panel this must be protected from dampness and installed above flood level by means of a correctly fitted CEE-earthed socket.

**ATTENTION** The mixers must be connected in the **type of start**, as shown in the tables on page 3 a. 4. In case of different connection please consult the manufacturer. In addition to that we recommend to use a soft starter for mixers > 15 kW.

In the case of mixers where a control panel is not supplied as standard the following applies:



The power supply and pump cable must be connected to the terminals of the control panel in accordance with the designations provided by a qualified person in compliance with local regulations. An overload switch must be fitted.

**ATTENTION** For use in the open air the following VDE Regulation applies:



"Submersible pumps/submersible mixers

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zur Verwendung im Freien müssen mit einer festen Anschlußleitung mit einer Länge von mindestens 10 m versehen sein." Im Ausland gelten unterschiedliche Bestimmungen.

Bitte fragen Sie Ihren Elektrofachmann.

used outdoors must be fitted with a power cable of at least 10 m length. Other regulations may apply in other countries.

Please consult your electrician.

Motoranschlußschaltbilder : / Wiring Diagrams :	
<p>Bild 13 / Fig. 13      RW 3021 bis 4024 RW 3021 to 4024</p>	<p>Bild 14 / Fig. 14      RW 4031 bis 9035 RW 4031 to 9035</p>

**ACHTUNG** Ex-Motoren dürfen in explosionsgefährdeten Bereichen nur mit angeschlossener Temperatur-überwachung (Adern: F0, F1) betrieben werden.



Der "Wächterkreis" (F1) muß mit den Motorschützen elektrisch verriegelt werden, die Quittierung muß manuell erfolgen.

### 5.2.1 Drehrichtungskontrolle

Bei der ersten Inbetriebnahme und auch an jedem neuen Einsatzort ist eine Drehrichtungskontrolle durchzuführen.

Zur Feststellung der Drehrichtung ist das Rührwerk an der Kette hängend und am Führungsrohr eingehängt vor dem Absenken in das Medium kurz anlaufen zu lassen.

Die Drehrichtung (Propeller-Rotation) ist richtig, wenn :

- Der Propeller von hinten über den Motor gesehen nach rechts dreht.
- Der Propeller in der Richtung des auf dem Motor angebrachten Drehrichtungspfeiles dreht.



Das Rührwerk ist bei der Drehrichtungskontrolle so abzusichern, daß keine Personenschäden durch den sich drehenden Propeller und den Luftstrom entstehen können. Nicht in den Propeller greifen.

Sind mehrere Rührwerke an eine Steueranlage ange-

**ATTENTION** Explosion-proof motors may only be operated in explosive areas with the temperature monitoring system connected (Leads: F0, F1).



The "Monitoring Circuit" (F1) must be connected to the contactors in such a manner that resetting must be carried out manually.

### 5.2.1 Checking direction of rotation

At the initial start-up and after each fresh change of location, the direction of rotation must be checked.

To determine the direction of rotation suspend the mixer from a chain at the guide tube and allow it to run for a short period before it is lowered into the medium.

The direction of rotation (propeller rotation) is correct if :

- The propeller when viewed from the rear over the motorhousing must rotate in a clockwise manner.
- The propeller rotates in the direction of the rotation arrow located on the motor-housing.



When checking the direction of rotation take care that no injury can be caused by the rotation of the propeller or the resulting air flow. Do not place a hand or other part of the body near the propeller.

If a number of mixers are connected to a single EBA (2) 1 597 0403 D/GB 07.97

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schlossen, ist jedes Rührwerk einzeln zu prüfen.

### 5.2.2 Drehrichtungsänderung

Bei falscher Drehrichtung ist eine Drehrichtungsänderung an Schaltanlagen **ohne** Drehrichtungsschalter durch Vertauschen zweier Phasen des Zuleitungskabels in der Steueranlage von einer Elektrofachkraft vorzunehmen.



Die Drehrichtungsänderung an Schaltanlagen **ohne** Drehrichtungsschalter darf nur von einer Elektrofachkraft durchgeführt werden.

control unit, then each mixer must be checked individually.

### 5.2.2 Changing direction of rotation

If the direction of rotation is incorrect and the unit is **not** fitted with a mechanism for changing the direction of rotation then two phases of the power supply cable in the control panel must be changed over by a qualified person.



Changing direction of rotation on mixers not fitted with a change-over switch must only be carried out by a qualified person.

### 5.2.3 Anschluß der Dichtungsüberwachung

Zum Integrieren der Dichtungsüberwachung in bauseits erstellte Steueranlagen für die Rührwerke ist ein ABS DI-Baustein erforderlich und gemäß den nachstehenden Schaltplänen anzuklemmen.

**HINWEIS** DI-Bausteine sind für die Spannungen 110 V, 230 V, 400 V und 440 V verhältnis. DI-Bausteine gehören nicht zum serienmäßigen Lieferumfang.

### 5.2.3 Connection of the seal monitor

In order to integrate the seal monitoring system into a control panel supplied by the customer it is necessary to fit an ABS DI-module and connect it in accordance with the circuit diagrams below.

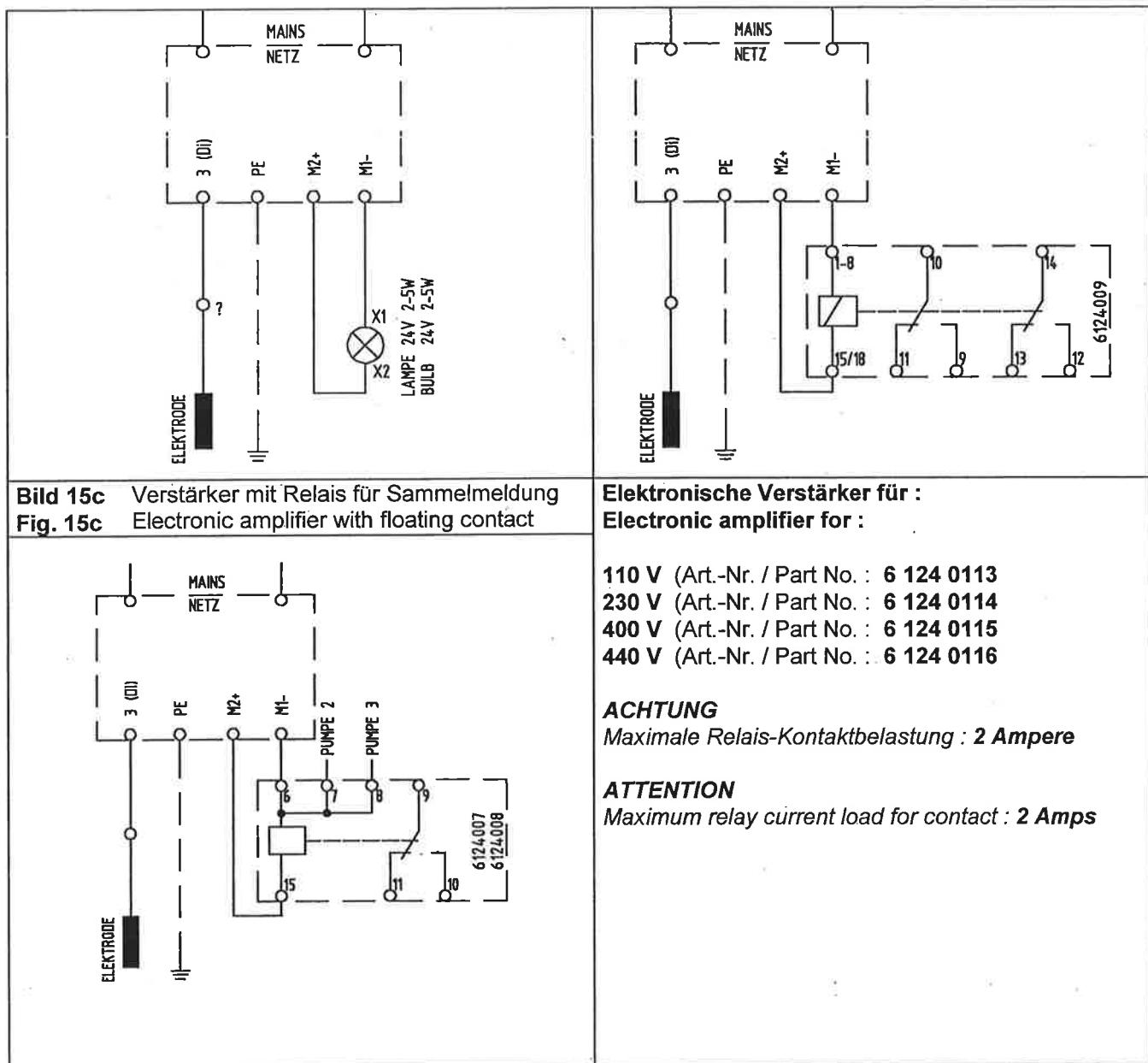
**NOTE** DI-modules are available for voltages 110 V, 230 V, 400 V, and 440 V. DI-modules are not supplied as standard with the motor

**Bild 15a** Verstärker mit Leuchtmelder  
**Fig. 15a** Electronic amplifier with bulb

**Bild 15b** Verstärker mit Relais für Einzelmeldung  
**Fig. 15b** Electronic amplifier with floating contact

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900



### 6. Inbetriebnahme

Vor der Inbetriebnahme ist das Rührwerk zu überprüfen und eine Funktionsprüfung durchzuführen. Insbesondere ist zu prüfen :

- Erfolgte der Elektro-Anschluß gemäß den gültigen Bestimmungen ?
- Ist der Motorschutzschalter richtig eingestellt ?  
Sind die Motoranschlußkabel so verlegt, daß sie nicht vom Propeller erfaßt werden können ?
- Stimmt die Drehrichtung ?
- Stimmt die Mindestüberdeckung ?

### 6. Commissioning

Before commissioning the mixer examine it carefully and carry out a functional check. Particular attention should be paid to the following :

- Has the electrical connection been carried out in accordance with the current regulations ?
- Is the motor protection switch correctly set ?
- Has the motor connection cable been laid in such a manner that it cannot be caught up in the propeller ?
- Is the direction of rotation correct ?
- Is there adequate water coverage over the

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

(Siehe Maßtabelle auf Seite 5)

### 6.1 Betriebsarten

**ACHTUNG** Rührwerke dürfen nur voll getaucht betrieben werden !

**ACHTUNG** Der Einsatz im direkt belüfteten Bereich ist nicht zulässig !

**ACHTUNG** Das Rührwerk muß völlig in dem Medium eingetaucht arbeiten. Beim Betrieb darf keine Luft vom Propeller angesaugt werden. Es ist auf ruhigen Strömungsverlauf des Mediums zu achten. Das Rührwerk soll ohne starke Vibrationen laufen.

**Unruhiger Strömungsverlauf und Vibrationen können auftreten:**

- bei starkem Durchrühren in zu kleinen Behältern.
- bei Behinderung des freien Zu- bzw. Ablaufes im Bereich des Strömungsrings.

Die Arbeitsrichtung des Rührwerkes probeweise ändern.

propeller ? (see dim. table on page 5)

### 6.1 Types of operating

**ATTENTION** Mixers may only be operated fully submerged !

**ATTENTION** The operation in the aerated area is not allowed !

**ATTENTION** The mixer must be fully submerged in the medium. During operation no air should be drawn in by the propeller. A quiet flowing action in the medium must occur. The mixer must not vibrate excessively.

**Uneven liquid flow and vibrations may be caused by :**

- over active mixing in small tanks.
- prevention of free inflow or outflow in the area of the flow-ring if fitted.

Changing position or direction of the mixer may assist.

### 7. WARTUNG



Bei Wartungs- und Instandsetzungsarbeiten sind die Sicherheitregeln für Arbeiten in umschlossenen Räumen von abwassertechnischen Anlagen sowie die allgemein anerkannten Regeln der Technik zu beachten.



**WARNUNG**

Lebensgefährliche Gase

### 7. Maintenance



When carrying out any repair or maintenance work, the safety regulations covering the working in enclosed areas of sewage installations, as well as good general technical practice must be observed.



**WARNING**

Dangerous gases

**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900****Unfallverhütungsvorschriften  
beachten !**

Beim Einstiegen in den Behälter Gurtzeug und Rettungsleine gebrauchen und mit einer Aufsichtsperson arbeiten.

Ausreichend belüften !



Vor Beginn der Wartungsarbeiten ist das Rührwerk allpolig vom elektrischen Netz zu trennen und gegen Wiedereinschalten zu sichern.

**HINWEIS** Die hier angegebenen Wartungshinweise sind keine Anleitung für Eigenreparaturen, da hierfür spezielle Fachkenntnisse erforderlich sind.

**ACHTUNG** Eingriffe an explosionsgeschützten Motoren dürfen nur in/von dafür ermächtigten Werkstätten/Personen ausgeführt werden. Bei Reparaturen dürfen nur Originaleile des Herstellers verwendet werden.

Ein Wartungsvertrag mit unserem Werkkundendienst sichert Ihnen in jedem Fall den besten fachmännischen Service.

**Observe all accident prevention regulations !**

When entering into the tank make use of harness and safety line and always work with another person in attendance.

Ensure adequate venting !



Before beginning any maintenance work the mixer must be totally disconnected from the mains, and secured against being inadvertently switched back on.

**NOTE** The maintenance hints given here have not been designed for "Do-It-Yourself" repairs, as special technical knowledge is required to repair these units.

**ATTENTION** Repair work on explosion-proof motors may only be carried out by workshops or persons authorized for this. During repair work, only original parts supplied by the manufacturer must be used.

A Maintenance Contract with our Service Department will guarantee you the best technical service in all eventualities.

### 7.1 Allgemeine Wartungshinweise

ABS Rührwerke sind bewährte Qualitätserzeugnisse mit sorgfältiger Endkontrolle. Dauergeschmierte Kugellager in Verbindung mit Überwachungseinrichtungen sorgen für optimale Betriebsbereitschaft des Rührwerkes, wenn sie entsprechend der Betriebsanweisung angeschlossen und eingesetzt werden.

Sollte dennoch eine Störung auftreten, ist keinesfalls zu improvisieren, sondern der ABS-Kundendienst zu Rate zu ziehen.

Dies gilt insbesondere beim wiederholten Abschalten durch den Überstromauslöser in der Steueranlage, bei Ansprechen der DI-Überwachung oder der Temperaturwächter.

Für eine lange Lebensdauer sind regelmäßige Kontrollen und Pflegearbeiten zu empfehlen.

### 7.1 General maintenance hints

ABS mixers are reliable products of proven quality and are subject to careful testing before leaving the factory. Lubricated-for-life ball-bearings together with our monitoring device ensure optimum reliability of the mixer. It is, however, essential that the installation and usage is in accordance with our operating instructions.

Should, however, a problem arise do not improvise, but ask your ABS Service Centre for assistance.

This applies particularly if the overload relay in the control panel continually trips, if the DI-sealed monitor or thermal sensor is activated.

In order to ensure a long running-life, regular checks and care are recommended.

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

**ACHTUNG** Die Schäkel und Hebevorrichtungen sind in regelmäßigen Abständen von etwa 3 Monaten auf eventuellen Verschleiß zu überprüfen.

Die ABS-Service-Organisation berät Sie gern bei speziellen Einsatzfällen.

**HINWEIS** ABS gewährleistet im Rahmen der Liefervereinbarungen nur dann, wenn Reparaturen durch eine autorisierte ABS-Vertretung ausgeführt wurden und nachweislich original ABS-Ersatzteile verwendet wurden.

### 7.2 Ölfüllung und Ölwechsel



Altöl ist vorschriftsmäßig zu entsorgen.

#### 7.2.1 Ölfüllung der Ölkammer

Die Ölkammer der Rührwerke ist werkseitig mit Gleitöl gefüllt. Ein regelmäßiger Ölwechsel ist nicht erforderlich !

#### 7.2.2 Gleitölwechsel (Ölkammer)

Das Gleitöl der Ölkammer kann erst nach Demontage des Propellers gewechselt werden. (Siehe Abschnitt 7.4)

**ATTENTION** The shakle and all elements of the lifting unit have to be checked regularly every 3 month for signs or wear.

The ABS Service Organization would be glad to advise you on any special applications you may have.

**NOTE** The ABS guarantee is valid only if repair work has been carried out by an authorized ABS agent, and where original ABS spare parts have been used.

### 7.2 Oil filling and Oil change



Waste oil must be disposed of in the proper manner.

#### 7.2.1 Filling oil into the oil chamber

The oil chambers of the mixers have been filled at the works with lubricating oil. A regular oil change is not necessary !

#### 7.2.2 Changing of the lubrication oil (oil chamber)

Release of the lubricating oil can only take place after the propeller has been dismantled. (See 7.4)

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

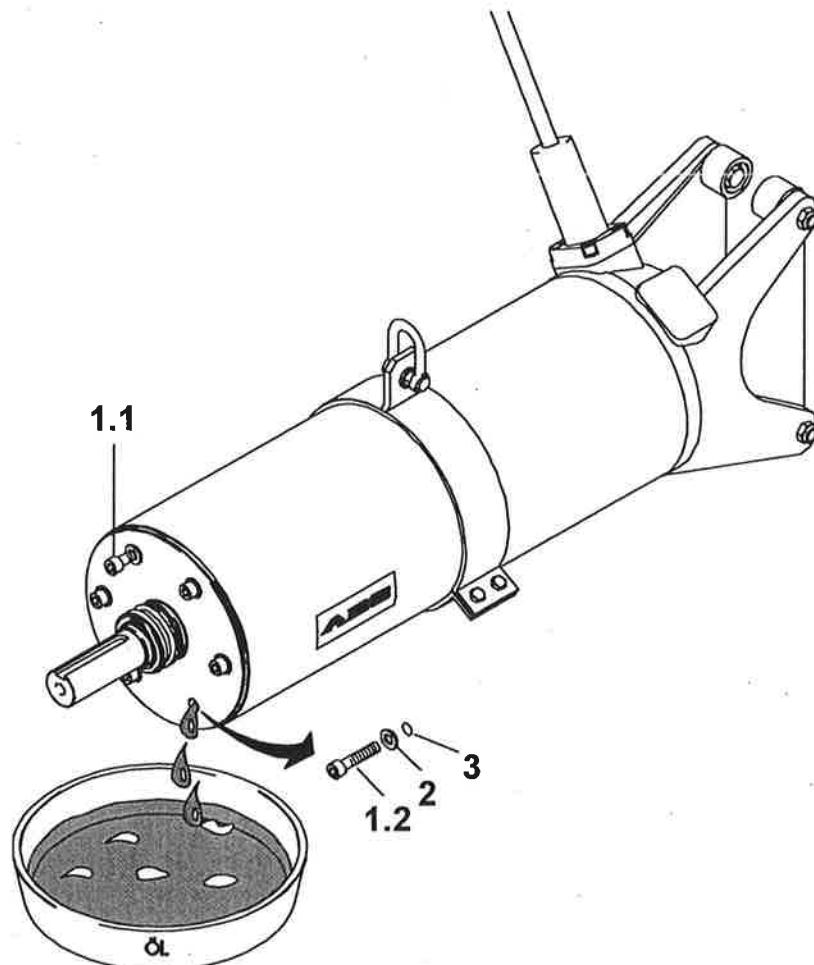


Bild 16 Gleitöl ablassen



Die Ölkammer der Rührwerke kann unter leichtem Überdruck stehen. Beim Lösen der Zylinderschraube (16/1.1) ist diese vorsichtshalber mit einem Lappen abzudecken, bis der Druck ausgeglichen ist.

- Obenliegende Zylinderschraube (16/1.1) vorsichtig lösen und Druck entweichen lassen
- Untenliegende Zylinderschraube (16/1.2) zusammen mit Scheibe (16/2) und Dichtring (16/3) demontieren und das Öl vollständig in ein geeignetes, ausreichend dimensioniertes Auffanggefäß ablassen.



Altöl ist vorschriftsmäßig zu entsorgen !

**Öl einfüllen :**

Zum Einfüllen des neuen Gleitöls ist das Gerät senkrecht mit dem Wellenstumpf nach oben zeigend, auf der Halterung abzustellen und gegen Kippen zu sichern.

Fig. 16 Release of the lubrication oil



As there may be a slight pressure build-up in the oil chamber of the mixer care should be taken when removing the plug screw (16/1.1) and this should be covered as a precaution with a cloth until the pressure has been released.

- Carefully open the upper socket head screw (16/1.1) and release the air pressure.
- Remove the lower socket head screw (16/1.2) together with washer (16/2) and sealing washer (16/3) and allow the oil to flow out fully into a suitable adequately dimensioned container.



Waste oil should be disposed of in a proper manner !

**Filling in the oil :**

Before filling in new lubricating oil the unit is placed vertically on its bracket with the shaft end facing upwards, taking care that it cannot topple over.

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

**ACHTUNG** Die O-Ringe (16/3) **müssen** in jedem Fall erneuert werden, wenn die Schrauben (16/1) gelöst worden sind.

- Die Befüllung erfolgt, wie zuvor das Ablassen durch eines der Schraubendurchgangslöcher des Gleitringdichtungsdeckels (16/1).

**ACHTUNG** Die in der nachstehenden Tabelle angegebenen Füllmengen sind genau einzuhalten. Die zulässige Abweichung von den angegebenen Werten beträgt max. + 10%

**ATTENTION** The O-rings (16/3) **must** always be renewed if the screws (16/1) have been removed.

- Filling takes place in a similar manner to the oil removal by filling in the oil through the plug holes of the mechanical seal cover (16/1).

**ATTENTION** The oil quantities given in the table below should be carefully adhered to. The maximum allowable deviation from the values given is max. + 10%.

**Gleitölfüllmengen der Ölkammer in Liter :**  
**Lubrication oil quantity of the oil chamber in liter :**

0,5

**Liste der freigegebenen Öle anderer Hersteller, die dem werkseitig eingefüllten Öl entsprechen :**

**List of the lubrication oils by the manufacturer which correspond to the oil type fitted at the factory :**

- Castrol Deusol CRI SAE 10
- BP Vanellus T Öl SAE 10
- Esso Essolub HDX SAE 10
- TEXACO / DEA WETEX W46
- Mobil Deval 1210
- Shell Voltol-Lubricant Oil-46

### 7.2.3 Ölfüllung Getriebe

**HINWEIS** Die Getriebeeinheit ist werkseitig mit hochwertigem Synthetik-Öl gefüllt. Das Getriebeöl braucht nicht gewechselt zu werden!

### 7.3 Reinigung

Zum Säubern des Propellers von anhängenden Faserteilen ist ein kurzzeitiger Lauf mit entgegengesetzter (falscher) Drehrichtung zulässig.

**ACHTUNG** Vor Drehrichtungsänderung Stillstand des Propellers abwarten.



Drehrichtungsänderungen an Schaltanlagen ohne Drehrichtungsschalter dürfen nur von einer Elektrofachkraft durchgeführt werden und sind daher zum Säubern des Propellers nicht zulässig.

Bei einer Außerbetriebnahme des Aggregates ist dieses durch Abspritzen mit klarem Wasser zu reinigen. Bei längerer Betriebsunterbrechung ist das Rührwerk trocken und frostsicher zu lagern.

Die Wiederinbetriebnahme nach einer längeren Betriebsunterbrechung ist gemäß Abschnitt 6 durchzuführen.

### 7.4 Demontage und Austausch von Propeller

### 7.2.3 Oil fillig of the gear box

**NOTE** The gear box is filled with high quality synthetic oil at works.  
The gear box oil doesn't need to be changed!

### 7.3 Cleaning

In order to clean the propeller blades of fibrous material it is permissible to run the mixer in the opposite direction (incorrect direction) for a short period.

**ATTENTION** The propeller must completely stop rotating before changing the direction of rotation.



Changing the direction of rotation on control panels not fitted with a direction of rotation change-over switch may only be carried out by a qualified person, and for this reason this procedure is not authorized as a method of cleaning the propeller.

If the mixer is to be taken out of commission then it should be cleaned by hosing down with clear water. If the unit is to remain out of service for a prolonged period then it should be stored in a dry and frost-proof location.

If the unit is to be reinstalled after a prolonged period out of use then proceed as per Section 6.

### 7.4 Dismantling and exchange of the propell-

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**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900**

und SD-Ring.

**Demontieren des Propellers :**

- Zylinderschraube (16/1) zusammen mit Laufradscheibe (16/2) Nord-Lock-Scheiben (16/3) lösen Dichtring (16/4) und Propeller (16/6) abziehen.

**HINWEIS** Das Klemmenband (16/3) für den SD-Ring (16/1) sowie der Dichtring (17/6) brauchen nicht demontiert werden, wenn nur der Propeller gewechselt werden soll !

**HINWEIS** Auf dem Umfang der Propellernabe, im Bereich der Überdeckung des SD-Ringes, können bedingt durch dessen Funktion Einlaufriefen entstehen. Dies beeinflußt aber nicht die Funktion, auch bei Austausch des SD-Ringes.

Der Zusammenbau erfolgt in umgekehrter Reihenfolge. Dabei ist die Paßfeder (17/8) auf eventuellen Verschleiß zu kontrollieren und evtl. auszutauschen.

**ACHTUNG** Anzugsmomente auf Seite 29 beachten !

ler and solid deflection (SD) ring.

**Dismanteling the propeller :**

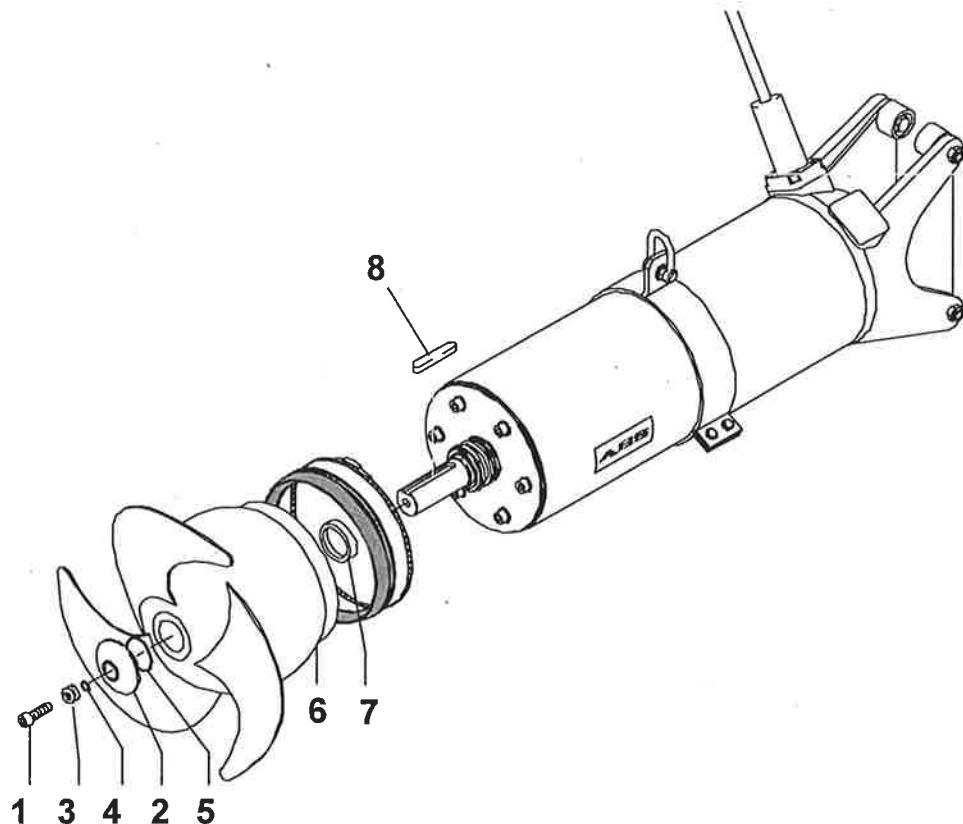
- Open socket head screws (16/1) together with impeller washer (16/2), Nord-Lock washers (16/3), remove the O-ring (16/4) and pull off propeller (16/6).

**NOTE** The fixing strap (16/3) for the SD-ring (16/1) and the sealing ring (17/6) dont need to be dismantled in case of only changing the propeller !

**NOTE** At the circumference of the propeller hub, in the area where it overlaps with the solid deflection ring, wear grooves may be visible. These are caused by the function of the ring and have no negative effect on the operation. This means that it is not necessary to change the hub when changing the Solid Deflection Ring.

Reassembly takes place in reverse manner. When doing this, the key (17/8) should be checked for wear and exchanged if necessary.

**ATTENTION** Use the tightening torques given on page 29.

**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900****Bild 17****Fig. 17**

## Einbau - und Betriebsanweisung RW 300 bis 900

## Installation and Operating Instructions RW 300 to 900

### Austausch des SD-Ringes (Solid-Deflection-Ring) :

Durch betriebsbedingten Verschleiß kann es erforderlich werden, den SD-Ring (18/1) nach Überprüfung auszutauschen.

- Klemmenband (18/3) durch Abkneifen der Bandklammer (18/4) demontieren.
- SD-Ring (18/1) vorsichtig aus der Nut des Motordeckels (18/2) ziehen und abstreifen.
- Bei der Montage des SD-Ringes (18/1) ist dieser gemäß Bild 18 von Hand umlaufend überzustülpen und in die Nut des Motordeckels zu drücken.
- Klemmenband (18/3) mit neuer er Bandklammer (18/4) mit einer Beißzange montieren.

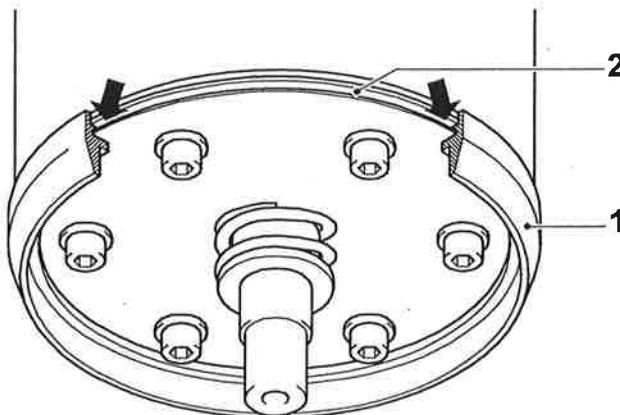


Bild 18

### Exchange of the SD-Ring (solid deflection ring) :

Due to wear during operation, it may be necessary to check the SD-ring (18/1) and change it.

- Cut off the clamp (18/3) and dismantle the fixing strap (18/4).
- Pull the SD-ring (18/1) carefully out of the groove of the motor cover (18/2) and strip back.
- When refitting the SD-ring (18/1), this should be pressed around its circumference by hand as shown in Fig. 18 and pressed down into the groove of the motor cover.
- Fix the fixing strap (18/3) with a new clamp (18/4) with the aid of a pincers.

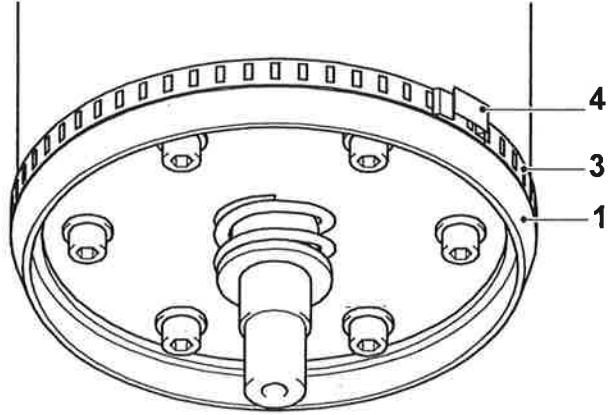


Fig. 18

### Anzugsmomente für ABS-Edelstahlschrauben :

M 8	=	18 Nm
M 10	=	33 Nm
M 12	=	57 Nm

**ACHTUNG** Bei Schraubensicherungen mit Nord-Lock-Scheiben ist das Anzugsmoment um 10 % zu erhöhen (für die Laufradschraube M10 also 36-37 Nm)

### Tightening torques for stainless steel screws :

**ATTENTION** In the case of fasteners using Nord-Lock washers, the tightening torques should be increased by 10% (for impeller screw M10 this would be 36-37 Nm).

Ersatzteile : RW 300

Spare parts : RW 300

**Einbau - und Betriebsanweisung RW 300 bis 900****Installation and Operating Instructions RW 300 to 900**

Zyl.-Schraube	(16/1)	Art.Nr. 11210243
Nord-Lock-Scheibe	(16/3)	Art.Nr. 11490026
Laufradscheibe	(16/2)	Art.Nr. 33565000
SD-Ring	(17/1)	Art.Nr. 43075026
Klemmenband	(17/3)	Art.Nr. 15070082
Bandklammer	(17/4)	Art.Nr. 15070083
Paßfeder	(16/11)	Art.Nr. 11630003

**Ersatzteile : RW 400**

Zyl.-Schraube	(16/1)	Art.Nr. 11210239
Nord-Lock-Scheibe	(16/3)	Art.Nr. 11490027
Laufradscheibe	(16/2)	Art.Nr. 32010511
SD-Ring	(17/1)	Art.Nr. 43070428
Klemmenband	(17/3)	Art.Nr. 15070082
Bandklammer	(17/4)	Art.Nr. 15070083
Paßfeder	(16/11)	Art.Nr. 11630118

**Ersatzteile : RW 650**

Zyl.-Schraube	(16/1)	Art.Nr. 11210239
Nord-Lock-Scheibe	(16/3)	Art.Nr. 11490027
Laufradscheibe	(16/2)	Art.Nr. 32010512
SD-Ring	(17/1)	Art.Nr. 43070430
Klemmenband	(17/3)	Art.Nr. 15070082
Bandklammer	(17/4)	Art.Nr. 15070083
Paßfeder	(16/11)	Art.Nr. 11630123

**Ersatzteile : RW 900**

Zyl.-Schraube	(16/1)	Art.Nr. 11210272
Nord-Lock-Scheibe	(16/3)	Art.Nr. 11490028
Laufradscheibe	(16/2)	Art.Nr. 32010517
SD-Ring	(17/1)	Art.Nr. 43070428
Klemmenband	(17/3)	Art.Nr. 15070082
Bandklammer	(17/4)	Art.Nr. 15070083
Paßfeder	(16/11)	Art.Nr. 11630073
O-Ring	(16/15)	Art.Nr. 11120003
O-Ring	(16/16)	Art.Nr. 11120019
Dichtring	(16/17)	Art.Nr. 43070440

Art.Nr. weiterer Ersatz- bzw. Verschleißteile sind der Ersatzteilliste zu entnehmen.

Socked head screw	(16/1)	Part No. 11210243
Nord-Lock washer	(16/3)	Part No. 11490026
Impeller screw	(16/2)	Part No. 33565000
SD-ring	(17/1)	Part No. 43070026
Fixing strap	(17/3)	Part No. 15070082
Fixing clamp	(17/4)	Part No. 15070083
Key	(16/11)	Part No. 11630003

**Spare parts : RW 400**

Socked head screw	(16/1)	Part No. 11210239
Nord-Lock washer	(16/3)	Part No. 11490027
Impeller screw	(16/2)	Part No. 32010511
SD-ring	(17/1)	Part No. 43070428
Fixing strap	(17/3)	Part No. 15070082
Fixing clamp	(17/4)	Part No. 15070083
Key	(16/11)	Part No. 11630118

**Spare parts : RW 650**

Socked head screw	(16/1)	Part No. 11210239
Nord-Lock washer	(16/3)	Part No. 11490027
Impeller screw	(16/2)	Part No. 32010512
SD-ring	(17/1)	Part No. 43070430
Fixing strap	(17/3)	Part No. 15070082
Fixing clamp	(17/4)	Part No. 15070083
Key	(16/11)	Part No. 11630123

**Spare parts : RW 900**

Socked head screw	(16/1)	Part No. 11210272
Nord-Lock washer	(16/3)	Part No. 11490028
Impeller screw	(16/2)	Part No. 32010517
SD-ring	(17/1)	Part No. 43070428
Fixing strap	(17/3)	Part No. 15070082
Fixing clamp	(17/4)	Part No. 15070083
Key	(16/11)	Part No. 11630073
O-Ring	(16/15)	Part No. 11120003
O-Ring	(16/16)	Part No. 11120019
Dichtring	(16/17)	Part No. 43070440

Part. nos. of further spare parts see spare parts list.



We know how water works

## ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

### SFI 581 - HYDROPHORE SYSTEM

20,00 SOB 222 W G2V/V.10 FOR IEC 100 Number: 2,00

Allweiler horizontal self-priming centrifugal pump with  
flexible coupling and el.-motor.

(Installed vertically here)

Technical specification: Centrifugal pump

Serialno.: 6037613, 6037612, ✓  
Capacity..... m3/h: 4,8  
Diff. pressure..... bar: 6,0  
Delivery head..... m: 60  
Speed..... rpm: 1750  
NPSHr..... m: 2,0  
Power absorbed..... Kw: 1,75  
Medium..... FW  
Temperature..... C: 20  
Viscosity..... mm2/s: 1  
Specific gravity.... kg/m3: 1000  
Pump casing..... material: Cast iron  
Impeller..... material: Brass  
Shaft..... material: St.St.  
Shaft seal..... type: Mech.seal

20,10 EL-MOTOR 100L-4 MARINE Number: 2,00

Technical specification: El-motor

Rated power..... KW: 2,5  
RPM..... Rpm.: 1750  
Voltage..... Volt: 3\*440  
Frequency..... Hz: 60  
Ampere In..... A: 4,9  
Starting method.... type: DOL  
Construction method. ....type: B14, hull 110 mm  
Protection..... IP55  
Isolation..... F

# Operating instructions

## Hydraulik I

Ident. no.:

Order no.:

Serial no.:

### Contents

- 0. Brief instructions**
- 1. General Application**
- 2. Safety**
- 3. Transportation and temporary storage Preservation**
- 4. Description Structural design**
- 5. Planning the system Pipes, safety equipment**
- 6. Installing the pump Safety measures**
- 7. Start-up / shut-down**
- 8. Maintenance**
- 9. Servicing, disassembly, reassembly  
Spare parts, standby pumps**
- 10. Faults; causes and correction**
- 11. Associated documents**
- 12. Pump identification**



This pump may only be installed and brought into service by trained personnel, who must precisely follow these operating instructions and the applicable legal requirements. If these operating instructions are not followed:

you may be putting yourself or your colleagues at risk, the pump or the pump unit may be damaged, and the manufacturer will not be liable for any resulting damage!

When working on the pump or pump unit, please remember that you are responsible for the safety of your colleagues!



These operating instructions conform to the provisions of EN292 part 2, sub-section 5.5 and the safety regulation EN809.

## 0. Brief instructions on starting up a pump unit supplied complete

- The pumped liquids must not have a tendency to crystallise out and must contain no potentially abrasive solids (see section 1.1 Application).
- Remove the **protective caps** from the **pipe sockets** before connecting the pipes.
- If the pump has been preserved, **drain off the preservative agent** (dispose of correctly) and clean the pump.
- Align the pump or pump unit on the foundation and fix in place.
- **Clean the pipes.**
- Note the directions of flow and rotation (see arrows on the pump).
- **Fill the pump with liquid** (the pump must have been thoroughly vented).
- **Open all the shut-off devices in the inlet and discharge pipes.**
- Check that the coupling guard is fitted and all the safety equipment is ready for operation.
- Fit a motor circuit-breaker. The electrical connection work may only be carried out by a qualified electrician. Check the voltage, speed and direction of rotation.
- Turn the unit manually and ensure that it is running smoothly and evenly.
- **Switch on the motor.**
- Once it has run up to operational speed, check the operating pressure on the manometer and set the operating point by restricting the pressure on the discharge side, if necessary.
- Do not allow the flow to fall below the minimum value.
- The pump must be constantly supplied with fluid. It must never be allowed to run dry.
- **Never touch** a pump while it is running - it may be hot.
- The power consumption increases as the pump head rises and the amount of liquid pumped decreases.
- **The pump must never be started up or operated when the inlet and/or discharge pipe is closed.**
- During assembly or operation, the pipes must not transmit stresses to the pump.



The safety instructions specified under point 2-ff must be followed.

## 1. General

### 1.1 Application

This is a self-priming side channel pump. It is suitable for pumping pure, cloudy and gaseous liquids containing no abrasives.

In design, it corresponds to a multistage ring section pump. The use of standardised components for several pump series and sizes makes it economical to keep a stock of standby parts and to purchase spare parts. The pump is driven by an electric motor.

The pump should be used only under the operating conditions specified by the customer and confirmed by the supplier. The correct and intended application is specified in the data sheet supplied with the pump, a copy of which is shown in the appendix.



**The pump must only be used for the application specified in the data sheet. Otherwise, it may endanger both people and the environment.**

**Do not allow the specific gravity to fall below or exceed the value specified in the data sheet, since this could result in damage to the pump.**



**Systems in which a failure or malfunction could lead to injury or damage should be fitted with alarm systems and/or standby units and should be checked at regular intervals to ensure that they are in good working order.**

**Units which are directly or indirectly linked to drinking water supplies should be thoroughly cleaned before installation and start-up to remove all impurities.**



**Never touch a pump while it is in use - it may be hot.**

The data relating to speed, pressure and temperature contained in the data sheet are values at which correct functioning of the pump is guaranteed. It is essential to adhere to these values.



**If the outlet side of a pump is closed while the pump is running, the temperature of the liquid in the pump may rise to a dangerous degree. Dangers may arise from overpressure and subsequent failure of part of the pump or pipework. Particular dangers arise if the liquid being pumped is flammable, as it will be more easily ignited at increased temperatures. Explosions may occur if the liquid is chemically unstable when overheated. These dangers are commonly prevented by providing a liquid return loop incorporating a pressure relief valve.**

It is also important not to fall below the specified inlet pressures (system pressures). If the order confirmation does not specify any pressures and/or temperatures, then the limit pressures and temperatures specified in the brochure apply, provided that no further restrictions are imposed by the type of shaft seal used.

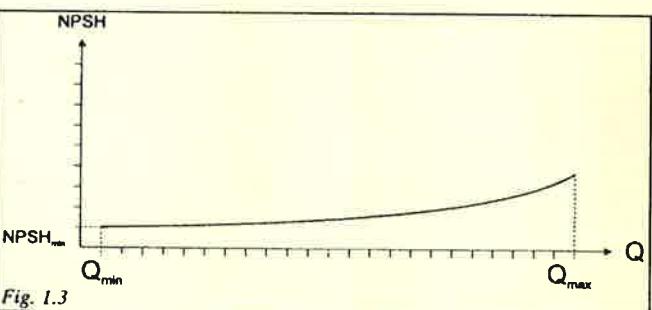
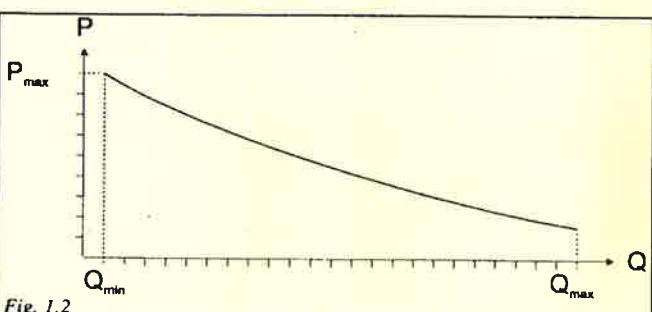
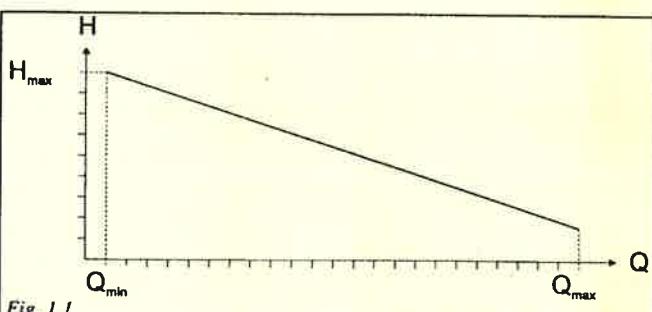
### 1.2 Testing

All our pumps undergo extensive testing on the test bench before they leave the factory.

Only pumps which are running perfectly and achieve the promised performance levels, taking account of the specified tolerances, are allowed to leave the factory. If these operating instructions are followed, we guarantee fault-free operation and full pumping capacity.

**Test pressure = 1.5 x pump operating pressure**

### 1.3 Characteristics of side channel pumps



#### Requirements:

1. Start up with the valves open.
2. Never work with the discharge pipe closed.
3. Only work within the range from  $Q_{min}$  to  $Q_{max}$ .

### 1.4 Guarantee

Our liability for defects in the goods supplied is set out in our delivery conditions. We accept no liability for damage caused by not following the operating instructions or not observing the conditions for use.

If the operational conditions subsequently change (e.g. different liquid to be pumped, different speed, viscosity, temperature or inlet conditions), then we must be given an opportunity to investigate the individual case and, if necessary, to confirm whether the pump is suitable for the intended purpose. Unless special arrangements are made, pumps supplied by us may only be opened or modified by us or by our authorised service partners during the guarantee period. Otherwise, we will not be liable for any defects.

### 1.5 Noise level

Depending on the pump size, the noise from our pumps falls within the range from 60 to 72 dB(A).

However, the pump is not necessarily the only possible source of irritating noise. Other possible sources of noise are:

- the drive
- the coupling, which may be fitted incorrectly
- other devices in the same area (e.g. heating system)
- the water pipes, cocks or valves. Flowing water always causes noise (e.g. water hammer). However, such noise may be reduced by suitable measures, so that it no longer causes a disturbance.

The water flow speed should be kept as low as possible.

Large pipes, pressure reducers and other devices are particularly suitable for reducing the flow speed.

If the pump is the major source of noise, the noise can be deadened by the following measures:

1. Place the pump on rubber buffers.
2. Insert a rubber connector into the inlet and discharge pipes, between the pump and the pipes.
3. Do not allow pipes to come into direct contact with walls, ceilings or floors.
4. If necessary, enclose the pump (but not the motor) in a sound-proof enclosure.

## 2. Safety

These operating instructions contain fundamental information which must be followed during installation, operation and maintenance. Consequently, before assembly and start-up, these operating instructions must be read by the mechanic and the competent technical personnel / operators, and must be available at all times in the vicinity of the machine / system.

In addition to the safety instructions given in this section, the other special safety instructions (e.g. for private use) given in other sections must also be followed. Local safety regulations will not be superseded by these operating instructions.

### 2.1 Identification of instructions in these operating instructions

If certain safety instructions in these operating instructions are not followed, there could be a risk to personal safety. These instructions are identified by the general hazard symbol:



Safety symbol according to ISO 3864-B.3.1

In the case of warnings about electrical voltage, the safety instructions are identified by:



Safety symbol according to ISO 3864-B.3.6

For safety instructions which, if they are not followed, could endanger the machine and its functioning, the word

#### Attention

**WARNING**

is inserted. Instructions attached to the machine, such as the direction of rotation arrows or liquid connection markers, must be followed and must be fully legible at all times.

### 2.2 Personnel qualifications and training

The operating, maintenance, inspection and assembly personnel must have the appropriate qualifications for this work. The area of responsibility, competence and staff supervision must be precisely stipulated by the owner. If none of the personnel has the necessary experience or knowledge, then they must be given training and instruction. If necessary, this can be provided by the manufacturer/supplier at the machine owner's request. The machine owner should also ensure that the content of the operating instructions is fully understood by his employees.

### 2.3 Risks if the safety instructions are not observed

Failure to observe the safety instructions can endanger people, the environment and the machine. Any claims for damages may be invalidated if the safety instructions are not followed. Failure to observe the safety instructions can, for example, lead to the following risks:

- Failure of important machine/system functions
- Failure of prescribed maintenance and repair methods
- Lives may be put at risk by electrical, mechanical and chemical hazards.
- Risk to the environment caused by the leaking of hazardous materials.

### 2.4 Safe working practices

The safety instructions given in these operating instructions, the applicable national accident prevention regulations and the owner's internal working, operational and safety regulations should be followed.

### 2.5 Safety instructions for the owner / operator

- If hot or cold machine parts represent a potential risk, these parts must be protected on site against accidental contact.
- Protective devices on moving parts to prevent accidental contact (e.g. coupling guard) must not be removed while the machine is in use.
- Leaks (e.g. from the shaft seal) of hazardous (e.g. explosive, poisonous, hot) liquids must be eliminated so that they do not endanger life or the environment. The legal regulations must be observed.
- Measures should be taken to prevent the risk of electric shock (for further information on this subject, see the VDE regulations and those of the local electricity company, for example).

### 2.6 Safety instructions for maintenance, inspection and assembly work

The owner must ensure that all maintenance, inspection and assembly work is carried out by authorised and qualified technical staff who have read and understood the operating instructions.

Work must only be carried out when the machine is shut down. The procedure for shutting down the machine described in the operating instructions MUST be followed.

Pumps or pump units containing media which are a potential hazard to health must be decontaminated. Pumps sent to us for repair should be cleaned beforehand so that they do not represent a hazard to the health of our employees. As soon as the work has ended, all safety and protective devices must be replaced or brought into service once more. Sections 7.1, 7.3 and 7.4.2 must be followed before starting up the machine again.

### 2.7 Conversion and production of spare parts by the owner

The machine may not be converted or modified without the manufacturer's prior approval. The use of original spare parts and accessories authorised by the manufacturer ensure operational safety. The use of other parts may invalidate our liability for any resulting damage.

### 2.8 Inadmissible operating methods

The operational safety of the machine can only be guaranteed if it is used in the manner intended, as described in Section 1 General of these operating instructions. The limit values specified in the data sheet must not be exceeded under any circumstances.

### 3. Transportation and temporary storage

#### 3.1 Safety measures



Never stand beneath a suspended load.

Always keep a safe distance from the load while it is being moved.

Only use the prescribed lifting tools and ensure that they are in perfect condition.

Adjust the length of the lifting devices so that the pump or unit is suspended horizontally.

Do not remove any documents that are attached to the pump.

Always handle the pump with care.

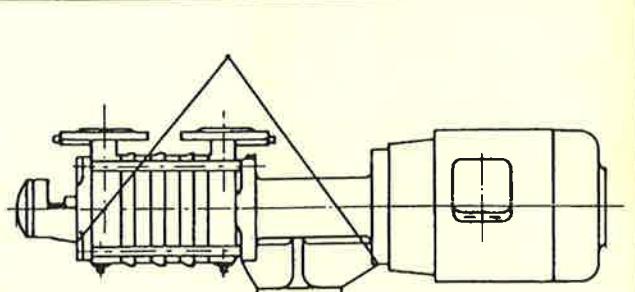


Fig. 3.2  
Close-coupled pump

#### 3.2 Packaging

The symbols on the packaging should be observed. The inlet and discharge sides of the pump must be closed off with caps during transportation and storage. When installing the pump unit, the flange caps should be removed.

#### 3.3 Unpacking

Before unpacking, carry out a visual inspection of the packaging. If any damage has occurred during transportation, note the extent of the damage on the receipt or delivery note. Any claims should be made immediately to the carrier company or carriage insurance company.

#### 3.4 Temporary storage

If the pump or unit is not installed immediately upon delivery, the machine must be stored in a dry and vibration-free area.

#### 3.5 Transportation

The pump must be transported correctly. Fig. 3.1 – 3.3 are showing the correct handling methods.



When moving the pump unit using a crane, the crane and slings must be of a suitable size. The slings must not be attached to the motor eyes.

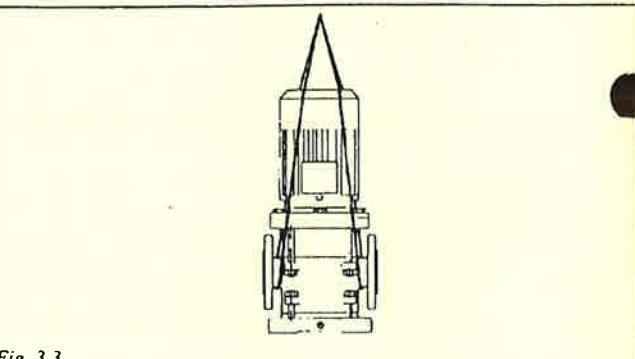


Fig. 3.3  
Vertical pump

#### 3.6 Preservation

If we have applied a preservative agent at the factory, this will be brought to the user's attention:

1. On the plate attached to the pump
2. By way of a notice on the delivery note and invoice.

#### Attention

The preservative agent will last for 6 months. Please note that all pumps made from cast iron spheroidal graphite cast iron that are brought into service (even for a trial run) must be corrosion protected when they are shut down again. A preservative agent should be applied both internally and externally, following the instructions in sections 3.6.1 + 3.6.2.

##### 3.6.1 Preservative agent

The preservative agent specified below may be used for both external and internal preservation.

- Preservative agent:  
SHELL FLUID BD22, Deutsche Shell AG, Frankfurt

For external preservation, all blank and unpainted parts, such as shaft ends, flange surfaces, are preserved. Apply the preservative agent using a brush or spray gun. For internal preservation, the inside of the casing, shaft, impellers and the shaft seal are preserved. Introduce the preservative agent by filling the pump. During the filling operation, turn the shaft slowly in the direction of rotation. Continue filling until the preservative agent reaches the sealing strips of the inlet and discharge flanges. Then, close the pressure and inlet sides using a blanking flange.

**NOTE:** The specified preservative agent should be regarded as a recommendation. Preservative agents with equivalent preservative characteristics from other mineral manufacturers may also be used.

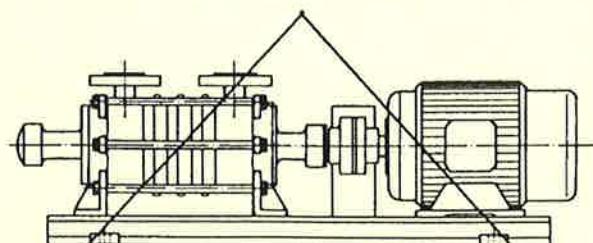


Fig. 3.1  
Pump with motor on a base plate

According to the preservative agent manufacturer's specifications, the preservative agent will last for 6 months. The effective ingredients of the preservative agent also provide adequate corrosion protection in areas with increased atmospheric humidity (at sea, tropical climate).

### 3.6.2 Removal and disposal of the preservative agent

Before start-up, the preservative agent must be removed. The preservative agent introduced for internal preservation must be drained off.



**Preservative agents must be disposed of correctly.**

The pump must be cleaned completely. This is of particular importance for pumps which are used in the food or drinking water supply industries.

A suitable solvent which is compatible with the pumped liquid (and with foodstuffs) may be used as the cleaning agent for removing the internal and external preservation.

### 3.7 Long-term storage and monitoring the preservation

If the pump is stored for long periods, the owner must check the preservation at regular intervals. The fill level of the pump should be checked every 6 months and the preservative agent topped up to the sealing strip on the discharge flange, if necessary.

## 4. Description

### 4.1 Structural design

Self-priming ring section pump which acts as a side channel pump. The capacity of the side channel pump is dependent, in particular, on the gap between the impeller and stage casing (0.15 to 0.17 mm).

**Given the narrow clearances, the pump is not suitable for pumping media containing solids** (in certain cases, a filter should be provided on the inlet side).

### 4.2 Casing

The joints between the casing and sides on the inlet and discharge sides run transversely. The casing and casing parts are sealed with respect to one another by means of gaskets.

### 4.3 Pipe sockets / flanges / dimensions

See data sheet.

### 4.4 Connecting auxiliaries

In the discharge casing, the pumps contain:

- 1 screw-in plug for connecting a manometer.
- 1 screw-in plug for draining off the liquid.

In the inlet casing, the pumps contain:

- 1 screw-in plug for connecting a mano / vacuummeter.
- 1 screw-in plug for draining off the liquid (complete drainage is not possible).

### 4.5 Impellers

These are open, star-shaped wheels which compensate for axial thrust by means of relief holes.

### 4.6 Shaft

The pump is equipped with a particularly rigid shaft, which ensures fault-free operation under all load phases.

### 4.7 Bearings and seals

See data sheet.

### 4.8 Drive

The pumps are driven by an electric motor. In most cases the motors used are fan-cooled three-phase AC squirrel cage motors, model B3 or B14, type of protection IP44/54 to IEC standards, insulation class B, motor winding for 380 V or 660 V, 50 or 60 Hz. Explosion-proof motors and other design versions may also be used.

### 4.9 Coupling and protective devices to prevent accidental contact

For our pumps, we use a flexible elastic coupling made by Flender, type N-Eupex, model B.

#### Important information for fitting the coupling:

Only use couplings where the pump-side coupling end can be connected to the nut on the shaft end in the axial plane. Turn or machine the hole in the hub of the pump-side coupling end so that the coupling halves can be slid on the shaft end without strong resistance. Do not hit with a hammer.



In order to prevent accidents, the coupling must be secured with a protective device in accordance with DIN 31001 to prevent accidental contact. When pumping explosive materials, the protective device must be made from a material which does not produce sparks (e.g.: brass).

### 4.10 Accessories

A list of the accessories supplied with the pump is given in the data sheet. The associated operating and installation instructions are also given in the appendix.

If you wish to fit other accessories to the pump or pump unit, please notify the manufacturer of the accessories you plan to use.

## 5. Planning the system

### 5.1 Piping system

#### Attention

Note the flow arrows on the pump's pipe sockets.  
 Select the nominal diameters of the pipes so that they correspond to the nominal diameters of the pipe sockets (see data sheet).  
 Do not forget to clean the pipes before they are installed.  
 Support the pipes to ensure that no stresses are transferred to the pump (which could result in broken pump components).  
 Avoid sudden changes in cross-section and direction.  
 Compensate for differences in nominal diameter using eccentric transitions, thus preventing air pockets forming in the pipe.  
 Upstream of the pump's inlet pipe socket, install a calming section with the same diameter as the nominal diameter of the inlet socket and ten times as long as the inlet socket diameter. This will prevent cavitation.  
 The flow speed in the inlet and feed pipes should not exceed 1 m/sec.

#### 5.1.1 Nominal diameter

The size of the pipes must guarantee perfect flow conditions in the pump and thus have no detrimental effect on the functioning of the pump. Every effort should be made to ensure that the flow speed in the inlet and discharge pipes does not exceed 1 m/sec.

Particular attention should be paid to the air-tightness of the inlet pipe and observing the NPSH values.

#### 5.1.2 Changes in cross-section and direction

The flow direction through the body of the pump is indicated by arrows on the pump casing.

Sudden changes in cross-section and direction and excessively sharp bends should be avoided.

#### 5.1.3 Supporting elements and flanged connections

Ensure that all pipes sockets are stress-free. The pipes should be supported in the vicinity of the pump and screwed loosely in place to prevent distortion. After loosening the screws, the flanges should not stand at an angle or spring back and should not be under pressure on both sides. Any thermal stresses on the pipe should be kept away from the pump by suitable measures, for example by fitting compensators. Hydraulic forces should also be absorbed by suitable pipe fasteners upstream and downstream of the pump.

#### 5.1.4 Cleaning the pipe before installation

#### Attention

It is important to ensure that the pipes are completely clean when they are brought into service. They must be free of weld beads, burrs, rust, etc. Flange seals must not project inwards. The sockets should be checked to ensure that they are air-tight (see Section 3.6 Preservation).



Do not dispose of corrosion protection agents in the sewage system.

### 5.2 Inlet pipe

In order to guarantee cavitation-free operation, the instructions in Section 5.4 Inlet conditions must be followed. The inlet pipe can be laid in any form. It may pass over the pump since the liquid can also be sucked over the top. The cross-section of the inlet pipe must not be smaller than the pump's suction pipe socket. Every effort should be made to achieve a flow speed of 1 m/sec in the suction pipe. Under particularly difficult pumping conditions, we also recommend providing a calming section on the suction side, upstream of the entry to the pump. The length of this calming section should be 10 x the pipe diameter. In suction mode, the suction strainer should be at least 0.2 m below the lowest level of the liquid (see fig. 5.1).

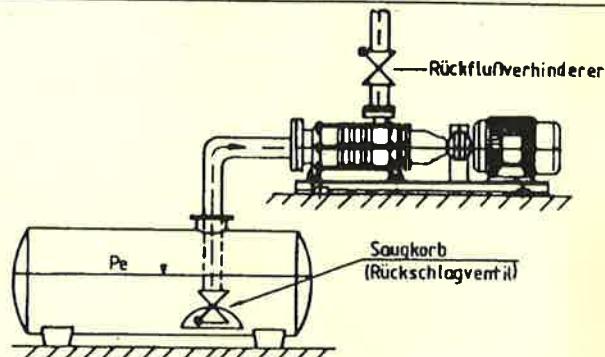


Fig. 5.1  
 Non-return valve  
 Suction strainer  
 (Non-return valve)

#### Attention

In order to maintain its self-priming capacity, the pump must always be filled with the liquid to be pumped.

The side channel pump is able to carry air or gases and to evacuate a suction pipe. The pumps must be filled with liquid. The suction capacity is restricted to a vacuummetric suction lift of approximately 7 m (for water at 20° C) and decreases as the wear increases. The priming time should be limited to 1 to 2 minutes at most, since the priming stagnates when the medium in the pump heats up. A non-return valve should be fitted in order to avoid having to lift out the pump after switching off (see fig. 5.2).

For inlet operation, ensure that the liquid level remains at least 0.5 m above the pipe socket. For supplying liquid from a tank under vacuum, we recommend installing a compensation line (CL) (see Fig. 5.2).

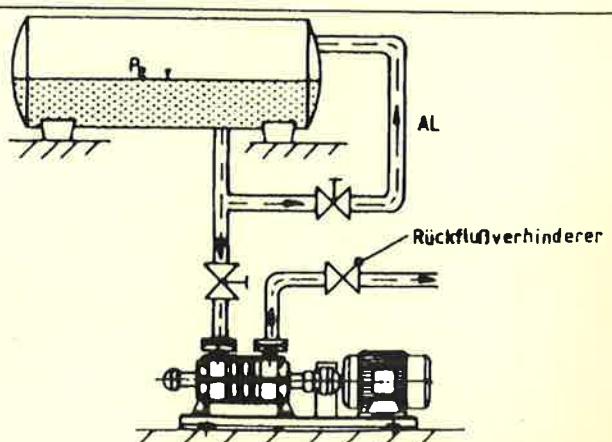


Fig. 5.2  
 Non-return valve

## 5.3 Discharge pipe

A constant cross-section of the pipes is also desirable on the discharge side. For a large pump head and long discharge pipes, it is sensible to fit a gently closing non-return element on the discharge side (non-return valve) (see fig. 5.1 + 5.2).

## 5.4 Supply conditions (NPSH)

In order to guarantee fault-free continuous operation, the inlet and suction conditions of the system should be matched to the pumping demand (NPSH).

The operating conditions are fulfilled if the system NPSH value ( $NPSH_{avail}$ ) is greater than the pump NPSH value ( $NPSH_{req}$ ).

**$NPSH_{avail} > NPSH_{req}$ .**

The ( $NPSH_{req}$ ) for each type of pump is given in the characteristic curves.

Upon request, we can send you a special leaflet on calculating the NPSH values.

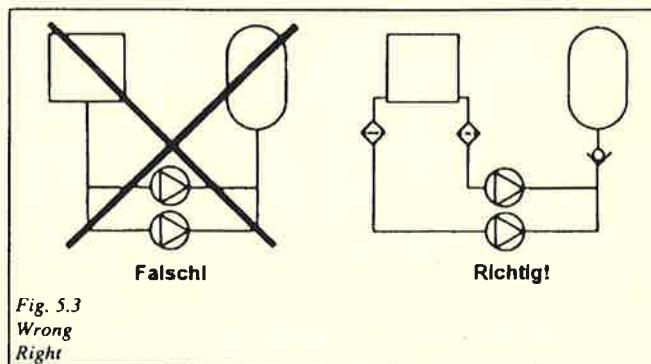
During inlet operation, it is important to ensure that the geodetic suction lift of 7 m (for water at 20° C) is not exceeded. Please note that, with media with low vaporisation pressures or water at a temperature greater than 20° C, the suction lift of the pump will decrease accordingly.

### Attention

When pumping liquids at close to boiling point, watch the NPSH value and the inlet height since this could lead to cavitation in the pump, which will damage the hydraulic system.

## 5.5 Notes on planning and constructing boiler installations

- Design the feed pump with an appropriate reserve in accordance with TRD 401.
- If there are two possible types of pump, the best option is always to use the pump with the better NPSH value.
- The length of the inlet and discharge pipes of the boiler feed pump should be kept as short as possible, and the number of elbows and bends kept to a minimum.
- The inlet pipe should be a nominal diameter size larger than the socket on the inlet casing. Do not make sudden reductions in the pipe diameter.
- When running two pumps in parallel, both pumps should be allocated a separate inlet pipe (see fig. 5.3).
- Never connect the inlet pipe vertically to the feed tanks. It should always be horizontal in order to prevent the formation of eddy currents (see fig. 5.3).



- Take precautionary measures to ensure that the feed pump can never run dry.

- In the case of extremely large pumps, fit a regulating valve in the discharge pipe.
- In the inlet and discharge pipe, allow for the installation of compensators. In addition, provision should be made for a filter in the inlet pipe and a non-return valve in the discharge pipe (see fig. 5.3).
- Do not fit quantity-dependent control valves in the pump's discharge pipe.
- When designing the system, the poorest NPSH value at the lowest possible pumping pressure should be taken into account.
- Provide pressure measuring devices on the inlet and discharge sides.
- Design the slide values in the inlet and discharge pipes so that they cannot be unintentionally closed.
- If the pressure differential is smaller than that intended, the NPSH range for the feed pump will not be so good. In order to prevent damage, the pump should be restricted accordingly (see fig. 5.4).

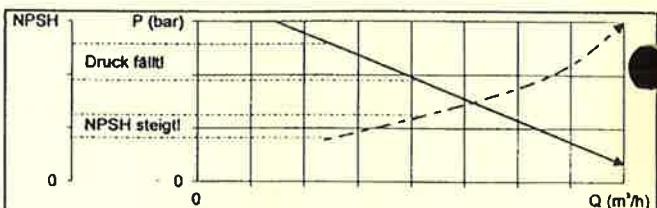


Fig. 5.4  
Pressure falling  
NPSH rising

## 5.6 Safety equipment

### Speed, pressure and temperature

Suitable safety measures must be taken on site to ensure that the speed, pressure and temperature cannot exceed the limit values specified in the data sheet (see DIN 24295, Point 3.4).

### Sealing, purging and cooling

Suitable regulating and monitoring options should be provided for any purging or sealing systems which may be fitted. For the required quantities and pressures, see the description of the shaft seals (see Section 8 Maintenance). In the case of dangerous media or high temperatures, care should be taken to ensure that the pump will shut down if the sealing or purging system fails. The sealing and purging systems must always be switched on before the pump is started up. They should not be switched off until the pump has stopped completely, if this is permitted by the type of operation (see Section 7 Start-up and shut-down).

### Minimum quantities, working range

The working range specified in the characteristic curve sheets should be used and the pump should not exceed or fall below this range during operation. The left-hand limit on the characteristic curve represents the minimum quantity for the pump.

Suitable measures, such as freewheel non-return valves or a by-pass line, should be provided on site in order to guarantee the minimum quantity for the pump under all operating conditions. Ensure that the transfer capacity is not exceeded.

If required, we will be pleased to help you with the design of the freewheel non-return valves or by-pass line.

The inlet and discharge sides of the pump should each be equipped with a manometer or manometer. In order to be able to maintain the pump head precisely (see rating plate), a regulating valve should be provided on the discharge side. For larger pump heads (> 20 m), long pipes, parallel operation and system counter-pressure, a non-return valve (R) should be installed on the discharge side in order to prevent back-flow through the pump when the unit is switched off (see fig. 5.1 + 5.2).

## 5.7 Electrical connections



The power supply cable for the driving motor should be connected by a qualified electrician in accordance with the motor manufacturer's circuit diagram. The applicable VDE regulations and the regulations of the local electricity company should be observed. All risks of electric shock should be eliminated.

## 5.8 Inspection

Once installation is complete, all the pipes and sockets should be tested to ensure they are airtight. The unit should be tested to ensure that it is free of blockages (It should be possible to turn the shaft assembly by hand).



The operational safety of the installation (electrical connections, coupling guards, etc.) should be checked with reference to the applicable accident prevention regulations.

## 5.9 Hydrostatic pressure test

When carrying out a hydrostatic pressure test on the piping systems, the pump should be excluded from the test.

If the pipes cannot be pressure tested without the pump, care should be taken to ensure that no foreign bodies enter the pump.

The **maximum pressure** that may be applied to the pump during the test is **1.3 times the design pressure of the pump**. The design pressure is given in the data sheet in the appendix.

In the case of pumps with a gland, the packing should be replaced after the pressure test (since it will be compressed too much and will no longer be suitable for use). When emptying the pipe after the pressure test, a preservative agent should be applied to the pump (to avoid rusting and problems during start-up). The pipes must be connected to the pump so that the reaction forces which occur on the pipes never exceed the maximum admissible forces and torques at the pipe sockets.

Before start-up, the piping system and installed fittings, devices, etc must be cleaned of impurities such as weld beads, scale, etc.

## 6. Installing the pump

### 6.1 Safety measures



Carefully connect the pipes in order to prevent the medium used leaking out during pumping and endangering the operators.

Ensure that the inlet and feed pipes and the discharge pipe are closed off.



Ensure that all the electrical connections are switched off in order to prevent potentially fatal electric shocks.

### 6.2 Assembly tools

No special tools are required for setting up and installation.

### 6.3 Initial installation

#### 6.3.1 Ambient conditions

The ambient temperature may be between -20° C and +40° C. The air humidity should be as low as possible in order to prevent corrosion.

#### 6.3.2 Sub-floor and foundation

The pump must stand on a flat, vibration-free floor or foundation. In cases of doubt, vibration-damping feet should be used.

#### 6.3.3 Spatial requirements

The spatial requirements of the pump unit are given in the table of dimensions. Ensure that there are no obstructions to prevent access to the shut-off and control valves and to the measuring devices.

##### Attention

Sufficient space should be provided for maintenance and repair work, particularly for replacing the drive motor or entire pump unit.

#### 6.3.4 Pre-installation checks

Before incorporating the pump into the system, the following points should be checked:

- Has the drive motor been switched off?
- Have the inlet, feed and discharge pipes been drained and closed off?
- Can the pump be easily turned by hand (by turning the impeller on the motor)?
- Have all the internal company regulations been followed?

#### 6.3.5 Installing the pump and incorporating it into the piping system

Align the pump with the pipes. The pipes should be supported so that, when the pump is connected, no twisting can occur. When tightening the screws, follow the sequence given below:

1. Tighten the flanged connections. Remove the protective caps from the connectors before connecting the pipe.

2. Tighten the pump feet and motor feet. The feet should only be hand tight.

#### 6.3.6 Checking the flexible coupling

After connecting the pipes, the alignment of the coupling must be checked, and adjusted if necessary.

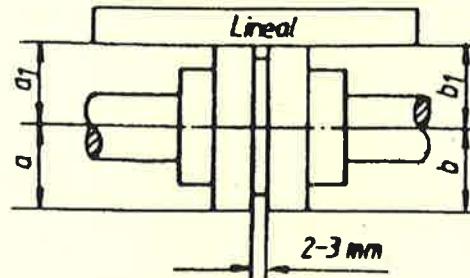


Fig. 6.1  
Aligning with a straight-edge

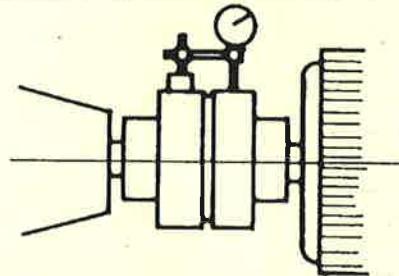


Fig. 6.2  
Aligning with a dial test indicator

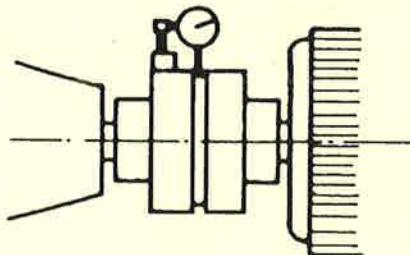
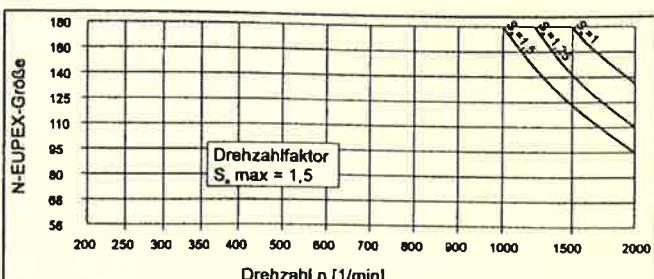


Fig. 6.3  
Aligning with a dial test indicator

**Admissible misalignment for flexible couplings** (only applies to original couplings supplied by us):

Size	Admissible shaft misalignment		
	radial $\Delta K_r$ mm	angular $\Delta K_w$ S <sub>max</sub> - S <sub>min</sub> mm	axial $\Delta K_a$ S <sub>min</sub> to S <sub>max</sub> mm
1(58)	0.10	0.10	2 - 4
2(68)	0.11	0.11	2 - 4
3(80)	0.13	0.13	2 - 4
4(95)	0.15	0.15	2 - 4
5(110)	0.18	0.18	2 - 4
6(125)	0.21	0.21	2 - 4
7(140)	0.24	0.24	2 - 4
8(160)	0.27	0.27	2 - 5



$\Delta K_r$  and  $\Delta K_w$  apply to smooth operation and an ambient temperature of -30° C to 80° C.

Admissible misalignment  $\Delta K_r + S_n$  or  $\Delta K_w + S_n$   
 $S_n$  = speed factor

$\Delta K_r$  and  $\Delta K_w$  may occur at the same time. The sum of the two misalignments must not exceed  $\Delta K_r$  or  $\Delta K_w$ .

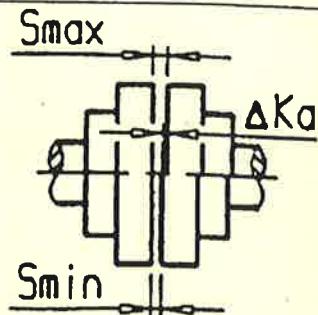


Fig. 6.7  
Axial misalignment



In order to prevent accidents, the coupling must be protected against accidental contact with a protective device in accordance with DIN 31001.

#### 6.4 Protective and control devices

The protective and control devices provided should be incorporated and connected up in accordance with the relevant instructions.



A motor circuit breaker should be fitted. When working on live components, first remove the mains plug or switch off at the main switch and remove the fuse. Ensure that the motor cannot be started up while the work is being carried out.

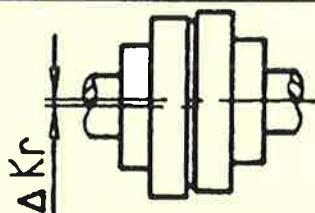


Fig. 6.5  
Radial misalignment

#### 6.5 Final tasks

The following final tasks should be carried out:

1. Check that the connecting flanges are airtight.
2. Check that the pump is running smoothly.

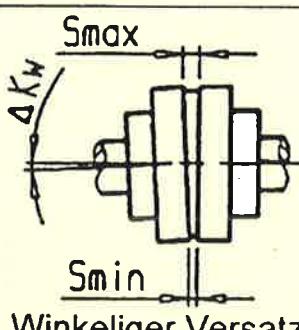


Fig. 6.6  
Angular misalignment

## 7. Start-up and Shut-down

### 7.1 Safety measures



Electrical connections must be made in accordance with the regulations of the local electricity company and the EExV specifications. The German Chemistry Society's guideline for hazardous locations must also be observed. This work must only be carried out by authorised personnel.



Fill the pump in accordance with the instructions, in order to avoid any risk of damage.

When using hot media, fill the pump slowly in order to prevent distortion or thermal shocks.

When using explosive, poisonous, hot or caustic media, ensure that they cannot endanger life or the environment.

Adjust the flow at a constant pump speed and only on the discharge side. The control device on the inlet or supply side must always be fully open during operation.

### 7.2 Preparations for start-up

#### 7.2.1 Filling the pump

Completely fill the pump with the medium to be pumped. Vent the pump at the flanges via the connection auxiliaries. This only needs doing once and, if necessary, can be carried out before the pipe is connected. The next time the pump is started up, it will prime itself automatically.

Check the pump shaft to ensure that it is running smoothly. Check that all the connection auxiliaries are ready for operation. Open all the shut-off devices in the inlet and discharge pipes. When pumping media at temperatures > 100° C, the pump (body of the pump) should be warmed before start-up, ideally by filling it with the hot medium and allowing this to flow through until the body of the pump reaches roughly the same temperature as the medium (at least 10 minutes).

#### Attention

Under no circumstances must the pump be allowed to run dry, since overheating could damage the pump components.

#### 7.2.2 Driving motor



The electrical connection work must be carried out by a qualified electrician, following the VDE and local regulations, particularly the protective measures. Check the operating voltage and speed of the motor. At 50 Hz, the speed should be 1450 rpm and at 60 Hz, it should be 1750 rpm. A motor circuit-breaker should be fitted.

#### 7.2.3 Bearings

The bearings are adequately greased at the factory and are ready for operation.

#### 7.2.4 Checking the direction of rotation

The direction of rotation of the motor must be the same as the rotation arrow on the pump. These arrows are marked on the pump.

The motor may be switched on briefly in order to check the direction of rotation. If the direction of rotation is incorrect, the pump may be damaged.

#### Attention

Never allow the pump to run against the prescribed direction of rotation. Only check the direction of rotation when the pump is full.

### 7.3 Start-up

#### 7.3.1 Switching on

Switch on the motor.

#### Attention

Never (even briefly) start or operate the pump when the discharge side is closed. Do not switch the pump on until the shut-off device is open. The slide valves in the inlet pipe must also be open.

If a bypass pipe is fitted, it must be closed during inlet operation. During supply operation, it may remain open. After running the unit to the nominal speed (see rating plate), adjust the pump head slowly closing the valve on the discharge side.

The priming time depends on the length of the inlet pipe and it will take a few seconds the first time the pump is used. If a foot valve or non-return valve is used in the inlet pipe, the pump will start to work as soon as it is switched on.

#### 7.3.2 Setting the pumping capacity values

Once normal pumping has started, the flow can be adjusted. The operational data for the pump is given on the rating plate and in the data sheet. The pump head required should be monitored on the manometer display and, if it is not correct, it should be adjusted on the discharge side. Never run the pump with the discharge side closed even during operation.

#### Attention

If there is a possibility that the pressure in the pump's cross-section at the discharge side could rise to an inadmissible level due to a malfunction during operation, suitable safety measures (e.g. fitting a safety valve) should be incorporated into the system.

#### 7.3.3 Maintaining a minimum flow

In order to prevent damage to the pump, never run it against a closed shut-off valve in the discharge pipe.

Safety measures (e.g. an overflow valve) should be incorporated into the system to ensure that the working pressure is not exceeded during operation on account of a malfunction.

#### Attention

The minimum flow is shown on the pump's output curve (smallest proven Q value).

#### 7.3.4 Temperature

Sudden changes in temperature (thermal shocks) should be avoided.

#### 7.3.5 Liquids with a high specific gravity

If the specific gravity of the liquid pumped is greater than that specified in the order data (i.e. greater than the specific gravity on which the design of the pump was based), the performance of the pump will decrease, while the power consumption will increase. Ensure that the motor is not overloaded.

### 7.3.6 Higher flow rates

#### Attention

If the flow is greater than that specified in the order and design data, ensure that the available inlet height is still sufficient (Condition: NPSH<sub>avail</sub> > NPSH<sub>req</sub>); otherwise, cavitation could occur, with damaging consequences.

#### Attention

For long stoppages, the pump should be filled with a suitable preservative agent. If there is a risk of frost, the pump, sealing circuit, etc, should be protected against freezing or drained and preserved.

If the pump is used as a boiler feed pump, ensure that the pump is not used at a lower working pressure than the intended pressure. If the feed boiler is occasionally run at a lower working pressure, then the pump must be restricted to the normal working pressure of the boiler by means of a manual shut-off valve on the discharge side and a manometer connected to the discharge socket on the pump casing.

### 7.3.7 Switching frequency

The pump must not be switched on and off more than 10 times per hour.

## 7.4 Shut-down and restart

### 7.4.1 Switching off

The valves on the discharge and inlet sides must not be closed before the pump is stopped. Switch off the motor.

Ensure that the pump runs down evenly. If non-return valves have been fitted, the shut-off devices may not close.

For long stoppages and in the event of excess (feed) pressure on the inlet side, the shut-off valve on the inlet side should be closed. The auxiliary devices (sealing liquid, etc.) should be switched off.

In the case of pumps in which the liquid is under vacuum, it is important to check before starting up again whether there is still enough liquid in the pump. The pump should be topped up if necessary.

If the pump remains pressurised and hot, even when shut down, all the available sealing pipes should be opened. The sealing devices must remain switched on if there is a risk of taking in air (when the pump is supplied from vacuum installations or if pumps are operated in parallel with a common intake pipe). If there is a risk of frost, completely empty the pump and pipes.

### 7.4.2 Restart

Check that the pump shaft has stopped. If the non-return valve in the discharge pipe is not airtight, backflow of the pumped liquid may cause the pump shaft to rotate backwards. The pump must not be switched on if the pump shaft is rotating backwards, since this could result in damage to the pump.

## 7.5 Precautions in the event of long stoppages

If pumps are stored for long periods before installation, they should be protected against moisture and dirt (e.g. by wrapping them in oiled paper or plastic film). For other measures: see Section 3.7 Long-term storage and monitoring the preservation.

If the pumps are stored, the inlet and discharge pipe sockets and all other intake and outlet sockets must immediately be closed off with blanking flanges or plugs.

During storage, the pump should be rotated at least once a month (do not switch on since it will be running dry). The position of parts such as the shaft and ball bearings should be moved each time. If necessary, they can be released by lightly tapping the shaft in the axial direction. They must be replaced after no more than 4 years, since the grease will be unusable on account of ageing.

## 8. Maintenance

### 8.1 Safety measures



When carrying out maintenance and repair work, the information given in Section 2. Safety must be followed. The service life will be prolonged if monitoring and maintenance work is carried out regularly on the pump and drive.

### 8.2 General monitoring

- The pump must never be operated dry or with an interruption in the flow. Check the liquid level in the inlet and feed tanks.
- Never allow the flow to fall below the minimum level.
- Monitor the speed and pump head.
- Do not overload the drive motor.
- The pumps and units should always run quietly and without vibration. All valves, filters, etc, on the inlet side should be kept completely open.
- Check the pressure and temperature monitoring devices and the flow measuring devices.
- Any standby pumps fitted should be brought into service once a week by switching on and off again.

### 8.3 Maintenance of components

#### 8.3.1 Bearings and lubrication

The external roller bearings are greased for life. There is no need to lubricate the closed bearings. The temperature of the bearings must not exceed 80° C. If the pump is operating correctly, the bearings should be replaced after approximately 10,000 operating hours. The internal carbon sliding bearings should also be replaced after this period of operation. If excess temperatures are identified, this indicates damage to the bearings, and the deep-groove ball bearings should be replaced as soon as possible (see Section 9. Servicing).

#### 8.3.2 Flexible coupling

The condition of the flexible elements in the coupling should be checked at regular intervals. Note: Replace any worn flexible elements. The distance between the two halves of the coupling should be checked for the first time after approximately 1000 operating hours (see Section 6.3.6 Checking the flexible coupling). The rubber coupling blocks in the jaw clutch couplings should be checked. If there is significant wear, it must be assumed that the motor is not flush with the pump or that the distance between the two halves of the coupling has changed. This will result in damage to the pump's bearings.

#### 8.3.3 Drive

See the operating instructions provided by the drive manufacturer.

#### 8.3.4 Stuffing box packings

Stuffing box packings require permanent maintenance.

To increase the service life of the stuffing box packing, it is necessary to check and adjust the packing thoroughly during the first hours of operation. The stuffing box packing must have a small leakage during operation. To prevent a dry-run, the stuffing box seat resp. screwed nut should be loosened.

Stuffing boxes may only be tightened so much that a small leakage of approx. 60 drops per minute still escapes (stuffing box lubrication!).

Packings that run dry do harden, overheat and destroy the shaft. After prolonged operation and frequent re-tightening of the packing rings, a further packing ring may be inserted. A fitting of a complete set of new packing rings is recommended after approximately 4.000 to 5.000 hours of operation and deformation of the rings upwards 25%.



It is strictly forbidden to re-pack the pump during operation or under pressure, due to the connected danger of accident therewith.

#### 8.3.5 Mechanical seals

Mechanical seals require no maintenance, but will only remain leak-free if looked after. During operation, ensure that the mechanical seals never run dry and the conditions of use are within the limits for use of the selected mechanical seal. A leak of approximately 2.5 cm<sup>3</sup> per hour is admissible.

If leaks occur at the mechanical seal, the seal cannot be tightened. We recommend dismantling and checking the mechanical seal, the shaft and the adjacent sealing elements. Since the service life of mechanical seals cannot normally be estimated, we recommend keeping a stock of spare seals.

## 9. Servicing, disassembly and reassembly

### 9.1 Safety regulations



For repairs carried out by your own personnel or by our specialist mechanics, ensure that the pump has been completely drained and cleaned. This applies in particular to pumps being sent to our factory or to one of our authorised service partners for repair.

In order to protect our employees and the environment, we cannot accept for repair any pumps which are still full of pumping medium. If pumps containing pumping medium are sent to us, we will invoice the customer/owner for the costs of environmentally-friendly disposal.

If pumps which have been operated with hazardous materials and/or media which represent a danger to the environment are sent for repair, the customer/owner must notify his own or our repair personnel on site or the staff at our factory or authorised service partner when the pump is returned for repair. In this case, the request for a customer service mechanic must be accompanied by details of the pumped liquid, for example in the form of a DIN safety data sheet.

For all work on site, your own staff and our mechanics must be told about the hazards which might arise in connection with the repairs..

These instructions describe the most important disassembly and assembly work. The assembly steps described in the individual sections must be followed rigorously.

### 9.2 Notes before disassembly

- During the guarantee period, the pump may only be opened by us or by one of our authorised service partners.
- Outside the guarantee period, the pump should only be disassembled and reassembled by experienced personnel.



Before commencing disassembly, the unit must be secured to prevent it being switched on accidentally.



The pump housing must be depressurised and drained.



All valves in the inlet, feed and discharge pipes must be closed.



All parts must have returned to the ambient temperature.



For repairs, the motor, baseplate and pipes should be removed from the pump.

### 9.3 Repairs to motors



Electrical repairs may only be carried out by a qualified electrician.

### 9.4 Disassembly

#### Attention

The relative positions of the individual parts of the casing should be marked before disassembly (e.g. with a chalk line) so that they can be reassembled in the correct position.



Detailed instructions for disassembly and reassembly are available on request.

Please refer to: see last page.

## 10. Faults; causes and correction

### 10.1 Safety regulations



Troubleshooting must only be carried out by experienced technical personnel. In the event of a fault, the pump must be switched off as quickly as possible.

### 10.2 Faults and how to correct them

Faults	Cause	To correct
Pumping capacity too low	<ul style="list-style-type: none"> <li>● Counter-pressure too high.</li> <li>● Suction lift too high or inlet height too low.</li> <li>● Filter clogged.</li> <li>● NPSH not observed.</li> <li>● Sealing gap too large due to wear.</li> <li>● Wrong direction of rotation or speed.</li> <li>● Casing or inlet pipe not airtight.</li> </ul>	<p>Reset the operating point.</p> <p>Check the liquid levels, open the shut-off devices on the inlet side.</p> <p>Clean the filter and dirt trap on the inlet side.</p> <p>Replace the worn pump parts.</p> <p>Connect the motor up again.</p> <p>Replace the casing seal. Check the flanged connections.</p>
Pump not priming	<ul style="list-style-type: none"> <li>● Inlet pipe or shaft seal on the inlet side not airtight.</li> <li>● Suction lift too great.</li> <li>● Gaps between impeller and stage too large due to wear.</li> <li>● Wrong direction of rotation.</li> <li>● Amount of liquid in the pump too low.</li> <li>● Inlet or discharge valve closed.</li> <li>● Wrong pipe connection.</li> <li>● Wrong electrical connection.</li> <li>● NPSH not observed.</li> <li>● Stopper not removed.</li> </ul>	<p>Replace the casing seal. Check the flanged connections.</p> <p>Check the liquid levels.</p> <p>Replace the worn pump parts.</p> <p>Connect the motor up again.</p> <p>Top the pump up again</p> <p>Open all the valves</p> <p>Connect the pump up again.</p> <p>Connect the motor up again.</p> <p>Clean the filter and dirt trap on the inlet side.</p> <p>Remove the stopper.</p>
Pump leaking	<ul style="list-style-type: none"> <li>● Casing screwed connection not airtight.</li> <li>● Seals defective.</li> </ul>	<p>Check the tightening torque of the casing screws.</p> <p>Replace the seals.</p>
Temperature rise in the pump	<ul style="list-style-type: none"> <li>● Pump or pipe not completely full.</li> <li>● Suction lift too high or inlet height too low.</li> <li>● Pump running dry.</li> </ul>	<p>Vent and fill the pump, inlet and feed pipes.</p> <p>Check the liquid levels, open the shut-off devices on the inlet side.</p> <p>Clean the filter and dirt trap on the inlet side.</p>

Faults	Causes	To correct
Pump not running smoothly or is noisy	<ul style="list-style-type: none"> <li>● Pump or pipe not filled completely.</li> <li>● Suction lift too high or inlet height too low (cavitation).</li> <li>● Pump has fallen below Q-min..</li> <li>● Pump not standing evenly on the sub-floor or is distorted by tension.</li> <li>● Foreign bodies in the pump.</li> </ul>	<p>Vent and fill the pump, inlet and feed pipes.</p> <p>Check the liquid levels, open the shut-off devices on the inlet side.</p> <p>Clean the filter and dirt trap on the inlet side.</p> <p>Check the pump installation.</p> <p>Dismantle and clean the pump.</p>
Motor circuit-breaker tripping	<ul style="list-style-type: none"> <li>● Foreign bodies in the pump.</li> <li>● Valve closed in the discharge pipe.</li> <li>● Admissible pumping conditions not observed.</li> <li>● Increase in output greater than the set upper threshold value.</li> <li>● Increased friction in the pump.</li> </ul>	<p>Dismantle the pump and replace the damaged parts.</p> <p>Open the shut-off devices.</p> <p>Note the pumping conditions specified in the data sheet.</p> <p>Check the motor circuit-breaker and electrical connections.</p> <p>Check whether:           <ul style="list-style-type: none"> <li>● the pump is blocked by impurities.</li> <li>● the stopper is too tight.</li> <li>● the shaft is mounted correctly.</li> </ul> </p>

## 11. Associated documents

### 11.1 Impeller gap dimensions

Pump, material version 10, 12, 22 with gasket ( $t_{max} = 120^\circ C$ )

Pump series	Impeller width	Depth on the discharge side	Thickness of the seal	Overall gap	Gap on each side
100/110	10 - 0.02	9.98 + 0.02	0.15 + 0.02	0.13 + 0.06	0.065 + 0.03
210/220/330	10 - 0.02	9.98 + 0.02	0.15 + 0.02	0.13 + 0.06	0.065 + 0.03
440	14 - 0.02	13.98 + 0.02	0.17 + 0.02	0.15 + 0.06	0.075 + 0.03
550	19 - 0.04	19.01 + 0.04	0.17 + 0.02	0.18 + 0.1	0.09 + 0.05
660	22 - 0.04	22.01 + 0.04	0.17 + 0.05	0.18 + 0.13	0.09 + 0.065

Pump, material version 32 with PTFE O-ring ( $t_{max} = 120^\circ C$ )

Pump series	Impeller width	Depth on the discharge side	Thickness of the seal	Overall gap	Gap on each side
100/110	10 - 0.02	10.15 + 0.02	0.03	0.18 + 0.04	0.09 + 0.02
210/220/330	10 - 0.02	10.15 + 0.02	0.03	0.18 + 0.04	0.09 + 0.02
440	14 - 0.02	14.16 + 0.02	0.03	0.19 + 0.04	0.095 + 0.02
550	19 - 0.04	19.18 + 0.04	0.03	0.21 + 0.08	0.105 + 0.04
660	22 - 0.04	22.18 + 0.04	0.03	0.21 + 0.08	0.105 + 0.04

Pump, material version 10, 12, 22 with gasket, T-shaped ( $t_{max} = 140^\circ C$ )

Pump series	Impeller width	Depth on the discharge side	Thickness of the seal	Overall gap	Gap on each side
100/110	10 - 0.02	10.04 + 0.02	0.15 + 0.02	0.19 + 0.06	0.095 + 0.03
210/220/330	10 - 0.02	10.07 + 0.02	0.15 + 0.02	0.22 + 0.06	0.11 + 0.03
440	14 - 0.02	14.07 + 0.02	0.17 + 0.02	0.24 + 0.06	0.12 + 0.03
550	19 - 0.04	19.14 + 0.04	0.17 + 0.02	0.31 + 0.1	0.155 + 0.05
660	22 - 0.04	22.16 + 0.04	0.17 + 0.05	0.33 + 0.13	0.165 + 0.065

Pump, material version 32 with PTFE-O-ring, T-shaped ( $t_{max} = 140^\circ C$ )

Pump series	Impeller width	Depth on the discharge side	Thickness of the seal	Overall gap	Gap on each side
100/110	10 - 0.02	10.21 + 0.02	0.03	0.24 + 0.04	0.12 + 0.02
210/220/330	10 - 0.02	10.24 + 0.02	0.03	0.27 + 0.04	0.135 + 0.02
440	14 - 0.02	14.25 + 0.02	0.03	0.28 + 0.04	0.14 + 0.02
550	19 - 0.04	19.31 + 0.04	0.03	0.34 + 0.08	0.17 + 0.04
660	22 - 0.04	22.33 + 0.04	0.03	0.36 + 0.08	0.18 + 0.04

The appendix contains:

### 11.2 Sectional drawing of the pump

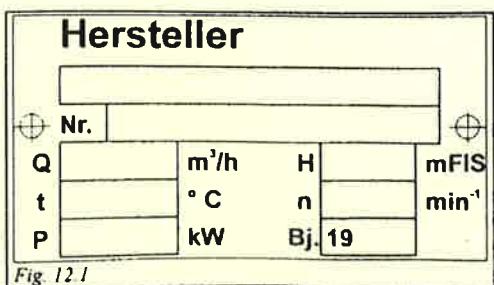
### 11.3 Sectional drawing of the shaft seal

### 11.4 Data sheet

The technical data for the pump is given in the data sheet. The dimensions are given in a table of measurements which will be sent to you upon request.

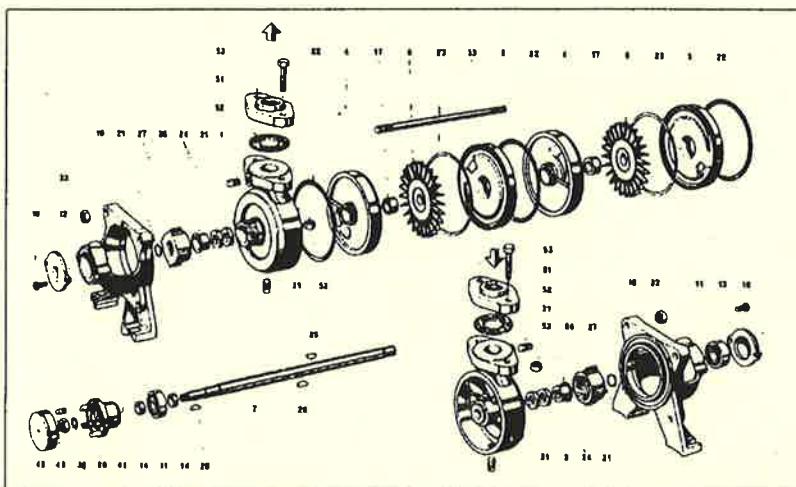
## 12. Identification

Each pump has a company rating plate conforming to DIN 24 299, as shown in fig. 12.1.

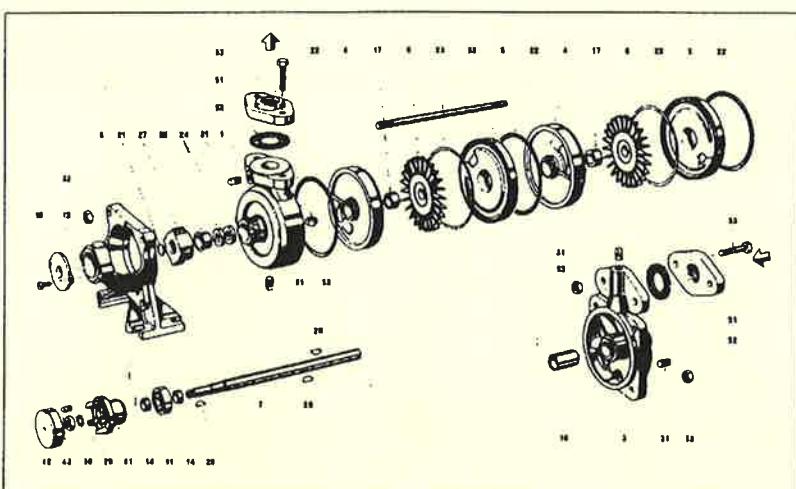


## 11.2 Sectional drawing of the pump

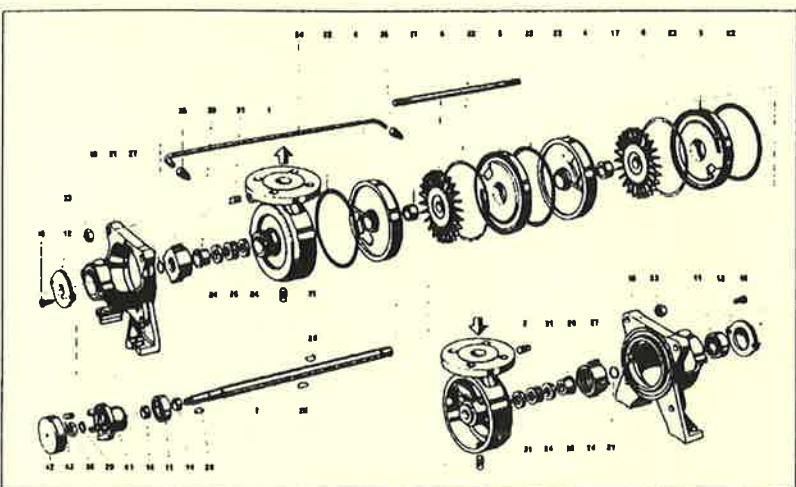
SON...WW



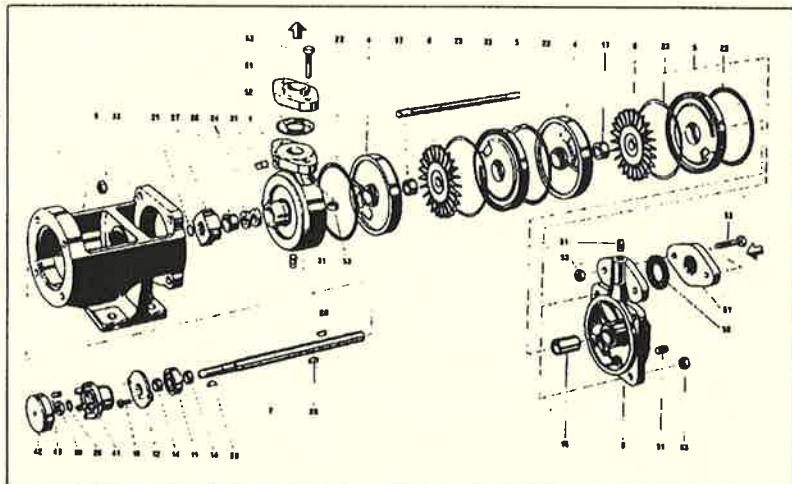
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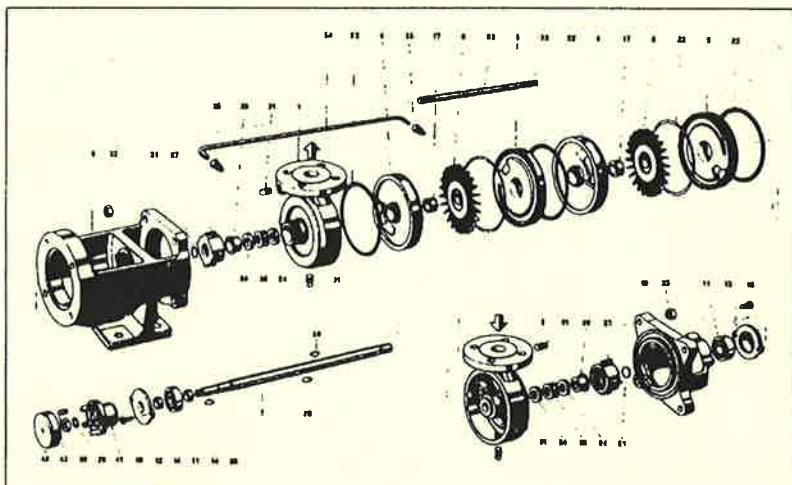
SRN...WW



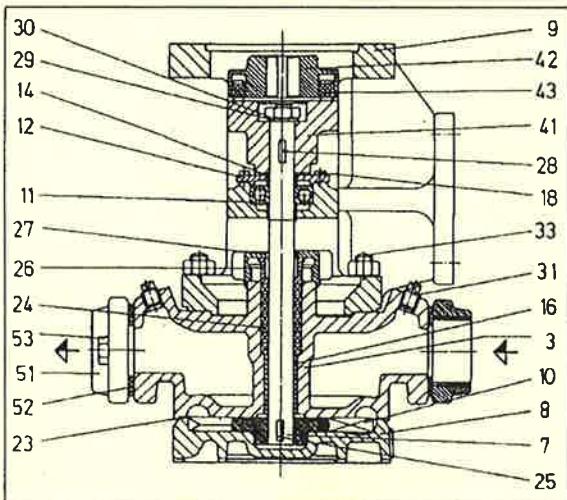
✓ SOB...W



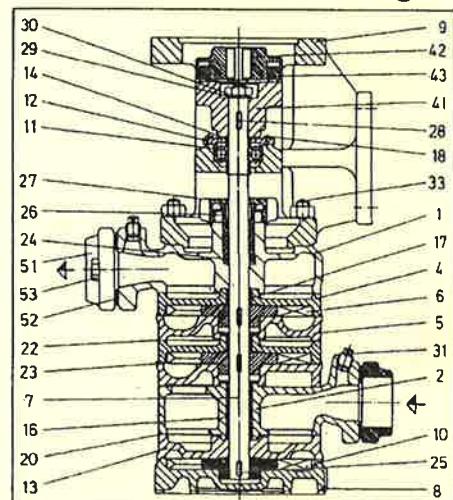
SRB...WW



SOV...W/SRV...W singlestage

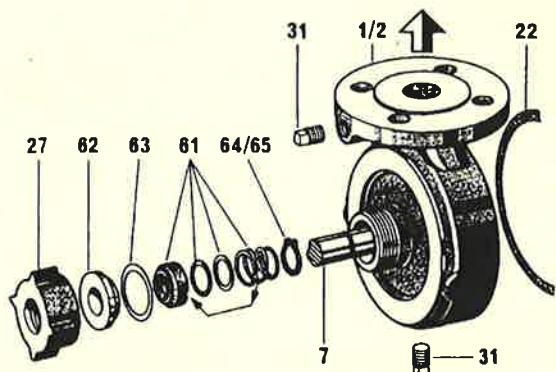


✓ SOV...W/SRV...W multistage

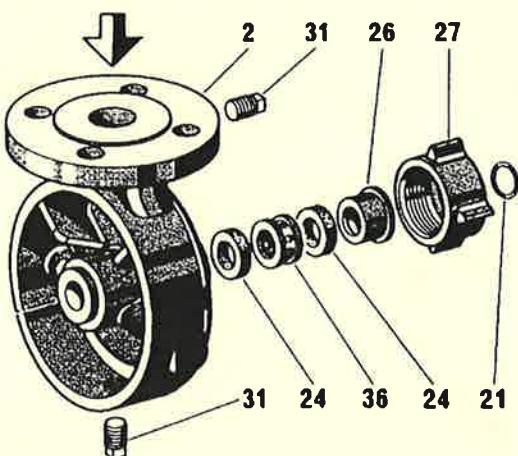


### 11.3 Sectional drawing of the shaft seal

#### Mechanical seal configuration



#### Stuffing box configuration



Teile-Nr.	Teilebezeichnung
1	Discharge casing
2	Suction casing
3	Suction cover
4	Discharge stage casing
5	Suction stage casing
6	Impeller
7	Shaft
8	Bearing housing
9	Housing bracket
10	Bearing housing
11	Antifriction bearing
12	Bearing cover
13	Bearing end cover
14	Spacer ring
16	Bearing bush, long
17	Bearing bush, short
18	Sockethead cap screw
21	Thrower
22	Gasket, wide
23	Gasket, narrow
24	Packing ring

Teile-Nr.	Teilebezeichnung
26	Stuffing box
27	Screwed nut
28	Woodruff key
29	Disc
30	Shaft nut
31	Plug
33	Connection bolt with nut
34	Crossover pipe
35	Screwed connection
36	Lantern ring
41	Coupling half, pumpside
42	Coupling half, motorside
43	Coupling insert
51	Counter flange
52	Flange seal
53	Hexagon head screw
61	Mechanical seal
62	Stationary seal
63	Gasket
64	Seeger ring
65	Clamp ring

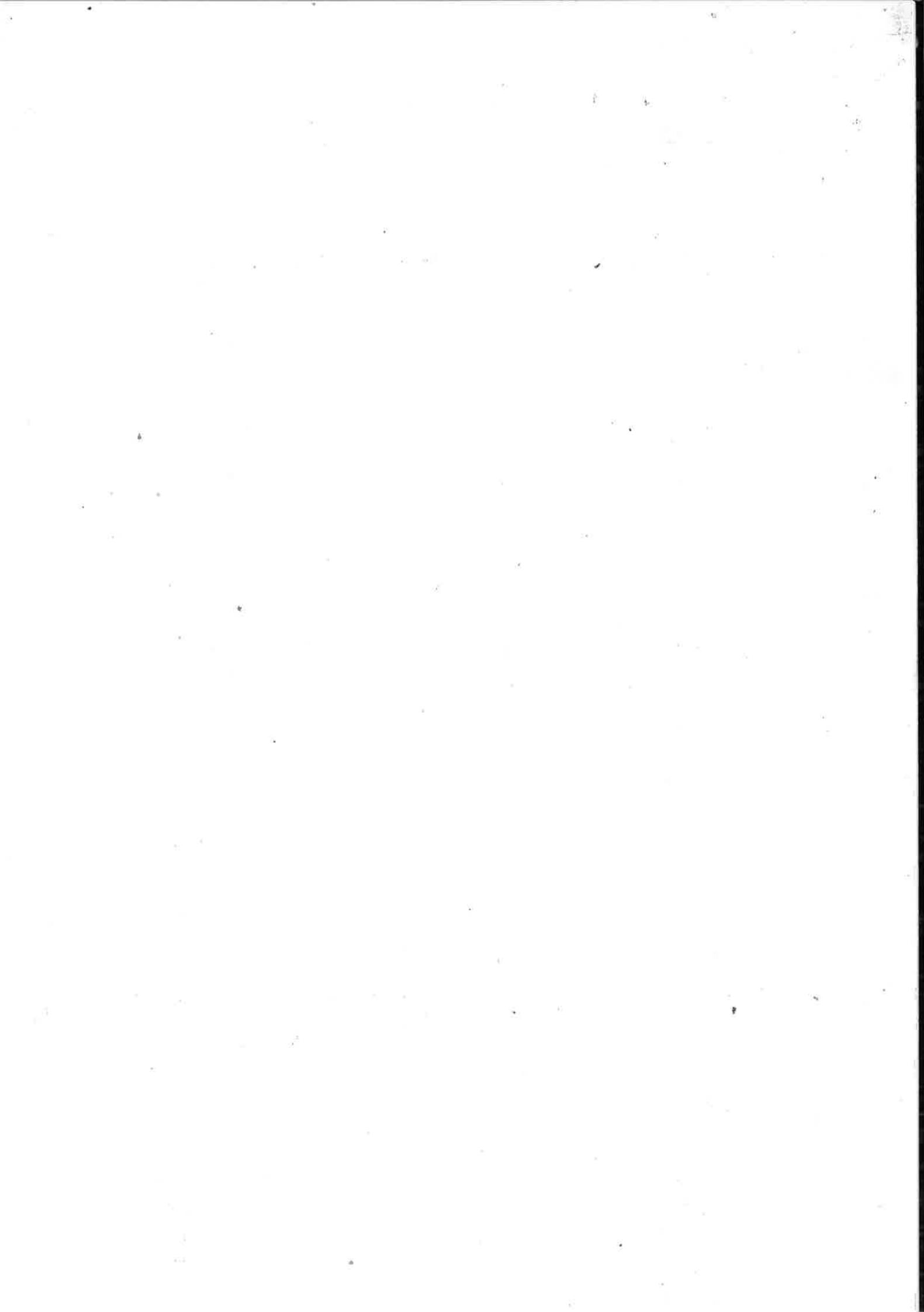
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Subject to technical alterations.

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**ALLWEILER**   
**Werk Radolfzell**

**Postfach 1140  
D-78301 Radolfzell  
Allweilerstraße 1  
D-78315 Radolfzell  
Germany  
Phone (07732) 86 0  
Fax (07732) 86 436  
Telex 793 437  
Cable  
pumpenfabrik radolfzell**



*Ref pos 3.*

ORDER SPECIFICATION

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10-07

SEWAGE PUMP

\*\*\*\*\*

22,00 AEB 1L 381	Number:	1,00
------------------	---------	------

Allweiler self-priming eccentric screw-pump with gearmotor.  
Safetyvalve and solenoidvalve for dry-run protection is included.

Technical specification: Eccentric screw pump

Serialno.:	6026681,
Capacity.....	....m3/h: 21,4
Diff.pressure.....	....bar: 2,0
Rpm.....	...rpm.: 416
Power absorbed.....	.....Kw: 2,7
NPSHr.....	.....m: 4,0
Medium.....	.....: Sewage
Temperature.....	.....C: 20
Viscosity.....	...mm <sup>2</sup> /s: 1
Spes. gravity.....	...kg/m <sup>3</sup> : 1000
Casing.....	material: Cast iron
Rotor.....	material: St.St.
Stator.....	material: Perbunan
Shaft sealing.....	....type: Std. packing

22,10 SK25F-AL-100L/4	Number:	1,00
-----------------------	---------	------

NORD / Allweiler gearmotor.

Technical specification: El-motor

Rated power.....	.....KW: 3,5
RPM.....	...Rpm.: 416
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: TO BE GIVEN
Starting method.....	....type: DOL
Construction method.	....type: B5
Protection.....	.....: IP55
Isolation.....	.....: F

22,20 SOLENOID VALVE,DRY RUN PROTECTION (F.W.)	Number:	1,00
--	---------	------

For fresh water. Against dry-running. Loose delivery.

22,30 SAFETYVALVE 1" BROADY TYPE 180	Number:	1,00
--------------------------------------	---------	------

Set point : 2,5 bar. Loose delivery.

---

## ORDER SPECIFICATION

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ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

### SEWAGE EJECTOR

---

23,00 GOLAR STRIPPING EJECTOR 1 1/2"-2"-2 1/2 Number: 1,00

Technical specification: Ejektors

Capacity ejector.... ....m<sup>3</sup>/h: 10  
Delivery head eject. ....mvs: 10 (incl. 3m suct.)  
Medium, ejector.... .....: Sewage  
Specific gravity.... ...kg/m<sup>3</sup>: 1025

# **TEAMTEC STRIPPING EJECTORS**

Previous Golar Stripping Ejectors

## **SCOPE OF SUPPLY:**

### **TEAMTEC STRIPPING EJECTORS type**

Previous Golar Stripping Ejectors

Drawing no.

Material: Ni-Al-Bz

Nozzle: Monel Metal

Capacity: xx m<sup>3</sup>/h at x mwc suction lift

Discharge head: xx mwc

Total head: xx mwc

Driving water: xx m<sup>3</sup>/h at xx bar

The following documentation is included in our scope off supply

Work certificate for pressure testing at 25 bar

Final Drawing

Instruction for use

Proposals to install

Spare part list



# **ALLWEILER**

Nye Vakås vei 4, 1395 Hvalstad, Norway

Ph. +47 66 77 50 50 Fax +47 66 84 79 10

E-mail [firmapost@allweiler.no](mailto:firmapost@allweiler.no) Internet [www.allweiler.no](http://www.allweiler.no)



## INSTRUCTIONS FOR USE OF TEAMTEC STRIPPING EJECTOR

### Type

Driving water for the ejector is supplied by an ordinary pump.

### Starting the ejector :

1. The valves are opened to enable the driving pump to suck water from the sea and deliver over board through the ejector.
2. The pump is started and regulated to deliver at the pressure necessary to obtain full capacity on the ejector. The driving pressure varies with the total delivery head, as shown below :

Discharge head	mwc	Driving pressure	bar
Discharge head	mwc	Driving pressure	bar
Discharge head	mwc	Driving pressure	bar

If the delivery line from the ejector is equipped with a manometer, the head can be read directly from the instrument. When the delivery line is below the sea level, the draft of the ship can be used as delivery head. If the delivery line is above the water level, the height of the line from the ejector is used to find the delivery head.

3. The suction valves are opened to enable the ejector to strip from the desired compartment.

NB! The suction valve shall not be opened before the driving pump has the necessary pressure to prevent water from entering the tank via the ejector at low driving pressure.

For the same reason the suction valves must be closed before shutting down the driving pump.

The ejector can be used as an ordinary vacuum cleaner, and we recommend that the means are provided to enable attachment of a suction hose to the ejector or to the stripping system.

If higher pressure than required is used, the capacity will not increase above the maximum which is shown on attached curve sheet. When the driving pressure is lower than specified, the capacity will drop radically, and it is therefore recommended to use somewhat higher driving pressure than specified above.

## GENERAL COMMENTS/PROPOSALS TO INSTALLATION OF EJECTORS.

When installing ejectors it is of utmost importance that the pipe dimensions connected to the ejectors have minimum sizes corresponding to the connection flange sizes on the ejectors.

When a common line is used for driving liquid supply or at the discharge side for ejectors of same size, the pipe diameter should be at least  $1,41 \times$  individual pipe diameter for each ejector.

The ejectors can be installed horizontally, vertically or inclined and in order to achieve the maximum performance, the ejectors should be installed as low as practical possible in the hull to keep the suction lift at a minimum.

In addition it is of great importance for the performance that a straight pipe length is fitted prior to the suction inlet of the ejector (see fig.1). This straight length of pipe will prevent turbulence in the suction inlet to the ejector thus securing the maximum suction performance.

A bend fitted prior to the suction intake on the ejector will reduce the suction capacity equal to 2 mwc increased suction lift.

At the discharge outlet of the ejectors we recommend a straight pipe length at minimum  $3 \times$  pipe dia. before the first bend/valve is fitted. This length is of no importance to the function of the ejector but it will prevent pitting inside the bend if the bend is fitted direct to the discharge flange on the ejector.

Bends, T pieces and valves on the driving liquid line are of less importance as long as one calculate the pressure drop they will create in the system thus making sure that the required driving pressure will be obtained at the ejector inlet.

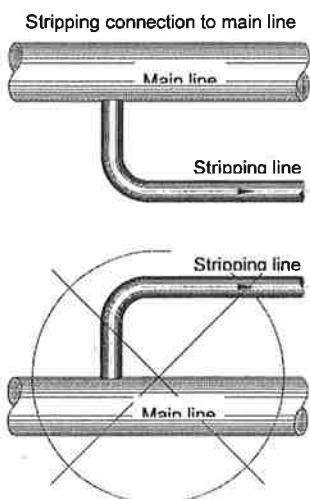


Fig. 2

When a stripping line is connected to a main line the connection must be fitted to the lower part of the main line (fig. 2).

When two ejectors are discharging into a common line it is recommended to have a sloped connection as showed in fig. 3.

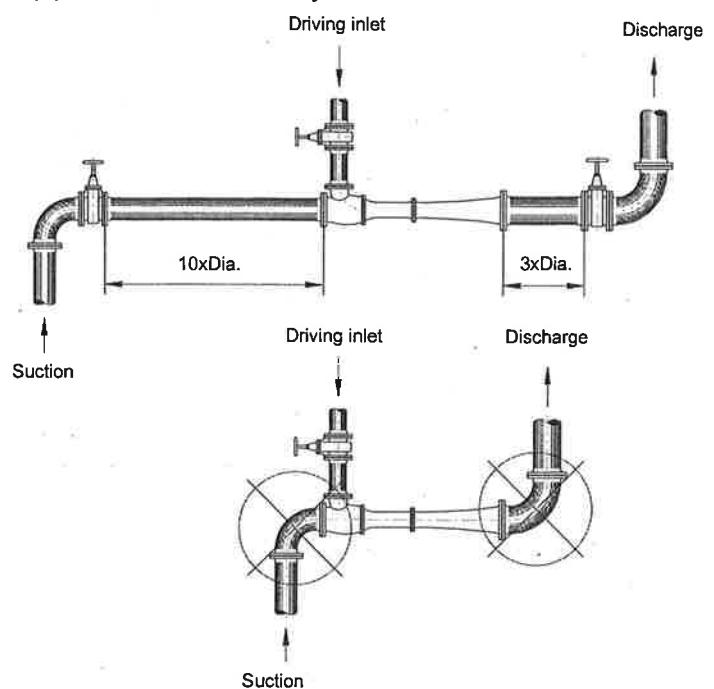


Fig. 1

Common discharge line from 2 ejectors

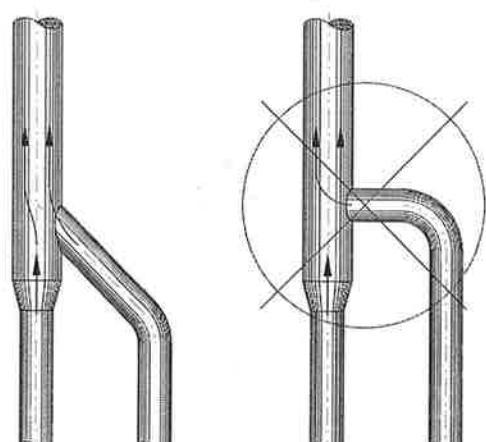
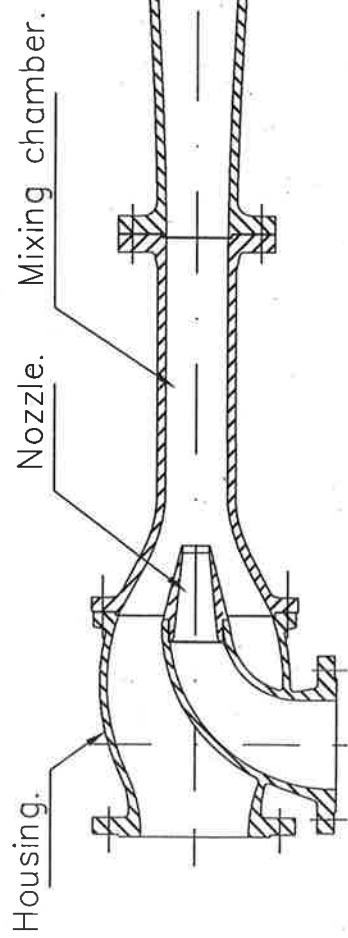
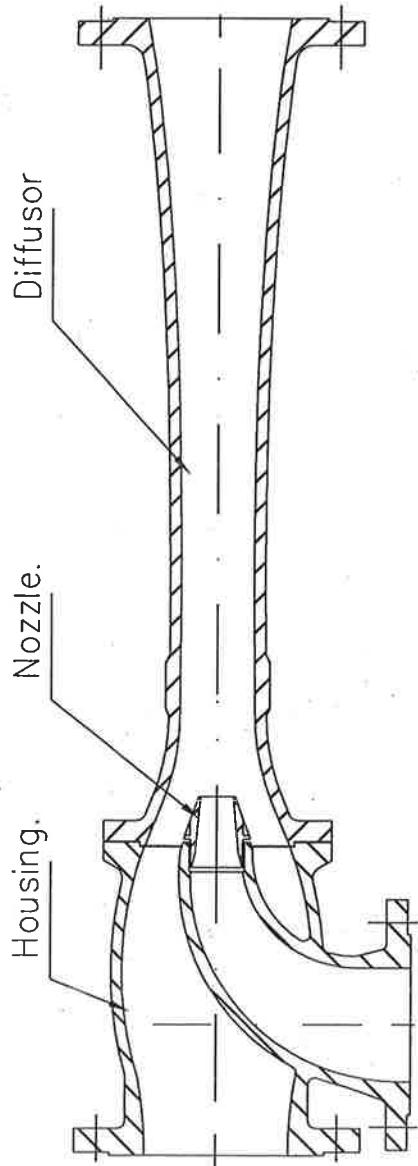
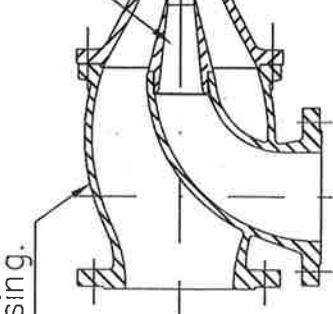
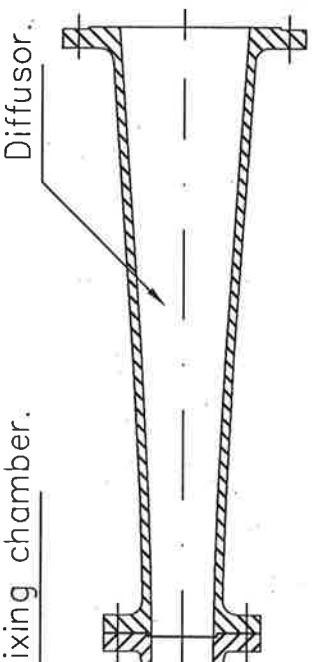


Fig. 3



When ordering spareparts  
following information is needed:  
Ejector type: \_\_\_\_\_  
Serial number: \_\_\_\_\_  
Name of part: \_\_\_\_\_



Date 10-01-97 Checked by	Drawn by EPN Std. checked by Approval	Traced by —	Scale —	TeamTec AS Tvedstrand - Norway Replacement for _____ Replaced of _____
<b>Sparepart List</b>				
Teamtec Stripping Ejectors				
Reference	Article no. 4501105			

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**ORDER SPECIFICATION**

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ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

**701 - FUEL OIL TRANSFER PUMP**  
\*\*\*\*\*

26,00 TRILUB 140 R 46 U8.6 V W115 IEC 100/112 Number: 2,00

Allweiler three-screw pump w/flexible coupling, el-motor and safety relief valve.

Technical specification: Screw spindle pump

Serialno.: 6037691, 6037690,  
Capacity..... ....m3/h: 19,7  
Diff. pressure..... ....bar: 2,0  
Rpm..... .... rpm: 3500  
Power absorbed..... ....Kw: 2,3  
NPSHr..... ....m: 4,4  
Medium..... ....: DO  
Viscosity..... ...mm<sup>2</sup>/s: 3  
Pump casing..... material: EN-GJL  
Screws..... material: 16 MnCrS 5 / GGc-F  
Bearing..... ext./int: Int.  
Shaft seals..... ....type: Mech.seal

26,10 EL-MOTOR 100L-2 MARINE Number: 2,00

Technical specification: El-motor

Rated power..... ....KW: 3,5  
RPM..... ....Rpm.: 3500  
Voltage..... ....Volt: 3\*690  
Frequency..... ....Hz: 60  
Ampere In..... ....A: 6,3  
Starting method.... ....type: DOL  
Construction method. ....type: B5  
Protection..... ....: IP55  
Isolation..... ....: F  
Temp.rise..... ....K: 90  
Test certificate.... ....: DNV

26,12 FLANGE, 2" SAE WELDED NECK TRILUB Number: 2,00

26,13 FLANGE, 1 1/2" SAE WELDED NECK TRILUB Number: 2,00

26,15 CERTIFICATE DNV, PUMP Number: 2,00

## Operating and Maintenance Instructions

VM No.: 652.0010 GB  
Edition: 05.00  
Ident No.: 550 296

### Screw pumps

Series **TRILUB TRL**

**Retain  
for future  
use!**

Order No.:

Pump Ident. No.:

Machine No.:

Pump Type:

Operating data, dimensions and other additional information can be found in the order-specific part of the documentation.



These Operating and Maintenance Instructions contain information from the pump manufacturer. They may need to be supplemented by instructions of the operator company for its personnel. These instructions do not take account of specific information relating to operation and maintenance of the process plant into which the pump is integrated. Such information can only be given by the persons responsible for construction and planning of the plant (plant manufacturer).

**Such specific instructions relating to operation and maintenance of the process plant into which the pump is integrated have priority over the instructions of the pump manufacturer. The plant manufacturer must on principle observe the limits of use!**

**Refer to the operating instructions of the plant manufacturer!**

### Contents

- 1. General**
- 2. Safety**
- 3. Transportation and Intermediate Storage**
- 4. Description**
- 5. Installation/Mounting**
- 6. Start-up/Shutdown**
- 7. Maintenance/Repair**
- 8. Operating Faults, Causes and Remedial Action**
- 9. Associated Documentation**

#### **Important note:**

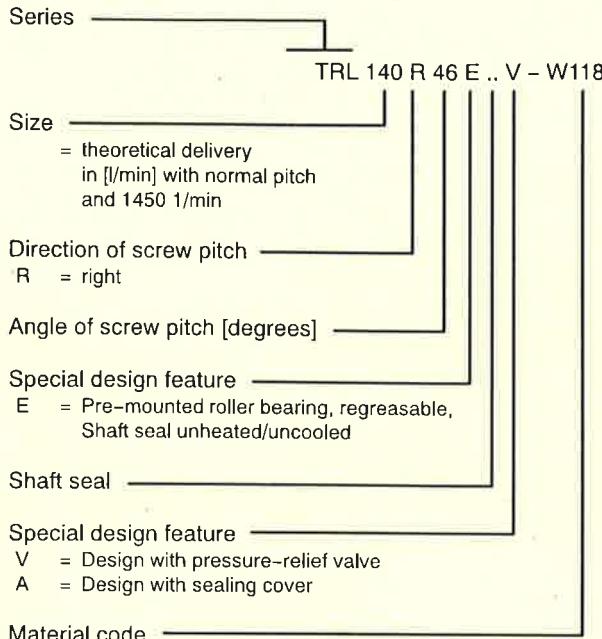
This operating manual is to be supplemented by the order-related informations.

## 1 General

### 1.1 Abbreviation

The abbreviation of the screw pump is set up according to the following schema, and is engraved on the type plate.

#### Example:



### 1.2 Proper use

Information on proper use of the pumps is provided in the technical data sheet.

The pumped liquid must not contain any abrasive constituents nor corrode the pump materials. In case of doubt consult the manufacturer.

### 1.3

### 1.3 Performance data

The exact performance data applicable to the pump can be taken from the order data sheet and/or acceptance test report, and are engraved on the name plate.

**The pressure data indicated there apply only to approximated static pressure load. In the case of dynamic alternating pressure load, consult the manufacturer.**

### 1.4

### 1.4 Warranty

Our warranty for shortcomings in the supply is laid down in our delivery conditions. No liability will be undertaken for damages caused by non-compliance with the operating instructions and service conditions. If at any later date the operating conditions change (e.g. different fluid conveyed, speed, viscosity, temperature or supply conditions), it must be checked by us from case to case and confirmed, if necessary, that the pump is suited for those purposes. Where no special agreements were made, pumps supplied by us may, during the warranty period, only be opened or varied by us or our authorized contract service workshops; otherwise our liability for any defects will cease.

### 1.5

### 1.5 Testing

Prior to leaving our factory, all pumps are subjected to a leak and pressure test. Additional tests will only be performed on request.

### 1.6

### 1.6 Availability

As a matter of principle, we recommend stocking replacement pumps and withdrawable units (hydraulic action system) where the supplied pumps are a decisive factor in maintaining a production or delivery process. In this way downtimes can be avoided, or reduced to a minimum.

## 2 Safety

These operating instructions contain basic safety instructions for installation, operation and maintenance. It is therefore essential that they are read by fitters and all specialist staff and customer personnel prior to installation and start-up. They must always be kept at hand at the place of installation.

The special safety instructions contained in the other chapters must be observed in addition to the general safety instructions in this chapter.

### 2.1 Identification of safety instructions in the operating manual

The safety instructions contained in these operating instructions which represent a danger to personnel if not complied with are specially marked by the general danger symbol:



Warning symbol  
as per DIN 4844-W9

Warning of danger from electric voltage is indicated as follows:



Warning symbol  
as per DIN 4844-W8.

Instructions which are essential to avoid endangering the machine and its operation are marked by the word

**ATTENTION**

Instructions affixed directly to the machine such as

- Directional markers
- Signs for fluid connections

must always be observed and maintained in fully legible condition at all times.

### 2.2 Personnel qualification and training

The operating, maintenance, inspection and mounting personnel must be appropriately qualified for the duties assigned to them. The scope of their responsibilities, competency and supervisory duties must be closely controlled by the customer. If the personnel do not have the required knowledge, they must be trained and instructed. If required, this may be provided by the manufacturer/supplier on behalf of the customer. The customer must additionally ensure that personnel fully understand the content of the operating instructions.

### 2.3 Dangers in the event of non-compliance with safety instructions

Failure to comply with the safety instructions may result in danger to persons, and place the environment and the machine at risk. Non-compliance with the safety instructions will lead to the loss of any claims for damages.

Non-compliance may result in the following dangers:

- Failure of important functions of the plant
- Failure of specified methods for maintenance and servicing
- Danger to persons resulting from electrical, mechanical and chemical effects
- Danger to the environment resulting from leakage of hazardous substances

### 2.4 Responsible working practices

The safety instructions contained in these operating instructions, current national accident prevention regulations, as well as internal working, operating and safety rules of the customer, must be observed.

### 2.5 Safety instructions for the user/operator

- Hot or cold machine parts representing a danger must be protected against accidental contact on site.
- Protection against accidental contact for moving parts (such as the coupling) must not be removed while the machine is in operation.
- When operating pump aggregates in a dust-laden environment (e.g. milling, chipboard manufacture, bakeries), the surfaces of the pumps and motors must be cleaned at regular intervals, depending on local conditions, in order to maintain the cooling effect and eliminate the possibility of spontaneous combustion. Please also see explosion protection regulations (ZH 1/10).
- Leakage (e.g. from the shaft seal) of hazardous substances being handled, such as explosive, toxic or hot materials, must be discharged in such a way that no danger to persons or the environment is created. Legal regulations must be observed.
- Dangers from electrical energy must be eliminated. For details in this regard, please refer to VDE and local power company regulations.



## 2.6 Safety instructions for maintenance, inspection and installation

The operating company must ensure that all maintenance, inspection and installation tasks are performed by authorized and qualified specialist personnel who have thoroughly studied the operating instructions.

Work on the machine is only to be carried out when the machine is at a standstill. The procedure for shutting down the machine described in the operating instructions must always be followed.

Pumps or aggregates handling fluids which are detrimental to health must be decontaminated. All safety and protective devices must immediately be refitted and made operational on completion of the work.

The instructions under Section 6.1, "Preparation for start-up", must be observed before restarting.

## 2.7 Unauthorized conversion and production of replacement parts

Conversion or modification of the machines is only permissible after consultation with the manufacturer. Original replacement parts and accessories approved by the manufacturer are intrinsic to safe operation. If other parts are used the manufacturer cannot be held liable for the consequences.

## 2.8 Unacceptable modes of operation

The operational safety of the machine supplied is only ensured when it is used in accordance with Section 1 of the operating instructions. The limit values given on the data sheet must not be exceeded under any circumstances.

## 3 Transportation and Intermediate Storage

### 3.1 Packaging

Attention must be paid to the figurative markings on the packaging.

The suction and pressure side and all auxiliary connections must always be closed during transportation and storage.

**ATTENTION** The coverings must only be removed immediately before connecting the pipeline.

### 3.2 Transportation

The pump or pump aggregate is to be safely transported to the place of installation, if required by means of lifting gear.

**!** The regulations for lifting loads in accordance with VBG 9a must be observed. Crane and sling equipment must be adequately dimensioned. Sling equipment must not be secured to the lifting eyes of the motor, except as additional protection against overturning in the event of nose-heaviness.

#### Transportation to and at the installation site

Make sure that the unit is transported safely and in a stable position. Overturning due to nose-heaviness must be prevented.

Complete aggregates must be transported to the place of installation as shown in the illustration.

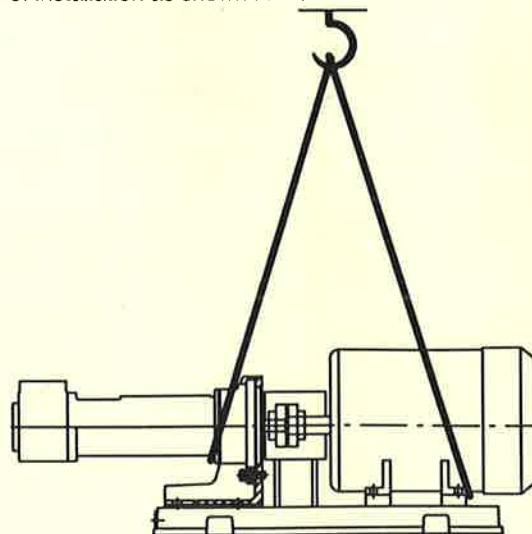


Fig. 3.1: Transportation of a horizontally mounted pump aggregate

In the case of vertically and horizontally mounted flanged pump aggregates, it is advisable to attach the cables to the wall/foot lantern or intermediate fitting lantern (not shown).

#### Transport damage

**ATTENTION** Check the pump for damage on receipt. Any damage detected must be notified immediately.

### 3.3 Preservation and storage of the screw pumps

#### 3.3.1 Preservation

In the case of storage or prolonged standstill, the pumps must be protected against corrosion. In those cases, an outside and inside preservation is to be provided. The durability of the protection against corrosion, which is limited in time, depends on the composition of the preservative to be applied and the storage conditions.

**ATTENTION** Under normal circumstances the pumps have no special preservative.

At an additional charge we can, however, supply pumps and replacement parts ex factory with a preservative adequate to the planned storage period.

We will be pleased to specify suitable preservatives for you on request.

##### 3.3.1.1 Outside preservation

The outside preservative should be applied by painting or spraying with a spray gun.

##### Points of preservation:

All bright and unvarnished parts (e.g. shaft ends, couplings, flange facings, valve and manometer connections).

##### 3.3.1.2 Inside preservation

The preservative is to be applied by filling the pump. For these purposes, the suction side of the pump must first be closed with a dummy flange. During filling, the pressure flange must be on a higher level than the suction flange. During the filling process, the shaft must be slowly cranked against the direction of rotation. Filling must be continued until the preservative reaches the sealing strip of the delivery flange, bubble-free. Then the outlet side is to be closed with a dummy flange.

**Note:** Not required for pumps made of stainless materials.

##### Points of preservation:

All bright parts inside the pump (e.g. pump casing inside, screw spindles, ball bearings, pressure-relief valves).

##### 3.3.1.3 Monitoring of preservation

In the event of prolonged storage, the preservation of the pump must be checked by the customer at regular intervals.

Every six months the pump level must be checked; if necessary, preservative must be topped up to the sealing strip on the pressure flange.

At the same time, the packing must be checked for destruction, and repaired if necessary.

**Note:** Liability for damages caused by improper preservation cannot be assumed by us.

#### 3.3.1.4 Depreservation

Prior to setting the pump in motion, the preservative applied must be removed.

**Environmentally compatible disposal must be ensured.**

The preservative applied for inside preservation can normally be removed by flushing the pump with the fluid to be conveyed.

Alternative, suitable solvents may be applied for removing the inside and outside preservation. Appropriate solvents are for example: petroleum, benzene, Diesel fuel, spirit, alkalis (industrial cleaners) or any other wax solvents. Steam jet cleaning devices with appropriate admixtures can also be used (allow wax solvent to act beforehand).

**ATTENTION** Prior to start-up after prolonged storage, all elastomers (O-rings, shaft seals) must be checked for their elasticity of shape. Embrittled elastomers must be exchanged. Elastomers of ethylene-propylene rubber (EPDM) must always be replaced. The pump must be filled with fluid to prevent seizing of the components. A pressure-relief valve attached or fitted in the pipeline must be checked for passage.

**Note:** If on the plant side, the pipelines, (oil) tanks or other parts are wetted with paraffin-containing preservative, the entire plant must be depreserved as paraffin is detrimental to the air separating capability of oil. This may result in unsteady operation of the pump and loud noise.

#### 3.3.2 Storage

During storage of the pump, the suction and outlet branches and all other supply and discharge branches must always be closed with dummy flanges or dummy plugs.

Storage should be in a dry, dust-free room. During storage, the pump should be cranked at least once a month. During this process, parts such as the shaft and bearings should change their position.

## 4 Description

### 4.1 Structural design

Three-screw pumps in flange design form, with a double-threaded driving spindle and two double-threaded idler spindles, enclosed in a pump casing with narrow running clearance.

### 4.1.1 Bearing and lubrication

By a pre-mounted, greased groove ball bearing to DIN 625.

Design E: regreasable by means of lubricating nipple. A grease flow regulator (labyrinth ring) ensures that overgreasing and thus impermissible heating of the bearing is avoided.

### 4.1.2 Shaft seal

Uncooled, maintenance-free mechanical seal of the unbalanced type.

Materials of the mechanical seal are to be found on the order data sheet.

### 4.1.3 Connections/branch positions/dimensions

Suction and pressure connections with SAE flange connection.

Suitable welding flanges to SAE may be included in the scope of supply.

Dimensions: see dimension sheets VM 835/...

### 4.1.4 Pressure relief valve

For safety reasons, screw pumps must generally be equipped with a pressure relief valve.

Most pumps are already equipped with a pressure relief valve ex-works. This is set as standard to a threshold pressure of  $13 \pm 2$  bar. (Special design feature V).

Different valve settings must be requested in relation to the individual order and are certified in a separate test record.



Pumps that are supplied without a pressure relief valve (Special design feature A) must be provided with a suitable safety valve by the customer. The safety valve must be fitted in the discharge pipeline between the pump and the first shut-off device.

### 4.2 Mode of operation

Through the suction connection, the fluid is conveyed into the suction chamber of the pump. From there the fluid flows into the spindle chambers, which are constantly formed by the rotary motion at the spindle end on the suction side. By the translatory rotary motion, the chambers filled with the fluid move from the suction side to the outlet side. During this process the closed chamber volume does not change. At the spindle end on the outlet side the chamber opens towards the delivery chamber. The fluid is steadily pushed out into the delivery chamber from where it is transported, through the pressure connection, into the pressure pipeline.

The axial thrust acting on the faces of the profile flanks on the outlet side is hydraulically balanced by an appropriate dimensioning of the compensating piston of the driving spindle. Thus the bearing is relieved of the hydraulic axial thrust. The axial thrust of the two idler spindles is hydrodynamically absorbed by the thrust cover.

The idler spindles are hydraulically driven by means of appropriate dimensioning of the spindles. Only the torque resulting from the fluid friction is transmitted via the profile flanks. They are therefore practically stress-free, and not subject to any wear.

As a result of the constant chamber volume the medium inside the pump is transported, almost entirely free of turbulence and squeezing, from the suction side to the outlet side.

The compartment for the shaft seal is connected to the pump suction chamber.

The structural design and mode of operation of the screw pump ensure a very low noise level and an almost pulsation-free delivery.

## 4.3 Construction of the pump aggregate

### 4.3.1 Drive

The pumps can be directly coupled with electric motors of the most varied designs, or any other prime movers. In most cases, surface-cooled three-phase squirrel cage induction motors are used as driving motors, type IM V1, class of protection IP 54 to IEC standard, class B insulation, outputs and speeds to DIN 42 677.

The exact motor data are to be found on the order data sheet.

### 4.3.2 Shaft coupling and contact protection

Power transmission is effected via a flexible coupling to DIN 740. Additional radial forces must not act on the driving spindle.

Protection against accidental protection to EN 809 is provided where a pump bracket or fitting lantern is supplied as part of the product package.

According to accident prevention regulations, the pump must only be operated with a protection against accidental contact as per EN 809.

If no contact protection is provided, it must be attached by the operator.

### 4.3.3 Pump bracket/Foot angle

Pump brackets and foot angles are available for horizontal or vertical mounting with V1 motors.

### 4.3.4 Fitting lantern

Fitting in the fluid tank is enabled by using fitting lanterns.

**Note:** A fitting lantern attached by the operator must have bore holes to drain off the fluid medium.

### 4.3.5 Base plate/Foot angle

Suitable foot angles are available for mounting of the flange pump for horizontal assembly with B3 motors. Base plates can be provided in cast or steel design.

## 5 Installation/Mounting

### 5.1 Installation

For installation methods and locations, please see installation drawing.



**Other methods of installation are not permissible without prior consultation with the manufacturer.**

#### 5.1.1 Place of installation

Temperature: min. -20 °C  
max. +40 °C

relative air humidity:

permanent	max.	85 %
temporary	max.	100 %

Installation height: max. 1000 m above NN

For data differing from this, please consult the manufacturer.



**ATTENTION** Intensive vibrations in the vicinity of the pump unit can lead to bearing damage and must therefore be avoided.

#### 5.1.2 Protective devices



In order to prevent injuries due to burns, at pumping liquid temperatures higher than 60°C protective devices in accordance with EN 809 must be provided **on site**.

#### 5.2 Foundation

##### 5.2.1 General

The foundation may be a floor/concrete base or a load-bearing steel foundation frame.



**ATTENTION** The foundations must be constructed in such a way that they can take the weight of the pump unit and all operating forces that occur.

##### 5.2.2 Characteristics of a steel foundation frame

A steel foundation frame must be constructed in such a way that pump feet or base plate are supported evenly and can be secured with screw fixings.



**ATTENTION** If the base plate is only supported at four points the pump aggregate will hang down in the middle. This will affect the alignment of the coupling and may also lead to severe noise being generated.

##### 5.2.3 Characteristics of a floor/concrete foundation

The foundation must be horizontal, flat and clean, and be capable of bearing the full load upon it.

**Note:** Concrete foundations must be executed with standard concrete of strength class B 25 as a minimum.

#### 5.3 Alignment of the pump aggregate

The pump aggregate must be aligned to its pre-set height and system dimensions. This is done using suitable steel shims, arranged directly adjacent to each fixing bolt.

The overall height of the steel shims is determined by the established system dimensions of the plant. The steel shims and the base plate must be positioned evenly and securely.

If the fixing holes are more than 750 mm apart, we recommend fitting additional steel shims in the middle of the base plate.

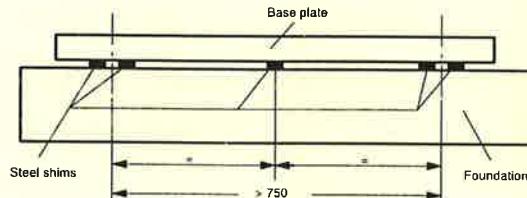


Fig. 5.1: Alignment with steel shims

Horizontal alignment of the aggregate is produced by way of flat-machined surfaces on the pump using a machine spirit level. Measurements are taken in longitudinal and transverse directions of the pump aggregate.

**Permissible deviation:** max. 1 mm per 1 m length.

#### 5.3.1 Fixing the pump aggregate

In order to prevent deformation of the base plate/pump, this must first of all be screwed tightly at three points. Before tightening the rest of the screws, spacers should again be positioned around the screw, in order to balance out the unevenness of the seating.

**ATTENTION** The prescribed tightening torque must be observed.

Precise details on the shape and dimension of the fixing are provided in the installation drawing.

#### 5.3.2 Checking the alignment

After aligning and tightening the screws, it must be possible to turn the pump and drive by hand, without any strain.

**Note:** The pump unit should not be welded to the base for technical installation reasons.

#### 5.4 Checking the coupling alignment

##### 5.4.1 Checking the coupling alignment in case of horizontal setup on base plate (if used)

A complete delivered pump aggregate has been carefully assembled at the factory. After proper installation, and prior to start-up of the pump aggregate, the alignment of the coupling must be checked.

The check can be made with a straight-edge and a feeler gauge, or with other suitable equipment (such as a laser alignment device).

The measurements are taken in two planes, each offset by 90°, on the circumference of the coupling.

If a height, lateral or angle offset is detected between the two coupling halves, the drive motor should be re-aligned such that the coupling halves are flush with each other (level out with flat packing shims as necessary).

The gap between the two coupling halves must be the same all round the circumference of the coupling. The specified gap is shown in the installation diagram.

The spacing between the straight-edge laid over both coupling halves and the respective shaft must be the same all round the circumference.

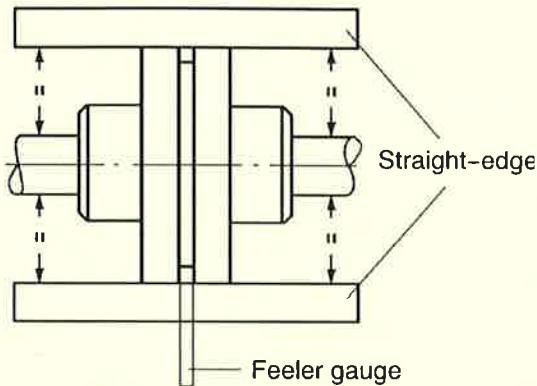


Figure 5.2: Alignment of the coupling with straight-edge and feeler gauge

For couplings with a distance piece (removable couplings) the alignment of the coupling can be checked with dial gauges.

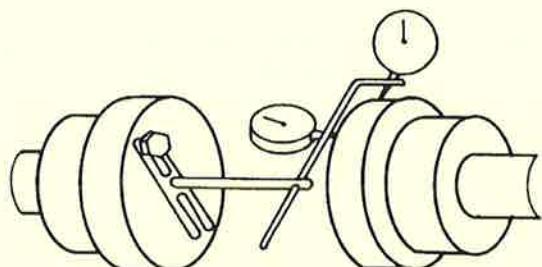


Figure 5.3: Alignment of the coupling with dial gauges

**Note:** The permissible axial and radial deviation, measured on the front face of the coupling and the coupling circumference respectively, may be max. 0.1 mm, but as far as possible should be kept below 0.05 mm.

When the fixing bolts have been aligned and tightened the pump/drive motor unit must be able to be spun by hand without pressure points.

**ATTENTION** Out-of-flush errors on the coupling may lead to heavier wear of the coupling, the anti-friction bearing and the shaft seal, and even cause the shaft end to be torn off.

#### 5.4.2 Coupling alignment in case of flanged aggregates (if used)

In the case of pumps with flanged drive motor, the pump and motor are precisely centered in the lantern. Alignment or re-alignment of the coupling is not required.

**Note:** Improper handling, e.g. during transportation, may impair the alignment between the pump and the motor. In this case the pump and the motor must be returned to the factory for checking.

#### 5.4.3 Coupling alignment of special designed couplings (if used)

Refer to the operating instructions of the coupling manufacturer.

#### 5.5 Assembly of pump and drive motor

If the aggregate is only assembled at the place of use, the coupling is assembled as follows:

1. Coat the pump and motor shaft ends with a fine film of molybdenum disulfide (e.g. Molykote) and insert keys.

2. Push on the coupling halves on the pump and motor side with the aid of a pusher device until the shaft end is flush to the coupling hub.  
If no puller is available, heating the coupling halves to approx. 100 °C (without rubber buffer) facilitates pushing.

**ATTENTION** The possibility of shock and stress on the pump and drive motor components must be eliminated.

3. Tighten the grub screw on both coupling hubs.

4. When assembling the pump and motor, make sure the specified gap between the coupling halves is maintained (see our installation drawings).

5. In the case of horizontally mounted pump aggregates fixed on a base plate or directly on the foundation, the coupling must be aligned as described in Section 5.4.

In the case of pump aggregates with flanged motor, the coupling does not need to be re-aligned.

6. Mount the contact protection.

According to accident prevention regulations, the pump must only be operated with a protection against accidental contact.

#### 5.6 Space required for maintenance and repair

**ATTENTION** The pump must be accessible from all sides in order to be able to carry out necessary visual inspections.

Adequate space must be provided for maintenance and repair work, in particular for removal of the drive motor or of the complete pump aggregate. It must also be ensured that all pipelines can be attached and removed without hindrance.

**5.7 Laying the pipelines****5.7.1 Nominal widths**

If possible, the nominal widths of the suction and pressure pipelines should be rated so that the rate of flow does not exceed a maximum of 1 m/s in the suction pipeline and 3 m/s in the pressure pipeline. If possible, suction pipelines laid "uphill" are to be avoided.

**5.7.2 Change of cross-sections and directions**

Sudden changes of cross-sections and directions, as well as hairpin bends, are to be avoided.

**5.7.3 Supports and flange connections**

The pipelines must be connected to the pump, stress-free. They must be supported close to the pump and must allow easy screwing-on to avoid twisting. When the connections are loosened the pipeline must neither be slanted nor springing, nor must it be under pressure.

Any thermal stresses occurring on the pipelines must be kept away from the pump by suitable means, e.g. installing compensators.

**5.7.4 Cleaning pipelines prior to attachment**

Prior to assembly, all pipeline parts and valves must be thoroughly cleaned; especially in the case of welded pipelines, burrs and welding beads must be removed. Flange gaskets must not protrude inwards. Blanking flanges, plugs, protective film and/or protective paint on flanges and seals must be removed completely.

Water residues, still in the pipeline network from pressing-out or steeping for example, must be removed.

Delivery of water destroys the pump. The pump relies on the fluid being conveyed for its lubrication.

**5.7.4.1 Inlet/suction conditions (NPSH)**

To ensure fault-free continuous operation, the inlet and suction conditions of the plant must be appropriately adjusted to the pump demand (NPSH<sub>req.</sub>)

The service condition is fulfilled when the plant NPSH value (NPSH<sub>avail.</sub>) is above the pump NPSH (NPSH<sub>req.</sub>). The NPSH<sub>req.</sub> is given in the characteristic sheets of the respective pumps

**ATTENTION** When pumping air-laden or volatile liquids, particular attention must be paid to the NPSH requirements of the plant.

**5.7.5 Stop valves**

Stop valves are to be installed in the suction and pressure pipelines close to the pump.

**5.7.6 Pressure-relief valve**

See Section 4.

**5.7.7 Check valve**

It is recommended to install a check valve between the pressure connection of the pump and the stop valve in order to prevent the pump from running dry when it is at a standstill and the pressure stop valve is open.

**5.7.8 Vent valve**

A vent valve must be provided at the highest point in the pressure pipeline.

**5.7.9 Filtering**

To protect the pump against coarse dirt contamination, we recommend as a matter of principle installing a filter in the suction pipeline, mesh width 0.6 mm.

**Note:** The service life of the pump is decisively influenced by the degree of dirt contamination of the fluid being conveyed, that is, by the number, size and hardness of the abrasive components.

**5.8 Safety and control devices****5.8.1 Manometers**

Suitable pressure gauges are to be installed in the suction and pressure pipelines.

**5.8.2 Safety device in the pressure pipeline**

For pumps delivered without a pressure-relief valve, an overload protection must be provided in the control, or a pressure-relief valve (return valve) in the pressure pipeline (see separate Operating Instructions).

**5.9 Electrical connections**

The power supply cables of the coupled drive motor must be connected by a trained electrician, according to the motor manufacturer's circuit diagram. The applicable VDE regulations and local power company rules must be observed.

Danger from electrical energy must be eliminated.



## 6 Start-up/Shutdown

### 6.1 Preparation for start-up

#### 6.1.1 Filling the pump with fluid

**ATTENTION** Prior to initial operation, the screw pump must be filled with fluid and bled. This at the same time provides the spindles with the sealing required for suction.

**The pump must not run dry.**

**ATTENTION** Before filling, the operator must ensure careful and thorough rinsing of the pump if the fluid to be conveyed is not chemically compatible with the test medium (see performance test report).

The fluid is filled through a bore hole in the pump casing or via the pressure pipeline. The pump must be filled with fluid until the fluid emerges free from air.

In the case of immersion pump aggregates the filling level must ensure adequate covering of the inlet rim before and during operation.

During bleeding of the pump and the plant, hazardous or environmentally harmful fluid and gas emerging must be safely collected and discharged.



#### 6.1.2 Control of drive motor direction of rotation

The direction of rotation of the motor must match the direction of rotation arrow on the pump. The motor can be briefly switched on with the suction and pressure valves open to check the direction of rotation. If the direction of rotation is wrong there is no pump suction. This damages the pump. The direction of rotation of the three-phase motor can be reversed by swapping any two phases.

**ATTENTION** If the direction of rotation is to be checked before the pump is filled with fluid, the drive motor must be disconnected from the pump. The pump must not run dry.

### 6.2 Start-up

#### 6.2.1 Starting

- Prior to starting, the stop valves in the suction and pressure pipelines must be completely opened.

- Where the pump is fitted with a pressure-relief valve, it is preset ex works. The opening pressure can be altered within narrow limits by means of an adjusting screw. The installation of a pressure-relief valve is always required when an impermissible pressure rise is possible, due to a stop device or throttle point in the pressure pipeline for example.

**ATTENTION** When starting and stopping the pump under pressure, make sure that the speed- and viscosity-dependent pressure load is not exceeded.

If this is not ensured, the pump must be started and stopped at zero pressure. This also applies to pumps with speed-controlled drive motors.

- During starting, a vent valve installed on the outlet side of the plant must be opened until the air has escaped from the suction side of the pump. As soon as fluid emerges the vent valve can be closed. The pump is self-priming and is automatically vented without counter-pressure.

- The fluid level in the tank must be checked. It must be ensured that, when the plant is running, the fluid level in the tank does not fall below the minimum limit. Top up fluid as necessary.

#### 6.2.2 Drive

Switch on the motor.

Pay attention to product-specific characteristics. Refer to the operating instructions of the drive motor manufacturer.

#### 6.2.3 Checking the delivery values

When the motor has reached its operating speed, the inlet pressure and outlet pressure of the pump must be checked using manometers.

The motor must not be overloaded. The current consumption can be checked with an ammeter. In this connection, the temperature and viscosity of the fluid must also be checked. The readings must be checked against the layout or acceptance test report.

**ATTENTION** If there should be an inadmissible increase in pressure, mounted pressure-relief valves may shift the media from the discharge to the intake side (recirculation).

Recirculation leads to heating up of the medium. An inadmissible pressure and temperature increase can be indicated by a pressure gauge and a thermometer. Determine the cause immediately and eliminate it in order to avoid damage to the pump as the result of excessive heating up and the related drop in viscosity.

**ATTENTION** At no time may the permitted maximum temperature be exceeded. Sudden temperature changes are to be avoided. Within the permitted operating temperature range, the temperature gradient may not exceed 2°C/min.

### 6.3 Shutdown

#### 6.3.1 Stopping and interrupting operation

- Switch off the motor. Make sure the pump runs down smoothly and evenly.

- If a check valve is installed in the pressure pipeline, the stop valve can remain open. If no check valve is fitted, the stop valve must be closed.

#### 6.3.2 Measures in case of prolonged interruption

If a prolonged interruption is intended, the pump must be drained thoroughly via the connections on the pump casing. We recommend removing immersion pumps from the tank or the plant.

Safe draining and environmentally compatible disposal of the fluid must be ensured.

Preservative should then be applied to the pump (see Section 3.3).



## 7 Maintenance/Repair

### 7.1 Maintenance

- The instructions in Section 2, *Safety*, must be observed in maintenance and repair work.
- Regular monitoring and maintenance of the pump and the drive motor are essential for optimum service life and safety.

#### 7.1.1 General monitoring

- The pump must not run dry.
- The drive motor must not be overloaded.
- The suction and pressure pipelines must be checked for leaks. Air must be prevented from entering the delivery system.
- The shaft seal must have no inadmissible leakage.
- Changes to the normal operating data may indicate faults. The causes must be established.
- Installed standby pumps must be started up once a week.
- Any additional devices on the pump/shaft seal must be operated and monitored in accordance with regulations.

#### 7.1.2 Maintenance of components

##### 7.1.2.1 Bearing

The bearing is designed for a service life of approx. 24,000 hours under normal operating conditions. The actual usable life may be lower, due to intermittent operation, high temperature, low viscosity or the like. The running noises and the temperature in the bearing area must be checked at regular intervals. We recommend monitoring bearings by means of shock pulse measurements. If damage to a bearing is detected, the bearing must be replaced.

 The bearing area can become very hot.  
Risk of burning if touched!

**As a precautionary measure, we recommend that the groove ball bearing is replaced every 2 years.**

Pumps with special design feature "E" are fitted with a greasable groove ball bearing. The groove ball bearing and the bearing area are adequately charged with grease at the factory. The groove ball bearing must be subsequently greased in accordance with the intervals below.

##### Rolling bearing greases

For the lubrication of the groove ball bearing, we recommend to use the below-listed rolling bearing greases or equivalent. The order of producers is no quality ranking.

Producer	Brand name	Designation to DIN 51825
Agip	Agip GR MU3	K3K-20
ARAL	Aralub HL3	K3K-20
BP	BP Energrease LS3	K3K-20
ESSO	BEACON 3	K3N-30
Fuchs	RENOLIT FWA 220	K3N-20
Klüber	MICROLUBE GL 263	K3N-20
Mobil-Oil	Mobilux 3	K3K-20
Shell	Shell Alvania Fett R3	K3N-30
SKF	SKF-Fett LGMT3	K3K-30

If none of the listed rolling bearing greases is available, we recommend in any case a multi-purpose grease on lithium basis which corresponds to the above DIN designation.

Grease mixture with grease grades of different basic oils and thickeners leads to a reduction of the lubricating properties and must therefore be avoided.

##### Relubrication period

The relubrication period depends on the temperature of the pumped liquid and pump speed.

Temperat. of pumped liquid	Pump speed	every ... hours	at least every... month
< 100 °C	1450/1750 min <sup>-1</sup> 2900/3500 min <sup>-1</sup>	6000 h 4000 h	6 4
> 100 bis 150 °C	1450/1750 min <sup>-1</sup> 2900/3500 min <sup>-1</sup>	2000 h 700 h	3 1

##### Grease quantity

The table below shows the allocation of the pump size to the groove ball bearing size with the grease filling in grams.

Pump size	Groove ball bearing Abbreviation	Grease quantity in grams
40	6304 J C3	8
80	6304 J C3	8
140	6306 J C3	16
210	6306 J C3	16
280	6307 J C3	18
440	6308 J C3	22

##### Relubrication

Relubrication is effected by means of a grease gun through the lubricating nipple (281).

Relubrication must be continued for such a period of time until the old grease is displaced and fresh grease emerges at the groove ball bearing.

The groove ball bearing can be lubricated with the pump running.

**7.1.2.2 Shaft seal**

The built-in mechanical seal is maintenance-free. A maximum dripping rate of 10 g/h may occur during operation and is normal. If the dripping is heavier, the shaft seal must be replaced.

 A defective shaft seal can cause uncontrolled discharge of pumping liquid.  
**This constitutes a hazard to people (possibility of spraying liquid) and to the environment!**

**7.1.2.3 Pressure-relief valve**

Pressure-relief valves must be checked from time to time, in particular after prolonged downtimes, for passage and functioning. Leaking pressure-relief valves may cause damage to the pump. Damaged parts should be replaced or repaired as necessary.

**7.1.2.4 Coupling**

The alignment of the coupling and the condition of the flexible elements in the coupling should be checked after initial start-up and at regular intervals.

**Note:** Worn flexible elements must be replaced.

**7.1.2.5 Drive**

Refer to the operating instructions of the motor manufacturer.

**7.2 Repair****General**

 The system operator is responsible for ensuring that instruction in safety is provided. The personnel must be made aware of all hazards that can arise in connection with the pumped liquid or the plant.

**Mounting and repair work**

Trained Service fitters are available on request to carry out mounting and repair work.

 For all repairs, it must be ensured that the pump is depressurised, completely drained and cool. The motor must be protected against unintended switching on. We must refuse acceptance of repair work on pumps filled with fluid, for the protection of our staff and for environmental reasons. The expenditures for disposal with respect to the environment are to be carried by the customer/operating company.

**Hazardous substances**

 Where repairs are to be carried out on pumps which have been operated with hazardous substances ① and/or environmentally harmful media, the customer/operator must inform its own personnel on site, or our personnel where repairs are returned to our factory or a service workshop, without being specifically requested to do so.

Together with the request for a Service fitter a verification of delivery material, for example in the form of a DIN safety data sheet, must be submitted to us. Alternatively, you can request a certificate of safety (form no. 448/191) from our Service department, filling it out truthfully, correctly and in full. Send the completed form to the center commissioned with carrying out the repair, or hand it to our Service fitter.

**① Hazardous substances are:**

- Toxic substances
- Health-endangering substances
- Corrosive substances
- Irritants
- Explosive substances
- Fire-inducing substances
- Highly flammable, easily flammable and normally flammable substances
- Carcinogenic substances
- Substances impairing fertility
- Genetically distorting substances
- Substances in other ways hazardous to humans

 Pumps or units which pump hazardous substances or substances that are dangerous to the environment must be completely decontaminated.

**7.2.1 Dismounting the screw pump**

Before dismounting, the following work must be carried out:

- 
- The power supply cable must be disconnected from the motor by an authorized electrician. Electrical danger must be eliminated! The motor must be secured against being switched on.
  - Close all stop devices in the suction and pressure pipelines.
  - Drain the fluid in flowable condition from the pump. **Note:** Use a collecting tank.
  - Hazardous substances and/or environmentally harmful media must be drained off and collected such that no danger to life and limb is created. Environmentally compatible disposal must be ensured.
  - The pump must be depressurized and drained.
  - Allow the pump and motor to cool to ambient temperature.
  - Remove the manometer cables, manometers and retaining brackets.
  - Remove the contact protection.
  - Remove the motor from the base plate or pump bracket where appropriate. **Note:** Use suitable lifting gear.
  - Remove immersion pump aggregates from the tank.
  - Remove supply/suction and pressure pipelines as appropriate.
  - Loosen the fastening and remove the pump from the base plate or pump bracket. **Note:** Use suitable lifting gear.

** The pump must be dismounted by a qualified technician using the pertaining drawings.**

To prevent damage, it is especially important to ensure that the components are dismounted concentrically and that they are not tilted.

**Dismounting instructions:**

- The fitting position of all components must be accurately marked before dismounting.

**7.2.2 Mounting the screw pump**

**ATTENTION** Before remounting check all parts for wear and aging and, as necessary, replace with **original replacement parts**.

Clean all parts before mounting. Always fit new gaskets.



**The pump must be mounted by a qualified technician using the pertaining drawings. The prescribed tightening torque must be observed.**

To prevent damage, it is especially important to ensure that the components are mounted concentrically and that they are not tilted.

**Mounting instructions:**

- The markings applied when dismounting must be observed. The components must be put back in their original fitting position.
- After tightening the screws it must be possible to turn the pump by hand without straining points.

**7.2.3 Tightening torque**

**Note:** With poor and lightly greased surfaces, the values must be increased by 10–15%, in order to reach the required performance.

Thread	Quality	Tightening torque [Nm]
M 4		1,1
M 6		3,9
M 8		9,8
M 10		18,6
M 12		32,3
M 16		78,4
M 20		156,8
M 24		289,1
M 27		426,3
M 30		578,2
M 4	5.6	2,5
M 6	5.6	8,8
M 8	5.6	21,6
M 10	5.6	43,1
M 12	5.6	73,5
M 16	5.6	181,3
M 20	5.6	352,8
M 24	5.6	661,5
M 27	5.6	975,1
M 30	5.6	1323,0
M 4	8.8	2,5
M 6	8.8	8,8
M 8	8.8	21,6
M 10	8.8	43,1
M 12	8.8	73,5
M 16	8.8	181,3
M 20	8.8	352,8
M 24	8.8	661,5
M 27	8.8	975,1
M 30	8.8	1323,0

**When the screw pump has been mounted the following work must be carried out:**

- Grease groove ball bearing (see Section 7.1.2.1).
- Align coupling (see Section 5.4).
- Attach supply/suction and pressure pipelines.
- Attach manometer lines, manometers and brackets to pump.
- Attach contact protection.
- The power supply cable must be connected to the motor by an authorized electrician. Electrical danger must be eliminated! Pay attention to direction of rotation.
- Fill pump with fluid.



**Start up pump as per instructions in Section 6.**

**7.3****Replacement parts/spare parts**

The parts marked with footnote ① in the parts list can be provided as replacement/spare parts.

However, for operational safety reasons, we recommend you always stock a complete standby pump. The advantage is that in the event of a fault or damage the standby unit can replace the non-functioning unit quickly and without great effort.

When ordering spare and replacement parts, besides the **part number, denomination and quantity**, the following should also be quoted:

**Pump abbreviation,  
Pump number,  
Year of construction.**

This information is engraved on the rating plate of the pump.

## 8 Operating Faults, Causes and Remedial Action

### 8.1 Faults with reference number for cause and remedial action

The table below is intended as a guide to identifying faults and their possible causes. Faults relating to the pressure-relief valve are listed separately.

If faults occur which are not listed here, or which cannot be traced back to the listed causes, we recommend consulting the factory, or one of our branch offices or sales offices.



The pump must be depressurized and drained when faults are being rectified.

Screw pump faults	Reference numbers for cause and remedial action
No pump suction and no delivery	1, 2, 3, 4, 5, 11
Delivery too low	2, 6, 7, 8, 9, 10, 11
Pump operates noisily	4, 5, 6, 7, 8, 10, 11, 12, 13
Irregular delivery	6, 7, 10
Pump gets too warm	6, 7, 11, 14, 16
Pump is seized	14, 15, 16
Motor overload	6, 13, 14, 15, 16
Pressure-relief valve faults	Reference numbers for cause and remedial action
Delivery pressure drops	17
Pressure-relief valve does not open	18
Pressure-relief valve does not close	19
Pressure-relief valve knocks	20

### 8.2 Causes and remedial action

Ref. no.:	Cause	Remedial action
1	Pump not filled with fluid before initial operation.	Fill pump with fluid.
2	Stop valves/sliders not open or only partially open.	Fully open stop valves/sliders during operation.
3	Motor direction of rotation wrong.	The direction of rotation of the motor must match the direction of rotation arrow on the pump. The direction of rotation can be reversed by swapping any two phases.
4	Suction pipeline or shaft seal leaky.	Retighten flange screw connections. Check shaft seal.
5	Air in suction and pressure system.	Open vent valve on pump pressure side until air has escaped. Close valve again.
6	Wrong fluid viscosity.	Check that viscosity matches entries in acceptance test report. In case of zero-pressure delivery of low-viscosity fluids, apply 1 to 2 bar to pump.
7	Pressure-relief valve leaking.	Check pressure-relief valve for passage. If necessary, regrind valve seat and/or exchange valve cone.
8	Geodetic suction head too high.	Check underpressure on suction side using connected pressure/vacuum gauge. Increase fluid level in tank, lower pump.
9	Motor speed too low.	Check speed and current consumption of motor. Check voltage and frequency against motor rating plate.
10	Air separating time in operating tank too short.	Provide better air separation in operating tank. Return lines must emerge below oil level of tank.
11	Fluid level in tank too low.	Fill tank to necessary fluid level.

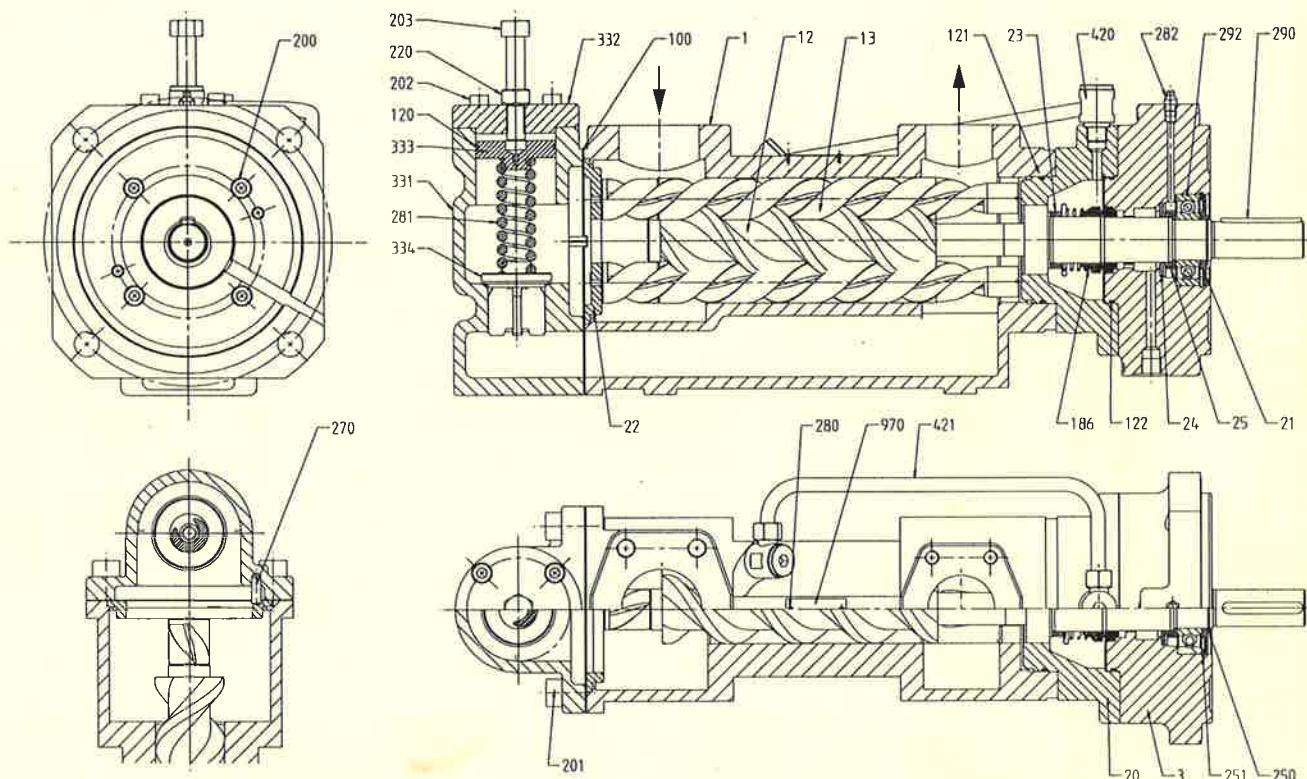
12	Flow rate in suction and pressure pipelines too high.	Flow rate in suction pipeline must not exceed max. 1 m/s, and in pressure pipeline max. 3 m/s.
13	Motor speed too high.	Check speed and current consumption. Check voltage and frequency against motor rating plate.
14	Delivery pressure too high.	Set specified delivery pressure via pressure-relief valve. Pump outlet pressure must not be exceeded.
15	Foreign bodies in pump.	Dismantle pump, remove foreign bodies and smooth damaged points with oilstone. Check suction filter and strainer.
16	Damaged ball bearing.	Replace ball bearing.
17	Pressure spring fatigued.  Valve seat leaking.	Install new pressure spring.  Install new valve cone.
18	Pressure spring heavily pre-tensioned.  Valve cone stuck in valve housing.  a) Due to foreign body or  b) Operating temperature of plant substantially higher than quoted on order.	Release pressure spring using adjusting screw, and reset to required pressure.  Dismantle pressure-relief valve. Clean internal parts.  Consult factory.
19	Pressure spring not pre-tensioned, or insufficiently pre-tensioned.  Valve seat leaking.	Turn adjusting screw to right until required operating pressure is reached.  Rework or replace valve cone and valve housing.
20	Pressure-relief valve knocking.	Check overpressure with pressure valve closed. Reset valve. Opening pressure 10 % above operating pressure.

## 9 Associated Documentation

### 9.1 Sectional drawing and parts list

TRL...E... - Flange pump, regreasable anti-friction bearing, shaft seal mechanical seal

~~Design with pressure-relief valve~~



The pictorial presentation may not correspond with the pump supplied.  
The actual design will be stated in the specific order documents.

Part No.	Denomination
1	Pump casing
3	Pump cover
12	Driving spindle
13	Idler spindle
20	Intermediate cover
21	Labyrinth ring
22	Thrust cover
23	Spacer ring
24	Labyrinth ring
25	Labyrinth ring
100 ①	Gasket
120 ①	O-ring
121 ①	O-ring

Part No.	Denomination
122 ①	O-ring
186 ①	Mechanical seal
200	Socket-head cap screw
201	Socket-head cap screw
202	Socket-head cap screw
203	Hexagon screw
220	Hexagon nut
250	Circlip
251	Circlip
270	Spring dowel
280	Rivet
281 ①	Valve spring
282	Grease nipple

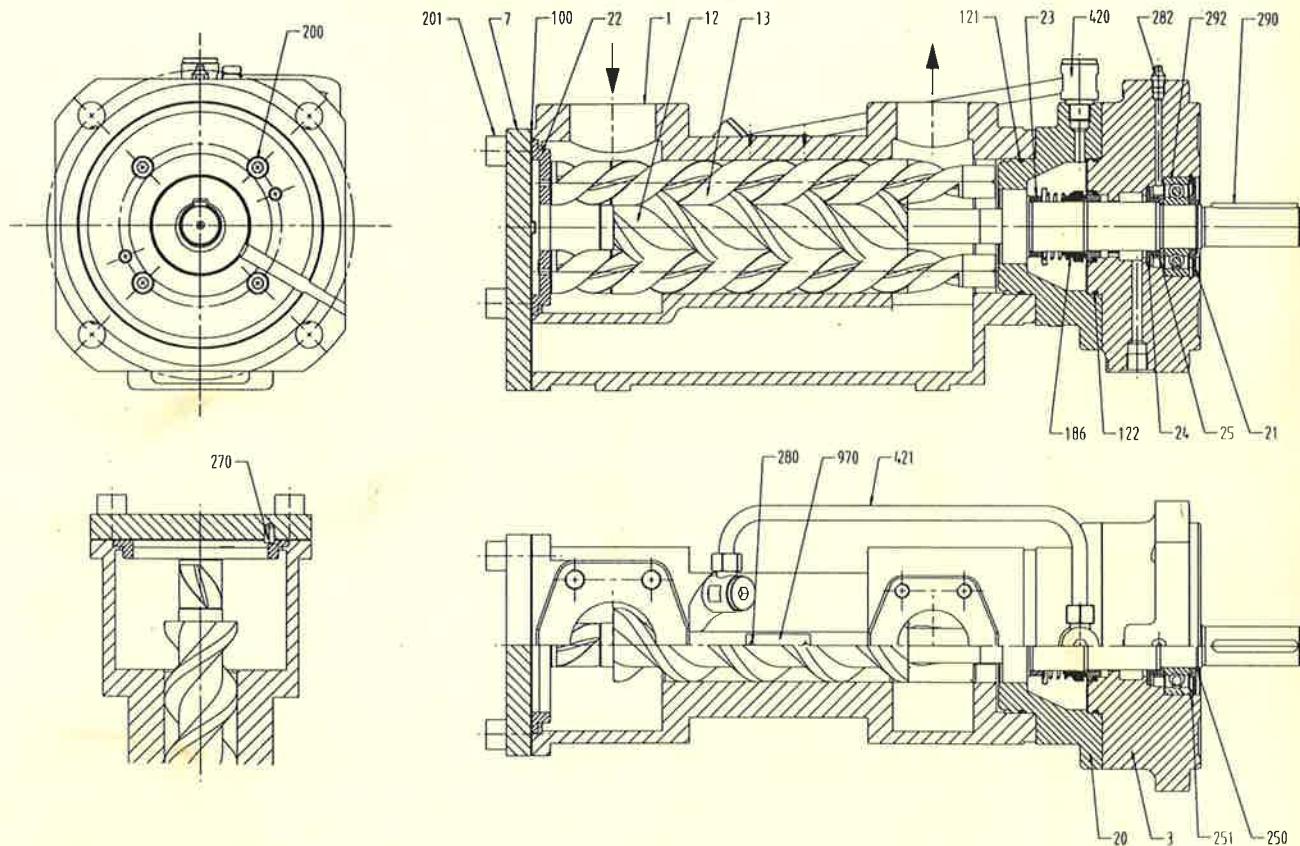
Part No.	Denomination
290	Key
292 ①	Groove ball bearing
331	Valve casing
332	Cover
333	Valve spring plate
334 ①	Valve cone
420	Screwed connection
421	Pipe
970	Name plate

① Spare parts

9.2 Sectional drawing and parts list

TRL...E.. - Flange pump, regreasable anti-friction bearing, shaft seal mechanical seal

Design with sealing cover



The pictorial presentation may not correspond with the pump supplied.  
The actual design will be stated in the specific order documents.

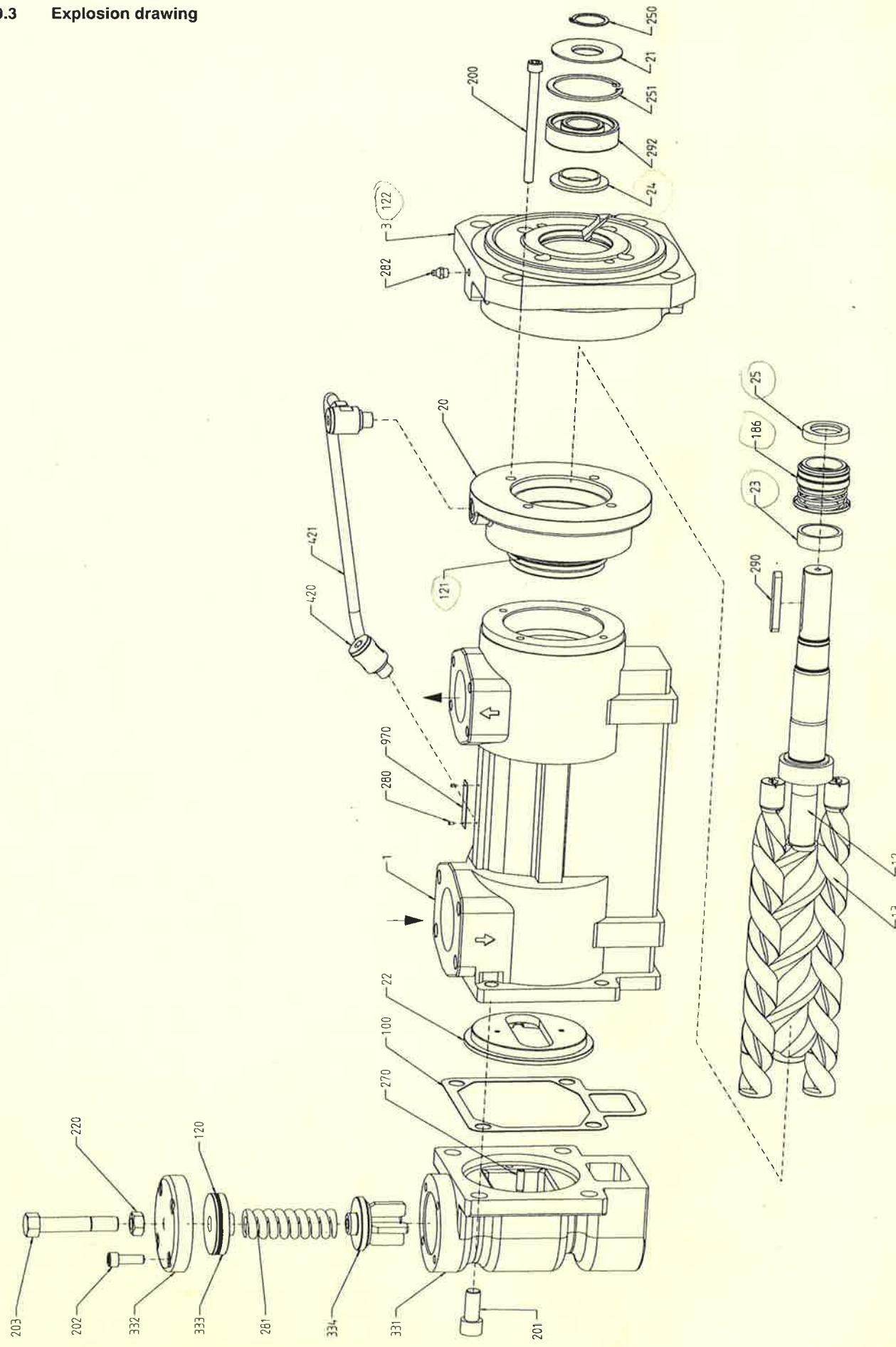
Part No.	Denomination
1	Pump casing
3	Pump cover
7	Sealing cover
12	Driving spindle
13	Idler spindle
20	Intermediate cover
21	Labyrinth ring
22	Thrust cover
23	Spacer ring
24	Labyrinth ring
25	Labyrinth ring
100 ①	Gasket
121 ①	O-ring

Part No.	Denomination
122 ①	O-ring
186 ①	Mechanical seal
200	Socket-head cap screw
201	Socket-head cap screw
250	Circlip
251	Circlip
270	Spring dowel
280	Rivet
282	Grease nipple
290	Key
292 ①	Groove ball bearing
420	Screwed connection
421	Pipe

Part No.	Denomination
970	Name plate
20	
251	
250	

① Spare parts

9.3 Explosion drawing





Subject to technical alterations.



A Member of the  
COLFAX PUMP GROUP

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Internet: <http://www.allweiler.com>

## ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2 Rev.no.: 2  
 CUSTOMER.....: Hayvard Leirvik as  
 CUSTOMER REF....: 096 CHS/ERP Date of issue: 30/10-07

SFI 711 - LUBE OIL PUMP (L O TRANSFER PIP)

\*\*\*\*\*  
 TRI LUB 80 R 46 WIIS (AS FITTED)

30,00 ~~TRE 40 R 46 U 18.1 V W 202 IEC 90 w/flanges~~ Number: 1,00

Allweiler self-priming three-screw pump with flexible coupling and el.-mtor. By externally adjustable built-in pressure relief valve. To be mounted vertical or horizontal.

Counterflanges are included.

Technical specification: Screw spindle pump

Serialno.:	6037692,
Capacity.....	....m3/h: 6,0
Diff. pressure.....	....bar: 1,5
Rpm.....	... rpm: 3500
Power absorbed.....	.....Kw: 2,2 - 1,25
NPSHr.....	.....m: 7,1 - 3,5
Medium.....	.....: Lube oil
Viscosity.....	....mm2/s: 750 - 200
Pump casing.....	material: N.Cast iron
Screws.....	material: Surface treated st.
Bearing.....	ext./int: Int.
Shaft seals.....	....type: Mech.seal
Safety valve.....	.....: Built-in

30,10 EL-MOTOR 90L-2 MARINE Number: 1,00

Technical specification: El-motor

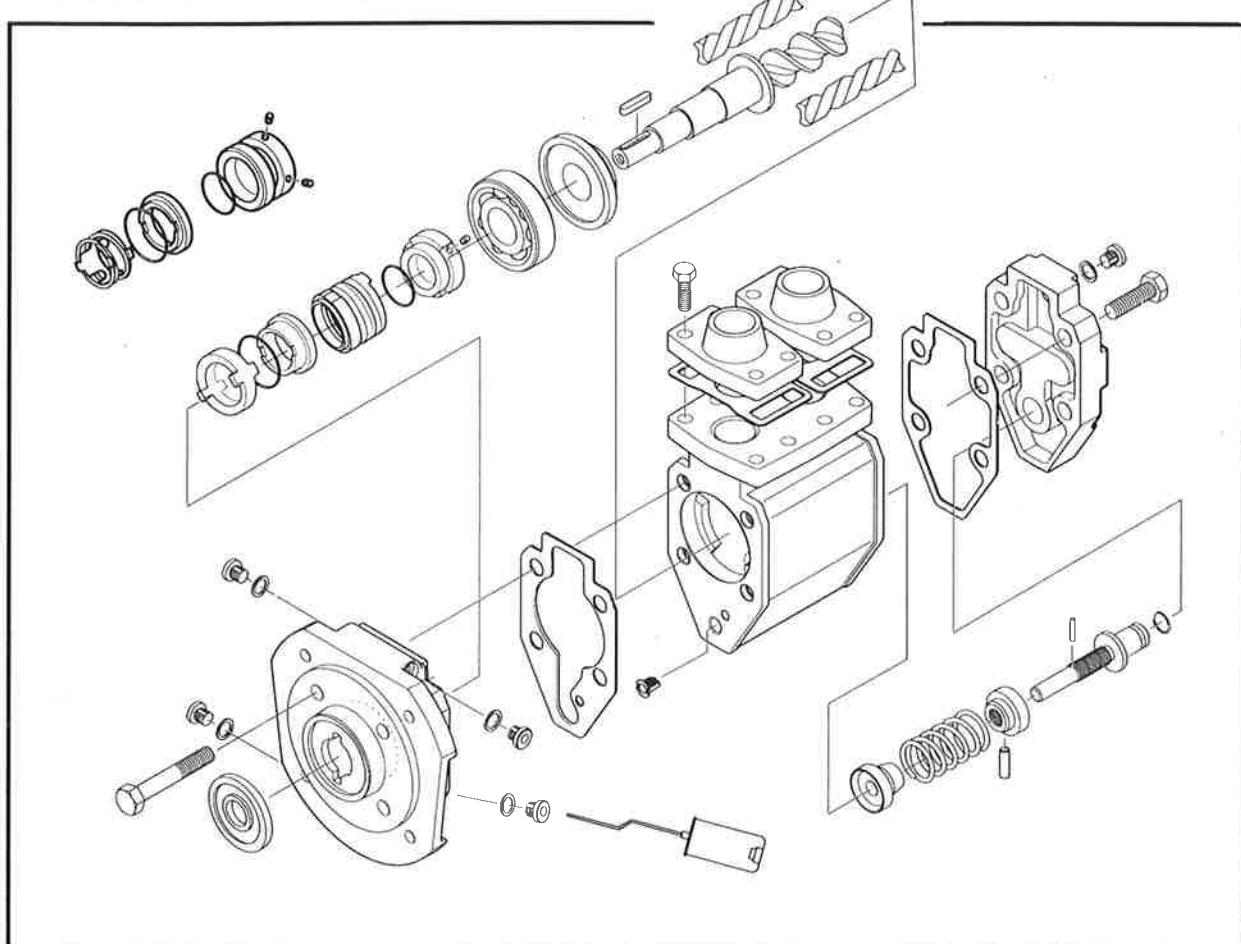
Rated power.....	.....KW: 2,5
RPM.....	...Rpm.: 3500
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: TO BE GIVEN
Starting method....	....type: DOL
Construction method.	....type: B5
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	.....K: 90

30,40 CERTIFICATE DNV, PUMP Number: 1,00

30,60 TEST REPORT DNV EL-MOTOR Number: 1,00



## Maintenance and Service Instruction



This instruction is valid for all TRE pump models shown on page 2

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List of components	2
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Ordering code/Service intervals	4
Sectional view	5
Useful tools/Shaft seal-assembly drawing	6
Dismantling/reassembly	7
Pressure relief valve/SealGuard	11



**Before commencing any work, read this instruction carefully! Failure to comply with these instructions may cause damage and personal injury!**

For more information about the pumps identification code, technical data and performance we refer to the TRE Product description. For more information about the pumps installation, Start-up and trouble shooting we refer to the "Installation and Start-up instruction" for Low Pressure Pumps, ident No 550 802.

## List of components

Valid for all pumps in sizes: TRE 20,40,80

With code for shaft seal: 18.1 = type carbon

18.2 = type Silicon carbide

18.3 = type Silicon carbide with SealGuard

Pos	Denomination	Q-ty	Components included in spare parts set: G053A	Notes
1010	Power rotor	1		
1020	Power rotor	1		
113	Key	1		
122	Ball bearing	1	x	
125	Secondary seal	1	x	1
201	Idler rotor	2		
202	Idler rotor	2		
351	Balancing bush	1		
401	Pump body	1		
416	Suction flange	1		
417	Screw	8		
418	Gasket to suction flange	1	x	
423	Gasket to discharge flange	1	x	
427	Discharge flange	1		
440	Return valve	1		
451	Screw	4		
453	Screw	4		
462	Plug	1		
462A	Sealing washer	1	x	
463	Plug	1		
463A	Sealing washer	1	x	
501	Front cover	1		
506	Gasket	1	x	
509	Shaft seal	1	x	
537	Deareration plug	2		
537A	Washer	2	x	
551	Rear cover	1		
556	Gasket	1	x	
557	Plug	1		
557A	Washer	1	x	
605	O-ring	1	x	
608	Valve spindle	1	x	
608A	Tension pin	1	x	
6120	Set screw	1	x	
613	Pin	1	x	
614	Valve piston	1	x	
615	Valve spring	1	x	
7310	Compl. Seal Guard	1		2,3
732	Gas generator	1		2

### Explanations:

G053A: Spare parts kit

### Notes:

1) For version 18.2 and 18.3

2) For version 18.3 only

3) Including Gasgenerator

## Exploded view

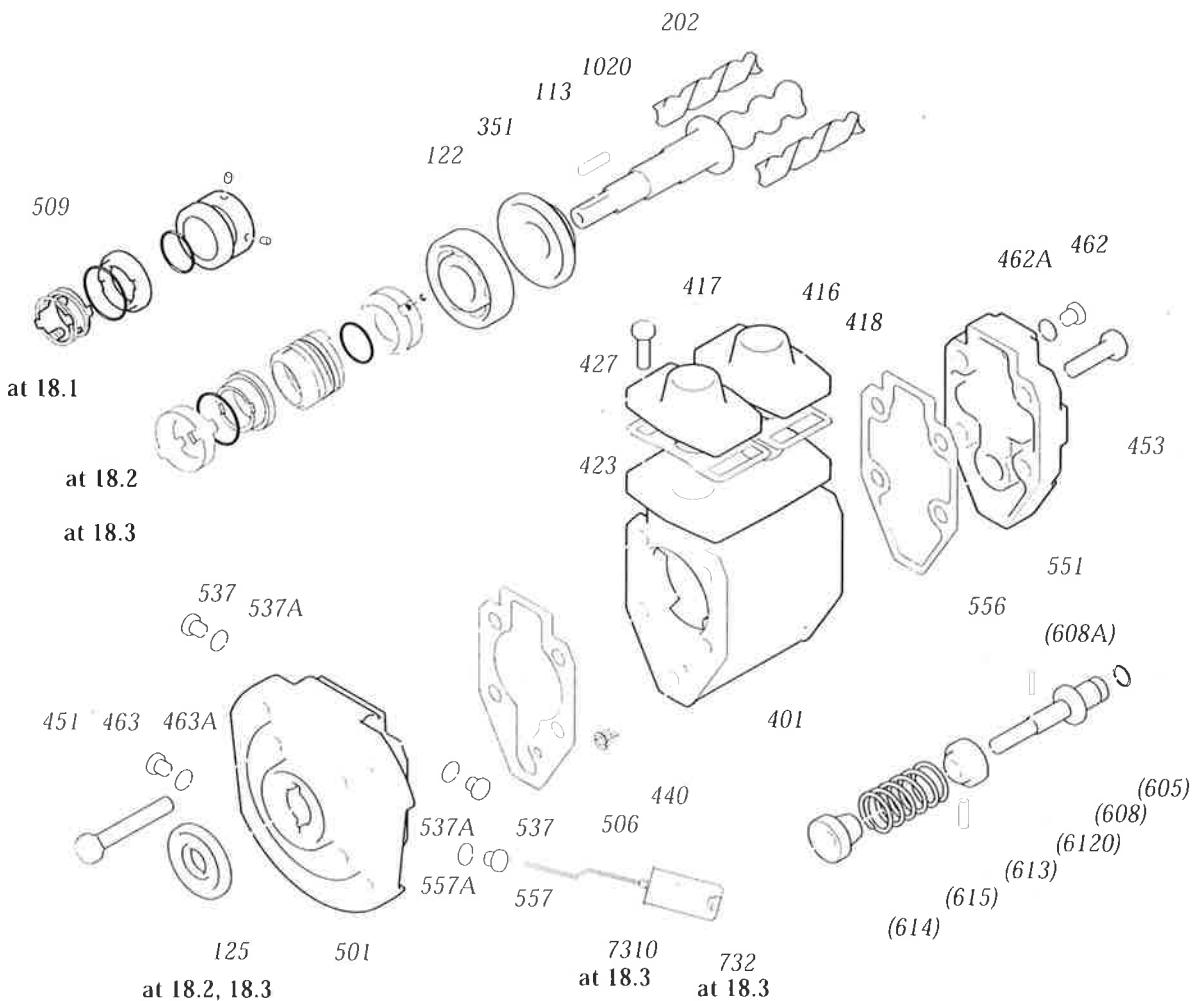


Fig. 1

**⚠** All work carried out on the pump has to be performed in such a manner that risks for personal injury are observed!

**⚠** When handling liquids that may harm skin use gloves and/or protective clothing.

**⚠** Before any maintenance work, ensure that the driver is deenergized and the pump hydraulically isolated.

**⚠** Connecting and disconnecting of electric cables must be done only by personnel authorized to do such work.

**⚠** When handling liquids which may involve fire hazards appropriate precautions to avoid danger are to be taken.

**⚠** In case of failure for a system with elevating pressure fluid jets may cause injury and/or damage.

**⚠** Oil leakage may make the floor slippery and cause personal injury.



## Ordering code

Item	Spare Parts sets	Part numbers for pump size		
		20	40	80
G053A	Spare parts kit with 18.1	70191335	70191335	70191337
	Spare parts kit with 18.2	70191336	70191336	70191338
	Spare parts kit with 18.3	70191336	70191336	70191338

**Recommendation:**

For maintenance the following spare part sets are recommended:

**Set:**            **To be used:**  
**G053A**        Spare parts kit  
 For service.

## Service intervals

The intervals for inspection and replacement of wear parts vary greatly with the properties of the pumped liquid and can only be determined by experience. Pumping liquid which contains abrasive materials, or liquid that is corrosive, will significantly reduce service life and call for shorter service intervals. Wear will normally show as unnormal:

- Vibration
- Noise
- Loss of capacity
- Reduction in flow/pressure
- Leakage

**⚠ If the pumps operating temperature exceeds 60°C let the pump cool off before any service, maintenance or dismantling work is commenced to avoid burn injury.**

## Inspection of shaft seal

Excessively leaking shaft seals (more than 10 drops per hour) should be changed without delay, as the leakage normally will grow worse and cause additional damage.

In installations where unplanned shut downs must be avoided, it is advisable to dismantle the pump for a thorough inspection and thereby change out shaft seal and ball bearing, every three years as a max period.

It is recommended always to have the spares included in minor spare part kit G053A available.

## Inspection of rotors

A quick inspection of the idler rotors can be made simply by removing the rear cover. Note that the driver must be deenergized and the pump hydraulically isolated before the rear cover is removed. If a more thorough investigation is needed, proceed as under "Dismantling/Reassembly".

## Sectional view

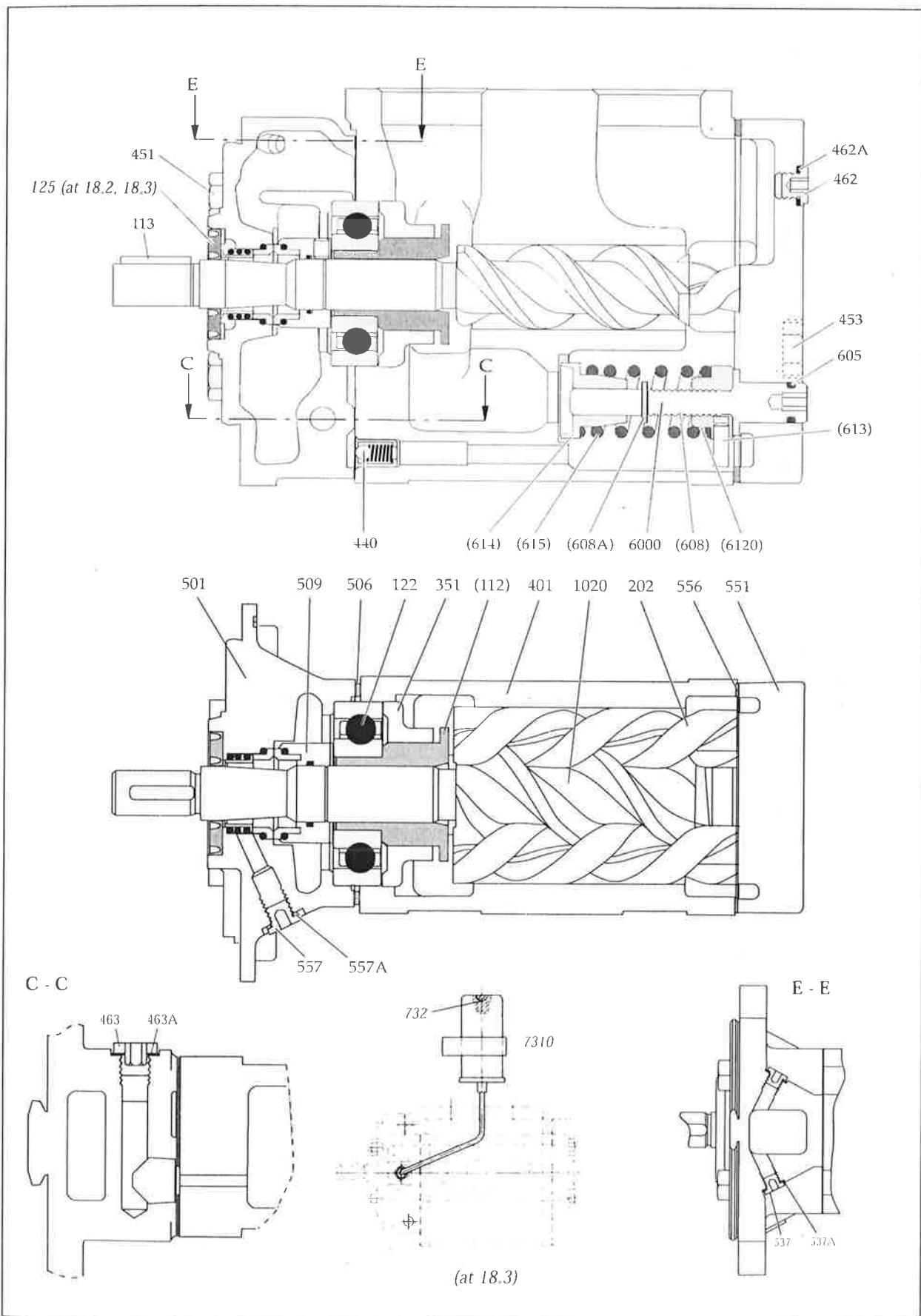


Fig. 2



## Useful tools

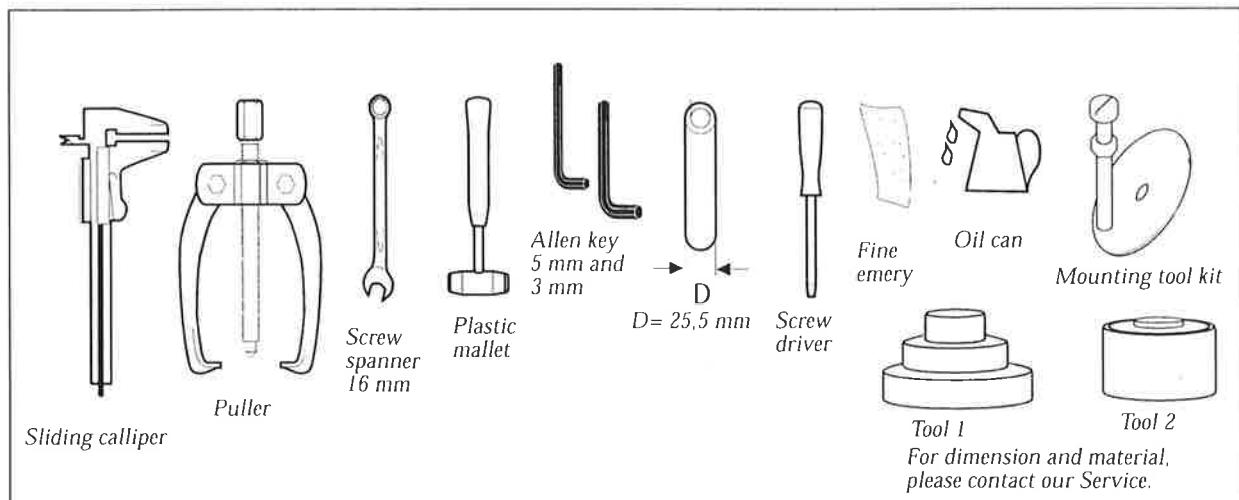


Fig. 3

## Shaft seal - assembly drawing

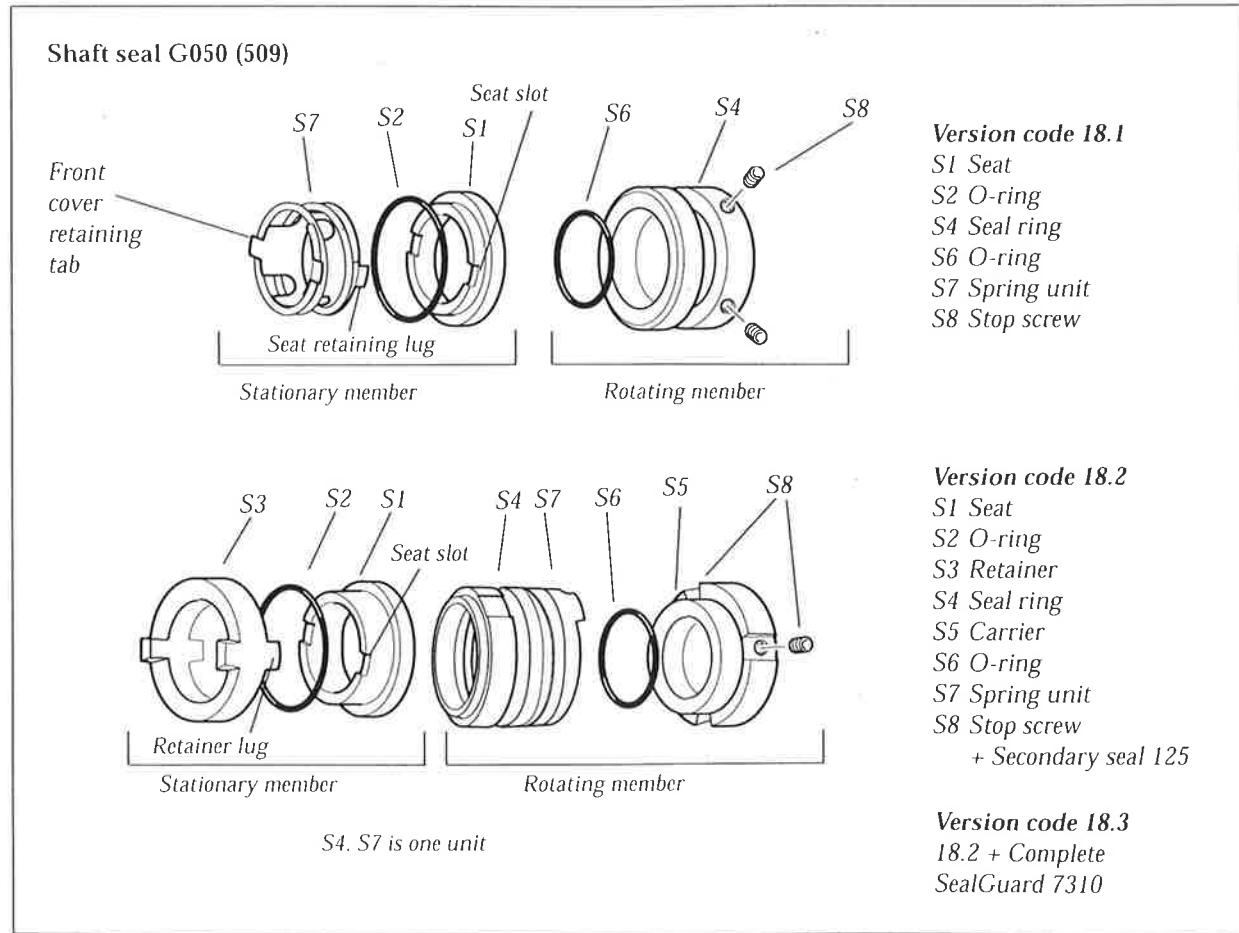


Fig. 4



## Dismantling

**A.**

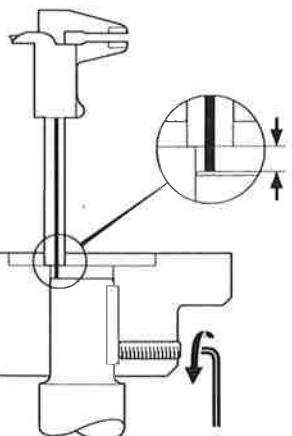
- Turn the electricity OFF.

- Close the valves.
- Remove the pump from the system.

**ATTENTION**

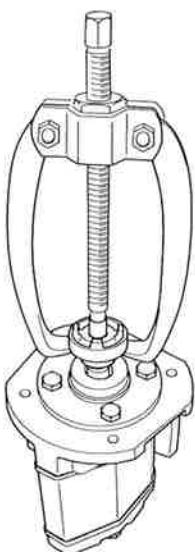
**Use appropriate vessels to collect oil spillage when removing and opening the pump.**

Fig. 5

**B.**

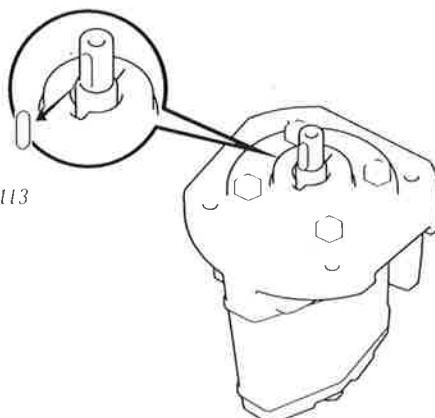
- Note the position of the shaft coupling.
- Release the stop screw.

Fig. 6

**C.**

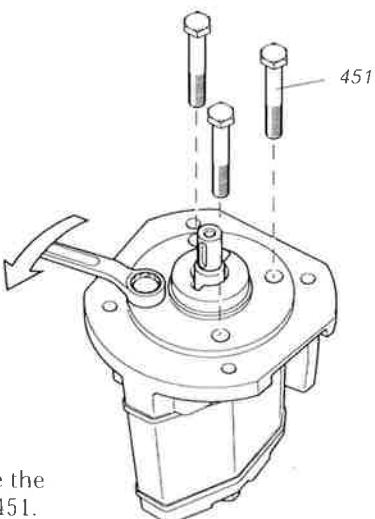
- Remove the shaft coupling.

Fig. 7

**D.**

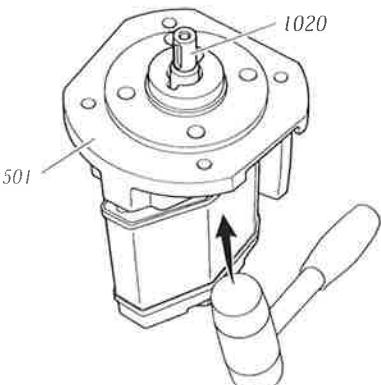
- Remove the key 113.

Fig. 8

**E.**

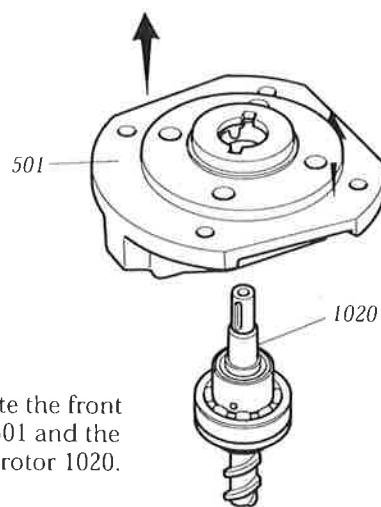
- Remove the screws 451.

Fig. 9

**F.**

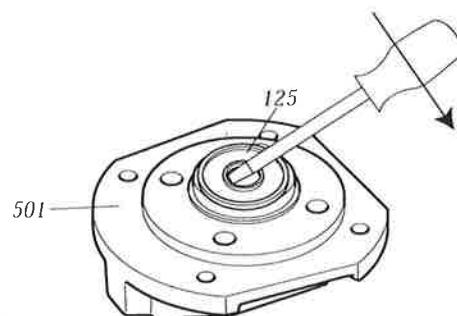
- Remove the front cover 501 and power rotor 1020.

Fig. 10

**G.**

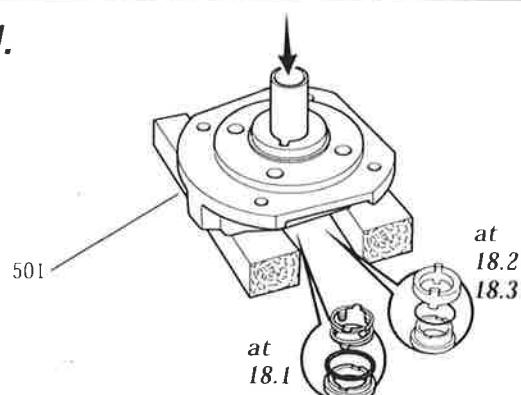
- Separate the front cover 501 and the power rotor 1020.

Fig. 11

**H. 18.2 and 18.3**

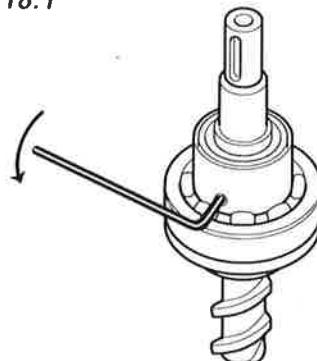
- Remove the secondary seal 125 with a suitable screw driver.

Fig. 12

**I.**

- Place the front cover 501 on a pair of wooden pieces.
- Press out the shaft seal, stationary member with a suitable tool.

Fig. 13

**J. 18.1**

- Loosen the shaft seal rotating member.

Fig. 14

**K. 18.2 and 18.3**

- Insert two suitable screw drivers in the carrier S5 slots and gently push the rotating member S4, S7 off the rotor shaft.
- Loosen the two stop screws S8 (3 mm Allen key) on the carrier S5 and pull it off.

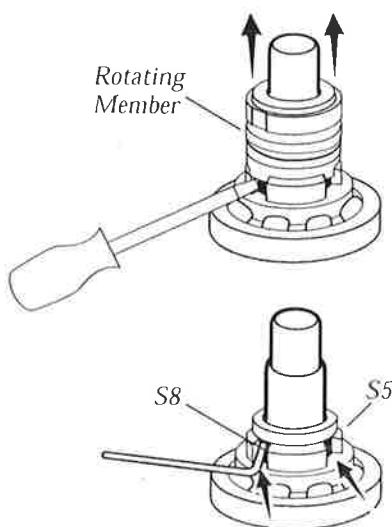
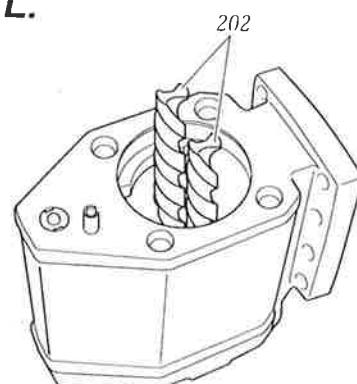


Fig. 15

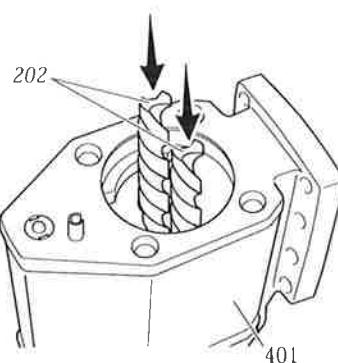
**L.**

- Remove and inspect the idler rotors 202.

Fig. 16

## Reassembly

**A.**

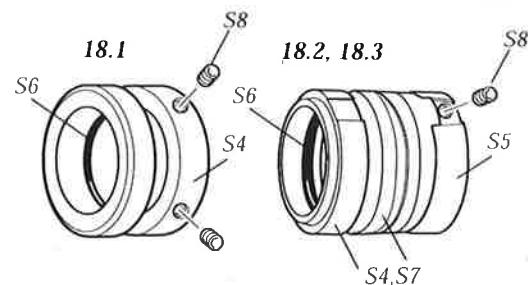


- Lubricate the idler rotors 202 and fit them into the pump body 401.

Fig. 17

**B.**

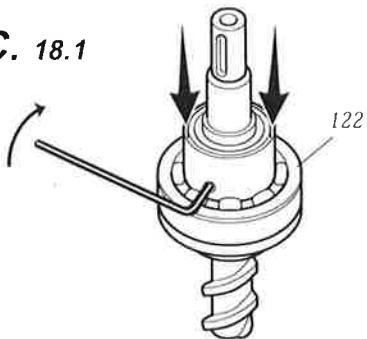
- Un-pack a new shaft seal 509.



- Check that the O-ring S6 is in place.

Fig. 18

**C. 18.1**



- Polish the power rotor shaft 1020 with a fine emery and oil.
- Fit the rotating member above the ball bearing 122 and lock it with its stop screws S8.

Fig. 19

**D. 18.2 and 18.3**

- Polish the power rotor shaft 1020 with a fine emery and oil.
- Fit the carrier S5 tight against the ball bearing. Make sure the carrier is not fitted upside down.
- Firmly tight the two stop screws S8.
- Lubricate the O-ring S6 in the rotating member with oil.
- Press the rotating member S4, S7 gently on to the rotor shaft and make sure the driving lugs enters the slots in the carrier S5.

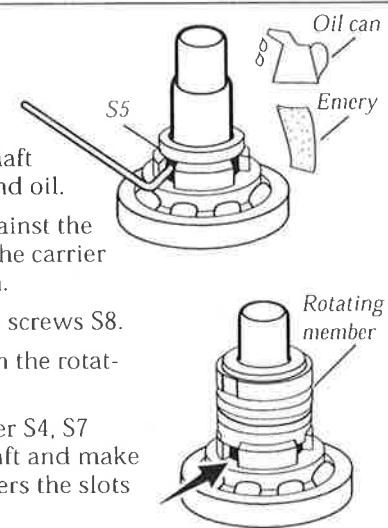
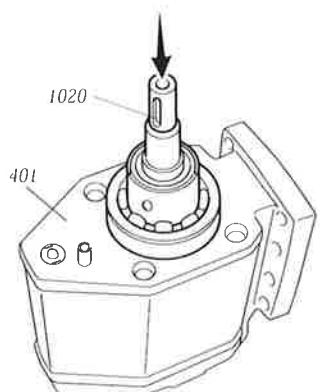


Fig. 20

**E.**



- Insert the Power rotor 1020 into the pump body 401.

Fig. 21

**F. 18.2 and 18.3**

- Press the Secondary seal 125 in place with a suitable tool in two steps as shown. Use a column drill machine as a press tool.
- NOTE!  
Tool nr 2 has one end for sizes 025, 032 and one end for size 038

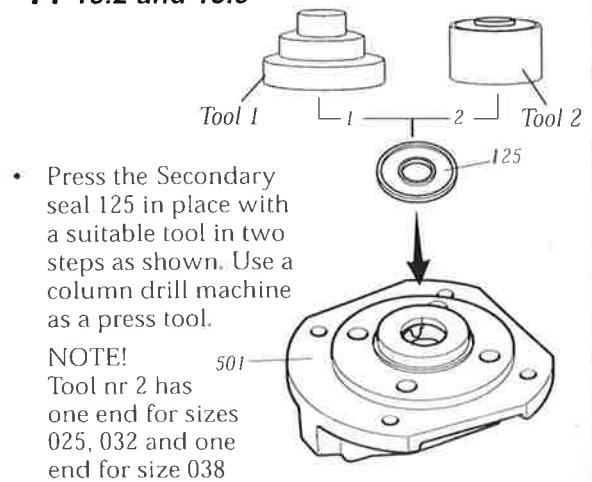


Fig. 22

**G. 18.1**

- Fit the spring unit S7 in place. Note the position for the Seat slots and lugs. (See fig 4.)
- Lubricate the O-ring S2 and put it on the seat S1. Fit the seat S1 on top of the spring unit. Watch position of the Seat slots and lugs. (See fig 4.)
- Press the seat gently into the recess in the front cover 501 with a suitable tool as shown.
- Turn the front cover 501 up-side down. The seat shall now remain in the cover.

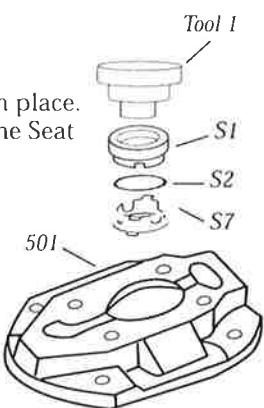


Fig. 23

**H. 18.2 and 18.3**

- Fit the retainer S3 in place. Note the position for the retainer lugs and cover slots. (See fig 4.)
- Lubricate the O-ring S2 and put it on the seat S1. Fit the seat S1 on top of the retainer. Watch the position of the seat slots and lugs. (See fig 4.)
- Press the seat gently into the recess in the front cover 501 with a suitable tool as shown.
- Turn the front cover 501 up-side down. The seat shall now remain in the cover.

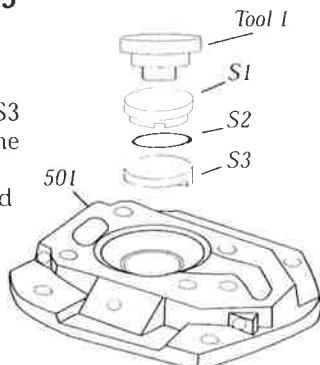


Fig. 24

**I.**

- Replace the gasket 506.
- Carefully fit the Front cover 501 on the pump.

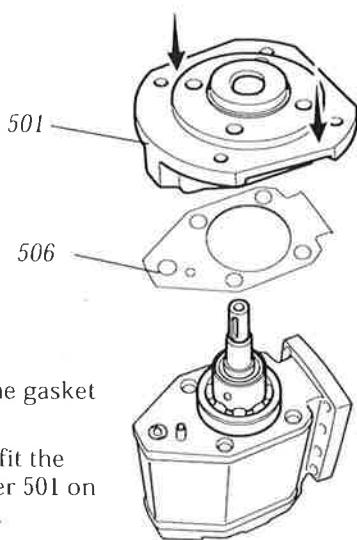


Fig. 25

**J.**

- Fit the screws 451.
- Tighten them crosswise, step by step to avoid deformation on bearing outer ring and seal damages.
- Turn the shaft to check that it moves without too much force.

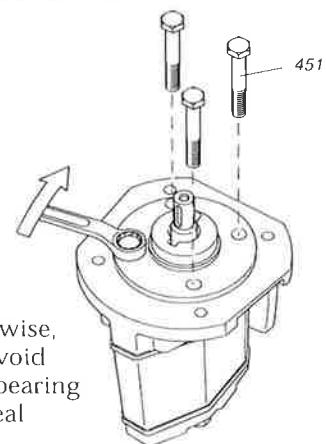


Fig. 26

**K.**

- Fit the key 113 back in place.

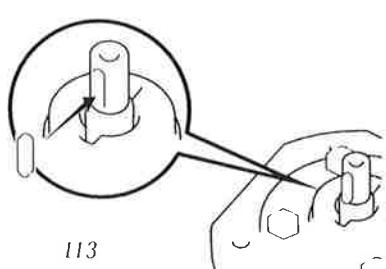


Fig. 27

**L.**

- Press on the shaft coupling to its original position.
- Tighten the stop screw.
- Install the pump back into the system and proceed according to instructions under "Start-up" in the Installation manual.

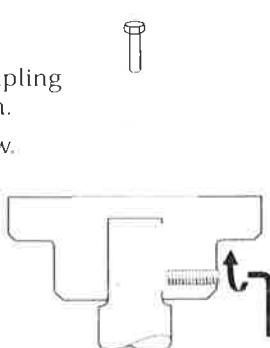


Fig. 28

## Pressure relief valve

**ATTENTION**

Spring tension.

- Release spring tension by turning set screw 6120 CCW as much as possible.
- Loosen and remove the screws 453.
- Separate the valve element from the rear cover 551.
- If necessary, replace the gasket 556 and the O-ring 605.
- Reassemble the parts in reverse order. Be careful to tighten the screws 453 crosswise.
- Readjust the valve pressure according to the "Installation and Start-up Instruction for Low pressure pumps".

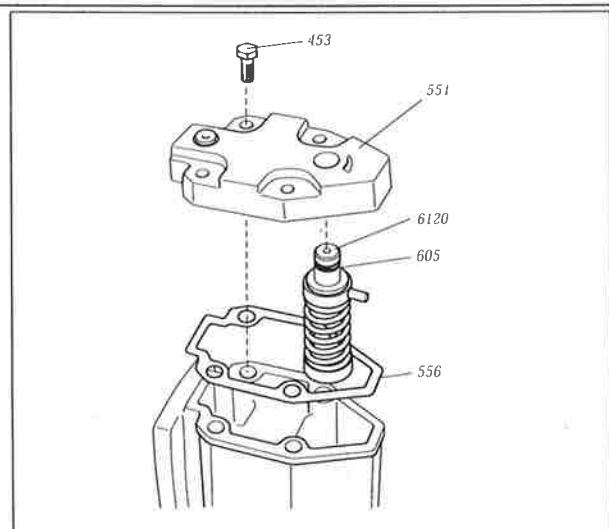


Fig. 29

## SealGuard

With code for shaft seal: 18.3 = type Silicon carbide with SealGuard

### Recharging

- 1) Disconnect the pipe connector (4) from the dispenser (2). Remove the check valve (3).
- 2) Remove the cover disk (10). Remove the gas generator (9) from the dispenser (2) with a 21 mm socket. Dispose the generator in the recycling system for batteries, where available. Push the piston to its "filled" position, and fill the dispenser with high-temperature resistant engine oil. Fit the check valve (3) and the connector (4) to the dispenser.
- 3) Feed oil into the hose (5) and seal compartment, for example with an oil-filled grease gun. Reconnect the hose (5) to the connector (4).
- 4) Fit a new gas generator (9) to the dispenser (2). Tighten with approx. 2 Nm. Clip on the cover disk (10).
- 5) Turn the gas generator set knob (3 mm Allen key) to no. 6 which will make the oil last for about 3 months.

**NOTE!**

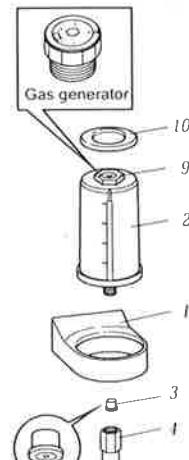
For longer periods of stand-by, the gas generator set-knob could be set to zero to avoid unnecessary oil consumption.



Keep away from open fire when removing the gas generator.

**ATTENTION**

The SealGuard can be readjusted or switched off during operation. Depending on temperature and setting, it can take from hours to a couple of days after starting, until oil is being dispensed.



For more information about SealGuard, read the Installation and start-up Instruction for SealGuard.

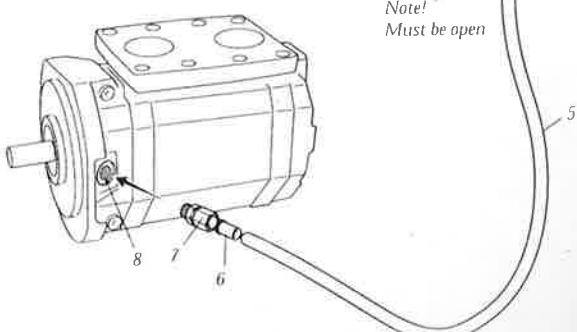


Fig. 30

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Subject to technical alterations



A Member of the  
COLFAX PUMP GROUP

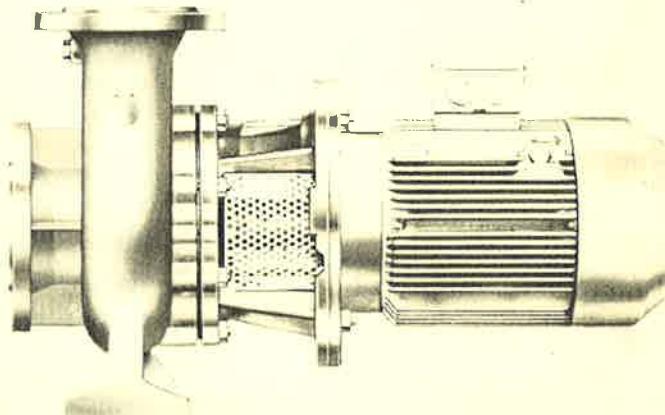
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Ident No 550 811  
October 2001

# Centrifugal Pump with Volute Casing

Operating manual

NB / CLB series



Version BA-2006.10  
Print-No. 550 148  
VM-No. 468.0005 GB

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We reserve the right to make technical changes.

CE

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# 1 About this document

This manual

- Is part of the pump
- Applies to the afore-mentioned pump series
- Describes safe and appropriate operation during all operating phases

## 1.1 Target groups

Target group	Duty
Operating company	<ul style="list-style-type: none"> <li>▶ Keep this manual available at the site of operation of the system, including for later use.</li> <li>▶ Ensure that personnel read and follow the instructions in this manual and the other applicable documents, especially all safety instructions and warnings.</li> <li>▶ Observe any additional rules and regulations referring to the system.</li> </ul>
Qualified personnel, fitter	<ul style="list-style-type: none"> <li>▶ Read, observe and follow this manual and the other applicable documents, especially all safety instructions and warnings.</li> </ul>

Tab. 1 Target groups and their duties

## 1.2 Other applicable documents

Document	Purpose
ATEX additional instructions	Operation in explosion hazard areas
Order data sheet	Technical specifications, conditions of operation
Setup drawing	Setup dimensions, connection dimensions etc.
Technical description	Technical specifications, operating limits
Sectional drawing	Sectional drawing, part numbers, component designations
Supplier documentation	Technical documentation for parts supplied by subcontractors
Spare parts list	Ordering spare parts
Declaration of conformity	Conformity with standards

Tab. 2 Other applicable documents and their purpose

### 1.3 Warnings and symbols

Warning	Risk level	Consequences of disregard
 <b>DANGER</b>	Immediate acute risk	Death, grievous bodily harm
 <b>WARNING</b>	Potentially acute risk	Death, grievous bodily harm
 <b>CAUTION</b>	Potentially hazardous situation	Minor bodily harm
<b>CAUTION</b>	Potentially hazardous situation	Material damage

Tab. 3 Warnings and consequences of disregarding them

Symbol	Meaning
	Safety warning sign ► Take note of all information highlighted by the safety warning sign and follow the instructions to avoid injury or death.
►	Instruction
1., 2., ...	Multiple-step instructions
✓	Precondition
→	Cross reference
	Information, advice

Tab. 4 Symbols and their meaning

### 1.4 Technical terms

Term	Meaning
Sealing medium	Medium for blocking or quenching shaft seals
Auxiliary systems	Systems for operating the pump

Tab. 5 Technical terms and their meaning

## 2 Safety

- The manufacturer does not accept any liability caused by
  - disregarding the entire documentation.

### 2.1 Intended use

- Only use the pump for pumping the agreed pumped media (→ order data sheet).
- Adhere to the operating limits and size-dependent minimum flow rate.
- Avoid dry running:  
Initial damage, such as destruction of the mechanical seal and plastic parts, will occur within only a few seconds.
  - Make sure the pump is only operated with, and never without, a pumped medium.
- Avoid cavitation:
  - Fully open the suction-side armature and do not use it to adjust the flow rate.
  - Do not open the pressure-side armature beyond the agreed operating point.
- Avoid overheating:
  - Do not operate the pump while the pressure-side armature is closed.
  - Observe the minimum flow rate (→ order data sheet).
- Avoid damage to the motor:
  - Do not open the pressure-side armature beyond the agreed operating point.
  - Note the maximum permissible number of times the motor can be switched on per hour (→ manufacturer's specifications).
- Consult the manufacturer about any other use of the pump.

#### Prevention of obvious misuse (examples)

- Note the operating limits of the pump concerning temperature, pressure, flow rate and motor speed (→ order data sheet).
- The power consumed by the pump increases with increasing density of the pumped medium. To avoid overloading the pump or motor, stay within the agreed density (→ order data sheet).  
Lower densities are allowed. Adapt the auxiliary systems accordingly.
- When pumping liquids containing solids, ensure the limits for the proportion of solids and the grain size are maintained (→ order data sheet, technical description).
- When using auxiliary systems, ensure there is a continuous supply of the appropriate operating medium.

### 2.2 General safety instructions

- Take note of the following regulations before carrying out
  - any work.

#### 2.2.1 Product safety

The pump has been constructed according to the latest technology and recognized technical safety rules. Nevertheless, operation of the pump can involve risks to life and health of the user or third parties and risk of damage to the pump and other property.

- Only operate the pump if it is in perfect technical condition and only use it as intended, staying aware of safety and risks, and in adherence to the instructions in this manual.
- Keep this manual and all other applicable documents complete, legible and accessible to personnel at all times.
- Refrain from any procedures and actions that would expose personnel or third parties to any risk.
- In the event of any safety-relevant faults, shut down the pump immediately and have the fault corrected by appropriate personnel.
- In addition to the entire documentation for the product, comply with statutory or other safety and accident-prevention regulations and the applicable standards and guidelines in the country where the pump is operated.

## 2.2.2 Obligations of the operating company

### Safety-conscious operation

- Only operate the pump if it is in perfect technical condition and only use it as intended, staying aware of safety and risks, and in adherence to the instructions in this manual.
- Ensure that the following safety aspects are observed and monitored:
  - Adherence to intended use
  - Statutory or other safety and accident-prevention regulations
  - Safety regulations governing the handling of hazardous substances
  - Applicable standards and guidelines in the country where the pump is operated
- Make protective equipment available.

### Qualified personnel

- Make sure all personnel tasked with work on the pump have read and understood this manual and all other applicable documents, especially the safety, maintenance and repair information, before they start any work.
- Organize responsibilities, areas of competence and the supervision of personnel.
- Ensure that all work is carried out by specialist technicians only:
  - Fitting, repair and maintenance work
  - Work on the electrical system
- Make sure trainee personnel only work on the pump under supervision of specialist technicians.

### Safety equipment

- Provide the following safety equipment and verify its functionality:
  - For hot, cold and moving parts: safety guarding provided by the customer
  - For possible build up of electrostatic charge: ensure appropriate grounding

### Warranty

- Obtain the manufacturer's approval prior to carrying out any modifications, repairs or alterations during the warranty period.
- Only use genuine parts or parts that have been approved by the manufacturer.

## 2.2.3 Obligations of personnel

- All directions given on the pump must be followed (and kept legible), e.g. the arrow indicating the direction of rotation and the markings for fluid connections.
- Do not remove the safety guarding for hot, cold or moving parts during operation.
- Use protective equipment if necessary.
- Only carry out work on the pump while it is not running.
- Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.
- Reinstall the safety equipment on the pump as required by regulations after any work on the pump.

## 2.3 Specific hazards

### 2.3.1 Explosion hazard area

- (→ ATEX additional instructions).

### 2.3.2 Hazardous pumped media

- Follow the safety regulations for handling hazardous substances when pumping hazardous (e.g. hot, flammable, poisonous or potentially harmful) media.
- Use protective equipment when carrying out any work on the pump.

### 3 Layout and function

#### 3.1 Labels

##### 3.1.1 Type plate



Fig. 1 Type plate (example)

- 1 Pump type
- 2 Year of manufacture
- 3 Differential head
- 4 Pump NPSH value
- 5 Kinematic viscosity
- 6 Power consumption
- 7 Density
- 8 Motor speed
- 9 Flow rate
- 10 Serial number

##### 3.1.2 ATEX plate

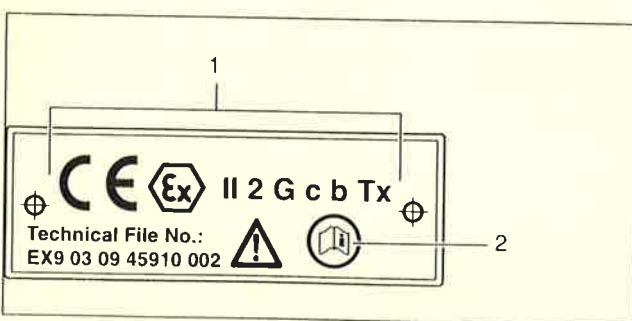


Fig. 2 ATEX plate (example)

- 1 Explosion protection mark
- 2 Reference to ATEX additional instructions

##### 3.1.3 Pump type code

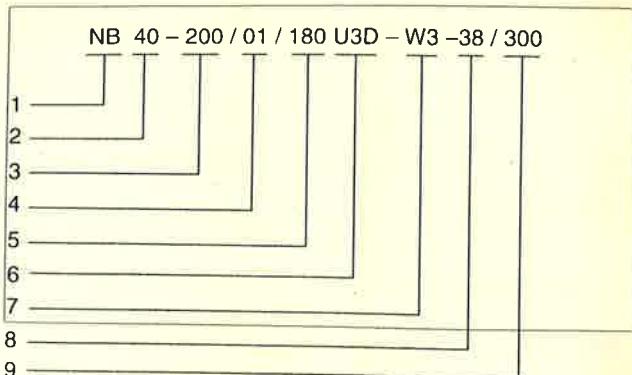


Fig. 3 Pump type code (example)

- 1 NB or CLB series
- 2 Pressure flange DN [mm]
- 3 Nominal impeller diameter [mm]
- 4 Hydraulic number (NB series only)
- 5 Actual impeller diameter [mm]
- 6 Shaft seal
- 7 Material key
- 8 Stub shaft bore hole diameter [mm]
- 9 Outer diameter of motor bell housing or intermediate ring or flange size of electric motor

### 3.2 Layout

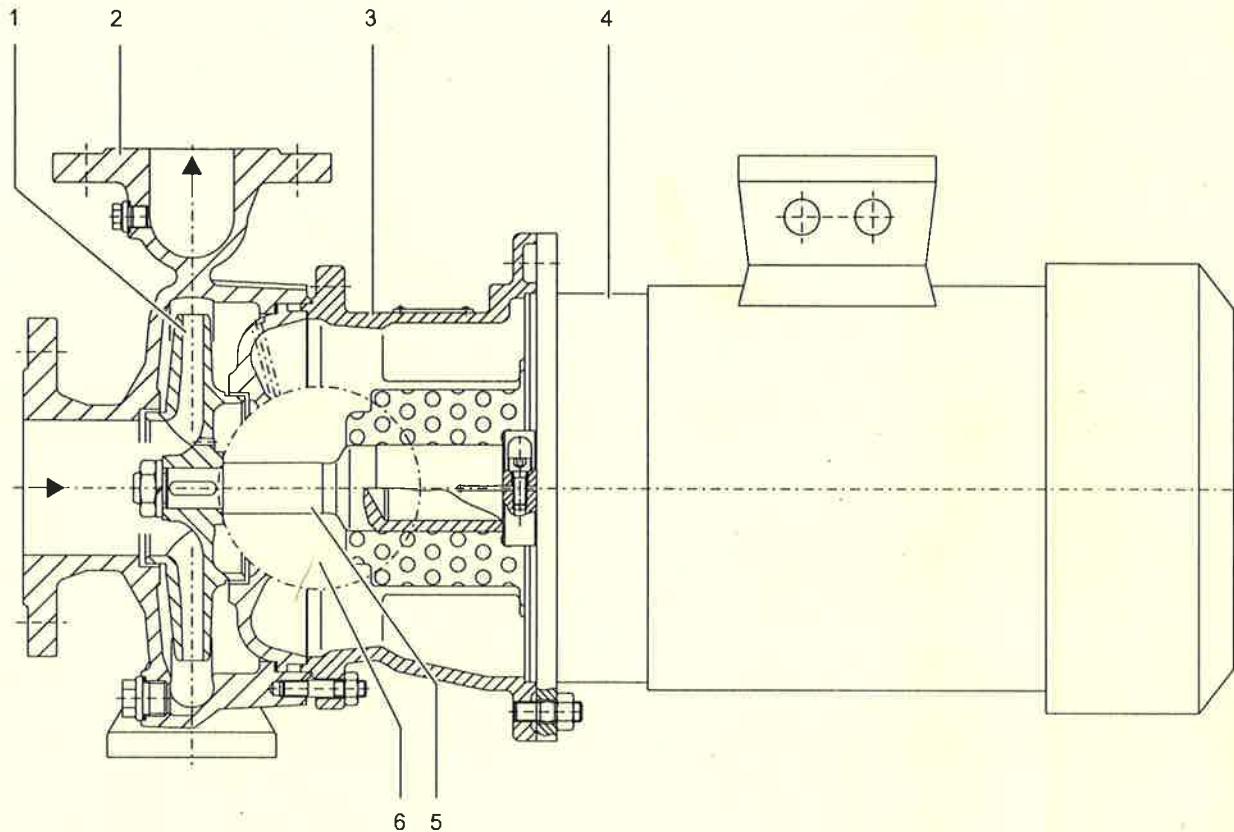


Fig. 4 NB/CLB layout

- |                 |   |                   |
|-----------------|---|-------------------|
| 1 Impeller      | 3 Motor bell housing                    | 5 Stub shaft      |
| 2 Volute casing | 4 Motor with fixed bearing at drive end | 6 Shaft seal part |

### 3.3 Shaft seals

Only one of the following shaft seals can be used.

#### 3.3.1 Mechanical seals

Mechanical seals have functional leaks.

- Single mechanical seal
- Single mechanical seal with quenching

### 3.4 Auxiliary systems

#### 3.4.1 Sealing systems

##### Quenching

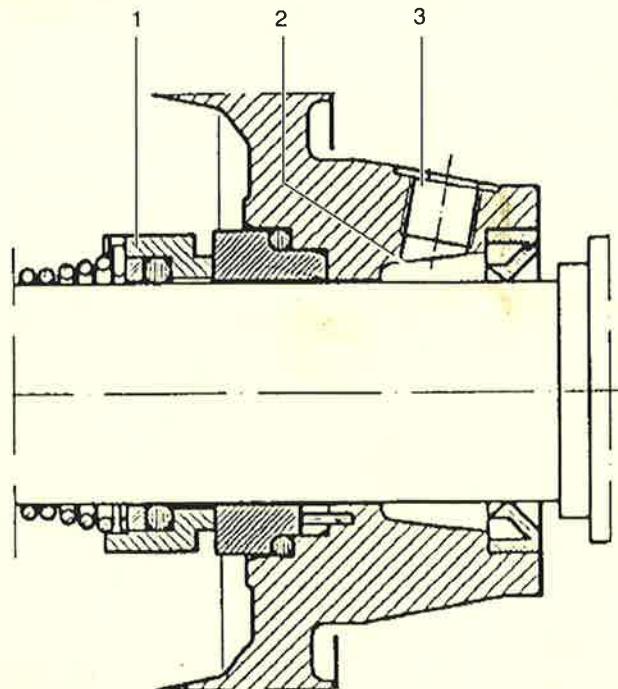


Fig. 5 Single mechanical seal with quenching  
(sketch)

- 1 Seal
- 2 Quench space
- 3 Quench medium connection

The pressure of the pumped medium is higher than the pressure of the sealing medium during quenching. The seal surfaces are lubricated by the pumped medium.

##### Application examples:

- Pumped media that can crystallize in the atmosphere and thus cause damage to the seal in the long-term
- Prevention of offensive odors
- Cooling of seals

Variant	Characteristics of the sealing medium
Open flow system	<ul style="list-style-type: none"> <li>• Supplied and drained continuously</li> <li>• Unpressurized</li> </ul>
Closed flow system	<ul style="list-style-type: none"> <li>• Circulating in a closed circuit</li> <li>• Unpressurized</li> </ul>

Tab. 6 Quenching - variants and characteristics

## 4 Transport, storage and disposal

### 4.1 Transport

- For weight specifications (→ documents for the particular order).

#### 4.1.1 Unpacking and inspection on delivery

1. Unpack the pump/aggregate on delivery and inspect it for transport damage.
2. Report any transport damage to the manufacturer immediately.
3. Dispose of packaging material according to local regulations.

#### 4.1.2 Lifting



##### Death or crushing of limbs caused by falling or overturning loads!

- Use lifting gear appropriate for the total weight to be transported.
- Fasten the lifting gear as illustrated below.
- Do not stand under suspended loads.
- Set the load down on a level surface.

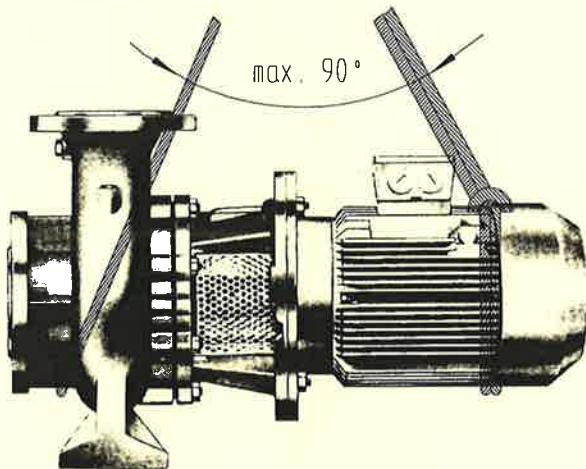


Fig. 6 Fastening the lifting gear to the pump aggregate

### 4.2 Preservation

- Not necessary for non-rusting materials

#### CAUTION

##### Material damage due to inappropriate treatment for storage!

- Treat the pump properly, inside and outside, for storage.
- 1. Choose a preservative appropriate for the type and duration of storage (→ 9.2.7 Preservatives, Page 39).
- 2. Use the preservative specified by the manufacturer.
- 3. All bare metal parts should be treated, inside and outside.

### 4.3 Storage

#### CAUTION

##### Material damage due to inappropriate storage!

- Treat and store the pump properly.

1. Seal all openings with blind flanges, blind plugs or plastic covers.
2. Make sure the storage room meets the following conditions:
  - Dry
  - Frost-free
  - Vibration-free
3. Turn the shaft once a month.
4. Make sure the shaft and bearing change their rotational position in the process.

#### 4.4 Removing the preservative

- Only necessary for pumps treated with preservative

##### **WARNING**

**Risk of poisoning from preservatives and cleaning agents in the foodstuffs and drinking water sector!**

- ▶ Only use cleaning agents which are compatible with the pumped medium (→ 9.2.6 Cleaning agents, Page 39).
- ▶ Completely remove all preservative.

##### **CAUTION**

**High water pressure or spray water can damage bearings!**

- ▶ Do not clean bearing areas with a water or steam jet.

##### **CAUTION**

**Damage to seals due to wrong cleaning agents!**

- ▶ Ensure the cleaning agent does not corrode the seals.
1. Choose the cleaning agent according to the application. (→ 9.2.6 Cleaning agents, Page 39).
  - With Tectyl 506 EH: allow benzine to soak in for 10 minutes (recommended).
  2. Dispose of cleaning agents in accordance with local regulations.
  3. For storage times in excess of 6 months:
    - Replace the elastomer parts made of EP rubber (EPDM).
    - Check all elastomer parts (O-rings, shaft seals) for proper elasticity and replace them if necessary.

#### 4.5 Disposal

- Plastic parts can be contaminated by poisonous or radioactive pumped media to such an extent that cleaning is insufficient.

##### **WARNING**

**Risk of poisoning and environmental damage by the pumped medium or oil!**

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Prior to the disposal of the pump:
  - Catch and dispose of any escaping pumped medium or oil in accordance with local regulations.
  - Neutralize residues of pumped medium in the pump.
  - Remove any preservative (→ 4.4 Removing the preservative, Page 14).
- ▶ Remove any plastic parts and dispose of them in accordance with local regulations.
- ▶ Dispose of the pump in accordance with local regulations.

## 5 Setup and connection

- For pumps in explosion hazard areas (→ ATEX additional instructions).

### CAUTION

#### Material damage caused by dirt!

- ▶ Do not remove the transport seals until immediately before setting up the pump.
- ▶ Do not remove any covers or transport and sealing covers until immediately before connecting the pipes to the pump.

### 5.1 Preparing the setup

#### 5.1.1 Checking the ambient conditions

- ▶ Make sure the required ambient conditions are fulfilled (→ 9.2.2 Ambient conditions, Page 38).

#### 5.1.2 Preparing the installation site

- ▶ Ensure the installation site meets the following conditions:
  - Pump is freely accessible from all sides
  - Sufficient space for installation/removal of the pipes and for maintenance and repair work, especially for the removal and installation of the pump and the motor
  - Pump not exposed to external vibrations (damage to bearings)
  - Frost protection

#### 5.1.3 Preparing the foundation and surface

- Setup options:
- ▶ With concrete foundation
  - ▶ With steel foundation frame
  - ▶ Without foundation
- ▶ Make sure the foundation and surface meet the following conditions:
- Level
  - Clean (no oil, dust or other impurities)
  - Foundation and surface can support the weight of the pump aggregate and all operating forces
  - Ensure the pump is stable and cannot tip over
  - With concrete foundation: standard concrete of strength class B 25

#### 5.1.4 Removing the preservative

- ▶ If the pump is to be put into operation immediately after setup and connection: remove the preservative prior to setup (→ 4.4 Removing the preservative, Page 14).

#### 5.1.5 Installing the heat insulation

- Only necessary to maintain the temperature of the pumped medium

### CAUTION

#### Material damage caused by overheating!

- ▶ Only install the heat insulation on the volute casing.
- ▶ Install the heat insulation properly.

## 5.2 Setting up the pump aggregate

### CAUTION

#### Material damage due to distortion of the pump!

- Place the pump on the foundation and fasten it to it as described in the following.

#### 5.2.1 Setting the pump aggregate on the foundation

- ✓ Implements, tools and materials:

- Foundation bolts (→ setup drawing)
- Steel washers
- Non-shrinking mortar/concrete
- Spirit level

1. Lift the pump aggregate (→ 4.1 Transport, Page 13).
2. Working from below, locate the foundation bolts in the fixing holes of the pump feet.

- Follow the manufacturer's instructions when using adhesive anchors.

3. Set the pump aggregate down on the foundation. When doing this, sink the foundation bolts into the prepared anchoring holes.
4. Use steel washers to align the pump aggregate to the height and system dimensions.
5. Make sure the steel washers lie flat against the pump feet, in full contact.
6. Use the integrated spirit level to check whether the pump is level end to end and side to side with a max. allowable tilt of 1 mm/m.
7. Repeat the procedure until the pump is aligned properly.

#### 5.2.2 Fastening the pump aggregate

1. Fill the anchoring holes with mortar grout.
2. When the concrete has set, bolt down the pump with the specified torque at three points.
3. Before tightening the remaining bolts, compensate for any unevenness in the surface using metal spacing shims next to each bolt.
4. Screw all bolts tight.
5. Turn the pump by hand:
  - Ensure the pump can be turned without pressure points.

## 5.3 Installing the motor

- Only necessary if the pump aggregate is assembled on site

1. Observe the following during the installation:
  - Maintain the specified tightening torques (→ 9.2.5 Tightening torques, Page 38).
2. Remove the retaining clamp for the stub shaft from the motor bell housing (341.xx):
  - Undo the bolts/nuts (901.10/920.10) for this purpose (→ 9.1.4 Sectional drawings of the NB series, Page 31).
3. Undo the hexagon head bolts (901.xx) and remove the washers (554.xx).
4. Remove one half of the guard sheet (686.xx) from the motor bell housing (341.xx).

- The Allen key required to undo the cheese head screw (914.xx) is inserted in one of the two cast-in recesses in the motor bell housing.

5. Undo the cheese head screw (914.xx) on the stub shaft (211.1/220.xx) and unscrew it completely (→ 9.1.4 Sectional drawings of the NB series, Page 31).
6. Install the flanged motor and screw it tight (→ 7.4 Installing, Page 24).
7. Install the safety guarding.

## 5.4 Planning the pipes

### 5.4.1 Specifying supports and flange connections

### CAUTION

#### Material damage due to excessive forces and torques exerted by the piping on the pump!

- Do not exceed the permissible limits (→ 9.2.8 Flange loads according to ISO 5199, Page 39).

1. Calculate the pipe forces, taking every possible operating condition into account:
  - Cold/warm
  - Empty/full
  - Unpressurized/pressurized
  - Shift in position of flanges
2. Ensure the pipe supports have permanent low-friction properties and do not seize up due to corrosion.

### 5.4.2 Specifying nominal diameters

- Keep the flow resistance in the pipes as low as possible.

1. Make sure the nominal suction pipe diameter is not smaller than the nominal suction flange diameter.
2. Make sure the nominal pressure pipe diameter is not smaller than the nominal pressure flange diameter.

#### 5.4.3 Specifying pipe lengths

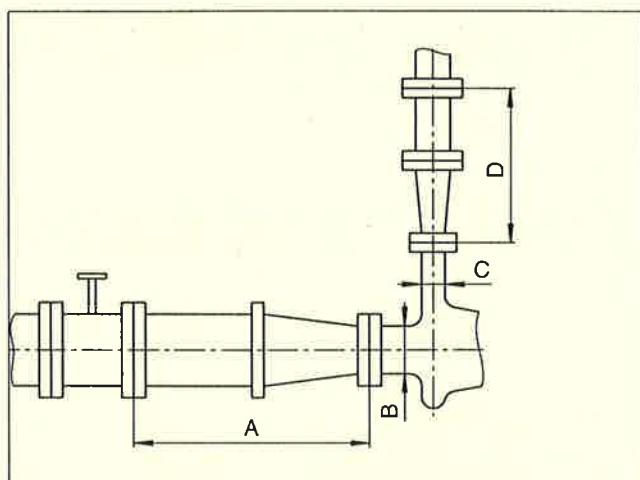


Fig. 7 Straight pipe lengths upstream and downstream of the pump (recommended)

- A > 5 x nominal suction pipe diameter
- B Nominal suction pipe diameter
- C Nominal pressure pipe diameter
- D > 5 x nominal pressure pipe diameter

► Maintain the recommended minimum values when installing the pump.

○ Suction side: shorter pipes are possible but may restrict the hydraulic performance.

Pressure side: shorter pipes are possible but can result in increased operating noise.

#### 5.4.4 Optimizing cross-section and direction changes

1. Avoid radii of curvature of less than 1.5 times the nominal pipe diameter.
2. Avoid abrupt changes of cross-section along the piping.

#### 5.4.5 Provide safety and control devices (recommended)

##### Avoid impurities

1. Integrate a filter in the suction pipe.
2. To monitor impurities, install a differential pressure gauge with a contact manometer.

##### Avoid reverse running

- Install a non-return valve between the pressure flange and the gate valve to ensure the medium does not flow back when the pump is switched off.

##### Make provisions for isolating and shutting off the pipes

○ For maintenance and repair work.

- Provide shut-off devices in the suction and pressure pipes.

##### Allow measurements of the operating conditions

1. Provide manometers for pressure measurements in the suction and pressure pipes.
2. Provide for motor-side torque measurements.
3. Provide for pump-side temperature measurements.

## 5.5 Connecting the pipes

### 5.5.1 Keeping the piping clean

#### **CAUTION**

##### **Material damage due to impurities in the pump!**

- Make sure no impurities can enter the pump.

1. Clean all piping parts and armatures prior to assembly.
2. Ensure no flange seals protrude inwards.
3. Remove any blind flanges, plugs, protective foils and/or protective paint from flanges.

### 5.5.2 Installing auxiliary pipes (if available)

- Follow the manufacturers' specifications for any available auxiliary systems.

1. Connect the auxiliary pipes to the auxiliary connections so that they are stress-free and do not leak (→ setup drawing).
2. To avoid air pockets, run the pipes with a continuous slope up to the pump.

### 5.5.3 Installing the suction pipe

1. Remove the transport and sealing covers from the pump.
2. To avoid air pockets, run the pipes with a continuous slope up to the pump.
3. Ensure no seals protrude inwards.
4. For suction operation: install a foot valve in the suction pipe to prevent the pump and suction pipe from running empty during downtimes.

### 5.5.4 Installing the pressure pipe

1. Remove the transport and sealing covers from the pump.
2. Install the pressure pipe.
3. Ensure no seals protrude inwards.

### 5.5.5 Inspection for stress-free pipe connections

✓ Piping installed and cooled down

1. Disconnect the pipe connecting flanges from the pump.
2. Check whether the pipes can be moved freely in all directions within the expected range of expansion:
  - Nominal diameter < 150 mm: by hand
  - Nominal diameter > 150 mm: with a small lever
3. Make sure the flange surfaces are parallel.
4. Reconnect the pipe connecting flanges to the pump.

## 5.6 Electrical connection



##### **Risk of death due to electric shock!**

- Have all electrical work carried out by qualified electricians only.



##### **Risk of death due to rotating parts!**

- Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.

### 5.6.1 Connecting the motor

- Follow the instructions of the motor manufacturer.

1. Connect the motor according to the connection diagram.
2. Make sure no danger arises due to electric power.
3. Install an EMERGENCY STOP switch.

### 5.6.2 Checking the direction of rotation



##### **Risk of death due to rotating parts!**

- Use protective equipment when carrying out any work on the pump.
- Keep an adequate distance to rotating parts.

#### **CAUTION**

##### **Material damage caused by dry running or wrong direction of rotation!**

- Fill the pump with fluid (to be pumped) and bleed it (→ 6.1.4 Filling and bleeding, Page 19).

  1. Switch the motor on and immediately off again.
  2. Check whether the direction of rotation of the motor corresponds to the arrow indicating the direction of rotation on the pump.
  3. If the direction of rotation is different: swap two phases.

## 6 Operation

- For pumps in explosion hazard areas (→ ATEX additional instructions).

### 6.1 Preparations for the initial start-up

#### 6.1.1 Identifying the pump type

- ▶ Identify the pump type (→ order data sheet).
- The pump types vary e.g. with regard to the shaft seal, auxiliary systems.

#### 6.1.2 Removing the preservative

- Only necessary for pumps treated with preservative
- ▶ (→ 4.4 Removing the preservative, Page 14).

#### 6.1.3 Preparing auxiliary systems (if available)

- The manufacturer does not accept any liability for damage arising from the installation or use of a third-party or unapproved auxiliary system.

#### Sealing systems

1. Verify that the sealing medium is suitable to mix (i.e. compatible) with the pumped medium.
2. Identify the sealing system:
  - (→ order data sheet)
  - (→ 3.4.1 Sealing systems, Page 12).
3. Install the sealing system (→ manufacturer's specifications).
4. Make sure the parameters required for the installed sealing system are met (→ 9.2.3 Parameters for auxiliary systems, Page 38).

#### 6.1.4 Filling and bleeding

- ✓ Auxiliary systems ready for operation

### ⚠ WARNING

#### Risk of injury and poisoning due to hazardous pumped medial

- ▶ Safely collect any leaking pumped medium and dispose of it in accordance with environmental rules and requirements.

### CAUTION

#### Material damage caused by dry running!

- ▶ Make sure the pump is filled properly.
- 1. Fill the pump and the suction pipe with pumped medium.
- 2. Open the suction-side armature.
- 3. Open the pressure-side armature.
- 4. If available: open the auxiliary systems and check the flow rate.
- 5. Verify that no pipe connections are leaking.

## 6.2 Start-up

### 6.2.1 Switching on

- ✓ Pump aggregate set up and connected properly
- ✓ All connections stress-free and sealed
- ✓ Any available auxiliary systems are ready for operation
- ✓ All safety equipment installed and tested for functionality
- ✓ Pump prepared, filled and bled properly



#### Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Allow the pump to cool down completely before starting any work.



#### Risk of injury and poisoning caused by pumped medium spraying out!

- ▶ Use protective equipment when carrying out any work on the pump.

### CAUTION

#### Material damage caused by dry running!

- ▶ Make sure the pump is filled properly.

### CAUTION

#### Risk of cavitation when throttling down the suction flow rate!

- ▶ Fully open the suction-side armature and do not use it to adjust the flow rate.
- ▶ Do not open the pressure-side armature beyond the operating point.

### CAUTION

#### Material damage caused by overheating!

- ▶ Do not operate the pump while the pressure-side armature is closed.
- ▶ Observe the minimum flow rate (→ order data sheet).

1. Open the suction-side armature.
2. Close the pressure-side armature.
3. Switch on the motor and check it for smooth running.
4. Once the motor has reached its nominal speed, open the pressure-side armature slowly until the operating point is reached.
5. For pumps with hot pumped media, make sure any temperature changes do not exceed 50 °C/h.
6. After the initial stress caused by pressure and operating temperature, check that the pump is not leaking.

### 6.2.2 Switching off

- ✓ Pressure-side armature closed (recommended)

### WARNING

#### Risk of injury due to hot pump parts!

- ▶ Use protective equipment when carrying out any work on the pump.

1. Switch off the motor.
2. Check all connecting bolts and tighten them if necessary.

## 6.3 Shutting down

### WARNING

#### Risk of injury and poisoning due to hazardous pumped media!

- ▶ Safely collect any leaking pumped medium and dispose of it in accordance with environmental rules and requirements.

- Take the following measures whenever the pump is shut down:

Pump is	Measure
...shut down for a prolonged period	► Take measures depending on the pumped medium (→ Table 8 Measures depending on the behavior of the pumped medium, Page 21).
...emptied	► Close the suction-side and pressure-side armatures.
...dismounted	► Isolate the motor from its power supply and secure it against unauthorized switch-on.
...put into storage	► Follow the storage instructions (→ 4.3 Storage, Page 13).

Tab. 7 Measures to be taken if the pump is shut down

Behavior of pumped medium	Duration of shutdown (depending on process)	
	Short	Long
Solids sediment	► Flush the pump.	► Flush the pump.
Solidifying/ freezing, non-corrosive	► Heat up or empty the pump and containers.	► Empty the pump and containers.
Solidifying/ freezing, corrosive	► Heat up or empty the pump and containers.	► Empty the pump and containers. ► Treat the pump and containers with preservative.
Remains liquid, non-corrosive	-	-
Remains liquid, corrosive	-	► Empty the pump and containers. ► Treat the pump and containers with preservative.

Tab. 8 Measures depending on the behavior of the pumped medium

## 6.4 Start-up following a shutdown period

1. If the pump is shut down for over 1 year, take the following measures before starting it up again:

Shutdown period	Measure
> 1 year	► For versions with roller bearings without lifetime lubrication: relubricate
> 2 years	► Replace elastomer seals (O-rings, shaft sealing rings). ► Replace antifriction bearings.

Tab. 9 Measures to be taken after prolonged shutdown periods

2. Carry out all steps as for the initial start-up (→ 6.2 Start-up, Page 20).

## 6.5 Operating the stand-by pump

- ✓ Stand-by pump filled and bled
  - Operate the stand-by pump at least once a week.
1. Completely open the suction-side armature.
  2. Open the pressure-side armature to the extent that the stand-by pump reaches its operating temperature and is heated through evenly (→ 6.2.1 Switching on, Page 20).

## 7 Maintenance

- For pumps in explosion hazard areas (→ ATEX additional instructions).
- Trained service technicians are available for fitting and repair jobs. Present a pumped medium certificate (DIN safety data sheet or safety certificate) when requesting service.

### 7.1 Inspections

- The inspection intervals depend on the operational strain on the pump.



#### Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.

#### WARNING

#### Risk of injury and poisoning due to hazardous pumped media!

- ▶ Use protective equipment when carrying out any work on the pump.

1. Check at appropriate intervals:
  - Maintenance of minimum flow rate
  - Normal operating conditions unchanged
  - No impermissible vibrations
2. For trouble-free operation, always ensure the following:
  - No dry running
  - No leaks
  - No cavitation
  - Suction-side gate valves open
  - Unclogged and clean filters
  - Sufficient supply pressure
  - No unusual running noises or vibrations
  - No excessive leakage at the shaft seal
  - Proper functioning of auxiliary systems
  - Put the installed stand-by pump into operation at least once a week

### 7.2 Maintenance

- The stub shaft of the pump and the motor shaft are connected firmly together. Notes on maintenance of the bearing (→ operating manual of the motor manufacturer).
- Mechanical seals are subject to natural wear, which strongly depends on the actual operating conditions. Therefore, general statements regarding their service life cannot be made.



#### Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.



#### Risk of death due to electric shock!

- ▶ Have all electrical work carried out by qualified electricians only.

#### WARNING

#### Risk of injury and poisoning due to hazardous or hot pumped media!

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down completely before commencing any work.
- ▶ Make sure the pump is unpressurized.
- ▶ Empty the pump, safely collect the pumped medium and dispose of it in accordance with environmental rules and requirements.

#### 7.2.1 Mechanical seals

- Mechanical seals have functional leaks (→ manufacturer's specifications).

Single mechanical seals with quenching: any drastic rise in the level of the quenching system indicates a major leak at the product-side mechanical seal.

- ▶ In the event of a larger leak: replace the mechanical seal and its auxiliary seals and check the integrity of the auxiliary systems.

## 7.3 Dismounting



### Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.



### Risk of death due to electric shock!

- ▶ Have all electrical work carried out by qualified electricians only.



### **WARNING**

### Risk of injury and poisoning due to hazardous or hot pumped media

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down completely before commencing any work.
- ▶ Make sure the pump is unpressurized.
- ▶ Empty the pump, safely collect the pumped medium and dispose of it in accordance with environmental rules and requirements.

### 7.3.1 Returning the pump to the manufacturer

- ✓ Pump unpressurized
  - ✓ Pump completely empty
  - ✓ Electrical connections isolated and motor secured against switch-on
  - ✓ Pump cooled down
  - ✓ Auxiliary systems shut down, unpressurized and emptied
  - ✓ Manometer lines, manometer and fixtures dismounted
1. Enclose a truthfully (fully) completed safety certificate when returning pumps or individual parts to the manufacturer. Order a safety certificate from the manufacturer if necessary.
  2. Take necessary measures, depending on the required repair work, as listed in the table below when returning the pump to the manufacturer.

Repair carried out	Measure for return
...at the customer's premises	<ul style="list-style-type: none"> <li>▶ Return the defective component to the manufacturer.</li> </ul>
...at the manufacturer's premises	<ul style="list-style-type: none"> <li>▶ Flush the pump and decontaminate it if it was used to pump hazardous media.</li> <li>▶ Return the complete pump (not disassembled) to the manufacturer.</li> </ul>
...at the manufacturer's premises for warranty repairs	<ul style="list-style-type: none"> <li>▶ Only in the event of hazardous pumped media: flush and decontaminate the pump.</li> <li>▶ Return the complete pump (not disassembled) to the manufacturer.</li> </ul>

Tab. 10 Measures for return

### 7.3.2 Preparations for dismantling

- ✓ Pump unpressurized
  - ✓ Pump completely empty, flushed and decontaminated
  - ✓ Electrical connections isolated and motor secured against switch-on
  - ✓ Pump cooled down
  - ✓ Auxiliary systems shut down, unpressurized and emptied
  - ✓ Manometer lines, manometer and fixtures dismounted
- In production, the pumps are constructed to a standard process. The slide-in unit can be removed without removing the volute casing and piping.
1. When dismantling, observe the following:
    - Mark the precise orientation and position of all components before dismantling.
    - Dismantle components concentrically without canting.
  2. Dismount the pump (→ sectional drawing).

### 7.3.3 Removal of the flanged motor

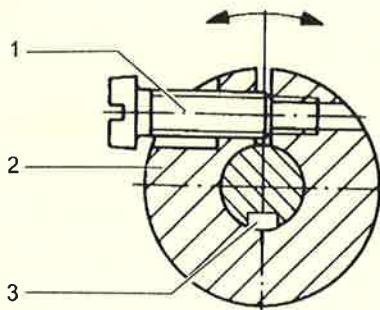


Fig. 8 Widening the stub shaft

- 1 Cheese head screw
- 2 Stub shaft
- 3 Shaft key groove of the motor shaft

  Tighten the jack screw with a screwdriver without applying any excessive force.

1. Widening the stub shaft (220.xx/211.1):
  - Unscrew the cheese head screw (914.xx).
  - Screw the cheese head screw (M10 x 40 or M12 x 40 ISO 1207, not included in the scope of delivery) into the stub shaft.
2. Remove the flanged motor.

### 7.4 Installing

 The shaft key is not required for the installation.

 Stub shaft, free from oil and grease

#### CAUTION

##### Material damage caused by knocks and bumps!

 Do not knock or hit any components of the pump.

  Reinstall the components concentrically, without canting, in accordance with the markings made.

1. Observe the following during the installation:
  - Replace worn parts with genuine spare parts.
  - Replace seals, inserting them so that they cannot rotate.
  - Maintain the specified tightening torques ( $\rightarrow$  9.2.5 Tightening torques, Page 38).
2. Clean all parts ( $\rightarrow$  9.2.6 Cleaning agents, Page 39). Do not remove any prepared markings.
3. Install the pump ( $\rightarrow$  sectional drawing).
4. Install the pump in the system ( $\rightarrow$  5 Setup and connection, Page 15).

### Installation of the flanged motor

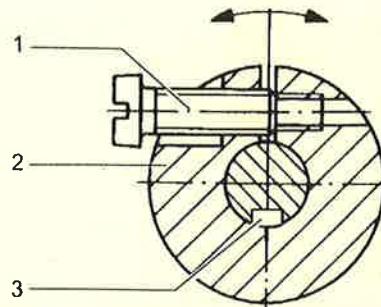


Fig. 9 Widening the stub shaft

- 1 Cheese head screw
- 2 Stub shaft
- 3 Shaft key groove of the motor shaft

  Tighten the jack screw with a screwdriver without applying any excessive force.

1. Widening the stub shaft (220.xx/211.1):
  - Screw the cheese head screw (M10 x 40 or M12 x 40 ISO 1207, not included in the scope of delivery) into the stub shaft.
2. Install the flanged motor, while ensuring:
  - The slot of the stub shaft (220.xx/211.1) is opposite to the shaft key groove of the motor shaft
  - The stub shaft (220.xx/211.1) is against the collar of the motor shaft
3. Undo and unscrew the jack screw. Screw in the cheese head screw (914.06/914.16) and tighten it with a torque wrench ( $\rightarrow$  9.2.5 Tightening torques, Page 38).
4. Install the safety equipment:
  - Guard sheet for the motor bell housing
5. Install the auxiliary devices:
  - Manometer lines and fixtures at the pump
  - Auxiliary pipes
6. Turn the pump by hand:
  - Ensure the pump can be turned without pressure points.

## 7.5 Ordering spare parts

- For trouble-free replacement in the event of faults, we recommend keeping entire slide-in units or spare pumps available on site.

The application guidelines conforming to DIN 24296 recommend provisioning for two years of continuous use (→ 9.3 Spare parts for two years of continuous operation according to DIN 24296, Page 41).

- ▶ Have the following information ready to hand when ordering spare parts (→ type plate):
  - Pump type
  - Pump number
  - Year of manufacture
  - Part number
  - Designation
  - Quantity

## 8 Troubleshooting

For faults which are not specified in the following table or cannot be traced back to the specified causes, please consult the manufacturer.

Possible faults are identified by a fault number in the table below. This number identifies the respective cause and remedy in the troubleshooting list.

Fault	Number
Pump not pumping	1
Pumping rate insufficient	2
Pumping rate excessive	3
Pumping pressure insufficient	4
Pumping pressure excessive	5
Pump running roughly	6
Pump leaking	7
Motor power uptake excessive	8

Tab. 11 Fault number assignment

Fault number								Cause	Remedy
1	2	3	4	5	6	7	8		
X	-	-	-	-	-	-	-	Supply/suction pipe and/or pressure pipe closed by armature	► Open the armature.
-	X	-	X	-	-	-	-	Supply/suction pipe not fully opened	► Open the armature.
X	X	-	-	-	-	-	-	Stub shaft loose	► Tighten the stub shaft firmly (-> 7.4 Installing, Page 24).
X	X	-	X	-	X	-	-	Supply/suction pipe, pump or suction strainer blocked or encrusted	► Clean the supply/suction pipe, pump or suction strainer.
-	X	-	X	-	X	-	-	Supply/suction pipe cross-section too narrow	► Increase the cross-section. ► Remove any encrustations from the suction pipe. ► Open the armature completely.
X	-	-	-	-	-	-	-	Transport and sealing cover still in place	► Remove the transport and sealing cover. ► Dismount the pump and inspect it for dry-running damage.
-	X	-	X	-	X	-	-	Differential head excessive: $NPSH_{pump}$ larger than $NPSH_{system}$	► Increase the supply pressure. ► Consult the manufacturer.
X	-	-	-	-	X	-	-	Supply/suction pipe not bled properly or not filled up completely	► Fill up the pump and/or piping completely and bleed them.
X	-	-	-	-	X	-	-	Supply/suction pipe contains air pockets	► Install the armature for bleeding. ► Correct the piping layout.
X	X	-	X	-	X	-	-	Air is sucked in	► Seal the source of malfunction.
X	X	-	X	-	X	-	-	Excessive amount of gas: pump is cavitating	► Consult the manufacturer.
-	X	-	X	-	X	-	-	Pumped medium temperature too high: pump is cavitating	► Increase the supply pressure. ► Lower the temperature. ► Consult the manufacturer.

Fault number								Cause	Remedy
1	2	3	4	5	6	7	8		
-	X	-	X	-	-	-	X	Viscosity or specific gravity of the pumped medium outside the range specified for the pump	► Consult the manufacturer.
-	X	-	X	-	-	-	-	Geodetic differential head and/or pipe flow resistances too high	► Remove sediments from the pump and/or pressure pipe. ► Install a larger impeller and consult the manufacturer.
-	X	-	-	X	X	-	-	Pressure-side armature not opened wide enough	► Open the pressure-side armature.
X	X	-	-	X	X	-	-	Pressure pipe blocked	► Clean the pressure pipe.
X	X	-	X	-	X	-	-	Pump running in the wrong direction	► Swap any two phases on the motor.
X	X	-	X	-	-	-	-	Motor speed too low	► Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary. ► Increase the motor speed if speed control is available.
-	X	-	X	-	X	-	-	Pump parts worn	► Replace the worn pump parts.
-	-	X	X	-	X	-	X	Pressure-side armature opened too wide	► Throttle down at the pressure-side armature. ► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
-	-	X	-	-	X	-	X	Geodetic differential head, pipe flow resistances and/or other resistances lower than specified	► Throttle down the flow rate at the pressure-side armature. Observe the minimum flow rate. ► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
-	-	X	-	X	-	-	-	Viscosity lower than expected	► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
-	-	X	-	X	X	-	X	Motor speed too high	► Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary. ► Reduce the motor speed if speed control is available.
-	-	X	-	X	X	-	X	Impeller diameter too large	► Throttle down the flow rate at the pressure-side armature. Observe the minimum flow rate. ► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
X	X	-	X	-	X	-	-	Impeller out of balance or blocked	► Dismount the pump and inspect it for dry-running damage. ► Clean the impeller.
-	X	-	X	-	X	-	-	Hydraulic parts of the pump dirty, clotted or encrusted	► Dismount the pump. ► Clean the parts.
-	-	-	-	-	-	-	X	Defective antifriction bearing in motor	► Replace the antifriction bearing.

Fault number								Cause	Remedy
1	2	3	4	5	6	7	8		
-	-	-	-	-	-	-	-	Lubricant: too much, not enough or unsuitable	► Reduce, top up or replace the lubricant.
-	-	-	-	-	-	X	-	Connecting bolts not tightened properly	► Tighten the connecting bolts.
-	-	-	-	-	-	X	-	Mechanical seal worn	► Replace the mechanical seal.
-	-	-	-	-	-	X	-	Housing seal defective	► Replace the housing seal.
-	-	-	-	-	-	X	-	Shaft sleeve is infiltrated	► Replace the shaft sleeve and/or O-ring.
-	-	-	-	-	-	X	X	Pump distorted	► Check the pipe connections and pump attachment.
-	X	-	X	-	X	-	X	Motor running on 2 phases	<ul style="list-style-type: none"> <li>► Check the fuse and replace it if necessary.</li> <li>► Check the cable connections and insulation.</li> </ul>

Tab. 12 Troubleshooting list

## 9 Appendix

### 9.1 Sectional drawings

#### 9.1.1 Auxiliary connections

Abbreviation	Connection
FD, FD1	Pumped medium / emptying
FF	Filling
FV, FV1	Filling / Bleeding
LO	Leak / egress
PM1	Pressure gauge
PM2	Pressure gauge

Tab. 13 Abbreviations of the connection designations

#### 9.1.2 Part numbers and designations of the NB series

Part no.	Designation
102.01	Volute casing
108.01	Stage casing
161...	Housing cover
171.01	Impeller
220...	Stub shaft
230.01	Impeller
230.02	Impeller, first stage
230.03	Impeller, second stage
341.01	Motor bell housing
400.01	Gasket
400.02	Gasket
411.01	Seal ring
411.02	Seal ring
411.04	Seal ring
411.05	Seal ring
412.01	O-ring
412.07	O-ring
433...	Mechanical seal
509.01	Intermediate ring
509.02	Intermediate ring
514.01	Threaded ring
523.02	Shaft sleeve
525.01	Spacer sleeve
525.02	Spacer sleeve
554.07	Washer

Part no.	Designation
565.01	Rivet
672.01	Vent
686.01	Guard sheet
801.01	Flanged motor
901.01	Hexagon head bolt
901.02	Hexagon head bolt
901.07	Hexagon head bolt (Ribe-Triform)
901.10	Hexagon head bolt
902.01	Stud bolt
902.08	Stud bolt
903.01	Screw plug
903.02	Screw plug
903.04	Screw plug
904.05	Grub screw
914.01	Cheese head screw
914.02	Cheese head screw
914.06	Cheese head screw
914.10	Cheese head screw
920.01	Nut
920.03	Nut
922.01	Impeller nut
936.01	Spring ring
940.01	Shaft key
940.03	Shaft key
971.01	Name plate

Tab. 14 Designations of components of the NB series according to part numbers

**9.1.3 Part numbers and designations of the CLB series**

<b>Part no.</b>	<b>Designation</b>
102.1	Volute casing
161.1	Housing cover
211.1	Stub shaft
230.1	Impeller
341.1	Motor bell housing
400.1	Gasket
400.2	Gasket
411.1	Seal ring
411.2	Seal ring
433.1	Mechanical seal
509.1	Intermediate ring
509.2	Intermediate ring
525.1	Spacer sleeve
525.2	Spacer sleeve
554.1	Washer
560.1	Rivet
681.1	Guard sheet
801.1	Flanged motor
901.19	Hexagon head bolt
902.1	Stud bolt
902.2	Stud bolt
902.10	Stud bolt
903.1	Screw plug
903.2	Screw plug
908.1	Jacking screw
908.2	Jacking screw
914.16	Cheese head screw
914.17	Cheese head screw
920.1	Hexagon nut
920.2	Hexagon nut
920.10	Hexagon nut
922.2	Impeller nut
930.1	Spring ring
940.1	Shaft key
970.1	Name plate

Tab. 15 Designations of components of the CLB series according to part numbers

**9.1.4 Sectional drawings of the NB series**

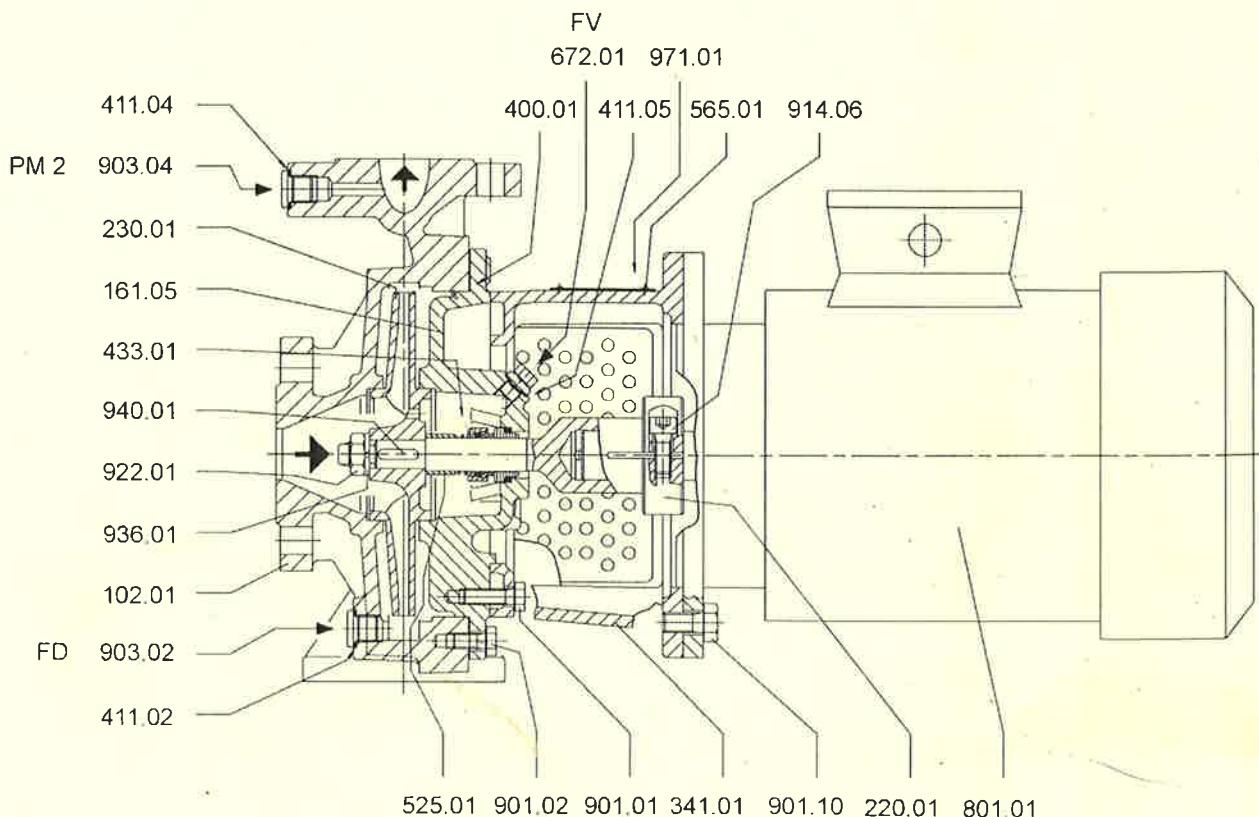


Fig. 10 **U3...D** – Unbalanced mechanical seal – sizes with diameter 16 at the shaft seal

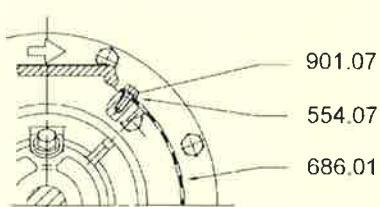


Fig. 11 Attachment of the guard sheet to the motor bell housing

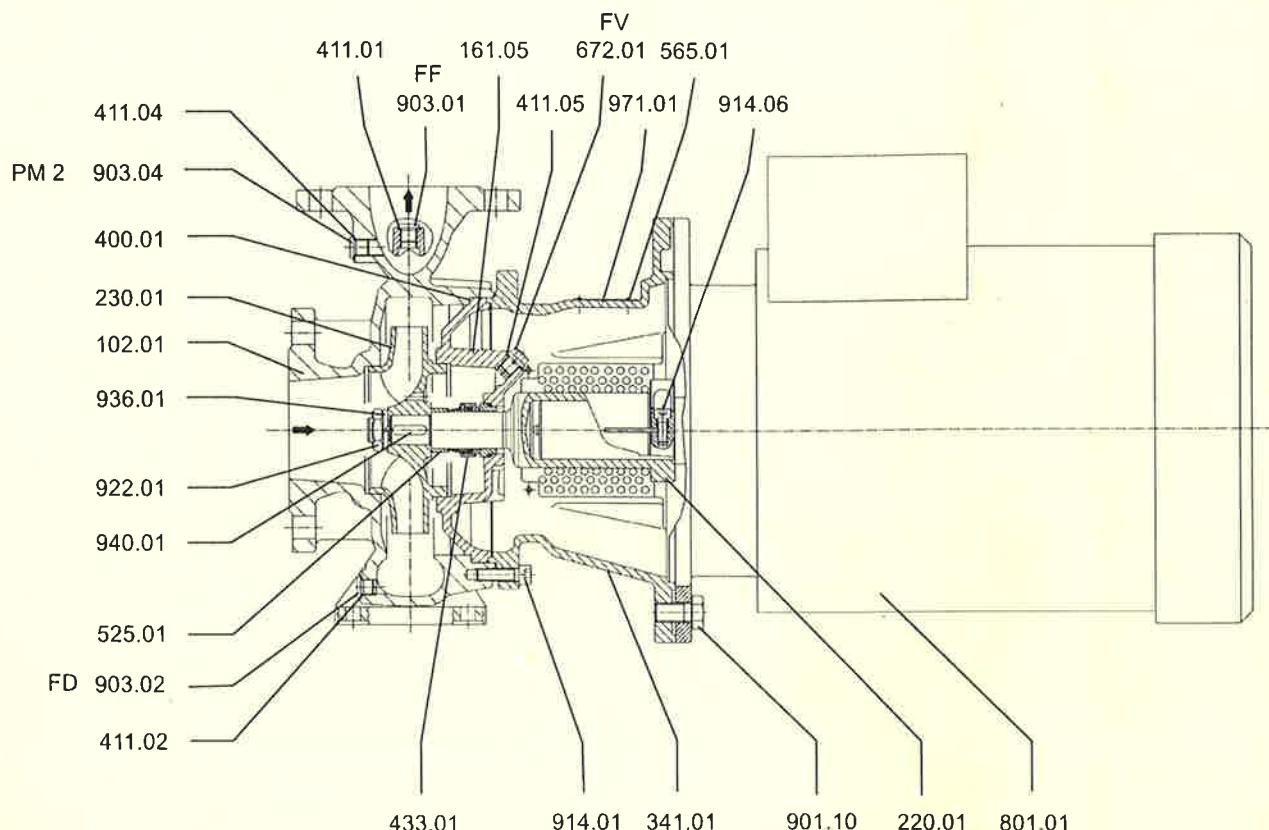


Fig. 12 U3...D – Unbalanced mechanical seal – sizes with diameter 24 and 30 at the shaft seal

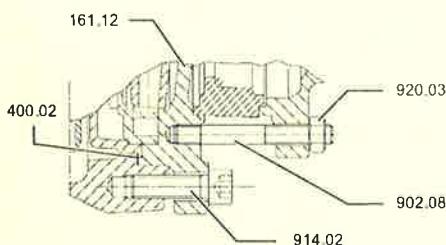


Fig. 13 Housing cover version for sizes 2/40-250/01 and 2/50-250/01

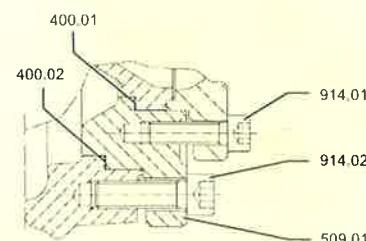


Fig. 15 Version with intermediate ring, sizes 40-250/01 and 50-250/01

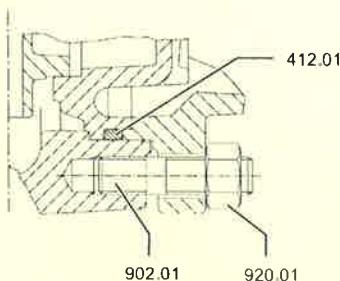


Fig. 14 Sizes with shaft diameter 24 at the shaft seal

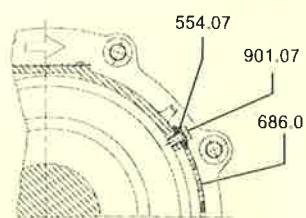


Fig. 16 Attachment of the guard sheet to the motor bell housing

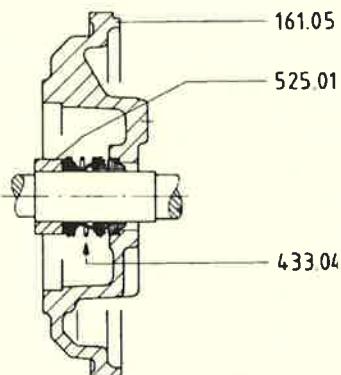


Fig. 17 **U3.9D, U3.12D** – Unbalanced mechanical seal

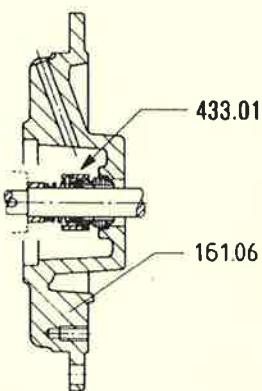


Fig. 18 **U3...K** – Unbalanced mechanical seal

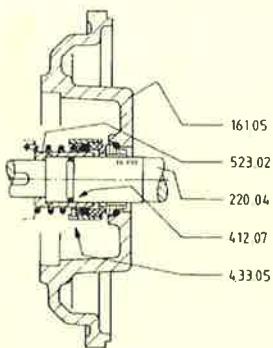


Fig. 19 **U2...D** – Balanced mechanical seal

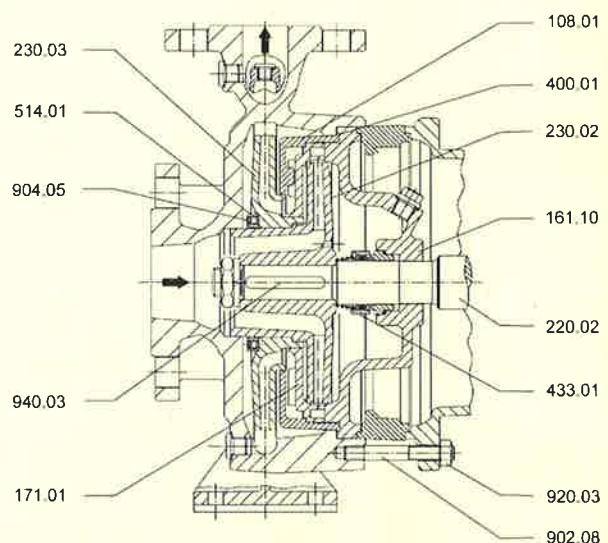


Fig. 20 Two-stage sizes with diameter 30 at the shaft seal, unbalanced mechanical seal **U3D** and **U3.20D**

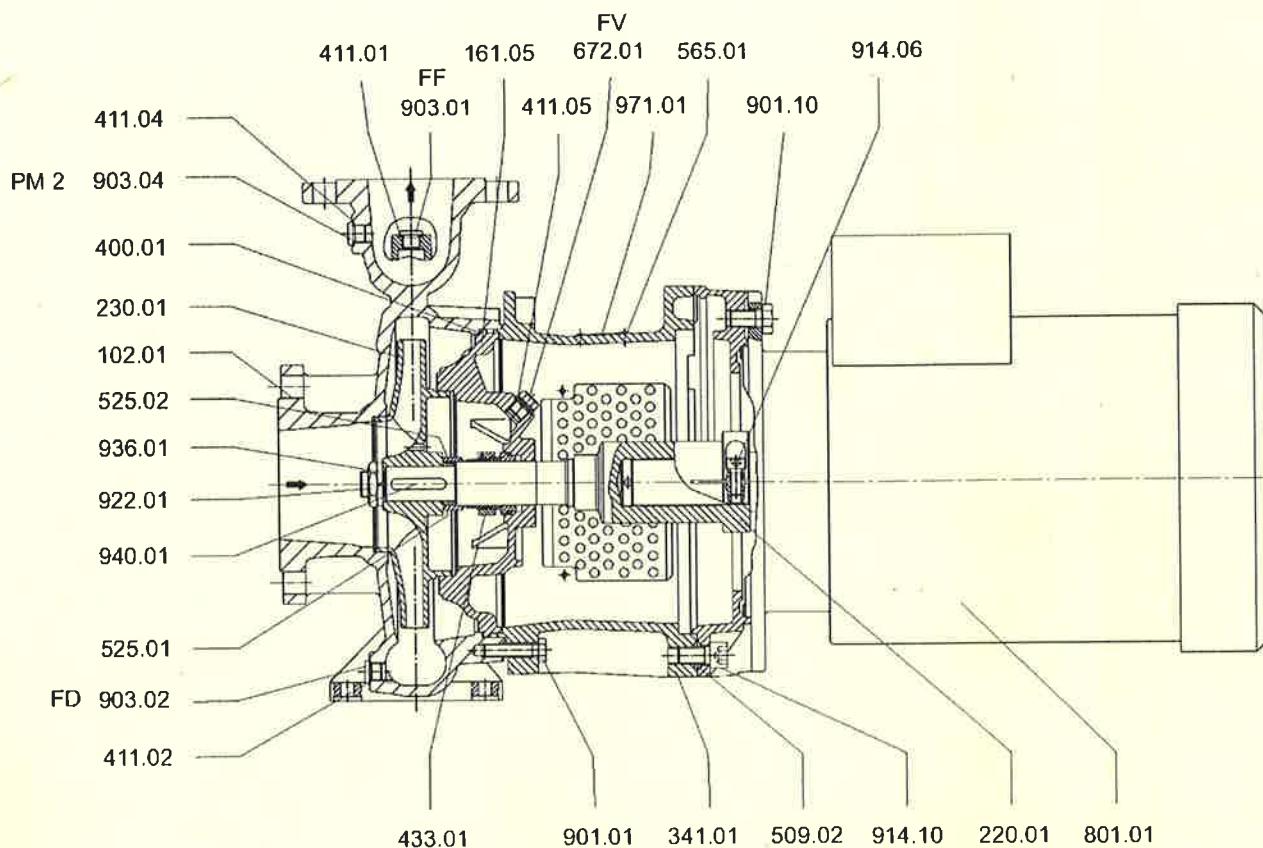


Fig. 21 U3...D – Unbalanced mechanical seal – sizes with diameter 40 at the shaft seal

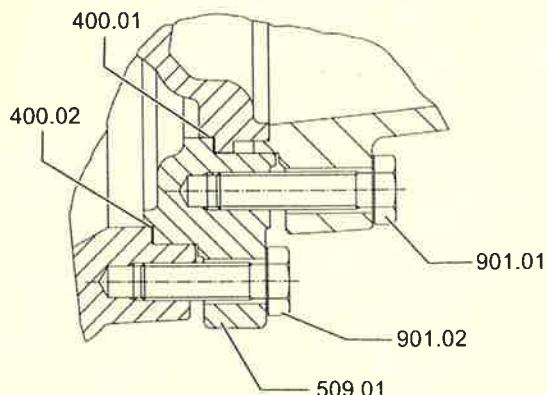


Fig. 22 Version with intermediate ring, sizes 65-315/01, 80-315/01, 100-315/01, 65-400/01

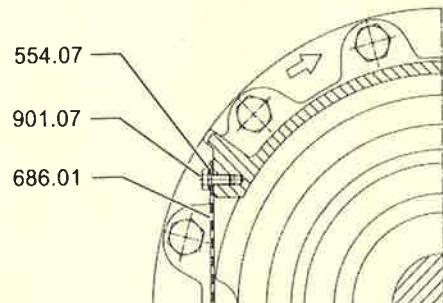


Fig. 23 Attachment of the guard sheet to the motor bell housing

**9.1.5 Sectional drawings of the CLB series**

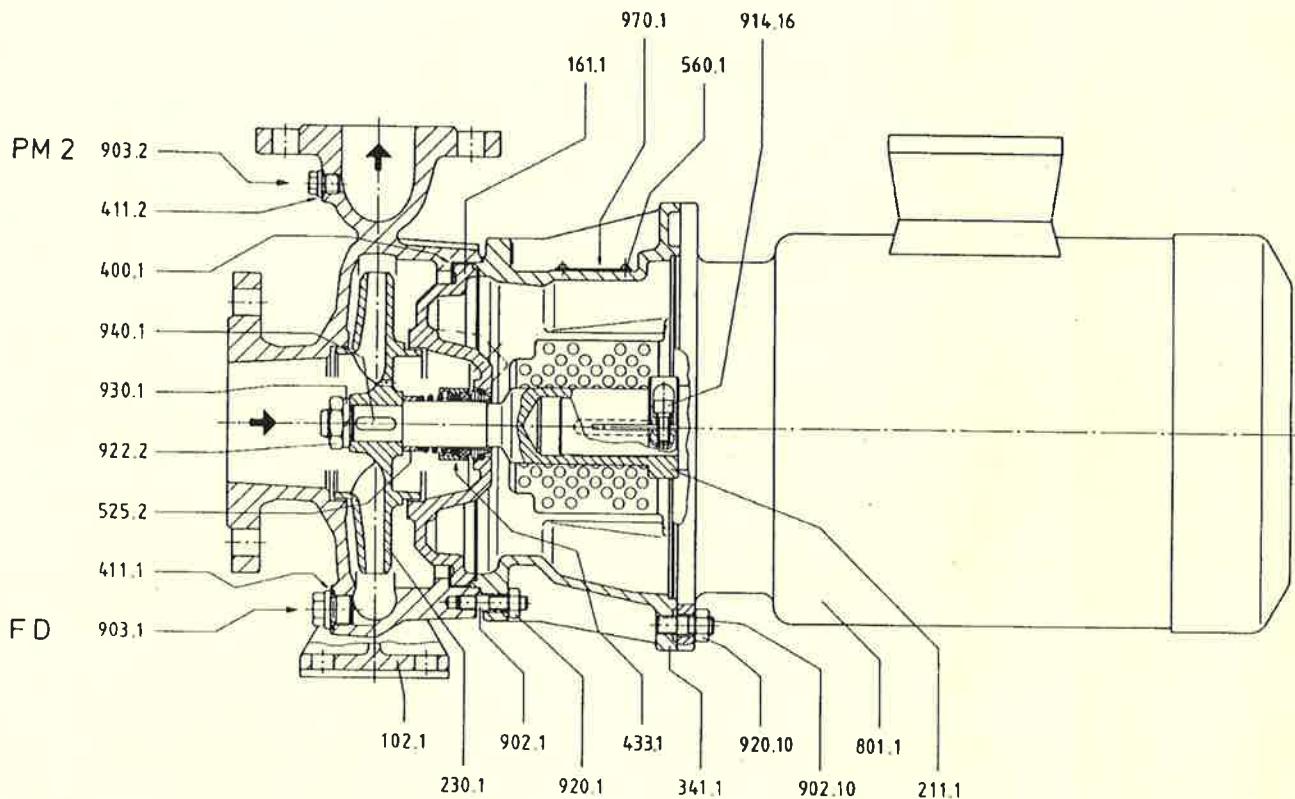


Fig. 24 **U3...D – Unbalanced mechanical seal – sizes with diameter 30 at the shaft seal**

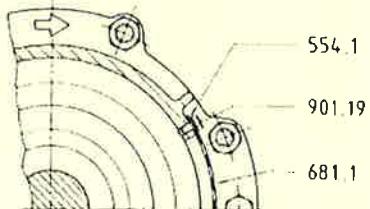


Fig. 25 **Attachment of the guard sheet to the motor bell housing**

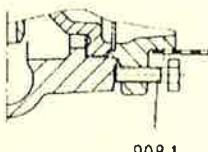


Fig. 26 **Jacking screws**

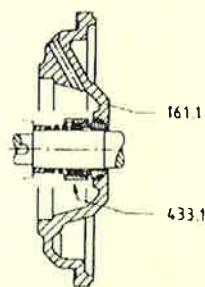


Fig. 27 **U3...D – Unbalanced mechanical seal**

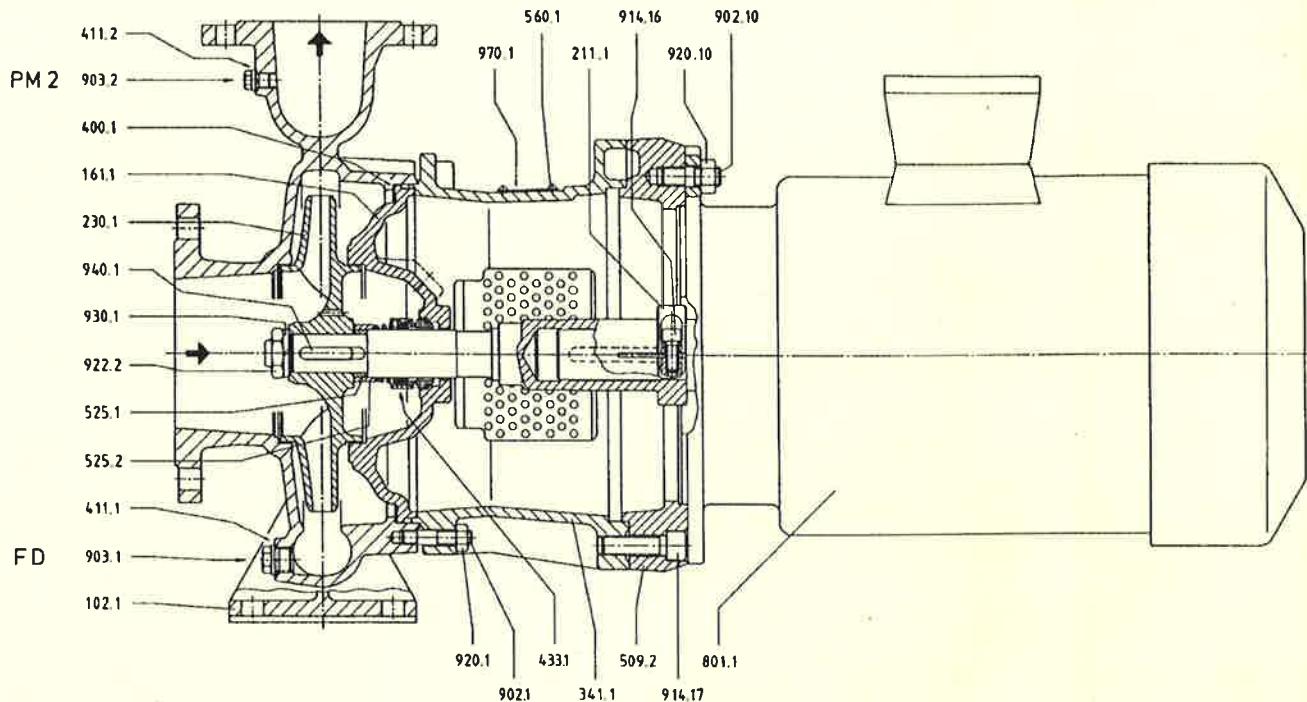


Fig. 28 U3...D – Unbalanced mechanical seal – sizes with diameter 40 at the shaft seal

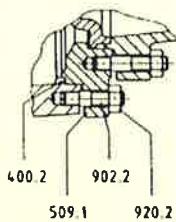


Fig. 29 Version with intermediate ring

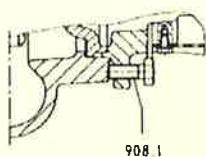


Fig. 30 Jacking screws

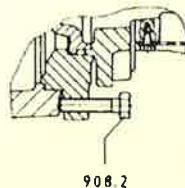


Fig. 31 Jacking screws for version with intermediate ring

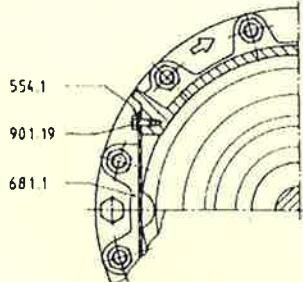


Fig. 32 Attachment of the guard sheet to the motor bell housing

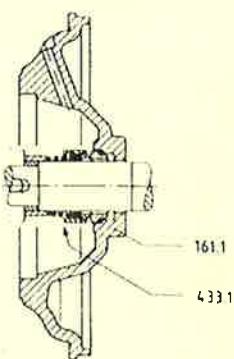


Fig. 33 U3.11D – Unbalanced mechanical seal

✓ Main SWR-P/P

## 9.2 Technical specifications

More technical specifications (→ order data sheet).

### 9.2.1 Stub shaft diameter at the shaft seal

Pump size NB	Diameter of the stub shaft at the shaft seal [mm]
20-160	16
25-160	16
32-125	24
40-125	24
50-125	24
65-125	24
25-200	30
32-160	30
32-200	30
40-160	30
40-200	30
40-250	30
50-160	30
50-200	30
50-250	30
65-160	30
65-200	30
80-160	30
100-160	30
2/25-200	30
2/32-200	30
2/40-250	30
2/50-250	30

Pump size NB	Diameter of the stub shaft at the shaft seal [mm]
65-250	
65-315	
65-400	
80-200	
80-250	
✓ 80-315	
100-200	40
100-250	
100-315	
✓ 125-200	
125-250	
150-200	

Tab. 16 Assignment of the pump size to the stub shaft diameter – NB series

Pump size CLB	Diameter of the stub shaft at the shaft seal [mm]
25-160	
25-200	
32-160	
32-200	
40-160	
40-200	30
50-160	
50-200	
65-160	
80-160	
32-250	
40-250	
40-315	
50-250	
50-315	
65-200	
65-250	
80-200	
80-250	
100-200	

Tab. 17 Assignment of the pump size to the stub shaft diameter – CLB series

### 9.2.2 Ambient conditions

Operation under other ambient conditions should be agreed with the manufacturer

Temperature [°C]	Relative humidity [%]		Setup height above sea level [m]
	Long-term	Short-term	
-20 to +40	≤ 85	≤ 100	≤ 1000

Tab. 18 Ambient conditions

### 9.2.3 Parameters for auxiliary systems

#### Sealing medium in open flow system

Sealing medium for	Volume [l/h]	Pressure
Quenching	150	Unpressurized

Tab. 19 Operating parameters for sealing medium in open flow system

### 9.2.4 Sound pressure levels

Measuring conditions:

- Distance to the pump: 1 m
- Operation: cavitation-free
- Motor: IEC standard motor
- Tolerance ±3 dB

Lower-noise versions of the motors are available if the expected noise levels exceed the permissible limits.

Nominal motor power PM [kW]	Sound pressure level [dB] for pump with motor at speed [min⁻¹]			
	1450	1750	2900	3500
1.5	58	58.5	63	64
2.2	60	60.5	66	67
3.0	62	62.5	68	69
4.0	63	63.5	69	70
5.5	65	65.5	71	72
7.5	66	66.5	72	73
11.0	68	68.5	74	75
15.0	69	69.5	75	76
18.5	70	70.5	76	77
22.0	71	71.5	77	78
30.0	72	72.5	78	79
37.0	73	73.5	79	80

Tab. 20 Sound pressure levels

### 9.2.5 Tightening torques

Part no.	Thread gage	Quality	Tightening torque [Nm]
<b>NB</b>			
901.01	M8 M10 M12	4.6 8.8 8.8	8 35 63
901.02	M8 M12	8.8	22 63
901.10	M8 M10 M12 M16	8.8 8.8 5.6 8.8	22 35 35 150
902.01/ 920.01	M10 M16	5.8	24 100
903.01 903.02 S 903.04 D	G ¼ G ½	St	10 15
904.05	M8	A4	12
914.06	M8 M10	12.9	25 50
914.10	M16	8.8	167
922.01	M12 x 1.5 M16 x 1.5 M20 x 1.5 M24 x 1.5	1.4571	20 52 106 177
<b>CLB</b>			
902.1/920.1	M10 M12	A4-80	35 60
902.2/920.2	M12	A4-80	60
902.10	M12 M16	8.8	60 160
903.1 903.2	G ¼ G ½	St	10 30
914.16	M8 M10	12.9	25 50
914.17	M16	8.8	160
922.2	M20 x 1.5 M24 x 1.5	1.4021	210 350

Tab. 21 Tightening torques

### 9.2.6 Cleaning agents

Application area	Cleaning agents
Foodstuffs and drinking water sector	E.g. spirit, Ritzol 155, strong alkaline soapy solution, steam jet (for individual parts only)
Other	Benzine, wax solvents, diesel, paraffin, alkaline cleaners

Tab. 22 Cleaning agents

### 9.2.7 Preservatives

Use Valvoline preservatives or similar (recommended).

Type of storage	Storage duration [months]	Preservative inside/ outside	Renew [months] inside/ outside
In closed, dry and dust-free room	6–12	Tectyl 511 M	–
	> 12	Tectyl 506 EH	48/48
In open air, central European climate	6–12	Tectyl 542	–
	> 12	Tectyl 506 EH	48/18
In open air, tropical climate, aggressive industrial atmosphere or close to sea	6–12	Tectyl 542/ Tectyl 506 EH	–
	> 12	Tectyl 506 EH	48/12

Tab. 23 Valvoline preservatives

### 9.2.8 Flange loads according to ISO 5199

#### Empirical formulas for forces and torques

$$\sum |F_{vs}| = \sum |F_{zs}|$$

$$\sum |F_{hs}| = \sum |F_{xs}| + \sum |F_{ys}|$$

$$\sum |F_{vd}| = \sum |F_{zd}|$$

$$\sum |F_{hd}| = \sum |F_{xd}| + \sum |F_{yd}|$$

$$\sum |M_{td}| = \sum |M_{xd}| + \sum |M_{yd}| + \sum |M_{zd}|$$

$$\sum |M_{ts}| = \sum |M_{xs}| + \sum |M_{ys}| + \sum |M_{zs}|$$

Fig. 34 Empirical formulas for forces and torques

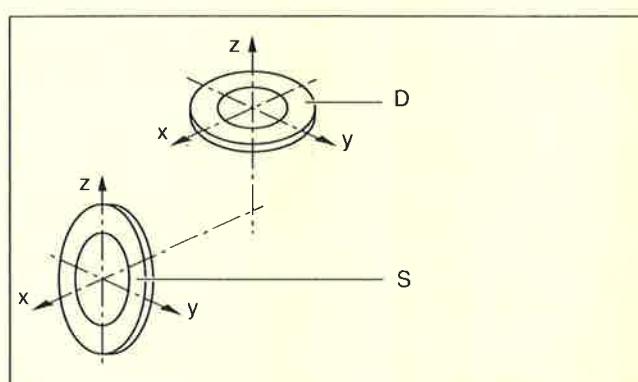


Fig. 35 Flange loads at the pump

#### Formulas for conditions to be checked

$$\sum |M_t| = \sum |M_x| + 3 \times \sum |M_y| + \sum |M_z| \leq M_{t\max}$$

$$\sum |F_h| = \sum |F_{xs}| + 2,5 \times \sum |F_{xd}| + \sum |F_y| \leq F_{h\max}$$

$$\sum |F_v| = \sum \left( |F_{vs}| + \frac{2}{3} |F_{vd}| \right) \leq F_{v\max}$$

$$\left( \frac{\sum |F_v|}{F_{v\max}} \right)^2 + \left( \frac{\sum |F_h|}{F_{h\max}} \right)^2 + \left( \frac{\sum |M_t|}{M_{t\max}} \right)^2 \leq 1$$

-  To calculate the maximum permissible flange load: multiply the table value with the correction factor M, depending on the material and temperature (→ Figure Correction factor M and operating temperature, Page 40).

<b>Pump size</b>	<b>Values for NB, CLB, CNB series</b>		
	<b><math>F_v \text{ max } (z) [N]</math></b>	<b><math>F_h \text{ max } (x, y) [N]</math></b>	<b><math>M_t \text{ max } [\text{Nm}]</math></b>
20–160	1300	1000	200
25–160	2000	1400	400
25–200	1900	1400	350
32–125	2300	1600	500
32–160	2300	1600	500
32–200	2100	1500	450
32–250	2500	1700	550
40–125	2700	1800	650
40–160	2700	1800	650
40–200	2400	1700	550
40–250	2800	1900	700
40–315	2900	2000	700
50–125	3200	2100	800
50–160	3200	2100	800
50–200	2800	1900	700
50–250	3200	2200	850
50–315	3300	2200	850
65–125	4200	2800	1200
65–160	4200	2800	1200
65–200	4500	2900	1300
65–250	4000	2600	1100
65–315	4700	3100	1400
65–400	3200	2200	850
80–160	5300	3400	1650
80–200	5600	3600	1700
80–250	4900	3200	1400
80–315	5900	3800	1850
100–160	5000	3200	1500
100–200	7000	4400	2300
100–250	7900	5000	2700

<b>Pump size</b>	<b>Values for NB, CLB, CNB series</b>		
	<b><math>F_v \text{ max } (z) [N]</math></b>	<b><math>F_h \text{ max } (x, y) [N]</math></b>	<b><math>M_t \text{ max } [\text{Nm}]</math></b>
100–315	7200	4600	2400
125–200	7300	4600	2400
125–250	9700	6100	3450
150–200	12600	8000	4800

Tab. 24 Flange loads

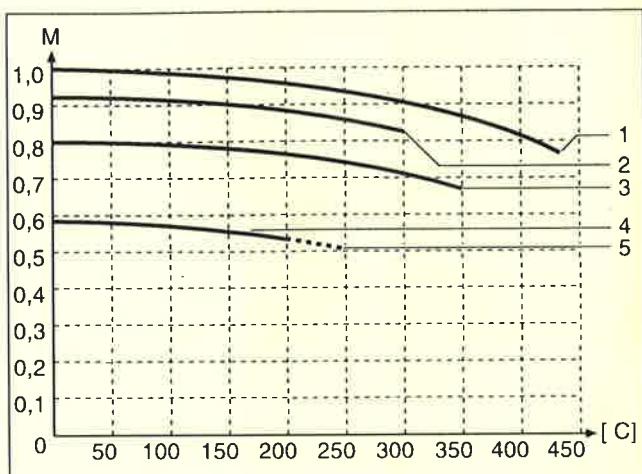


Fig. 36 Correction factor M and operating temperature

- 1 Non-alloyed steel cast
- 2 Austenitic steel cast
- 3 Spheroidal iron EN-GJS-400
- 4 Gray cast iron EN-GJL-200
- 5 Bronze G-CuAl10Ni

### 9.3 Spare parts for two years of continuous operation according to DIN 24296

Part no.	Part designation	Number of identical pumps (including stand-by pumps)						
		2	3	4	5	6 or 7	8 or 9	> 9
Set/quantity of spare parts								
171.01	Impeller (all two-stage pump sizes)	1	1	1	2	2	3	30 %
211.1 914.16 922.2 930.1 940.1	Stub shaft Cheese head screw Impeller nut Spring ring Shaft key	① 1	1	2	2	2	3	30 %
220.01 914.16 922.01 936.01 940.01	Stub shaft Cheese head screw Impeller nut Spring ring Shaft key	① 1	1	2	2	2	3	30 %
220.02 914.16 922.01 936.01 940.03	Stub shaft Cheese head screw Impeller nut Spring ring Shaft key	① 1	1	2	2	2	3	30 %
230.01 230.1	Impeller (all single-stage pump sizes)	1	1	1	2	2	3	30 %
230.02 230.03 514.01 904.05	Impeller, first stage Impeller, second stage Threaded ring Grub screws	① 1	1	1	2	2	3	30 %
400.1/01 400.2/02	Gasket (set) Gasket (for version with intermediate ring)	4	6	8	8	9	12	150 %
433...	Mechanical seal	2	3	4	5	6	7	90 %

Tab. 25 Spare parts for two years of continuous operation

①) Delivered as a mechanical unit (BG) or sales unit (VG)

## 9.4 Document of compliance

### Document of compliance

The pump, together with additional equipment, we (as signed person) sent for inspection or repair.

Type: \_\_\_\_\_

Delivery date: \_\_\_\_\_

Item-no.: \_\_\_\_\_

Order-no.: \_\_\_\_\_

Reason for the inspection / repair order: \_\_\_\_\_

have never been used for harmful / environmentally hazardous substances.

have been used for application of \_\_\_\_\_

and have been in contact with fluids for which a liability of labeling occur, or which have toxic ingredients.

Last fluid which has been pumped: \_\_\_\_\_

The pump has been carefully drained, as well as cleaned inside and outside before shipping / allocation.

Specific safety arrangements are not necessary for further handling.

Following safety arrangements concerning flushing medium, fluid left over and waste disposal are necessary:



If any critical medium has been inside the pump please necessarily enclose a safety data sheet to

We confirm, that the made statements are correct and complete, and that the shipment will be made due to legal requirements.

Company / Address: \_\_\_\_\_

Phone: \_\_\_\_\_

\_\_\_\_\_

Fax: \_\_\_\_\_

Customer-no.: \_\_\_\_\_

--	--	--	--	--	--

Name of drawer:  
(in block letters)

Position: \_\_\_\_\_

Date \_\_\_\_\_

Company stamp / Signature





*REF POS 3.*

ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.3  
CUSTOMER.....: Havyard Leirvik AS  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 3  
Date of issue: 16/03-11

711 - SLUDGE PUMP

\*\*\*\*\*

35,00 AEB 1L 101 Number: 1,00

Allweiler self-priming eccentric screw-pump with gearmotor.  
Safetyvalve and solenoidvalve for dry-run protection is included.

Technical specification: Eccentric screw pump

Serialno.:	6026683,
Capacity.....	.....m <sup>3</sup> /h: 5,1
Diff.pressure.....	.....bar: 2,0
Rpm.....	.....rpm.: 431
Power absorbed.....	.....Kw: 0,91
NPSHr.....	.....m: 2,9
Direction.....	..cw/ccw: ccw
Medium.....	.....: Sludge
Temperature.....	.....C: 20
Viscosity.....	...mm <sup>2</sup> /s: 1-250
Casing.....	material: Cast iron
Rotor.....	material: St.St.
Stator.....	material: Perbunan
Shaft sealing.....	...type: Std. packing

35,10 GEARMOTOR SK SERIES Number: 1,00

NORD / Allweiler gearmotor.

Technical specification: El-motor

Rated power.....	.....KW: 1,3
RPM.....	...Rpm.: 431
Voltage.....	...Volt: 3*440
Frequency.....	.....Hz: 60
Starting method.....	....type: DOL
Construction method.	....type: B5
Protection.....	.....: IP55
Isolation.....	.....: F

35,20 SOLENOID VALVE,DRY RUN PROTECTION (F.W.) Number: 1,00

35,30 SAFETYVALVE 1/2" 4 BAR Number: 1,00

*Ref pos 3.*

## ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2  
 CUSTOMER.....: Havyard Leirvik as  
 CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
 Date of issue: 30/10-07

### 711 - SLUDGE PUMP

\*\*\*\*\*

35,00 AEB 1L 101 Number: 1,00

Allweiler self-priming eccentric screw-pump with gearmotor.  
 Safetyvalve and solenoidvalve for dry-run protection is included.

Technical specification: Eccentric screw pump

Serialno.:	6026683,
Capacity.....	...m <sup>3</sup> /h: 5,1
Diff.pressure.....	.....bar: 2,0
Rpm.....	....rpm.: 431
Power absorbed.....	.....Kw: 0,91
NPSHr.....	.....m: 2,9
Direction.....	..cw/ccw: ccw
Medium.....	.....: Sludge
Temperature.....	.....C: 20
Viscosity.....	...mm <sup>2</sup> /s: 1-250
Casing.....	material: Cast iron
Rotor.....	material: St.St.
Stator.....	material: Perbunan
Shaft sealing.....	....type: Std. packing

35,10 GEARMOTOR SK SERIES Number: 1,00

NORD / Allweiler gearmotor.

Technical specification: EI-motor

Rated power.....	.....KW: 1,3
RPM.....	...Rpm.: 431
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Starting method....	....type: DOL
Construction method.	....type: B5
Protection.....	.....: IP55
Isolation.....	.....: F

35,20 SOLENOID VALVE,DRY RUN PROTECTION (F.W.) Number: 1,00

35,30 SAFETYVALVE 1/2" 4 BAR Number: 1,00

---

**ORDER SPECIFICATION**

---

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10-07

---

**721.101.10/20 - SW COOLING PUMP ME, FREQUENCY CONTROLLED**  
\*\*\*\*\*

40,00	NB 125-200/01/230-U3.1D-W3 IEC 180	Number:	2,00
-------	------------------------------------	---------	------

Allweiler single-stage centrifugal pump with flanged on el.-motor. To be mounted vertical or horizontal. Axial inlet, radial outlet.

Technical specification: Centrifugal pump

Serialno.:	6037615, 6037614,
Capacity.....	....m3/h: 180
Diff. pressure.....	....bar: 2,5
Delivery head.....	.....m: 25
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 2,5
Speed.....	... rpm: 1780
NPSHr.....	.....m: 4,5
Power absorbed.....	.....Kw: 20
Medium.....	.....: SW
Temperature.....	.....C: 32
Viscosity.....	....mm <sup>2</sup> /s: 1
Specific gravity....	....kg/m <sup>3</sup> : 1025
Pump casing.....	material: Ni.Al.Bronze
Impeller.....	material: Ni.Al.Bronze
Shaft.....	material: 1.4404 316L
Shaft seal.....	....type: Mech.seal

40,01	AELD 65 AUTOMATIC ASPIRATOR	Number:	2,00
-------	-----------------------------	---------	------

Automatic self-priming unit.

40,10	EL-MOTOR 180M-4 V1 IP54	Number:	2,00
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Technical specification: El-motor

Rated power.....	.....KW: 21,3
RPM.....	..Rpm.: 1750
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: 37
Starting method....	....type: FREQ. CONTROLLED
Construction method.	....type: V1, FIXED BEARING
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	....K: 90

40,20	CERTIFICATE DNV, PUMP	Number:	2,00
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40,22	TEST REPORT DNV EL-MOTOR	Number:	2,00
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*Ref pos 40*

## ORDER SPECIFICATION

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10/07

### 721.102.10 - SW COOLING PUMP ME, BACK-UP

\*\*\*\*\*

41,00	NB 125-200/01/230-U3.1D-W3 IEC 180	Number:	1,00
-------	------------------------------------	---------	------

Allweiler single-stage centrifugal pump with flanged on el.-motor. To be mounted vertical or horizontal. Axial inlet, radial outlet.

Technical specification: Centrifugal pump

Serialno.:	6037616,
Capacity.....	....m3/h: 180 - 90
Diff. pressure.....	....bar: 2,5 - 0,6
Delivery head.....	.....m: 25 - 6,25
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 2,5 - 0,6
Speed.....	... rpm: 1780-880
NPSHr.....	.....m: 4,5 - 3,5
Power absorbed.....	.....Kw: 20
Medium.....	.....: SW
Temperature.....	.....C: 32
Viscosity.....	...mm <sup>2</sup> /s: 1
Specific gravity....	...kg/m <sup>3</sup> : 1025
Pump casing.....	material: Ni.Al.Bronze
Impeller.....	material: Ni.Al.Bronze
Shaft.....	material: 1.4404 316L
Shaft seal.....	....type: Mech.seal

41,01	AELD 65 AUTOMATIC ASPIRATOR	Number:	1,00
-------	-----------------------------	---------	------

Automatic self-priming unit.

41,10	EL-MOTOR 180L-4/8 V1 IP54	Number:	1,00
-------	---------------------------	---------	------

Technical specification: El-motor

Rated power.....	....KW: 22/5,8
RPM.....	...Rpm.: 1750/850
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: ?/?
Starting method....	....type: DOL/DOL
Construction method.	....type: V1, FIXED BEARING
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	....K: 90

41,20	CERTIFICATE DNV, PUMP	Number:	1,00
-------	-----------------------	---------	------

41,22	TEST REPORT DNV EL-MOTOR	Number:	1,00
-------	--------------------------	---------	------

*Ref pos 3.*

## ORDER SPECIFICATION

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10/07

### BILGE- / FIRE PUMP

\*\*\*\*\*

55,00 AEB 1E 750-ID/111PO1 G122PP 5846

Number:

2,00

Allweiler self-priming eccentric screw-pump with gearmotor flanged on.  
Safetyvalve and solenoidvalve for dry-run protection is included.

Technical specification: Eccentric screw pump

Serialno.:	6026704, 6026703,
Capacity.....	....m3/h: 58
Inlet pressure.....	....bar: 0
Diff.pressure.....	....bar: 6/3
Outlet pressure.....	....bar: 6/3
Rpm.....	....rpm.: 555
Torque.....	.....Nm: 150
Power absorbed.....	.....Kw: 12,8
Direction.....	..cw/ccw: ccw
Medium.....	.....: Seawater/Bilgewater
Viscosity.....	...mm2/s: 1-150
Spes. gravity.....	...kg/m3: 1025
Casing.....	material: Cast iron GG-25
Rotor.....	material: 1,4301 St. St.
Stator.....	material: Perbunan N
Shaft sealing.....	....type: Stuffing box

55,10 GEARMOTOR SK42F 160L4 Number: 2,00

Technical specification: El-motor

Serialno.:	6026704, 6026703,
Rated power.....	.....KW: 15
RPM.....	...Rpm.: 1750/555
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: appr. 23
Construction method.	....type: Gearmotor
Protection.....	.....: IP 55

55,11 TEST REPORT DNV GEAR-MOTOR Number: 2,00

55,20 CERTIFICATE DNV, PUMP Number: 2,00

55,30 Lezer DN 40 full flow valve Number: 2,00

Set point 7 bar

55,40 SOLENOID VALVE, DRY RUN PROTECTION Number: 2,00

ONLY FW

*Ref pos 40*

ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

EMERGENCY FIRE PUMP

\*\*\*\*\*

60,00 NB 32-160/170-U3.1D-W3- FOR IEC 160 Number: 1,00

Allweiler single-stage centrifugal pump with flanged on el-motor. To be mounted vertical or horizontal. Axial inlet, radial outlet.

Technical specification: Centrifugal pump

Serialno.:	6037617,
Capacity.....	....m3/h: 31
Diff. pressure.....	....bar: 6,0
Delivery head.....	.....m: 60
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 6,0
Speed.....	... rpm: 3590
NPSHr.....	.....m: 3,2
Power absorbed.....	.....Kw: 8,9
Medium.....	.....: SW
Temperature.....	.....C: 32
Viscosity.....	...mm <sup>2</sup> /s: 1
Specific gravity....	...kg/m <sup>3</sup> : 1025
Pump casing.....	material: Ni.Al.Bronze
Impeller.....	material: Ni.Al.Bronze
Shaft.....	material: 1.4404 316L
Shaft seal.....	....type: Mech.seal
Drawing number.....	.....: 15871-02

60,01 AELD 65 AUTOMATIC ASPIRATOR Number: 1,00

0,10 EL-MOTOR 160M-2 MARINE Number: 1,00

Technical specification: El-motor

Rated power.....	.....KW: 12,6
RPM.....	...Rpm.: 3590
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: TO BE GIVEN
Starting method....	....type: DOL
Construction method.	....type: V1, FIXED BEARING
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	.....K: 90

60,20 CERTIFICATE DNV, PUMP Number: 1,00

60,50 TEST REPORT DNV EL-MOTOR Number: 1,00

*Ref pos 40*

## ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2  
 CUSTOMER.....: Havyard Leirvik as  
 CUSTOMER REF.....: 096 CHS/ERP

Rev.no.: 2  
 Date of issue: 30/10-07

### 722.105.10 - FW COOLING PUMP

\*\*\*\*\*

65,00 NB 80-315/279-U3.1D-W18 IEC 160

Number: 1,00

Allweiler close-coupled centr.pump w/el-motor.  
 To be mounted vertical or horizontal. Axial inlet,  
 radial outlet.

Technical specification: Centrifugal pump

Serialno.:	6037618,
Capacity.....	....m3/h: 80
Diff. pressure.....	....bar: 3,5
Delivery head.....	.....m: 35
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 3,5
Speed.....	... rpm: 1750
NPSHr.....	.....m: 2,1
Power absorbed.....	.....Kw: 10,7
Medium.....	.....: FW
Viscosity.....	...mm <sup>2</sup> /s: 1
Specific gravity....	...kg/m <sup>3</sup> : 1000
Pump casing.....	material: Cast iron
Impeller.....	material: Ni.Al.Bronze
Shaft.....	material: 1.4404 316L
Shaft seal.....	....type: Mech.seal

65,10 EL-MOTOR 160L-4 V1 IP54

Number: 1,00

Technical specification: El-motor

Rated power.....	....KW: 17,3
RPM.....	....Rpm.: 1750
Voltage.....	....Volt: 3*440
Frequency.....	....Hz: 60
Ampere In.....	.....A: 30
Starting method....	....type: DOL
Construction method.	....type: V1, FIXED BEARING
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	....K: 90K

65,20 CERTIFICATE DNV, PUMP

Number: 1,00

*Ref pos 40*

ORDER SPECIFICATION

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10-07

722.105.30 - FW COOLING PUMP, BACK-UP

\*\*\*\*\*

67,00	NB 80-315/285-U3.1D-W18 IEC 160	Number:	1,00
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Allweiler close-coupled centr.pump w/el-motor.  
To be mounted vertical or horizontal. Axial inlet,  
radial outlet.

Technical specification: Centrifugal pump

Serialno.:	6037620,
Capacity.....	....m3/h: 100
Diff. pressure.....	....bar: 3,5
Delivery head.....	.....m: 35
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 3,5
Speed.....	... rpm: 1750
NPSHr.....	.....m: 2,4
Power absorbed.....	.....Kw: 13
Medium.....	.....: FW
Viscosity.....	...mm <sup>2</sup> /s: 1
Specific gravity....	...kg/m <sup>3</sup> : 1000
Pump casing.....	material: Cast iron
Impeller.....	material: Ni.Al.Bronze
Shaft.....	material: 1.4404 316L
Shaft seal.....	....type: Mech.seal

67,10	EL-MOTOR 160L-4 V1 IP54	Number:	1,00
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Technical specification: El-motor

Rated power.....	.....KW: 17,3
RPM.....	...Rpm.: 1750
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: 30
Starting method....	....type: DOL
Construction method.	....type: V1, FIXED BEARING
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	.....K: 90K

67,20	CERTIFICATE DNV, PUMP	Number:	1,00
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*Ref pos 40*

## ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2  
 CUSTOMER.....: Havard Leirvik as  
 CUSTOMER REF.....: 096 CHS/ERP

Rev.no.: 2  
 Date of issue: 30/10-07

### 722.105.40 - FW COOLING PUMP FOR HARBOUR

\*\*\*\*\*  
 68,00 NB 50-125/128-U3.1D-W18 IEC 112 Number: 1,00

Allweiler close-coupled centr.pump w/el-motor.  
 To be mounted vertical or horizontal. Axial inlet,  
 radial outlet.

Technical specification: Centrifugal pump

Serialno.:	6037621,
Capacity.....	....m3/h: 30
Diff. pressure.....	.....bar: 3
Delivery head.....	.....m: 30
Inlet pressure.....	.....bar: 0
Outlet pressure.....	.....bar: 3
Speed.....	... rpm: 3500
NPSHr.....	.....m: 3,7
Power absorbed.....	.....Kw: 4
Medium.....	.....: FW
Viscosity.....	...mm <sup>2</sup> /s: 1
Specific gravity....	...kg/m <sup>3</sup> : 1000
Pump casing.....	material: Cast iron
Impeller.....	material: Ni.Al.Bronze
Shaft.....	material: 1.4404 316L
Shaft seal.....	....type: Mech.seal

68,10 EL-MOTOR 112M-2 V1 IP54 Number: 1,00

Technical specification: El-motor

Rated power.....	.....KW: 6,3
RPM.....	...Rpm.: 3500
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: 11
Starting method....	....type: DOL
Construction method.	....type: V1, FIXED BEARING
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	.....K: 90K

*Ref pos 40*

## ORDER SPECIFICATION

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10-07

### 722.105.50 - FW COOLING PUMP FOR HARBOUR

\*\*\*\*\*  
69,00 NB 50-125/133-U3.1D-W18 IEC 112 Number: 1,00

Allweiler close-coupled centr.pump w/el-motor.  
To be mounted vertical or horizontal. Axial inlet,  
radial outlet.

Technical specification: Centrifugal pump

Serialno.: 6037622,  
Capacity..... ....m3/h: 50  
Diff. pressure..... ....bar: 3  
Delivery head..... ....m: 30  
Inlet pressure..... ....bar: 0  
Outlet pressure..... ....bar: 3  
Speed..... ... rpm: 3500  
NPSHr..... .....m: 5,3  
Power absorbed..... .....Kw: 5,6  
Medium..... .....: FW  
Viscosity..... ...mm2/s: 1  
Specific gravity.... ....kg/m3: 1000  
Pump casing..... material: Cast iron  
Impeller..... material: Ni.Al.Bronze  
Shaft..... material: 1.4404 316L  
Shaft seal..... ....type: Mech.seal

69,10 EL-MOTOR 112M-2 V1 IP54 Number: 1,00

Technical specification: El-motor

Rated power..... .....KW: 6,3  
RPM..... ...Rpm.: 3500  
Voltage..... ....Volt: 3\*440  
Frequency..... ....Hz: 60  
Ampere In..... ....A: 11  
Starting method.... ....type: DOL  
Construction method. ....type: V1, FIXED BEARING  
Protection..... .....: IP55  
Isolation..... .....: F  
Temp.rise..... .....K: 90K

*Ref pos 40*

## ORDER SPECIFICATION

ALLWEILER ORDER NO:	85683.2	Rev.no.:	2
CUSTOMER.....:	Havyard Leirvik as		
CUSTOMER REF.....:	096 CHS/ERP	Date of issue:	30/10-07

722.140.10 - CIRC. PUMP FW GENERATOR

\*\*\*\*\*

79,00	NB 32-125/116 U3.1D-W18 IEC 90	Number:	2,00
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Allweiler close-coupled centr.pump w/el-motor.  
To be mounted vertical or horizontal. Axial inlet,  
radial outlet.

) Technical specification: Centrifugal pump

Serialno.:	6037624, 6037623,
Capacity.....	....m3/h: 21,6
Diff. pressure.....	....bar: 2,0
Delivery head.....	.....m: 20
Inlet pressure.....	....bar: 0
Outlet pressure.....	....bar: 2,0
Speed.....	... rpm: 3500
NPSHr.....	.....m: 3,8
Power absorbed.....	....Kw: 2,14
Medium.....	.....: FW
Temperature.....	.....C: 20
Viscosity.....	...mm <sup>2</sup> /s: 1
Specific gravity.....	...kg/m <sup>3</sup> : 1000
Pump casing.....	material: Cast iron
Impeller.....	material: Ni.Al.Bronze
Shaft.....	material: 1.4404 316L
Shaft seal.....	....type: Mech.seal

79,10	EL-MOTOR 90L-2 V1 IP54	Number:	2,00
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) Technical specification: El-motor

Rated power.....	.....KW: 2,55
RPM.....	....Rpm.: 3500
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: 5
Starting method....	....type: DOL
Construction method.	....type: V1, FIXED BEARING
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	.....K: 90K

*Ref pos 40*

ORDER SPESIFICATION

ALLWEILER ORDER NO: 85683.2  
CUSTOMER.....: Havyard Leirvik as  
CUSTOMER REF....: 096 CHS/ERP

Rev.no.: 2  
Date of issue: 30/10/07

581.123.10 - HOT WATER CIRC. PUMP

\*\*\*\*\*

80,00 NB 20-160/153 U3.1D W18 IEC 71 Number: 1,00

Allweiler close-coupled centr.pump w/el-motor.  
To be mounted vertical or horizontal. Axial inlet,  
radial outlet.

Technical specification: Centrifugal pump

Serialno.:	6037625,
Capacity.....	.....m3/h: 2,5
Diff. pressure.....	.....bar: 1
Delivery head.....	.....m: 10
Inlet pressure.....	.....bar: 0
Outlet pressure.....	.....bar: 1
Speed.....	... rpm: 1750
NPSHr.....	.....m: 2
Power absorbed.....	.....Kw: 0,212
Medium.....	.....: FW
Temperature.....	.....C: 20
Viscosity.....	...mm <sup>2</sup> /s: 1
Specific gravity....	...kg/m <sup>3</sup> : 1000
Pump casing.....	material: Cast iron
Impeller.....	material: Ni.Al.Bronze
Shaft.....	material: 1.4404 316L
Shaft seal.....	....type: Mech.seal

80,10 EL-MOTOR 71-4 IP54 Number: 1,00

Technical specification: El-motor

Rated power.....	.....KW: 0,29
RPM.....	...Rpm.: 1650
Voltage.....	....Volt: 3*440
Frequency.....	.....Hz: 60
Ampere In.....	.....A: 0,8
Starting method....	....type: DOL
Construction method.	....type: V1, FIXED BEARING
Protection.....	.....: IP55
Isolation.....	.....: F
Temp.rise.....	.....K: 90K

## CONTENS:

1. AELD 65
2. Pressure gauges
3. Vega Swing 61 R (Dry run protection)
4. Safetyvalve leser Mud
5. Pressure gauges Mud
6. Solenoid valve
7. Safety Valve Broady

**Betriebsanleitung / Operating instructions**

Kommissions-Nr. / Serial No.  
Bestell-Nr. / Order No.

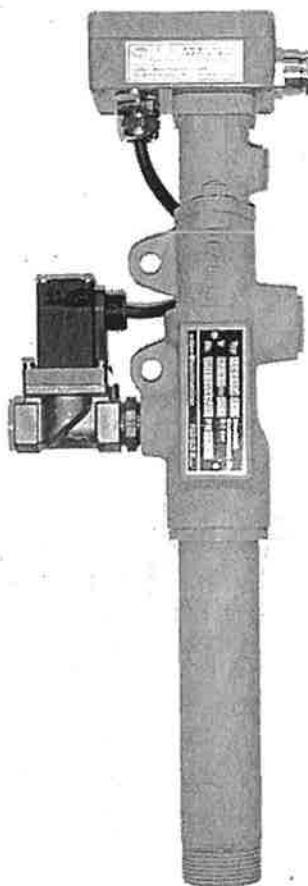
Typ / Type  
Spannung / Voltage  
Schaltplan / Circuit diagram

AELD  
230V 50/60Hz



Diese Betriebsvorschrift enthält grundlegende Hinweise, die bei Aufstellung, Betrieb und Wartung zu beachten sind. Daher ist diese Betriebsvorschrift unbedingt vor Montage und Inbetriebnahme vom Monteur sowie dem zuständigen Fachpersonal / Betreiber zu lesen und muß ständig am Einsatzort des Gerätes verfügbar sein.

These operating instructions contain basic information to be observed during installation, operation and maintenance. For this reason the operating instructions should always be read by the mechanic as well as responsible operator before assembly and start-up and should be available at all times at the place of installation of the unit.

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  - 2.2 Personalqualifikation und Schulung
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  - 2.4 Sicherheitsbewußtes Arbeiten
  - 2.5 Sicherheitshinweise für Betreiber
  - 2.6 Hinweise für Wartungs-, Inspektions- und Montagearbeiten
  - 2.7 Eigenmächtiger Umbau und Ersatzteilherstellung
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- 7.2 Dimensions
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## 1. Allgemeines

Diese Betriebsanleitung enthält grundlegende Hinweise, die bei Aufstellung, Betrieb und Wartung zu beachten sind. Daher ist diese Betriebsanleitung unbedingt vor Montage und Inbetriebnahme vom Monteur sowie dem zuständigen Fachpersonal/Betreiber zu lesen und muß ständig am Einsatzort der Maschine/Anlage verfügbar sein.

Ein störungsfreier Betrieb der Maschine/Anlage kann nur erreicht werden, wenn diese sorgfältig montiert und richtig gewartet wird. Es ist unbedingt darauf zu achten, daß die vorliegende Betriebsanleitung beachtet wird und die Maschine/Anlage nicht für andere als die von uns angegebenen Betriebsverhältnisse eingesetzt wird. Die Betriebsanleitung berücksichtigt nicht die ortsbezogenen Sicherheitsbestimmungen, für deren Einhaltung auch seitens des hinzugezogenen Montagepersonals, der Betreiber verantwortlich ist. Das Fabrikschild an der Maschine/Anlage nennt die Baureihe/Größe, die Werks-Nr., die wir bei Rückfragen, Nachbestellung und insbesondere bei Bestellung von Ersatzteilen stets anzugeben bitten. Im Schadensfalle wenden Sie sich bitte an unsere nächstgelegene Kundendienststelle.

### Achtung

Diese Anlage darf nicht über die auf dem Fabrikschild festgelegten Grenzwerte bezüglich Menge, Drehzahl, Druck und Temperatur oder andere in der Betriebsanleitung-Vertragsdokumentation enthaltenen Anweisungen betrieben werden. Vorgeschriften elektrische Anschlußwerte sowie Montage- und Wartungsanweisungen sind unbedingt einzuhalten. Das Handhaben der Maschine/Anlage außerhalb der vorgenannten Bedingungen führt zu Überbeanspruchungen, denen sie nicht standhalten kann. Das Nichtbeachten dieser Warnungen kann zu Personen- und Sachschäden führen.

### Zur Beachtung

Die Beschreibungen und Instruktionen in dieser Betriebsanweisung betreffen die Standardausführung. Diese Betriebsanleitung berücksichtigt weder alle Konstruktionseinzelheiten und Varianten noch alle möglichen Zufälligkeiten und Ereignisse, die bei Montage, Betrieb und Wartung auftreten können.

Voraussetzung für das Handhaben der Anlage ist der Einsatz von fachlich geschultem Personal. Sofern nicht alle Informationen und Anweisungen in dieser Betriebsanleitung gefunden werden, fragen Sie bei der nächstgelegenen Kundendienststelle nach.

Der Hersteller übernimmt für die Anlage keine Verantwortung, wenn diese Betriebsanleitung nicht beachtet wird.

## 1. General

These operating instructions contain basic information to be observed during installation, operation and maintenance. For this reason the operating instructions should always be read by the mechanic as well as responsible personnel/operator before assembly and start-up and should be available at all times in the vicinity of the machine/system.

Malfunction-free operation of the machine/system is only possible when it is assembled carefully and maintained properly. Always ensure that these operating instructions are observed and that the machine/system is not used for other operating conditions as those specified by us. The operating instructions do not take in consideration local safety regulations for which the operator is responsible for maintaining also on the part of installation personnel used. The factory rating plate on the machine/system specifies the model/size, serial number, which we request you to specify on any queries, subsequent orders and particularly when ordering replacement parts. In the event of damage please contact our nearest customer service point. Safety information, which can result in a hazard for the machine and its functions when not observed, is indicated by the following word:

### Caution

This system must not be operated beyond the limits specified on the factory rating plate in terms of quantity, rotary speed, pressure and temperature or other instructions contained in the operating instructions and contract documents. Always observe prescribed electrical connection values as well as installation and warning information. Operation of the machine/system outside of the specified conditions leads to excessive stress, which it cannot withstand. Failure to observe this warning can lead to personnel injury and property damage.

### Note

The descriptions and instructions in these operating instructions apply to the standard version. These operating instructions cannot take into consideration all design details and variations nor all possibilities and events, which can occur during installation, operation and maintenance.

The system should be operated only by properly trained personnel. If you cannot find all information or instructions in these operating instructions, please ask at the nearest customer service point.

The manufacturer assumes no liability for the system when these operating instructions are not observed.

## 2. Sicherheitshinweise

### 2.1 Kennzeichnung von Hinweisen in der Betriebsanleitung

Die in der Betriebsanleitung enthaltenen Sicherheitshinweise, die bei Nichtbeachtung Gefährdungen für Personen hervorrufen können, sind mit dem allgemeinen Gefahrensymbol



Sicherheitszeichen nach DIN 4844 - W 9,

bei Warnungen vor elektrischer Spannung mit



Sicherheitszeichen nach DIN 4888 - W 8

besonders gekennzeichnet.

Bei Sicherheitshinweisen, deren Nichtbeachtung Gefahren für die Maschinen und deren Funktion hervorrufen kann, ist nachfolgendes Wort eingefügt.

#### Achtung

Direkt an der Maschine angebrachte Hinweise wie z.B.

- Drehrichtungspfeil
- Kennzeichen für Fluidanschlüsse müssen unbedingt beachtet und in vollständig lesbarem Zustand gehalten werden.

### 2.2 Personalqualifikation und Schulung

Das Personal für Bedienung, Wartung, Inspektion und Montage muß die entsprechende Qualifikation für diese Arbeiten aufweisen. Verantwortungsbereich, Zuständigkeit und die Überwachung des Personals müssen durch den Betreiber genau geregelt sein. Liegen bei dem Personal nicht die nötigen Kenntnisse vor, so ist dieses zu schulen und zu unterweisen. Dies kann, falls erforderlich, im Auftrag des Betreibers der Maschine durch den Hersteller/Lieferer erfolgen. Weiterhin ist durch den Betreiber sicherzustellen, daß der Inhalt der Betriebsanleitung durch das Personal voll verstanden wird.

### 2.3 Gefahren bei Nichtbeachtung der Sicherheitshinweise

Die Nichtbeachtung der Sicherheitshinweise kann sowohl eine Gefährdung von Personen als auch für Umwelt und Maschine zur Folge haben. Die Nichtbeachtung der Sicherheitshinweise kann zum Verlust jeglicher Schadensersatzansprüche führen. Im einzel-

## 2. Safety

### 2.1 Marking of information in these operating instructions

Safety information contained in these operating instructions, which could result in hazards for humans when not observed, is generally marked with the following hazard symbol:



Safety symbol according to DIN 4844 - W 9.

Warnings for electrical voltage are marked with



safety sign according to DIN 4888 - W 8

Safety information, which can result in a hazard for the machine and its functions when not observed, is indicated by the following word:

#### Caution

Information attached directly to the machines such as

- Direction of rotation arrows
- Markings for fluid connections must be observed under all circumstances and kept in a completely legible condition.

### 2.2 Personnel qualifications and training

The personnel for operation, maintenance, inspection and installation must be properly qualified for such work. The range of responsibility and supervision of the personnel must be regulated precisely by the operator. If the personnel does not possess the required knowledge, they must be trained and/or instructed. If necessary this can be accomplished by the manufacturer/supplier upon request of the machine operator. Moreover, the operator must ensure that the personnel is completely familiar with the contents of the these operating instructions.

### 2.3 Hazards upon failure to observe safety information

Failure to observe the safety instructions can result in a hazard to humans as well as for the environment and the machine. Failure to observe the safety instructions can void all liability claims. In detail failure to observe the safety instructions can result in the following haz-

nen kann Nichtbeachtung beispielsweise folgende Gefährdungen nach sich ziehen:

- Versagen wichtiger Funktionen der Maschine/Anlage
- Versägen vorgeschriebener Methoden zur Wartung und Instandhaltung
- Gefährdung von Personen durch elektrische, mechanische und chemische Einwirkungen
- Gefährdung der Umwelt durch Leckage von gefährlichen Stoffen

## 2.4 Sicherheitsbewußtes Arbeiten

Die in dieser Betriebsanweisung aufgeführten Sicherheitshinweise, die bestehenden nationalen Vorschriften zur Unfallverhütung sowie eventuelle interne Arbeits-, Betriebs-, und Sicherheitsvorschriften sind zu beachten.

## 2.5 Sicherheitshinweise für den Betreiber

- Führen warme und kalte Maschinenteile zu Gefahren, müssen diese Teile bauseits gegen Berührung gesichert sein.
- Berührungsschutz für sich bewegende Teile darf bei in Betrieb befindlicher Maschine nicht entfernt werden.
- Leckagen (z.B. an der Wellenabdichtung) gefährlicher Medien (z.B. explosiv, giftig, warm) müssen so abgeführt werden, daß keine Gefährdung für Personen und Umwelt entsteht. Gesetzliche Bestimmungen sind einzuhalten.
- Gefährdungen durch elektrische Energie sind auszuschließen (Einzelheiten hierzu sind z.B. in den Vorschriften des VDE und der örtlichen Energieversorgungsunternehmer)

## 2.6 Hinweise für Wartungs-, Inspektions- und Montagearbeiten.

Der Betreiber hat dafür zu sorgen, daß alle Wartungs-, Inspektions- und Montagearbeiten von autorisierten und qualifizierten Fachpersonal ausgeführt werden, daß sich durch eingehendes Studium der Betriebsanleitung ausreichend informiert hat.

Grundsätzlich sind Arbeiten an der Maschine nur im Stillstand durchzuführen. Die in der Betriebsanleitung beschriebene Vorgehensweise zum Stillsetzen der Maschine/Anlage muß unbedingt eingehalten werden. Bei Maschinen/Anlagen, die mit nachstehend aufgeführten Gefahrstoffen und/oder umweltgefährdenden Fördermedien betrieben werden, muß der Kunde/Betreiber im Reparaturfall oder bei einer Rücksendung an unser Werk bzw. unsere Vertragswerkstatt das eigene bzw. unser Personal vor Ort unaufgefordert informieren. In diesem Fall ist uns mit der Anforderung eines Kundendienst-Monteurs ein Fördergutnachweis, z.B. in Form eines DIN-Sicherheitsblattes vorzulegen.

Alternativ fordern Sie ein Unbedenklichkeitsbescheinigungs-Formular an und füllen dieses wahrheitsgemäß, korrekt und vollständig aus. Senden

ards:

- Failure of important machine/system functions
- Failure of specified methods for maintenance and repair
- Hazards for humans resulting from electrical shock, mechanical and chemical effects.
- Hazard for the environment resulting from leakage of dangerous substances.

## 2.4 Safety-conscious operation

The safety instructions contained in these operating instructions, the existing national regulations on accident prevention as well as all internal operating, labour and safety regulations must be observed.

## 2.5 Safety instructions for operator

- If hot and cold machine parts present a hazard, such parts must be secured against unintentional contact.
- Contact guards for moving parts should never be removed from machines while in operation.
- Leakage (e.g. at shaft seals) of dangerous substances (e.g. explosive, toxic, hot) must be eliminated in such a manner that hazards do not result for humans or the environment. Observe all legal regulations.
- Hazards resulting from electrical power must be excluded (for details see VDE regulations and regulations of local power company).

## 2.6 Information on maintenance, inspection and assembly work

The operator must ensure that all maintenance, inspection and assembly work is accomplished by authorized and qualified personnel, who have informed themselves by studying the operating instructions in detail.

Work should be performed on the machine only when it is standing still as a matter of principle. The procedures described in the operating instructions for shutting down the machine/system must be maintained under all circumstances. On machines/systems, which are operated with the hazardous substances listed below and/or environment polluting substances, the customer/operator must inform his own or our personnel locally or our plant or authorized workshop when the machine is returned, before repair is performed. In such cases it is necessary to submit to us a certificate on the substances transported, e.g. in the form of a DIN safety sheet, when a customer service mechanic is requested.

As an alternative you can request a safety certification form and fill it out truthfully, correctly and completely. Return this form filled out to the point where the repair is to be performed or present it to our requested service

Sie das ausgefüllte Formular an die mit der Reparatur beauftragte Stelle oder legen Sie dieses unserem angefordertem Kundendienst-Monteur vor.

mechanic.

#### Gefahrstoffe:

- giftige Stoffe
- gesundheitsgefährdende Stoffe
- ätzende Stoffe
- Reizstoffe
- explosionsgefährliche Stoffe
- brandfördernde, hoch- und leichtentzündliche Stoffe
- krebserzeugende Stoffe
- fruchtschädigende Stoffe
- erbgutverändernde Stoffe
- Stoffe die auf sonstige Weise dem Menschen gefährlich sind

Bei allen Arbeiten vor Ort ist das eigene bzw. unser Montagepersonal auf Gefahren, welche im Zusammenhang mit Reparaturen entstehen können, aufmerksam zu machen.

Die in der Betriebsanleitung beschriebenen Montageschritte sind konsequent einzuhalten.

Unmittelbar nach Abschluß der Arbeiten müssen alle Sicherheits- und Schutzeinrichtungen wieder angebracht und in Funktion gesetzt werden.

Vor der erneuten Inbetriebnahme sind die im Abschnitt Inbetriebnahme aufgeführten Punkte zu beachten.

#### 2.7 Eigenmächtiger Umbau und Ersatzteilherstellung

Umbau und Veränderungen der Maschine/Anlage sind nur nach Absprache mit dem Hersteller zulässig. Originalersatzteile und vom Hersteller autorisierte Zubehör dienen der Sicherheit. Für Schäden, die durch die Verwendung von Nicht-Originalteilen und Zubehör entstehen, ist jedwede Haftung des Herstellers ausgeschlossen.

#### 2.8 Unzulässige Betriebsweisen

Die Betriebssicherheit der gelieferten Maschine/Anlage ist nur bei bestimmungsgemäßer Verwendung entsprechend Kapitel 1 - Allgemeines - der Betriebsanleitung gewährleistet. Die im Datenblatt angegebenen Grenzwerte dürfen auf keinen Fall überschritten werden.

#### 2.9 Transport

Beim Transport der Maschine/Anlage sind die dafür vorgesehenen Transportösen (sofern vorhanden) für die Tragseile zu verwenden.

Die Kranvorrichtung und die Tragseile müssen ausreichend dimensioniert sein.

#### Hazardous substances:

- Toxic substances
- Health endangering substances
- Caustic substances
- Irritating substances
- Explosive substances
- Combustible, highly and easily inflammable substances
- carcinogenic substances
- Embryo-damaging substances
- Gene-mutating substances
- Substances dangerous for humans in other manners

When tasks are carried out on site, your own personnel or ours are to be cautioned at all times about the hazards which can occur when carrying out repair/maintenance tasks.

The assembly procedure described in the Operating Instructions is to be strictly adhered to.

Directly after ending work, all safety and protection measures must be brought into effect once more and applied.

Before a re-starting of operation, the points listed and described in the Section „Putting into / out operation“ must be observed.

#### 2.7 Unauthorised conversion or production of replacement parts

Conversion or modification of the machine/system is permissible only with the manufacturer's approval. Original parts and accessories authorized by the manufacturers ensure safety. Damage resulting from the use of non-original parts and accessories exclude any liability on the part of the manufacturer.

#### 2.8 Impermissible methods of operation.

The operating safety of the delivered machine/system is ensured only when used as intended according to Chapter 1 - General - in the operating instructions. The limits specified in the data sheet must not be exceeded under any circumstances.

#### 2.9 Transport

When transporting the machine/system use the transport eyes (if present) intended for this purpose for the hoisting cables.

The crane and hoisting cables must be sufficiently dimensioned.

### 3. Allgemeine Beschreibung

#### 3.1 Hinweise zu Sonderausführungen

Bitte beachten Sie bei Sonderausführungen die Seite „Sonderausführung“.

#### 3.2 Verwendung

Ansaugautomat für Kreiselpumpen, für die ein kurzzeitiger Trockenlauf zulässig ist.

Für Kreiselpumpen, für die ein Trockenlauf nicht zulässig ist, empfehlen wir die Typenreihen AELE, AELC und AELG.

#### 3.3 Bauart

Druckgesteuerter Ansaugautomat mit Druckluftejektor als Vakuumerzeuger. Durch das Polyamid Düsenystem ist das Gerät weitgehend unempfindlich gegen aggressive Flüssigkeiten wie z.B. Seewasser.  
Komponenten:

- Druckluftejektor mit integriertem Absperrventil
- Druckluft-Magnetventil
- Druckschalter
- Klemmenkasten

#### 3.4 Funktion

Bei Einschaltung der Kreiselpumpe schaltet zunächst nur der Ansaugautomat ein. Nach Ablauf des Zeitrelais in der Pumpensteuerung schaltet die Kreiselpumpe zu. Der Ansaugautomat schaltet über den Druckschalter ab, sobald die Kreiselpumpe den Förderdruck aufgebaut hat. Sinkt der Förderdruck durch Gasanfall während des Pumpenbetriebes wieder ab, schaltet der Ansaugautomat zur Nachevakuierung ein.

Wird ein längerer Trockenlauf der Pumpe zugelassen, so kann auf das Zeitrelais in der Pumpensteuerung verzichtet werden.

### 4. Installation

#### Achtung

Grundsätzlich müssen alle Entlüftungsleitungen vom Anschlußpunkt zum Ansaugautomaten hin stetig steigend verlegt werden. Für die zu wählenden Nennweiten der Entlüftungsleitungen gilt als Anhaltspunkt die Größe der dafür vorgesehenen Anschlüsse am Ansaugautomaten.

Das Langnippel und die dazugehörige Gegenmutter dürfen bei der Installation nicht verdeckt werden.

Der Ansaugautomat wird als betriebsfertige Montageeinheit geliefert und gemäß Installationsbeispiel im Anhang min. 300mm oberhalb des höchsten zu entlüften-

### 3. General Description

#### 3.1 Note for special design

In case of special design please pay attention to the page named „Special design“.

#### 3.2 Application

Automatic aspirator designed for centrifugal pumps where dry running is admissible for short periods of time.

We recommend the following ranges for centrifugal pumps where dry running is not admissible: AELE, AELC and AELG.

#### 3.3 Design

Pressure controlled automatic aspirator with a compressed-air ejector acting as a vacuum generator. Due to the polyamide nozzle system, the unit is resistant, to a large degree, against aggressive fluids (eg. see water). Components:

- Compressed-air ejector with integrated shut-off valve
- Compressed-air solenoid valve
- Pressure switch
- Terminal box

#### 3.4 Operation

When the centrifugal pump is turned on, only the automatic aspirator will be activated. After the time-limit relay sequence has been completed, the centrifugal pump is also activated. As soon as the centrifugal pump has built up the necessary discharge pressure, the aspirator is switched off via the pressure switch. Should the discharge pressure fall again during pump operation through gas accumulation, the automatic aspirator starts up once more for re-evacuation.

If a longer period of dry running is permissible, the time-limit relay sequence in the pumping control system does not have to be carried out..

### 4. Installation

#### Caution

Fundamentally every ventilating pipe is to be installed ascending from the ventilating point to the priming unit. As a indication for selecting the nominal size of the ventilating pipes please refer to the respective connection size at the priming unit.

The long nippel and the corresponding check nut may not to be twisted.

The automatic aspirator is delivered as a ready-to-install unit and is to be fitted, according to installation example inside appendix, min. 300mm above the highest point to

den Punktes (z.B. dem Pumpengehäuse) angeordnet. Dieser Entlüftungspunkt wird über eine steigend zu verlegende Entlüftungsleitung mit dem Anschluß A verbunden. Der Abluftstutzen B darf nicht abgesperrt werden. Der Anschluß C ist mit Druckseite der Kreiselpumpe zu verbinden.

Die maximale Aufstellungshöhe über dem niedrigsten saugseitigen Flüssigkeitsstand darf bei Wasser als Fördermedium nicht mehr als 7 m, abzüglich der dynamischen Verluste des Saugsystems betragen.

### Achtung

**Die Nennweite der Rohrleitung zur Druckluftversorgung muß so gewählt werden, daß die erforderliche Arbeits-Druckluft am Anschluß P des Ansaugautomaten während des Betriebes anliegt.**

Über den Anschluß P ist der Ansaugautomat mit Druckluft oder ähnlichem Treibgas zu versorgen.

### 5. Inbetriebnahme

Bei der Inbetriebnahme sind folgende Schritte zu beachten:

- Rohrverbindungen und Rohrleitungen auf ordnungsgemäße Verlegung und Dichtigkeit überprüfen.
- Elektroanschlüsse kontrollieren.
- Druckluftanschluß kontrollieren

### Achtung

Abweichungen bei Sonderausführungen beachten.

### 6. Wartung und Instandsetzung

Das System arbeitet mit geringem Wartungsaufwand. Folgende Kontrollen bzw. Arbeiten sollten je nach Fördermedium, Betriebsart und Betriebsdauer in festzulegenden Zeitabständen durchgeführt werden.

- Kontrolle aller Komponenten auf ordnungsgemäße Funktion

#### 6.1 Demontage und Montage eines Druckluftejektors



**Vor Beginn der Demontage ist der Druckluftejektor elektrisch frei zu schalten.**

be evacuated (e.g. the pump casing).

The highest point to be evacuated will be connected to connection A by means of an ascending air vent pipe. Exhaust nozzle B must not be shut-off. The connection C has to be connected to the discharge side of the centrifugal pump.

In case of water as pumping media the maximum installation height over the lowest intake-sided liquid level must not exceed 7 m, minus the dynamical losses of the suction system.

### Caution

**The nominal size of the piping for compressed-air supply has to be selected, that the required working air is available at the connection P of the automatic aspirator during operation.**

Via connection P the automatic aspirator is to be supplied with compressed air or equivalent driving gas.

### 5. Commissioning

For commissioning pay attention to following steps:

- Check all pipe connections and pipes for proper lay and leakage.
- Check all electrical connections.
- Check the compressed air connection

### Caution

Please pay attention to modification for special design.

### 6. Maintenance and repair

The system functions with slightly maintenance work. Following inspections respectively work should be performed in fixed intervals which depend on pumping medium, operation mode and operation time.

- Check all components for proper function

#### 6.1 Disassembly and assembly of the compressed air ejector



**Before starting work, the compressed air ejector must be switched to a power off mode.**



**Vor Beginn der Demontage ist der Druckluftejektor von der Druckluftversorgung zu trennen.**

Anzugsdrehmomente für die Schraubverbindungen sind der dementsprechenden DIN-Norm zu entnehmen.

**Achtung**

Wir empfehlen alle Dichtungen bei Instandsetzungsarbeit zu ersetzen.

Demontage des Druckluftejektors:

- Kabelstecker am Magnetventil des Druckluftejektors abnehmen.
- Abluft- und Druckluftleitung lösen.
- Befestigungsschrauben des Druckluftejektors entfernen und Druckluftejektor abnehmen.

Die Montage erfolgt in umgekehrter Reihenfolge.

## 6.2 Demontage und Montage des Düsensystems

- Druckluftejektor einspannen und Langnippel herausdrehen.
- Mischdüse aus dem Gehäuse herausziehen.
- Treibdüse aus dem Gehäuse herausnehmen.

Der Zusammenbau erfolgt in umgekehrter Reihenfolge.

**Achtung**

Bei der Montage ist das Langnippel fest in das Gehäuse zu schrauben. Die montierte Gegenmutter darf dabei nicht verdreht werden. Das Langnippel ist mit Schraubensicherungsmittel (z.B. Loctite) neu einzusetzen.

## 6.3 Demontage und Montage des Absperrventils

- Lösen des Druckschaltergehäuse am Druckluftejektor



### Druckschaltergehäuse steht unter Federdruck

- Entnahme der Druckfeder und Lösen der Mutter an der Federführung. Zum Gegenhalten die Mutter am Kolben verwenden (Düsenseite).
- Federführung, Führungsring und Ventildichtung aus Druckluftejektor entnehmen.



**Before starting work, the compressed air ejector must be disconnected from the compressed air supply.**

Starting torque for the thread connections are to be taken from the corresponding DIN-Norm.

**Caution**

We advise to exchange all sealings at repair work.

Disassembly of the compressed air ejector:

- Take off cable plug at the solenoid valve of the compressed air ejector.
- Loosen the exhaust and compressed air pipe.
- Loosen the assembling screws of the compressed air ejector and remove the compressed air ejector

Assembly takes place in reversed order.

## 6.2 Disassembly and assembly of the jet system

- Fix the compressed air ejector and turn out the long nibble.
- Pull out the mixing jet of the casing
- Take out the driving jet of the casing.

Assembly takes place in reversed order.

**Caution**

The long nipple has to be screwed on the casing powerful. The check nut may not to be twisted. The long nipple must be fitted with a bolt protection medium (e.g. Loctite).

## 6.3 Disassembly and assembly of the shut-off valve

- Loosen the pressure switch casing at the compressed air ejector



### Pressure switch casing is spring pressurized.

- Take out the compression spring and loosen the safety nut at the spring seating. Use the safety nut at the piston (jet side) for supporting.
- Take out spring seating, guide ring and valve sealing of the compressed air ejektor.

- Kolbenstange mit montiertem Kolben entnehmen.

Der Zusammenbau erfolgt in umgekehrter Reihenfolge.

- Take out the Piston rod with mounted piston.

Assembly takes place in reversed order.

Achtung

Caution

Bei der Montage des Kolbens ist der Dichtring mit einem entsprechend geformten Werkzeug durch den Druckluftanschluß einzudrücken.

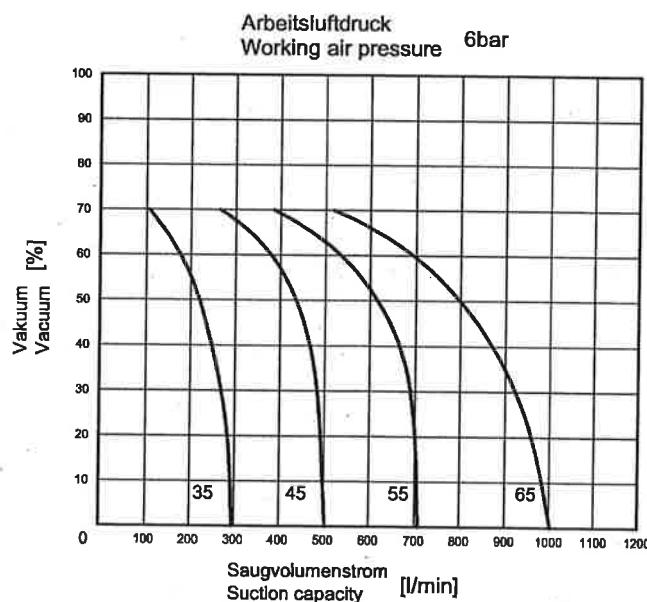
When assembling the piston the gasket is to be pressed via compressed air supply by a similar formed tool.

**7. Anhang****7.1. Produktdaten**

Betriebsspannung Schutzart Leistungsaufnahme Nenndruck Arbeits-Druckluft erforderlich	220V-230V 50/60 Hz IP65 16 VA PN 10 5 - 7 bar	Operating voltage Enclosure Power input Nominal pressure Compressed working air required	
<b>Material:</b>			
Ejektorgehäuse Düsensystem Innenteile Dichtungen	GCuSn10 Polyäthylen Edelstahl NBR	Bronze GCuSn10 Polyethylene Stainless Steel NBR	
<b>Düsengröße:</b>			
Saugvolumenstrom max. Luftverbrauch bei 6 bar	Nl/min l/min	300 70 500 120 700 180 1000 240	<b>Size of Nozzle:</b>  Suction capacity max. Air consumption at 6 bar
<b>Druckstufe:</b>		U V W	<b>Pressure-Stage:</b>  Switch-on Point Switch-off Point
Einschaltpunkt Ausschaltpunkt	bar bar	0,3 0,5 0,6 1,1 1,1 1,6	

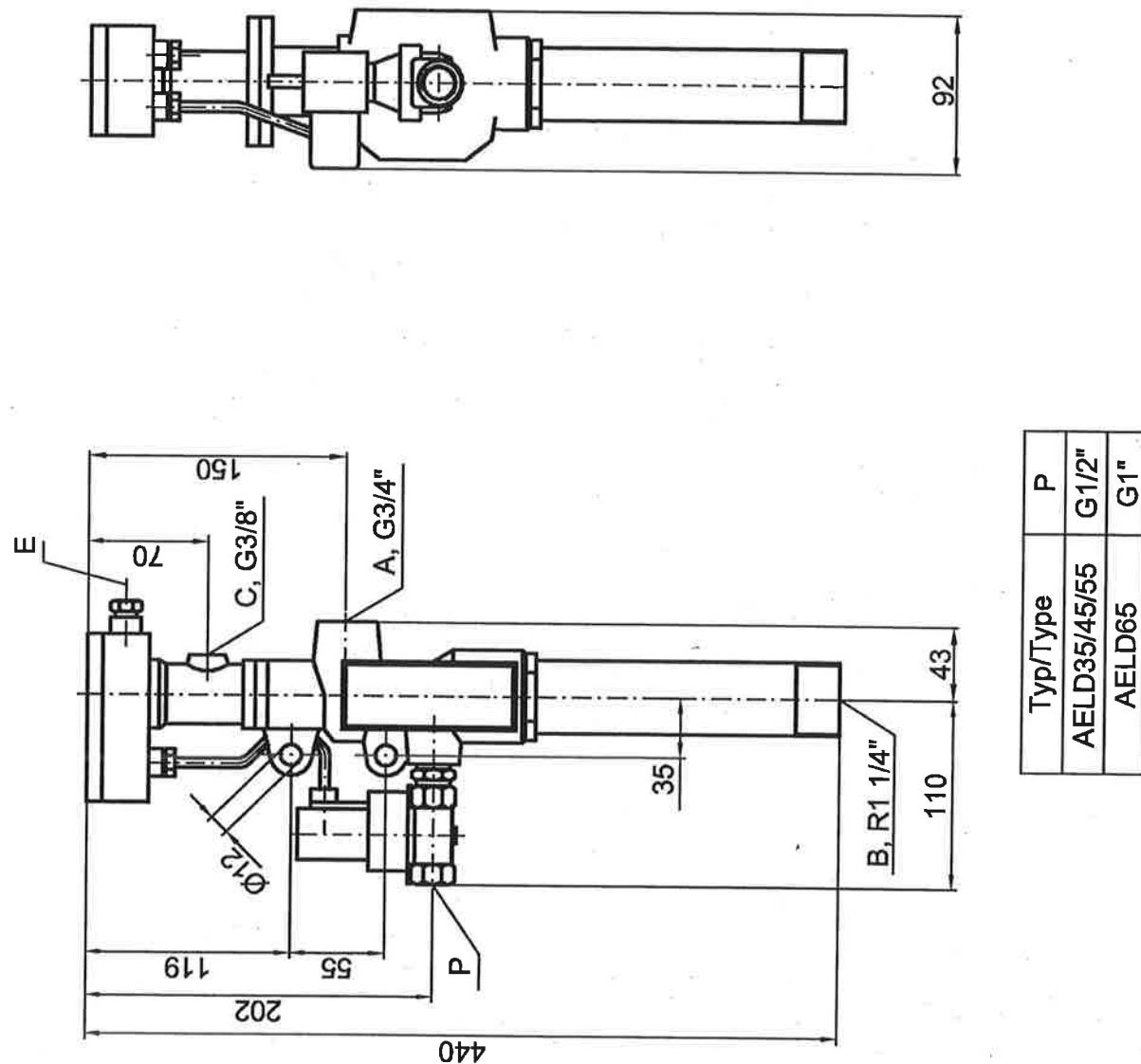
**Anschlüsse:**

Entlüftung Saugseitig Entlüftung Druckseitig Abluft Drainage Druckschalter Kabel Arbeits-Druckluft	A1 A2 B C E P	Venting suction side Venting discharge side Exhaust, Drainage Pressure switch Cable Compressed working air
---	------------------------------	---

**Connections:**

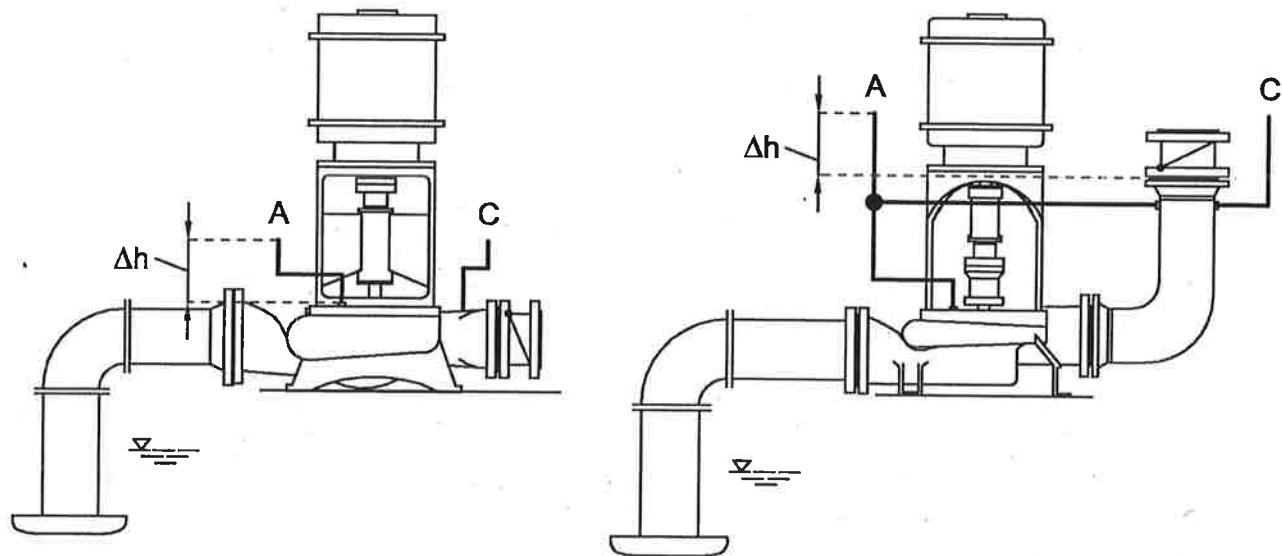
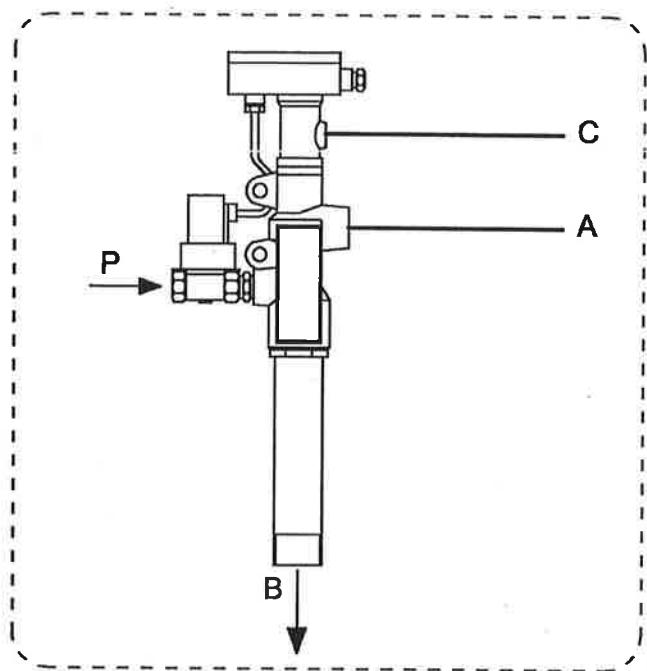
## 7.2 Maßblatt

## 7.2 Dimensions

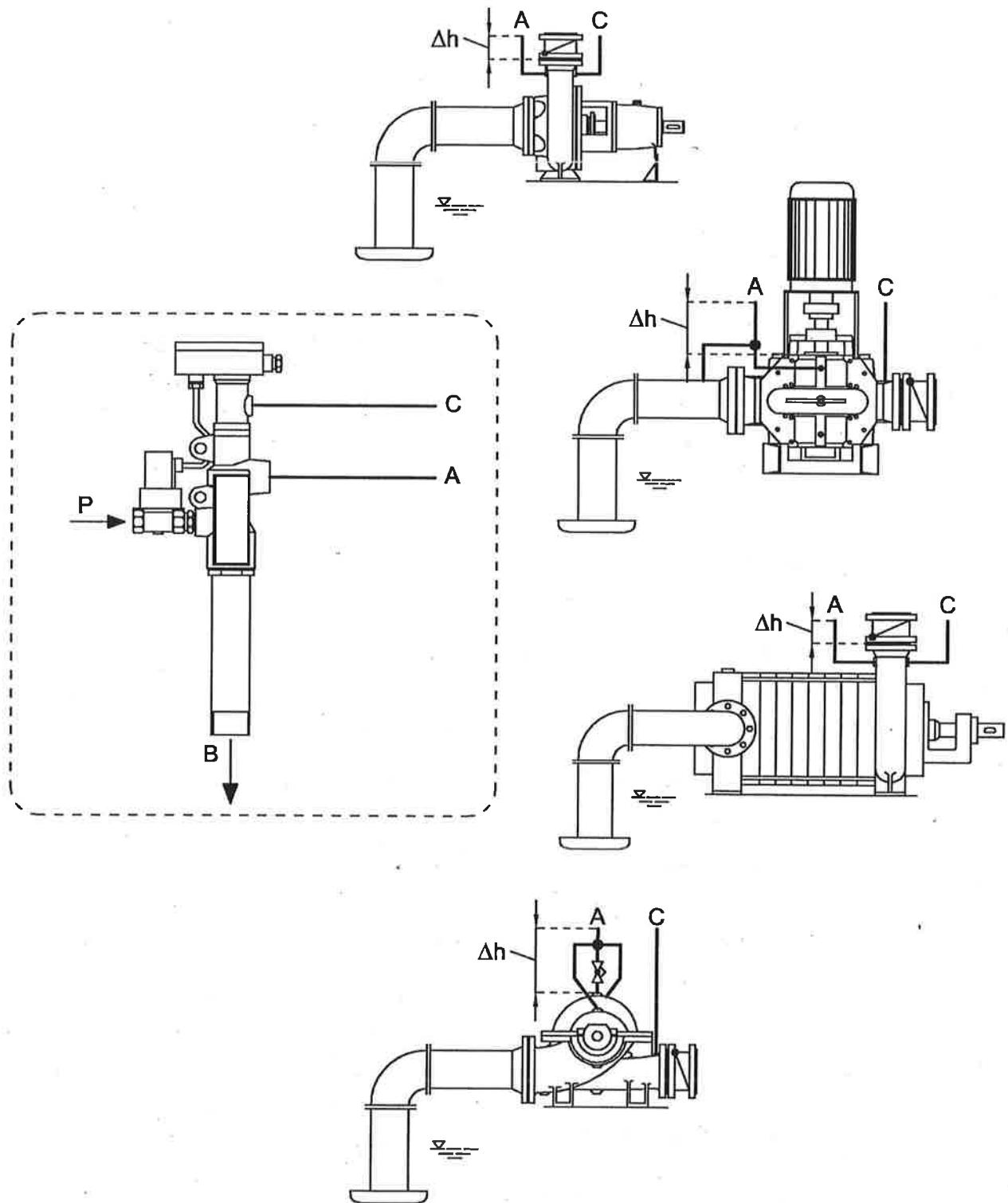


## 7.3 Installationsbeispiel

## 7.3 Installation example



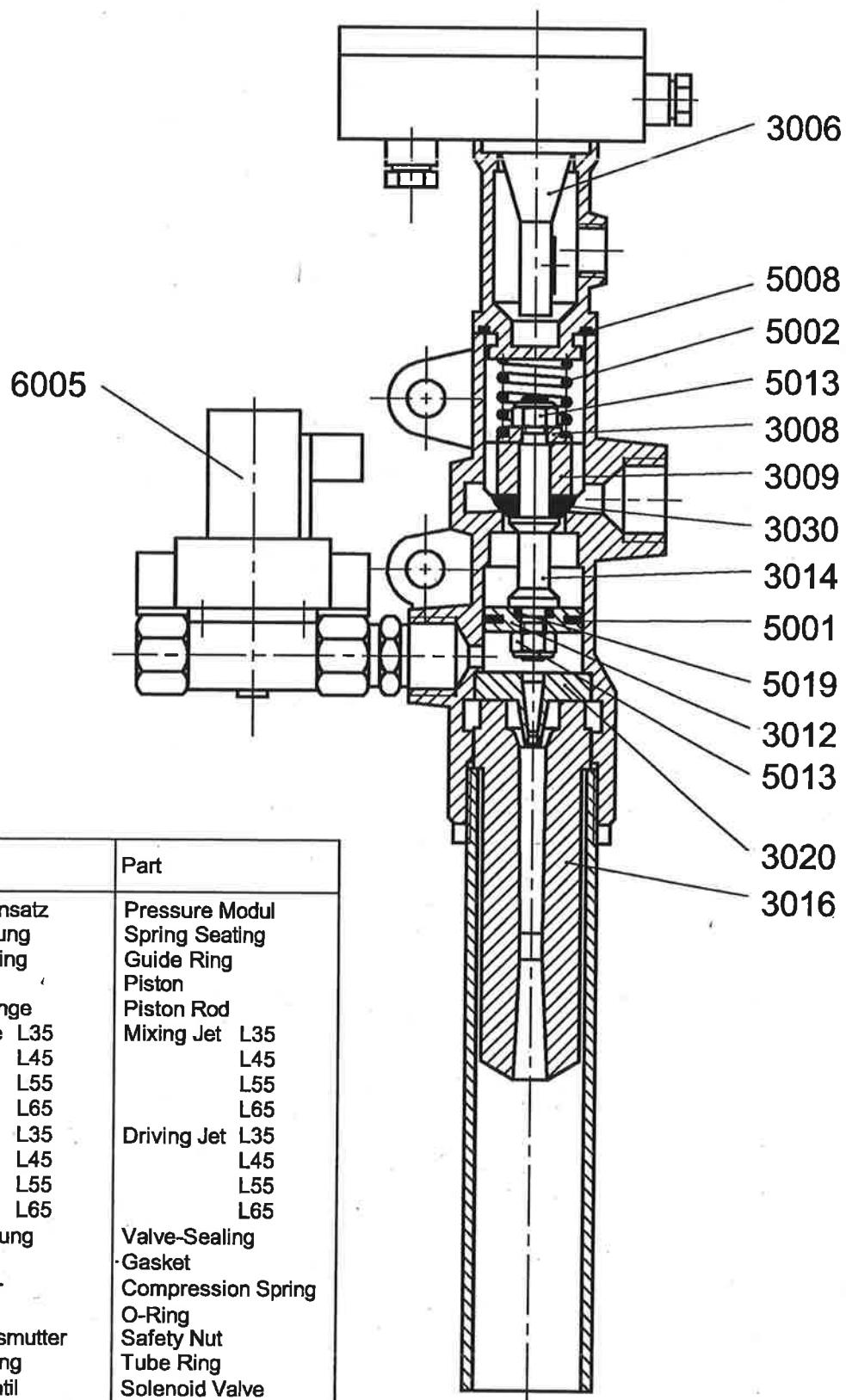
14899/A4



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## 7.4 Ersatzteile

## 7.4 Spare parts

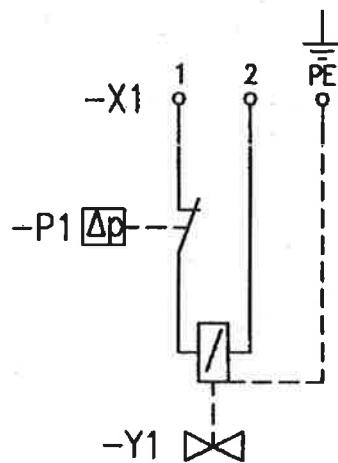


## 7.5 Schaltplan

Schaltplan des Ansaugautomaten

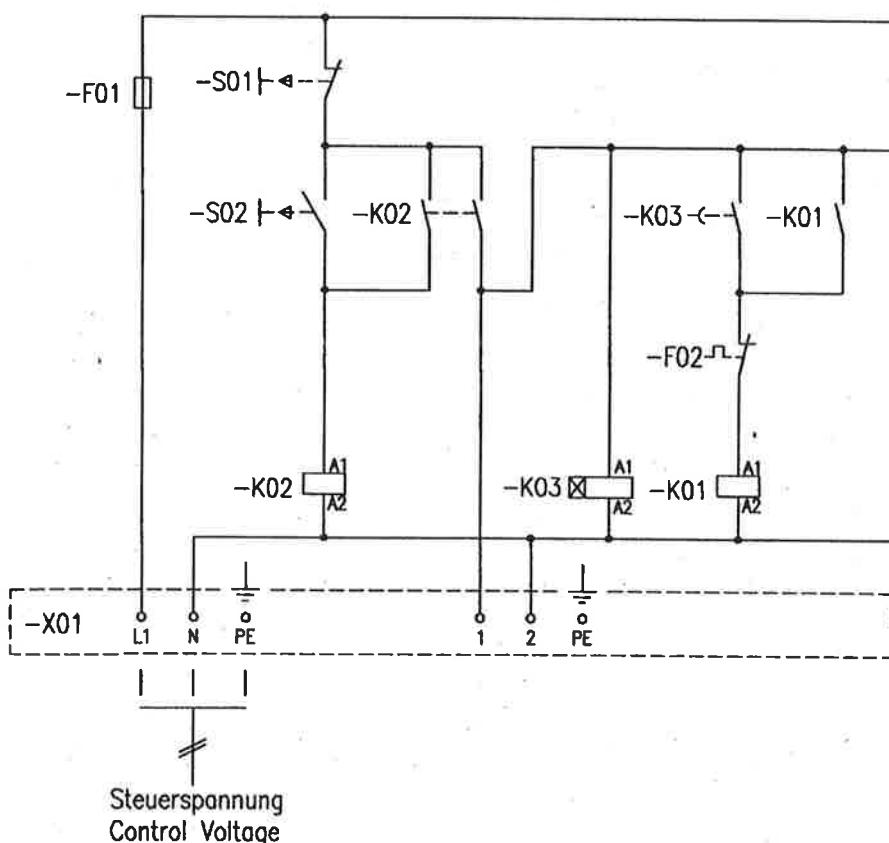
## 7.5 Circuit diagramm

Circuit diagramm of the aspirator



Empfohlene Anschlußschaltung mit zeitverzögerter Einschaltung der Kreiselpumpe.

Recommended connecting plan for time delayed starting of the centrifugal pumps.



30177/A3

## **INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR PRESSURE GAUGES TYPE IT 316/316 420 N2 AND E2 100.**

Make sure the wetted parts of the instrument (AISI 316) are suitable for use with the media.

Make sure the instrument range is appropriate to whatever is to be measured.  
Max pressure should be 2/3 of instrument range.

The instrument must be mounted in a position with as little vibration as possible.

The instrument must not be exposed to higher or lower ambient temperatures than intended. The calibration temperature for the instruments is 20°C unless otherwise is indicated in the order or packing list. Deviation from the calibration temperature will cause incorrect indication, depending on the extent of the deviation.

Unless otherwise indicated in the order or packing list, the instrument must be mounted in vertical position.

Instruments must be mounted free of mechanical tension. Wall mounted instruments must be mounted on plain surfaces. When connecting, hexagonal flats must be used. Instrument housing must not be used as a counterforce. Always use the hexagon for support when mounting connection tube.

It is important to mount the connection pipes so they do not cause mechanical tension. For instance, they can be made of an annealed material and laid in a loop before they are attached to the pressure gauge.

The application of pressure to the pressure gauge and its release must be effected without abrupt changes in pressure. Rapid changes in pressure must be avoided. It must be made sure that the columns of liquid that can form between instruments and the point of measurement do not cause significant errors in measurements.

Look for tags or instruction on the instruments.

Instruments with capillary tube and chemical seal:

Gauge and seal must be mounted at the same level to avoid inaccuracy.

Do not disassemble instrument or chemical seal from capillary tube.

Do not use instrument or capillary system as an earthing point for welding equipment.

Electrical connections to be connected according to drawing 401776.

Use shielded cable, twisted pair. Shield to be connected in one end. (Power supply end)

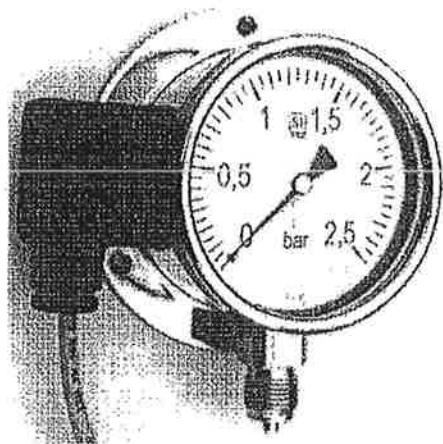
Instrument has reverse polarity protection. No damage, but also no function.

Power supply 12-36 VDC  
Accuracy  $\pm 1,0$  % F.S. (gauge) 0,5% F.S (el. signal)  
Max resistance (ohm) ( $U_b$ -12)/0,02 A  
Insulation resistance >100Mohm  
Process temperature -20+70°C  
Ambient temperature -20+70°C  
Storage temperature -40+125°C

**MAINTENANCE:**

No maintenance required besides calibration when out of range or by request from customer.

# Indicating Pressure Transmitter



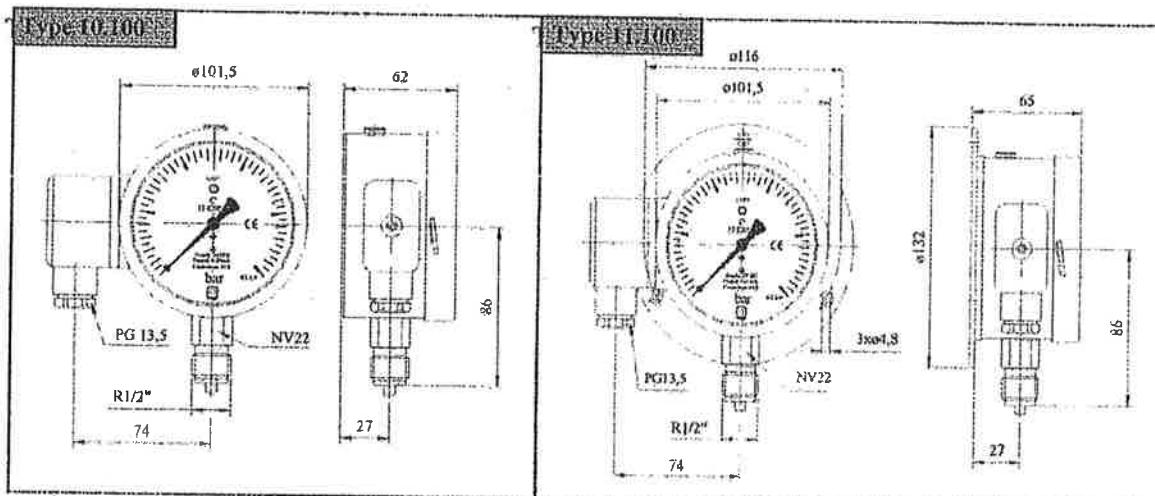
## Technical specifications

- Case diameter 100mm  
Option ø160mm on request
- Case material AISI 316 st.steel
- Pressure ranges: 0-0,6 bar up to 0-400 bar
- Liquid filled case available
- Standard scales in bar acc. to EN norm. Other units on request.
- Class of safety EEx ia IIC T4..T6
- approved

Specifications of materials:	
<i>Case</i>	AISI 316
<i>Element</i>	AISI 316
<i>Movement</i>	AISI 304
<i>Pointer</i>	Aluminium, black
<i>Dial</i>	Aluminium, white. Black lettering per DIN 16109
<i>Glass</i>	Mineral glass 3mm
Pressure ranges per EN 837:	-1 / +0,6 bar to 0-400 bar acc. to EN norm
Accuracy classes per DIN 16005:	
<i>Pressure gauge</i>	<±1,0% x F.S., class 1
<i>Output signal</i>	<±0,5% x F.S., class 0,5
Pressure standard	Standard 1,3 x F.S. Others on request
Output signal	Standard 4-20mA 2-wire.
Supply	+13...+28Vdc
Electrical circuit resistance	R <sub>I</sub> = (V supply - 13V)/20mA
Working temperature	-30.. +80°C, ±0,02%/K F.S.
Max. temperature	+80°C
Design temperature	-20.. +70°
- marking:	Immunity Issue
	IEC 801-2/3/4 EN 55022, class B
Intrinsically safe version	EEx-ia-IIC T4..T6
Wiring connection	Shielded 2-wire, protected against polarity crossing
Weather protection EN 60 529/ IEC 529	IP65

SI

## Dimension Drawings



## Ordering Code

IT	Indicating pressure transmitter
<i>Wetted parts</i>	
316	Element and process connection in AISI 316 st.steel
<i>Case material</i>	
316	Case in AISI 316 st steel
<i>Output signal</i>	
420	4-20mA
<i>Others</i>	
<i>Type (Electrical connection)</i>	
N2	2-wire standard
E2	2-wire intrinsically safe
<i>Type (way of mounting)</i>	
10	Direct mounting, bottom connection
11	Back flange for wall mounting, bottom connection
<i>Case diameter</i>	
100	Ø100mm
<i>Process connection</i>	
1/2"BSP	
Others	
<i>Ranges</i>	
	Standard ranges in bar acc. to EN 837

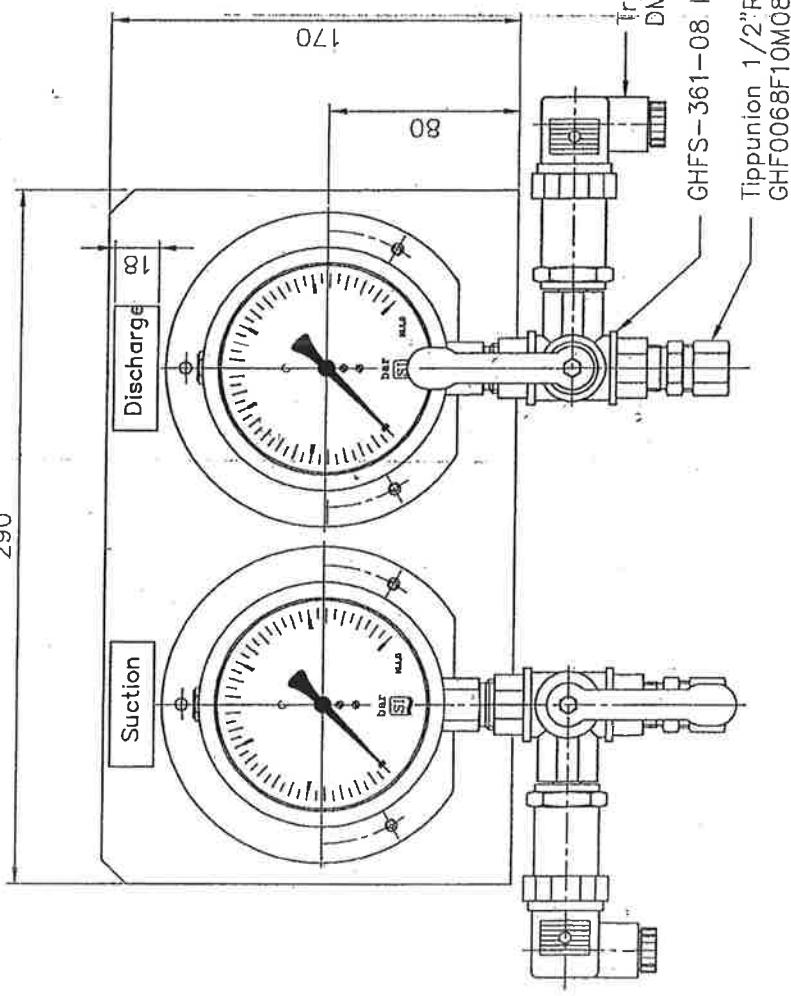
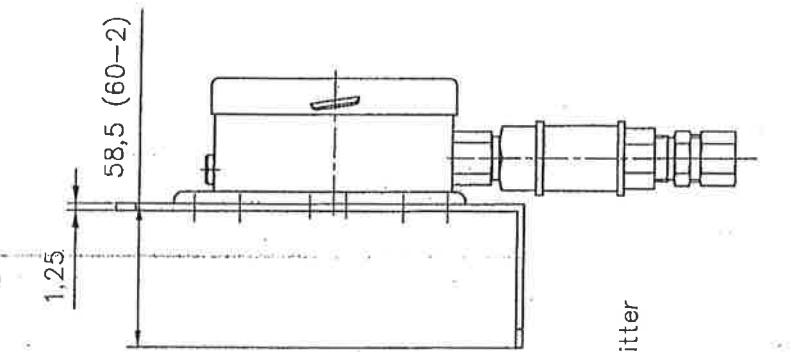
**Skotselv**  
**Instrumentering**

MANOMETERFABRIKK - FELTINSTRUMENTER

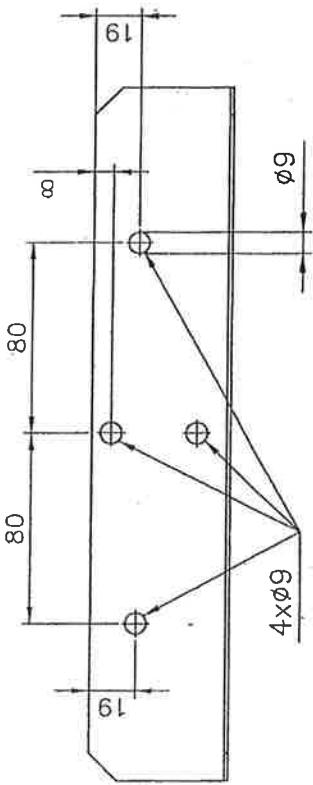
Skotselv Næringspark  
Verksveien 7 - NO-3330 Skotselv  
Tel: (+47) 32 25 09 70  
Fax: (+47) 32 25 09 71  
E-mail: [firmapost@skotselvinstrumentering.no](mailto:firmapost@skotselvinstrumentering.no)  
[www.skotselvinstrumentering.no](http://www.skotselvinstrumentering.no)

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Strandsvingen 62 NO-4031 Stavanger  
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SERGEM:  
P.O.Box 38 NO-5291 Os  
Tel: (+47) 56 57 61 40  
Fax: (+47) 56 57 61 41



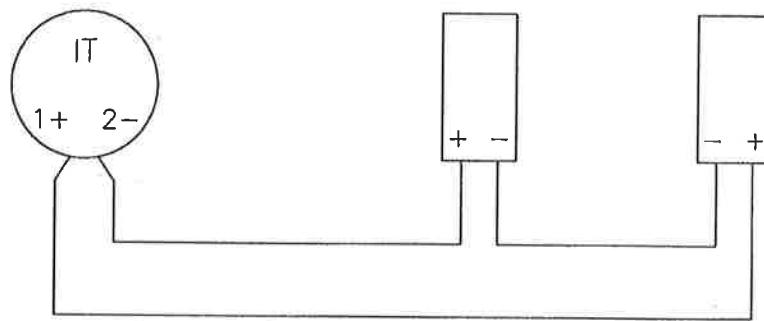
Panel plate  
see drwg. 300853



Dato	Konst./Tegnet	Godkjennt	Mønstretikk	Skotselv
07.01.03	J.O.H.		1:2	Instrumentering
Manometer M 11.100 R1/2" med				Erstatning for
ventil / trykktransm. DMP 331				Tegn. status
og tippunion 1/2"R - Ø10mm rør.				Rev. status
Beregning				0
Henvisning		Date	Date	Middels:
Forandring		Date	Date	NS-ISO 2768-1

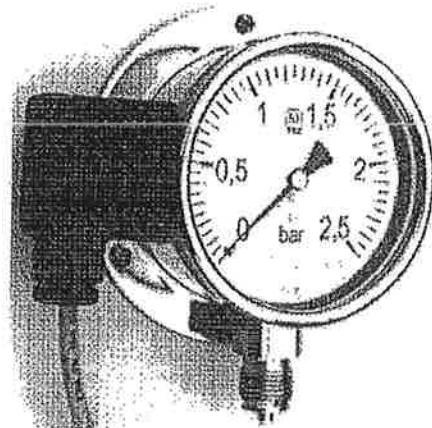
Indikator.

Power Supply  
24VDC



Dato 08.05.01	Konst/Tegnet J.O.H.	Godkjent H.L.	Målestokk X:X	Teck Skotselv INSTRUMENTERING			
		18.09.01					
Installasjonstegning IT 316/316-420 Standard.		Erstatning for		Erstattet av			
		Tegn. status			Rev. status		
		H	401737		0		
Henvisning		Beregning	NS-ISO 2768-1 Middels.				
Rev	Forandring	Dato	Sign	Rev	Forandring	Dato	Sign

# Indicating Pressure Transmitter



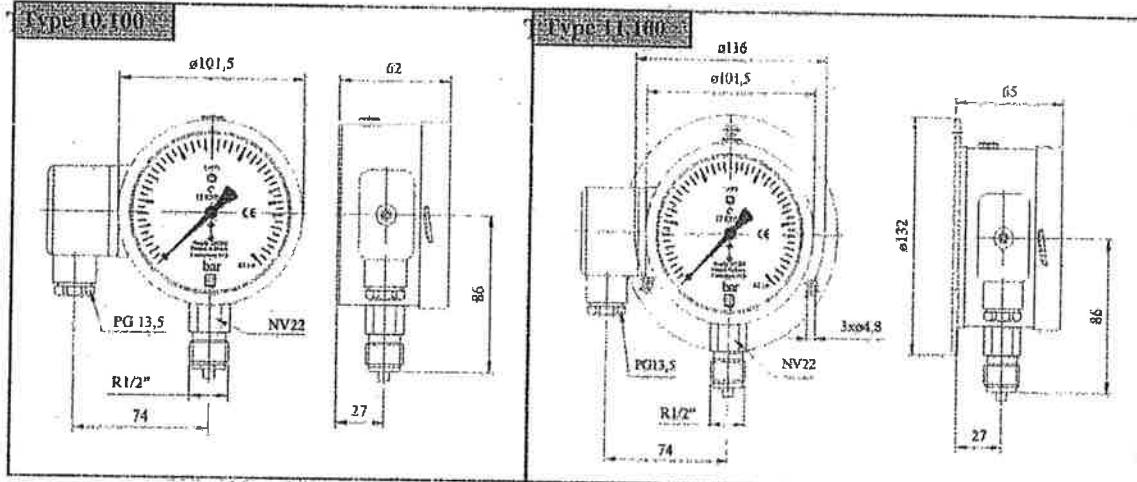
## Technical specifications

- Case diameter 100mm  
Option ø160mm on request
- Case material AISI 316 st.steel
- Pressure ranges: 0-0,6 bar up to 0-400 bar
- Liquid filled case available
- Standard scales in bar acc. to EN norm. Other units on request.
- Class of safety EEx ia IIC T4..T6
- approved

Specifications of materials:	
<i>Case</i>	AISI 316
<i>Element</i>	AISI 316
<i>Movement</i>	AISI 304
<i>Pointer</i>	Aluminium, black
<i>Dial</i>	Aluminium, white. Black lettering per DIN 16109
<i>Glass</i>	Mineral glass 3mm
Pressure ranges per EN 837:	-1 / +0,6 bar to 0-400 bar acc. to EN norm
Accuracy classes per DIN 16005:	
<i>Pressure gauge</i>	<±1,0% x F.S., class 1
<i>Output signal</i>	<±0,5% x F.S., class 0,5
Pressure standard	Standard 1,3 x F.S. Others on request
Output signal	Standard 4-20mA 2-wire.
Supply	+13...+28Vdc
Electrical circuit resistance	$R_I = (V \text{ supply} - 13V) / 20mA$
Working temperature	-30..+80°C, ±0,02%/K F.S.
Max. temperature	+80°C
Design temperature	-20..+70°
	Immunity Issue
Intrinsically safe version	EEx-ia-IIC T4..T6
Wiring connection	Shielded 2-wire, protected against polarity crossing
Weather protection EN 60 529 / IEC 529	IP65

Pressure-03-2000-01

## Dimension Drawings



## Ordering Code

<b>IT</b>	Indicating pressure transmitter
<i>Wetted parts</i>	
316	Element and process connection in AISI 316 st.steel
<i>Case material</i>	
316	Case in AISI 316 st.steel
<i>Output signal</i>	
420	4-20mA
<i>Others</i>	
<i>Type (Electrical connection)</i>	
N2	2-wire standard
E2	2-wire intrinsically safe
<i>Type (way of mounting)</i>	
10	Direct mounting, bottom connection
11	Back flange for wall mounting, bottom connection
<i>Case diameter</i>	
100	Ø100mm
<i>Process connection</i>	
½" BSP	
Others	
<i>Ranges</i>	
Standard ranges in bar acc. to EN 837	

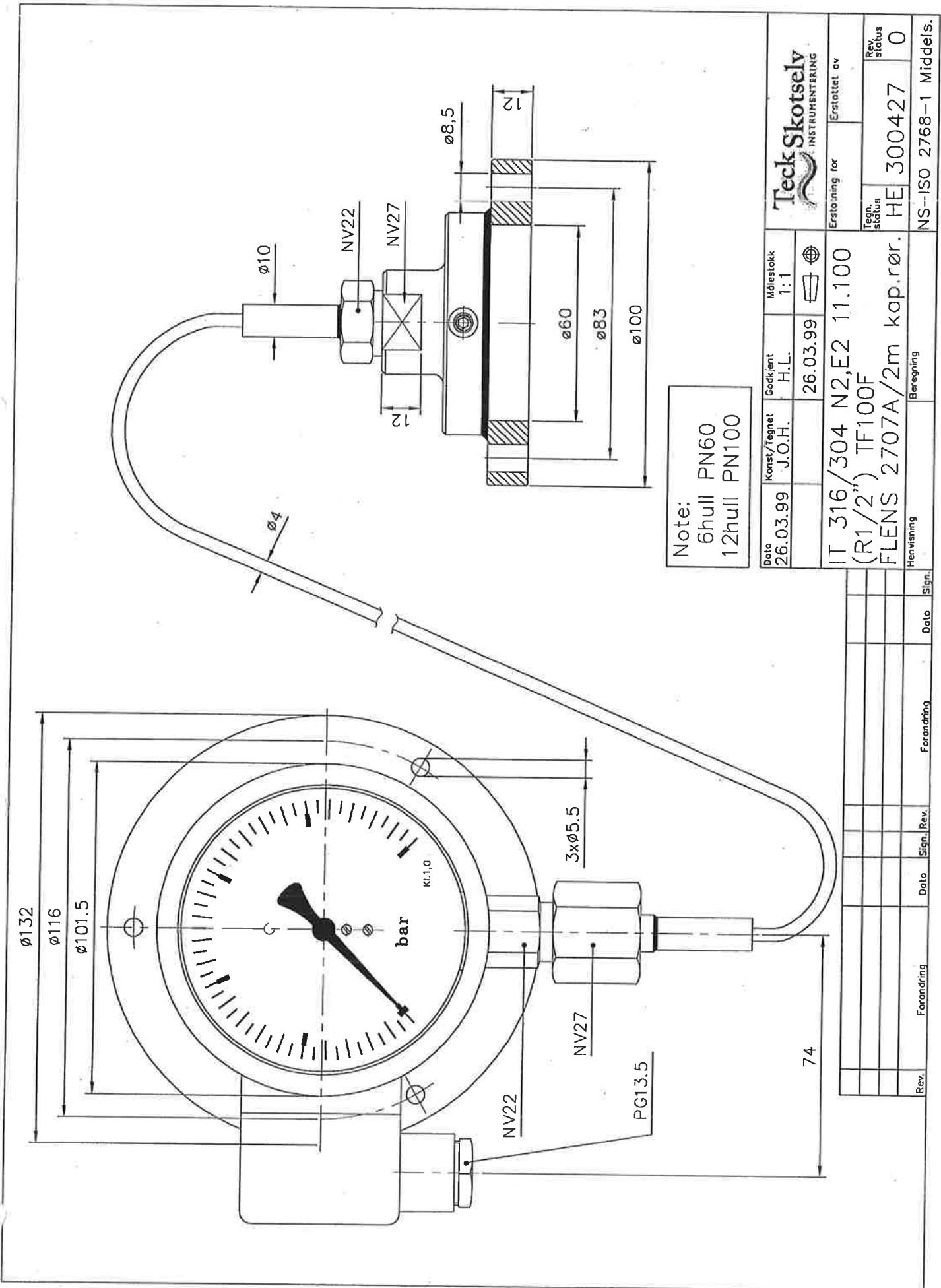
**Skotselv**  
**Instrumentering**

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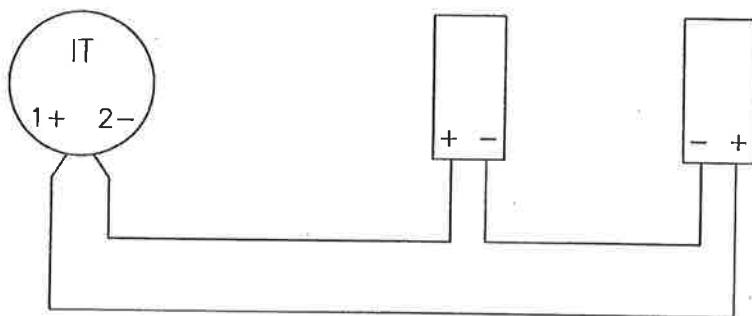
Skotselv Næringspark  
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Indikator. Power Supply  
24VDC



Dato 08.05.01	Konst/Tegnet J.O.H.	Godkjent H.L.	Målestokk X:X	<b>Teck Skotselv</b> INSTRUMENTERING		
		18.09.01		Erstatning for		
Installasjonstegning IT 316/316-420 Standard.			Tegn status	Erstattet av		
			H	401737	Rev. status	
Henvisning		Beregning	NS-ISO 2768-1 Middels.			
Rev	Forandring	Dato	Sign	Rev	Forandring	Dato

## MAGNETVENTIL FOR SMØREVANN (til eksenter skruepumper)

Magnetventilen skal ved oppstart av pumpen sørge for at pumpen blir tilført smørevann. En eksenter skruepumpe må ikke tørrkjøres, det er derfor viktig at den får smørevann i sekundene før pumpen "tar" og blir smurt av det pumpede mediet.

På undersiden av pumpen (se fig.) er det en tilkopling (pos. 502 i brosjyren) som smørervannledningen tilkobles. Magnetventilen koples til smørevannsledningen og videre derfra til en tank eller lignende, som alltid vil være under trykk, f.eks. hydroforannlegget. Videre må magnetventilen koples til starterskapet for pumpen, dvs. Når vi starter pumpen (On) skal magnetventilen åpne og slippe vann fra f.eks. hydroforannlegget til pumpen, dette vil da fungere som smørevann. Smørevannet blir avstengt når pumpen stoppes. Dette betyr at det vil alltid være tilkoplet smørevann mens pumpen går.

### Solenoid valve for priming water

- Eccentric screwpumps are not to operate in dry condition.
- Allweiler recommend use of priming water to prevent dry running. Pressurised FW system as the hydrophore system is typical to be used.

Piping for priming water is connected through pos. 502 in suction house. A solenoid valve, normally delivered from Allweiler, is to be operated from startercabinet and regulate inlet of priming water to the pump. On signal from starter to pump is also to open solenoid valve so primingwater is allowed entering the pump.



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SRA 013800282

EW

**FEATURES**

- Two-way normally closed valves for automatic control of water, air and neutral gas and other gases/liquids compatible with the sealing materials used
- Minimum operating differential pressure 0.3 bar
- Moulded epoxy solenoid can be converted from AC to DC by simply changing the coil

**GENERAL**

Differential pressure 0,3 to 16 bar (1 bar = 100 kPa)

Maximum allowable pressure 16 bar

Ambient temperature range -10°C to +60°C

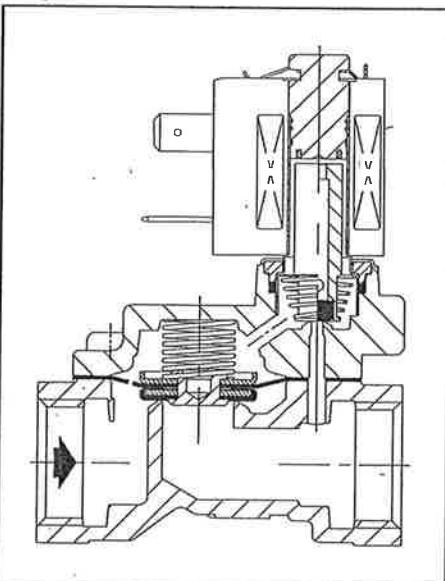
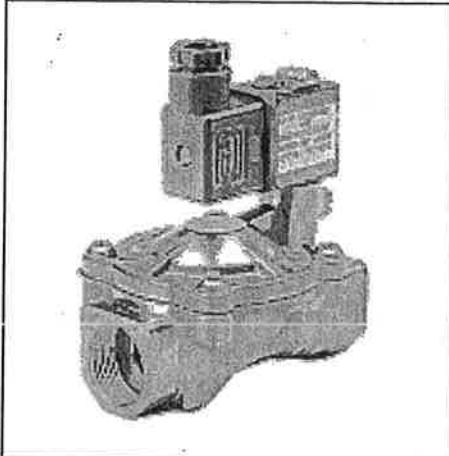
Maximum viscosity 40 cSt (mm<sup>2</sup>/s)

Response time (1)	3/8	1/2	3/4	1
opening time (ms)	25	30	55	70
closing (ms)	40	90	110	200

fluid	temperature range (2)	sealings
Water, air and neutral gas	-10°C to +85°C	NBR (nitrile / buna-n)

**CONSTRUCTION**

Body	Brass
Internal parts	Stainless steel
Springs	Stainless steel
Seals, diaphragm and disc	NBR
Shading coil	Copper
Coil isolation class	F
Connector	Spade plug
Connector specification	
for CM22-4W	3 x DIN 46244 (Pg 9P)
for CM25-5W	ISO 4400 (Pg 11P)
Electrical safety	VDE 0580

**ELECTRICAL CHARACTERISTICS**Standard voltages (3) DC (=) 24V  
AC (-) 24V - 115V - 230V / 50Hz

coil type	nominal power ratings			ambient temperature range (2)	protection
	inrush	holding	hot/cold		
	~ (VA)	~ (VA)	= (W)		
CM22-4W	12	6	4	5 / 6,9	-10 to +60 moulded IP65
CM25-5W	15	7	5	5 / 6,9	-10 to +60 moulded IP65

**SPECIFICATIONS**

pipe size	orifice size	flow coefficient Kv		operating pressure differential (bar)				coil type	catalogue number	OPTIONAL			
				maximum		water							
		(G*)	(mm)	(m <sup>3</sup> /h)	(l/min)	min.	(4)	~	=	~	=	~	~
3/8	12	2,4	40	0,3	10	10	10	10	10	CM22-4W	SC E238A001	V	E
3/8	12	2,4	40	0,3	16	16	16	16	16	CM25-5W	SC E238A006	V	E
1/2	12	2,4	40	0,3	10	10	10	10	10	CM22-4W	SC E238A002	V	E
1/2	12	2,4	40	0,3	16	16	16	16	16	CM25-5W	SC E238A007	V	E
1/2	15	4,2	70	0,3	10	10	10	10	10	CM22-4W	SC E238A003	V	E
1/2	15	4,2	70	0,3	16	16	16	16	16	CM25-5W	SC E238A008	V	E
3/4	20	6,6	110	0,3	10	10	10	10	10	CM22-4W	SC E238A004	V	E
3/4	20	6,6	110	0,3	16	16	16	16	16	CM25-5W	SC E238A009	V	E
1	25	9,9	165	0,3	10	10	10	10	10	CM22-4W	SC E238A005	V	E
1	25	9,9	165	0,3	16	16	16	16	16	CM25-5W	SC E238A010	V	E

(1) Air operation with  $\Delta p = 6$  bar

(2) Damage may occur when liquids solidify above the specified minimum temperature.

(3) Other voltages and 60Hz frequency, available on request.

(4) For minimum pressures lower than 0.3 bar, consult ASCO/JOUCOMATIC

## OPTIONS

- Valves can also be supplied with FPM (fluorelastomer / viton), EPDM (ethylene-propylene) sealings, diaphragm and disc.
- Use the appropriate optional suffix letter for identification
- Explosionproof EEx m coil for hazardous areas (only for versions with coil CM22-4W); see V1037 (section 10)
- Magnetic latch execution for CM22 coil type only; see V910-10 (Section 9/10)
- Manual operator, suffix MO
- Connectors with built-in indicator and electrical protection or prewired with cable length 2 m (see section 11)

## INSTALLATION

- Solenoid valves can be mounted in any position without affecting operation
- Pipe connections (G\*) have standard combination thread according to ISO 228/1 and ISO 7/1
- The third digit in the cataloguenumber indicates the standard pipe connection: E= ISO 228/1 and ISO 7/1
- Other pipe connections are available on request
- Installation/maintenance instructions are included with each valve
- Spare parts kits and replacement coils are available (see section 11)

## DIMENSIONS (mm), WEIGHT (kg)

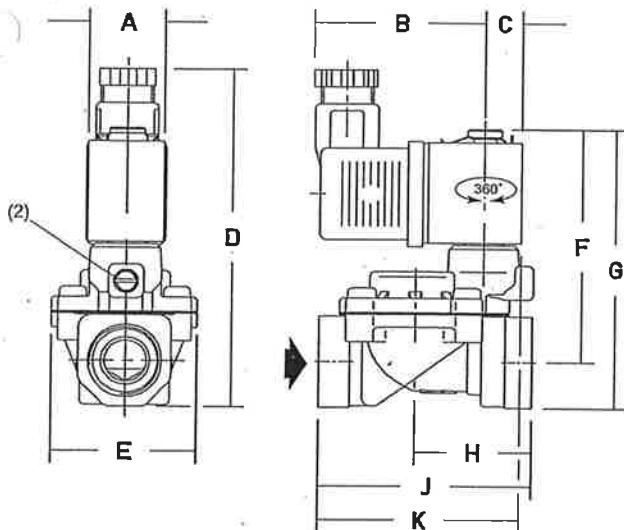


Fig. 1

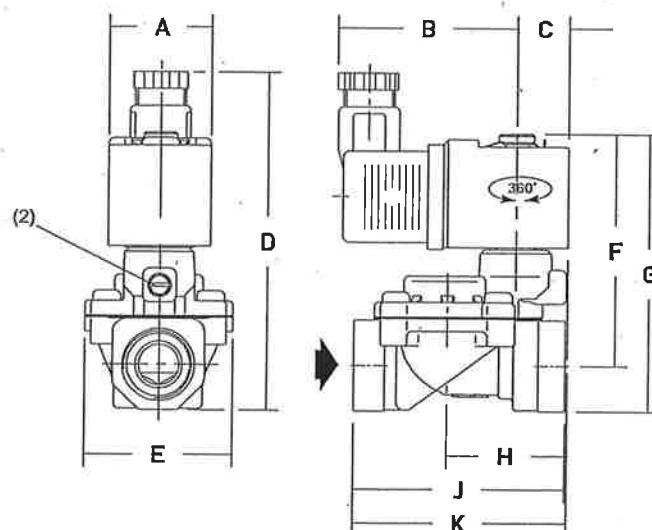


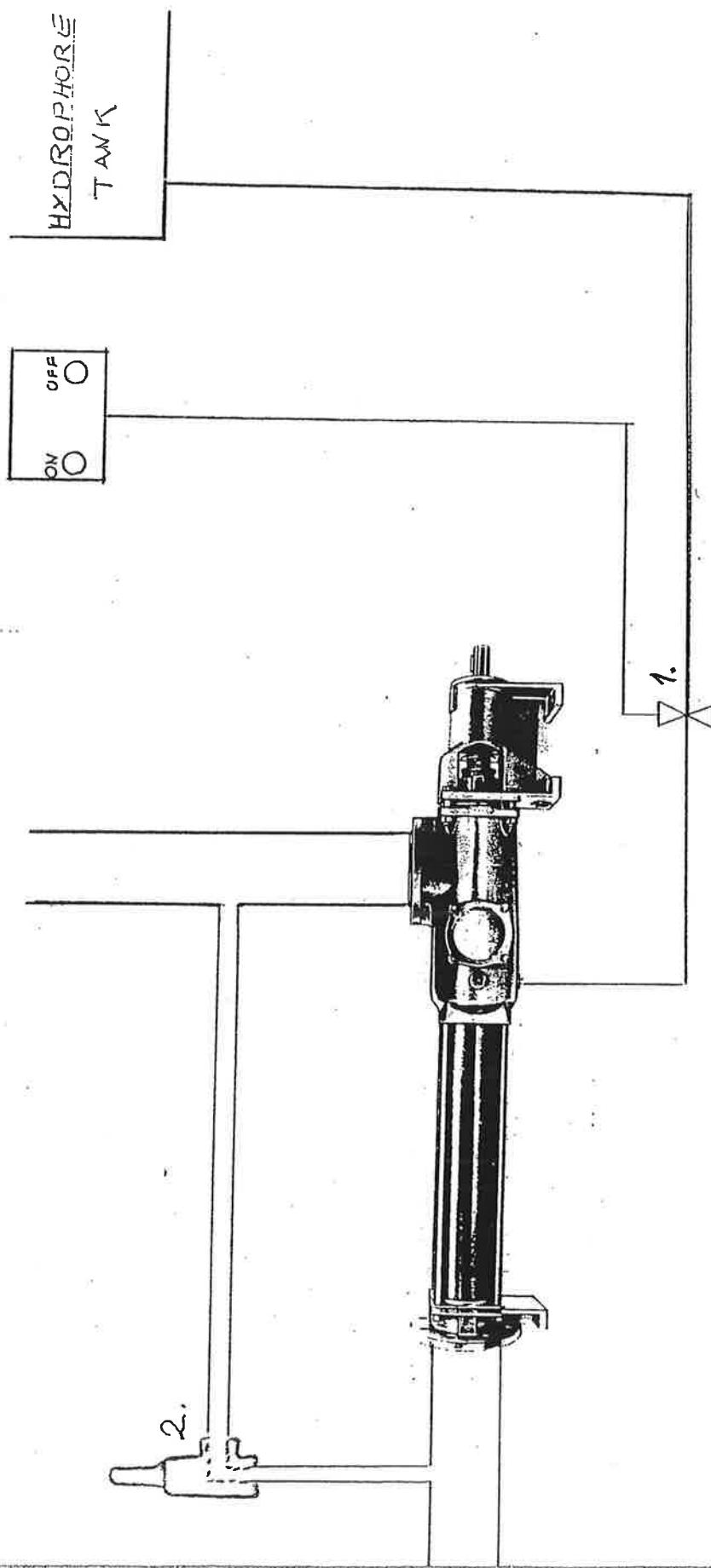
Fig. 2

catalogue number	(G*)	A	B	C	D	E	F	G	H	J	K	weight (1)	(C)
SCE238A001	3/8	22	49	11	95	43	68,5	82	34,5	62	58,5	0,4	fig. 1
SCE238A002	1/2	22	49	11	95	43	68,5	82	34,5	62	58,5	0,4	
SCE238A003	1/2	22	49	11	97	57	71	84,5	45,5	81,5	74,5	0,5	
SCE238A004	3/4	22	49	11	108	68	79,5	95,5	53	95	86,5	0,8	
SCE238A005	1	22	49	11	118	87	84,5	105	58	105,5	94	1,0	
SCE238A006	3/8	30	57	15	96,5	43	68,5	82	34,5	62	62,5	0,5	fig. 2
SCE238A007	1/2	30	57	15	96,5	43	68,5	82	34,5	62	62,5	0,5	
SCE238A008	1/2	30	57	15	99	57	71	84,5	45,5	81,5	78,5	0,6	
SCE238A009	3/4	30	57	15	110	68	79,5	95,5	53	95	90,5	0,9	
SCE238A010	1	30	57	15	119,5	87	84,5	105	58	105,5	98	1,1	

(1) Approx. weight in kg incl. coil and connector

~ Option: manual operated

Construction type



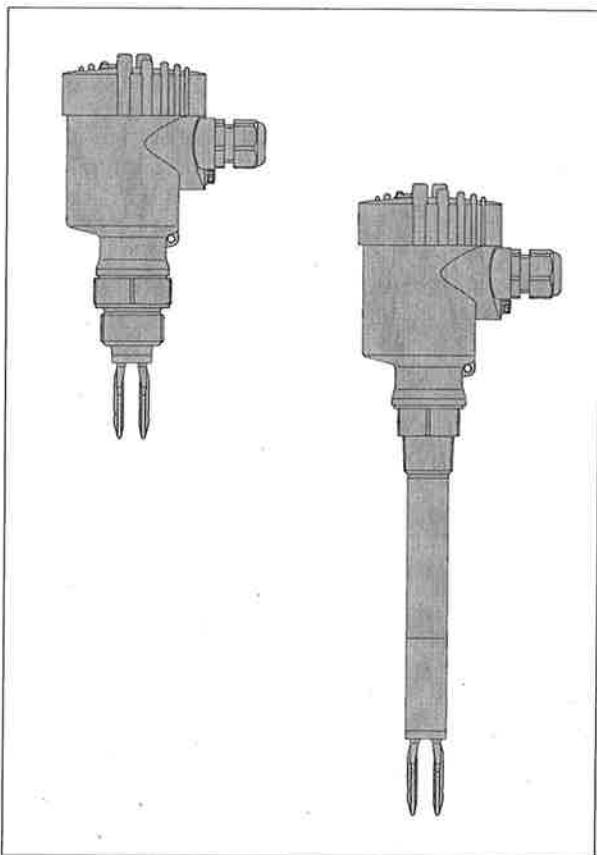
1. Solenoid Valve
2. Safety Valve

**VEGA**

Level and Pressure

## **Operating Instructions**

**VEGASWING 61, 63 with oscillator  
SWING E60C, R, T (EX)**



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**Safety information**

Please read this manual carefully, and also take note of country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

For safety and warranty reasons, only qualified VEGA personnel must carry out any internal work on the instruments, apart from that involved in normal installation and electrical connection.

**Note Ex-area**

Please note the attached safety instructions, containing important information on installation and operation in Ex areas.

These safety instructions are part of the operating instructions and come with the Ex approved instruments.

## 1 Product description

### VEGASWING 61 and 63

VEGASWING 61/63 vibrating level switches are used for level detection of liquids.

Typical applications are overfill and dry run protection. Using a tuning fork with a length of only 40 mm, VEGASWING 61 opens up new areas of application, e.g. in pipelines from DN 25. The vibrating level switches are available as compact instruments with different electronics versions.

VEGASWING series 60 vibrating level switches detect levels of liquids with a viscosity of 0.2 ... 10000 mPa s and a density  $\geq 0.5 \text{ g/cm}^3$ . Modular construction enables their use in vessels, tanks and pipelines.

Due to its simple and rugged measuring system, VEGASWING is virtually unaffected by the chemical and physical properties of the liquid. It does its job even under unfavourable conditions such as turbulence, air bubbles, foam generation, buildup, strong external vibration or constantly changing products.

- Tuning fork with only 40 mm length.
- Thread from  $\frac{3}{4}$ " and flanges from DN 25 (ANSI 1").
- Product temperature -50°C ... +250°C without shock limitation.
- In insensitive to external vibrations.
- Operating pressure up to 64 bar.
- Also ECTFE coated or enamelled.
- Viscosity 0.2 ... 10000 mPa s.
- Density range 0.5 g/cm<sup>3</sup> ... 2.5 g/cm<sup>3</sup>.
- Ex-Zone 0  
ATEX II 1/2G EEx d IIC T6
- Overfill protection acc. to WHG.
- Integrated fault monitoring.
- Fixed, exactly reproducible switching point.
- Switching point visible with closed instrument (LED).
- Setup without adjustment.
- Compact.
- Installation in any position.
- Min. or max. mode.

## 2 Function and application

### 2.1 Principle of operation

VEGASWING vibrating level switches detect levels in almost all liquids.

Viscosity: 0.2 ... 10000 mPa s  
Density: 0.5 ... 2.5 g/cm<sup>3</sup>

#### VEGASWING measuring principle

The tuning fork is piezoelectrically energised and vibrates at its mechanical resonance frequency of approx. 1200 Hz. The piezoelectric elements are fastened mechanically and are therefore not subject to temperature shock limitations. When the tuning fork is submerged in the product, the frequency changes. This change is detected by the integrated oscillator and converted into a switching command.

The integrated fault monitoring detects:

- interruption of the connection cable to the piezoelectric elements
- extreme wear on the tuning fork
- break of the tuning fork
- absence of vibration.

If one of the stated failures is detected or in case of voltage loss, the electronics takes on a defined switching condition, i.e. depending on the electronics version,

- the contactless electronic switch opens
- the relay deenergises
- the output transistor blocks.

### Compact instruments

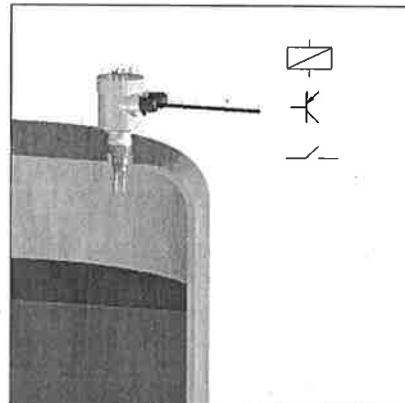
All VEGASWINGS are available as compact instruments, i.e. all instruments can also be operated without external processing. The integrated electronics evaluates the level signals and provides an output signal according to the oscillator type. With this output signal, a connected device can be operated directly (e.g. a warning system, a PLC, a pump etc.).

With one of the following oscillators you can convert the vibrating level switch into a compact instrument:

- contactless electronic switch (C)
- relay output (R)
- transistor output (T)

### 2.2 Measuring system

#### Level detection of liquids with compact instrument



Measuring system with VEGASWING as compact instrument

A measuring system consists of:

- a VEGASWING vibrating level switch with integrated oscillator (SWING E60C, R, T)
- connected devices which can be operated with VEGASWING.

### 3 Types and versions

#### 3.1 VEGASWING 60 - Overview

	61	63	61 ExD	63 ExD
<b>Version</b>				
Standard (fixed installation length)	•		•	
Tube version		•		•
<b>Approvals (SWING E60 R, C, T)</b>				
Ex-Zone 0 acc. to ATEX 100 a 1/2G EEx d IIC T6			•	•
Overfill protection acc. to WHG			•	•
<b>Mechanical connection</b>				
G ¾ A	•	•	•	•
¾" NPT	•	•	•	•
G 1 A	•	•	•	•
1" NPT	•	•	•	•
Flange from DN 25, ANSI 1"	•	•	•	•
Tri-Clamp 1"	•	•	•	•
Tri-Clamp 1½"	•	•	•	•
Bolting DN 40	•	•	•	•
Tuchenhagen Varivent	•	•	•	•
<b>Tuning fork material</b>				
1.4435 (316 L)	•	•	•	•
2.4610 (Hastelloy C4)	•	•	•	•
<b>Materials, mechanical connection</b>				
1.4435 (316 L)	•	•	•	•
2.4610 (Hastelloy C4)	•	•	•	•
<b>Coating</b>				
ECTFE (Halar)	•	•	•	•
Enamel	•	•	•	•
<b>Oscillator</b>				
Contactless electronic switch (SWING E60C)	•	•	•	•
Relay output (SWING E60R) DPDT	•	•	•	•
Transistor output (SWING E60T)	•	•	•	•
<b>Adapters</b>				
Temperature adapter 1.4435 (316 L) up to 250°C	•	•	•	•
Gastight leadthrough	•	•		

### 3.2 Technical data - VEGASWING 60

#### VEGASWING 61 and 63

##### Housing

Housing material	PBT (Polyester), Aluminium (plastic-coated)
Protection	IP 66 and IP 67 (meets both requirements)
Cable entry	2 x M20 x 1.5 or 2 x 1/2" NPT
Terminals	max. 1 x 1.5 mm <sup>2</sup>

##### Adapters

Gastight leadthrough (option)	
- material	1.4435/glass
- leakage rate	< 10 <sup>-6</sup> mbar l/sec
- pressure resistance	PN 64
Temperature adapter (option)	
- material	1.4435

##### Process connection

Thread	G 3/4 A, 3/4" NPT, G 1 A or 1" NPT PN 64
- material	1.4435 (316 L) or 2.4610 (Hastelloy C4)
Flanges	DIN from DN 25 and ANSI ab 1"
- material	1.4435, 1.4435 with Hastelloy C4 plated, enamelled steel, 1.4435 ECTFE-coating
Hygienic fittings	
- material	1.4435
- bolting	DN 40 PN 40
- Tri-Clamp	1", 1 1/2" PN 10
- conus	DN 25 PN 40
- Tuchenhagen Varivent	DN 50 PN 10

##### Extension tube (VEGASWING 63)

Material	1.4435 (316 L), 2.4610 (Hastelloy C4), Hastelloy C4 enamelled 1.4435 with ECTFE-coating
Length	
- steel 1.4435, 2.4610 (Hastelloy C4)	150 mm ... 4000 mm
- Hastelloy C4 enamelled	150 mm ... 1200 mm
- 1.4435 ECTFE-coated	150 mm ... 3000 mm

##### Tuning fork

Material	1.4435 (316 L), 2.4610 (Hastelloy C4), Hastelloy C4 enamelled, 1.4435 with ECTFE-coating
Surface quality (option)	
- standard	Ra approx. ≤ 3.0 µm
- polished	Ra ≤ 1.5 µm
- hygienic version (3A)	Ra ≤ 0.5 µm

**Weight**

Basic weight	
- with Aluminium housing	approx. 980 g
- with plastic housing	approx. 480 g
Tube extension (VEGASWING 63A)	approx. 0.11 kg/m

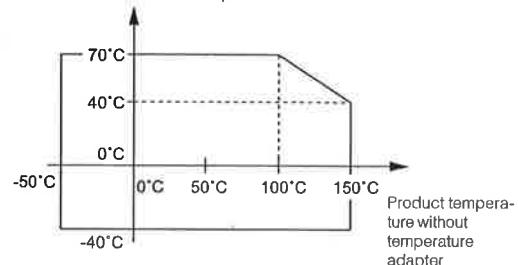
**Product**

Viscosity	0.2 ... 10.000 mPa s
- dynamic	(requirement: with density 1)
Density	0.7 ... 2.5 g/cm <sup>3</sup> (0.5 ... 0.7 g/cm <sup>3</sup> by switching over)

**Ambient conditions**

Ambient temperature on the housing	-40°C ... +70°C
Storage and transport temperature	-40°C ... +80°C
Product temperature	
- VEGASWING of 1.4435 / Hastelloy C4	-50°C ... +150°C
Product temperature with temperature adapter of 1.4435 (option)	
- VEGASWING of 1.4435 / Hastelloy C4	-50°C ... +250°C
- VEGASWING enamelled	-50°C ... +200°C
- VEGASWING with ECTFE-coating	-50°C ... +150°C

Permissible ambient temperature

**Operating pressure**

Operating pressure	max. 64 bar depending on mechanical connection
--------------------	---

**Function**

Modes	A - max. detection or overflow protection B - min. detection or dry run protection A/B-mode in oscillator
Integration time	approx. 500 ms
Frequency	approx. 1200 Hz
Hysteresis	approx. 2 mm with vertical installation
Control lamp	two-coloured LED for switching status indication green = output conducts red = output blocks red (flashing) = failure
- SWING E60 C, R, T	

**CE conformity CE**

VEGASWING 61 and 63 vibrating level switches meet the protective regulations of EMC (89/336/EWG) and NSR (73/23/EWG). Conformity has been judged acc. to the following standards:

EMC	Emission	EN 61 326/A1: 1998 (class B)
	Susceptibility	EN 61 326/A1: 1998
NSR		EN 61 010 - 1: 1993

**Oscillators****Contactless electronic switch (SWING E60C)**

Supply voltage	20 ... 253 V AC, 50/60 Hz or 20 ... 253 V DC
Output	contactless electronic switch
Domestic current requirement	approx. 3 mA (via load circuit)
Load current	min. 10 mA
	max. 400 mA (the ambient temperature can be max 60°C at I > 300 mA)
	max. 4 A to 40 ms (not WHG specified)
Protection class	I
Overvoltage category	III
Modes (switch over)	A = max. detection or overflow protection B = min. detection or dry run protection

**Relay output (SWING E60R)**

Supply voltage	20 ... 253 V AC, 50/60 Hz or 20 ... 72 V DC (the ambient temperature can be max. 50° C at U > 60 V DC)
Power consumption	1 ... 8 VA (AC), approx. 1,3 W (DC)
Output	relay output (DPDT) 2 floating spdt
Contact material	AgCdO and Au plated
Turn-on voltage	min. 10 mV
Switching current	max. 250 V AC, 250 V DC min. 10 µA
Breaking capacitance	max. 5 A AC, 1 A DC
Protection class	max. 750 VA AC, 54 W DC
Oversupply category	I
Modes (switch over)	III A = max. detection of overflow/overfill protection B = min. detection or dry run protection

**Transistor output (SWING E60T)**

Supply voltage	10 ... 55 V DC
Power consumption	max. 0.5 W
Output	floating transistor output overload and permanently short-circuit resistant
Load current	max. 400 mA
Voltage loss	max. 1 V
Turn-on voltage	max. 55 V DC
Blocking current	< 10 µA
Protection class	II
Oversupply category	III
Modes (switch over)	A = max. detection or overflow/overfill protection B = min. detection or dry run protection

**Approvals VEGASWING 61 and 63****Water Resources Law (WHG)**

Approval as part of an overfill protection system acc. to Water Resources Law (WHG)

Ambient temperature on the housing -40°C ... +70°C

Product temperature -50°C ... +150°C

- test report VEGASWING 61 EX and 63 EX with

oscillator SWING E60R, C, T EX

- with temperature adapter up to 250°C

Operating pressure max. 64 bar

**Explosion protection VEGASWING 61 EX0, 63 EX0 **

Certificate EC type approval certificate acc. to ATEX 100a

Flame proofing II 1/2G EEx d IIC T6

Permissible application range Ex Zone 0

Ambient temperature depending on see safety instructions

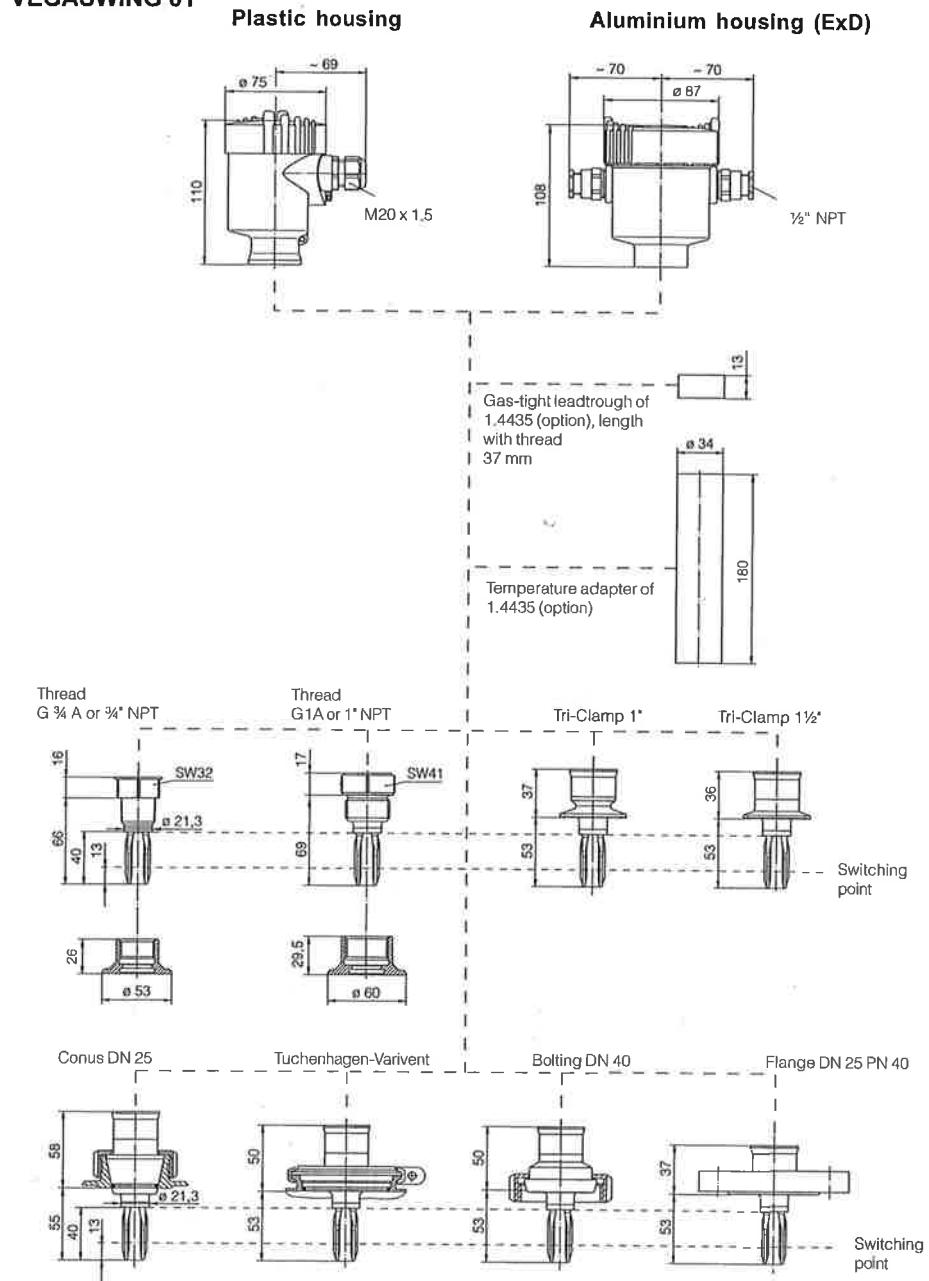
temperature class and Ex-Zone: see safety instructions

Electrical safety-relevant characteristics: see safety instructions

**3-A Conformity (foodstuffs)**

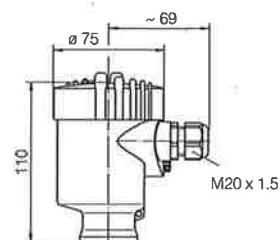
In conjunction with the surface quality  $R_a \leq 0.5 \mu\text{m}$  VEGASWING 61 and 63 meet the requirements of the food approval 3-A. The instrument is marked accordingly.

### 3.3 Dimensions - VEGASWING 60

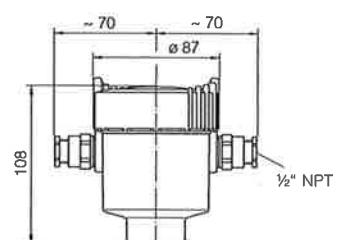
**VEGASWING 61**

**VEGASWING 63**

**Plastic housing**



**Aluminium housing (ExD)**



Thread  
G 3/4 A or 3/4" NPT

Thread  
G1A or 1" NPT

Gas-light leadthrough of  
1.4435 (option), length  
with thread  
37 mm

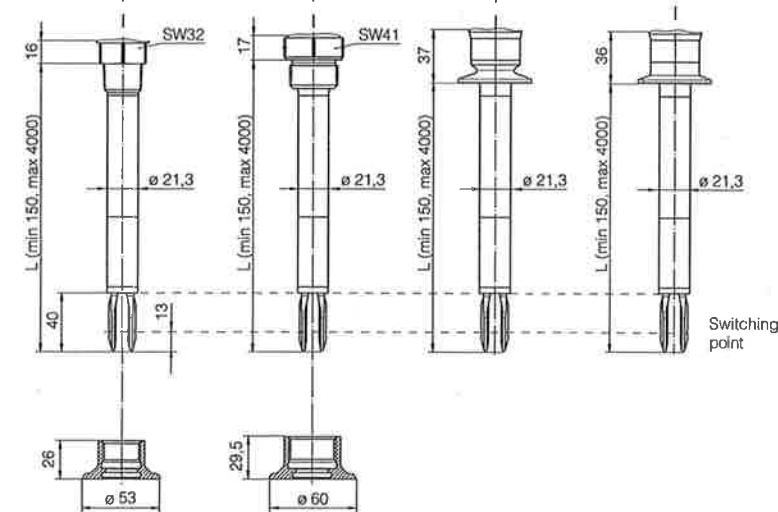
Temperature adapter of  
1.4435 (option)



Tri-Clamp 1"

Tri-Clamp 1 1/2"

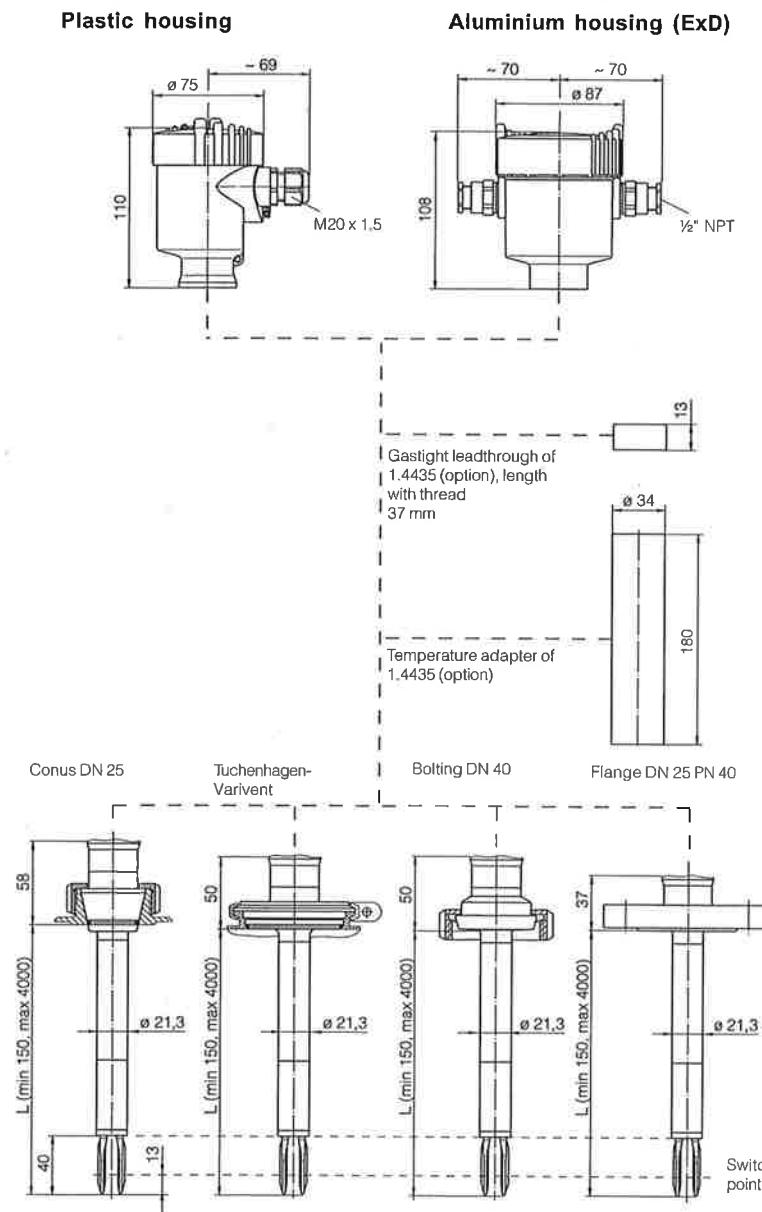
Switching point

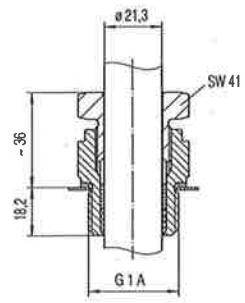
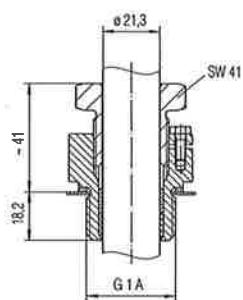
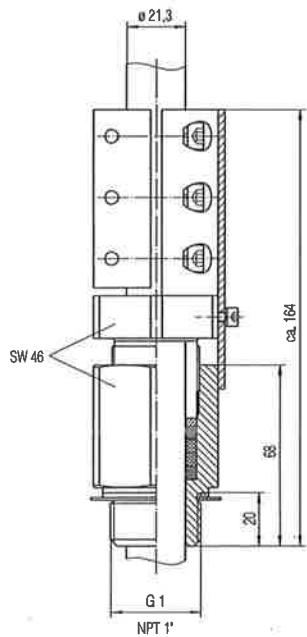


Types and versions

**VEGA**

### VEGASWING 63



**Lock fitting unpressurised****Lock fitting WHG, Ex Zone 0****Lock fitting 64 bar WHG, Ex Zone 0**

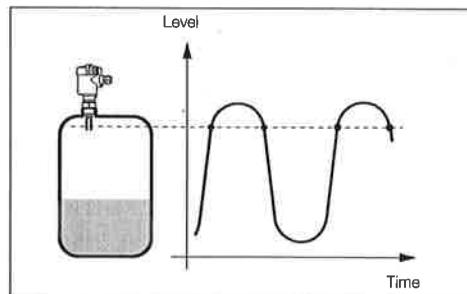
### 3.4 Application examples

#### Single point control

Measuring system for detection of the max. level, e.g. for overfill protection or operation of emptying pump.

Vibrating level switch at the appropriate switching point

- mounted at the appropriate height
- with tube extension in appropriate length

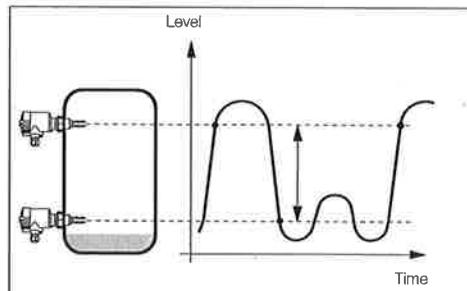


#### Double point control

Measuring system for detection of two levels (alternating function) e.g. pump control.

Vibrating level switch at the appropriate switching point

- mounted at the appropriate height
- with tube extension in appropriate length

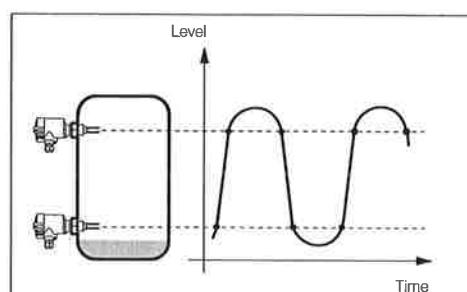


#### Double single point control

Measuring system for detection of the min. and max. level.

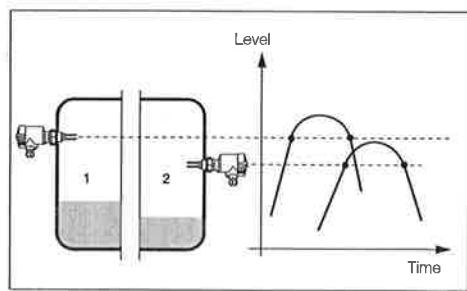
Vibrating level switch at the appropriate switching point

- mounted at the appropriate height
- with tube extension in appropriate length



**or**

Measuring system for detection of one level in each of two different vessels.



## 4 Mounting

### 4.1 VEGASWING

In principle, VEGASWING can be mounted in any position. The instrument must be mounted such that the tuning fork is at the height of the required switching point. Note the following installation instructions:

#### Transport

Do not hold VEGASWING on the tuning fork. Especially with flange and tube versions, the tuning fork can be damaged simply by the weight of the instrument. Transport enamelled and ECTFE coated instruments very carefully and avoid touching the tuning fork.

#### Switching point

The tuning fork is provided with lateral markings (notches), marking the switching point with vertical installation. The switching point refers to the medium water at the basic setting of the density switch  $\geq 0.7 \text{ g/cm}^3$ . Make sure when mounting VEGASWING that this marking is at the height of the requested level. Note that the switching point of the instrument shifts when the medium has a density other than that of water (water =  $1.0 \text{ g/cm}^3$ ). For products  $< 0.7 \text{ g/cm}^3$  the density switch has to be set to  $\geq 0.5 \text{ g/cm}^3$ .

#### Vertical installation

from top, from bottom

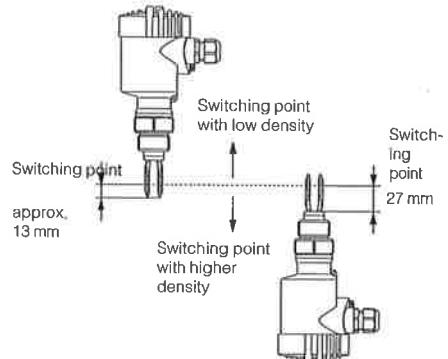
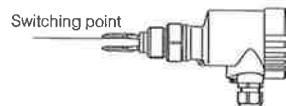


Fig. 2.1

#### Horizontal installation



recommended installation position for adhesive products:

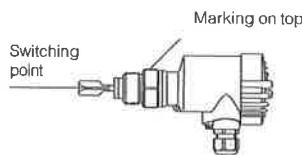


Fig. 2.2

### **Adhesive products**

In case of horizontal mounting in adhesive and viscous products, the surfaces of the tuning fork should be vertical in order to reduce buildup on the tuning fork (see fig. 2.2). The position of the tuning fork is marked by a notch on the hexagon of VEGASWING. With this you can check the position of the tuning fork when screwing it in. When the hexagon touches the seal, the thread can still be turned by approx. half a turn. This is sufficient to reach the recommended installation position.

In case of adhesive and viscous products, the tuning fork should protrude into the vessel to avoid buildup. Sockets for flanges and mounting bosses should therefore not exceed a certain length. The tuning fork should protrude into the vessel/pipeline.

### **Pressure**

When there is gauge pressure or underpressure in the vessel, the mounting boss must be sealed on the thread. Cover the thread with teflon tape, hemp or similar material or use a sufficiently resistant seal ring.

### **Vibrations**

Extreme vibrations and shocks, e.g. caused by stirrers and turbulence in the vessel, can cause the extension tube of VEGASWING 63 to vibrate. This will cause increased stress on the upper weld joint.

To counteract this, provide a fastening or straining directly above the tuning fork to fasten the extension tube (see fig. 2.3).



This applies mainly to applications in Ex areas category 1G or WHG. Make sure that the tube is not subjected to bending forces.

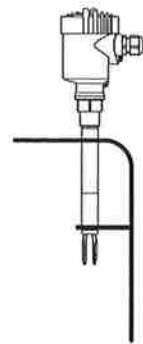


Fig. 2.3

### **Stirrers**

Through the action of stirrers or similar devices, the level switches can be subjected to strong lateral forces. For this reason, do not use an overlong extension tube for VEGASWING 63, but check if it is possible to mount a VEGASWING 61 level switch on the side of the vessel in horizontal position.

### **Cable entries**

Use a cable with round wire cross-section and tighten the cable entry firmly. The cable entry is suitable for cable diameters from 5 mm to 9 mm.

### Moisture

Turn the cable entries of horizontally mounted instruments downwards to avoid moisture ingress. For this purpose the plastic housing can be rotated by approx. 330°. For vertically installed instruments, loop the cable connected to the instrument housing downwards so that rain and condensation water can drain off. This applies mainly when mounting outdoors, in humid areas (e.g. by cleaning processes) or on cooled or heated vessels (see fig. 2.4).

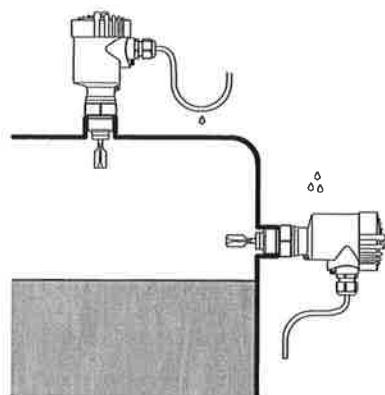


Fig. 2.4

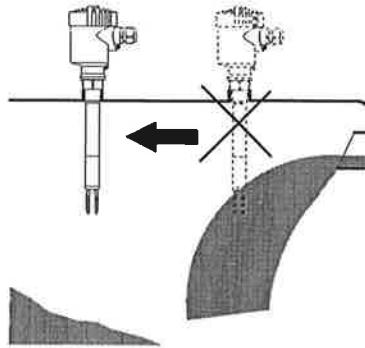


Fig. 2.5

### Chemical resistance



When applied in Ex areas zone 0, VEGASWING must be used only in combustible liquids against which the materials of the tuning fork system are sufficiently chemically resistant.

### VEGASWING with enamel

Treat instruments with enamel coating very carefully and avoid shocks. Unpack VEGASWING directly before installation. Insert VEGASWING carefully into the vessel opening and avoid touching any sharp vessel parts.

### Flow

(e.g. in tubes)

When mounting in pipelines or in vessels having a certain flow direction, VEGASWING should be installed such that the surfaces of the tuning fork are aligned with that direction.

### Lateral load

Make sure that the vibrating element is not subjected to lateral forces. To assure this, mount the instrument at a location in the vessel where no adverse conditions, e.g. caused by stirrers, filling openings etc. can occur. This applies mainly to instrument types with extension tube (see fig. 2.5). The surfaces of the tuning fork should be parallel to the product movement.

### Mounting boss

VEGASWING's thread starting point is defined. This means that every VEGASWING is in the same position after being screwed in. Remove therefore the supplied seal from the thread of VEGASWING. This seal is not required when using a welded socket. Screw VEGASWING into the welded socket.

You can determine the subsequent position of VEGASWING before welding (see fig. 2.2). Mark the appropriate position of the welded socket. Before welding, unscrew VEGA-SWING and remove the rubber ring from the socket.

The welded socket has a marking (notch). Weld this socket with the notch facing upwards, or in the case of pipelines, aligned with the direction of flow (see fig. 2.6).

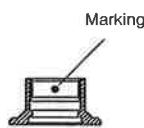


Fig. 2.6

## 5 Electrical connection

### 5.1 VEGASWING 61 and 63

#### Note

Switch off the power supply before starting connection work.

The electrical connection must be carried out according to the installed oscillator. Connect supply voltage according to the following wiring diagrams.

The oscillators SWING E60R and SWING E60C are in protection class 1. To maintain this protection class, it is obligatory that the earth conductor is connected to the inner earth conductor terminal. Also note the general installation regulations.

As a rule, connect VEGASWING to vessel ground (PA), or in plastic vessel, to the nearest ground potential. For this purpose, a grounding terminal is provided between the cable entries on the side of the housing. This connection serves to drain off electrostatic charges.

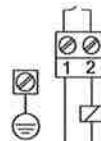
In Ex applications, it is also necessary to note the installation regulations for hazardous areas.

#### Contactless electronic switch (SWING E60C)

Power supply:  
20 ... 253 V AC, 50/60 Hz

20 ... 253 V DC

(for further information, see technical data)



AC      L1 N  
DC      + -  
or  
DC      - +

For direct control of relays, contactors, magnet valves, warning lights, horns etc. The instrument must not be operated without connected load (switching in series), as the oscillator can be destroyed when connected directly to mains. Not suitable for connection to low voltage PLC inputs.

The domestic current is temporarily lowered below 1 mA after switching off the load so that contactors, whose holding current is lower than constant domestic current of the electronics, are reliably switched off.

When VEGASWING is used as part of an overfill protection system acc. to WHG, also note the regulations of the general type approval.

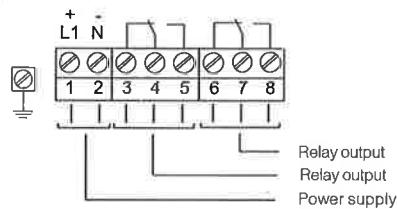
**Floating relay output (SWING E60R)**

Power supply:

20 ... 253 V AC, 50/60 Hz

20 ... 72 V DC

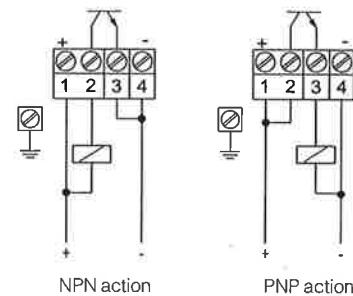
(for further information, see technical data)



For direct control of relays, contactors, magnet valves, warning lights, horns etc.

When VEGASWING is used as part of an overfill protection system acc. to WHG, also note the regulations of the general type approval.

For direct control of relays, contactors, magnet valves, warning lights, horns, as well as PLC inputs.

**Connection examples**

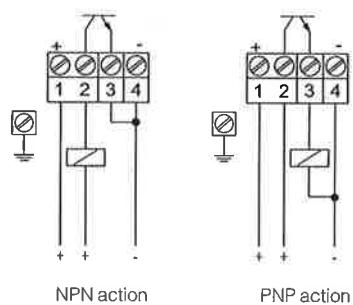
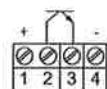
The transistor switches the supply voltage of the oscillator to the binary input of a PLC or to an electrical load. Through different connections to the consumer (load), PNP or NPN action can be preset.

**Floating transistor output (SWING E60T)**

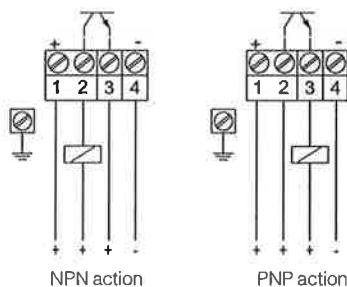
Power supply:

10 ... 55 V DC

(for further information, see the following connection examples, as well as technical data)

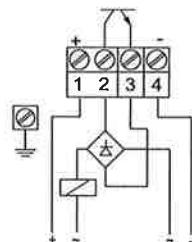


The transistor switches a second voltage source with the same reference potential to the binary input of a PLC or to an electrical load. Through different connections to the consumer (load), PNP or NPN action can be preset.

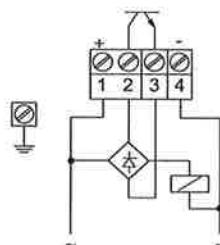


The transistor switches a second, galvanically isolated voltage source to the binary input of a PLC or to an electrical load. Through different connections to the consumer (load), PNP or NPN action can be preset.

### Control of alternating current loads



The transistor switches a galvanically separated alternating voltage 10 ... 42 V AC to a load.



The transistor switches an alternating voltage 10 ... 42 V AC, which is also supply voltage, to a load.

### Note

The transistor outputs of several VEGA-SWINGs can be switched in series or in parallel to connect their signals logically. The connection must be made such that terminal 2 always has a higher voltage relative to terminal 3.

## 6 Setup

The numbers in brackets relate to the following illustrations:

### 6.1 VEGASWING 61 and 63

#### Display and adjustment elements

The switching status of the electronics can be checked when the housing is closed (LED display). In basic adjustment, products with a density  $> 0.7 \text{ g/cm}^3$  can be detected. For products with lower density, the switch must be set to  $> 0.5 \text{ g/cm}^3$ .

The following display and adjustment elements are located on the oscillator:

- LED display (1)
- DIL switch for adaptation of the switching point (3) and A/B mode (2)

#### Note:

When testing, always immerse the tuning fork of VEGASWING into a liquid. Do not test the functionality of VEGASWING by touching it. This can damage the sensor.

#### A/B mode switch (2)

With the A/B mode switch you can change the switching condition of the contactless electronic switch, the relay or the transistor. You can set the requested mode acc. to „6.2 Function chart“ (A - max. detection or overfill protection, B - min. detection or dry run protection).

#### Switching point adaptation (3)

With this DIL switch (3) you can set the switching point for liquids with a density between 0.5 and 0.7  $\text{g/cm}^3$ . In the basic setting, liquids with a density  $> 0.7 \text{ g/cm}^3$  can be detected. For products with lower density, you have to set the switch to  $> 0.5 \text{ g/cm}^3$ . The information on the position of the switching point relates to the medium water (density value  $1.0 \text{ g/cm}^3$ ). In products with a different density this switching points shifts, depending on the density and type of installation, either in the direction of the housing or the tuning fork end. See also 4 Mounting - Switching point.

#### LED display (1)

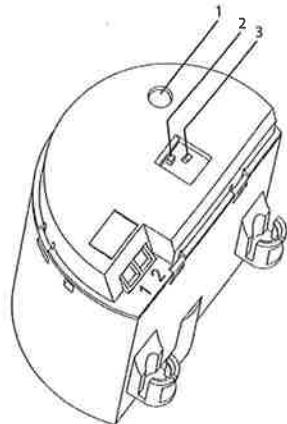
green	=	output conducts
red	=	output blocks
red (flashing)	=	failure

#### Fault monitoring

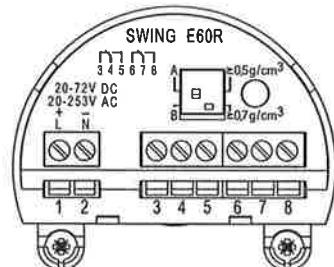
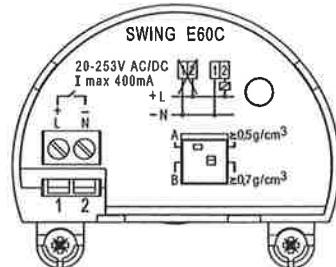
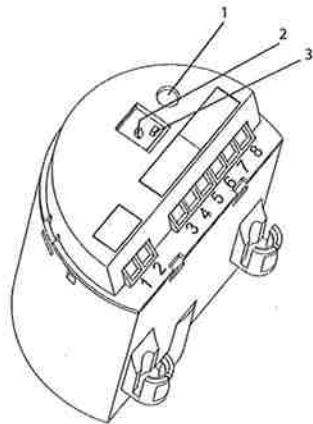
The oscillator of VEGASWING monitors the instrument continuously. The following criteria are checked:

- corrosion or damage to the tuning fork
- failure of the tuning fork
- line break to the actuation.

**Oscillator - SWING E60C**  
Contactless electronic switch



**Oscillator - SWING E60R**  
Relay output

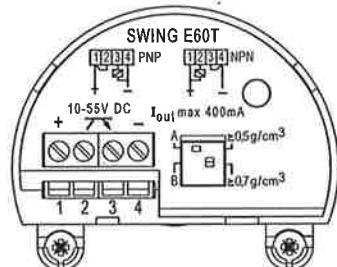
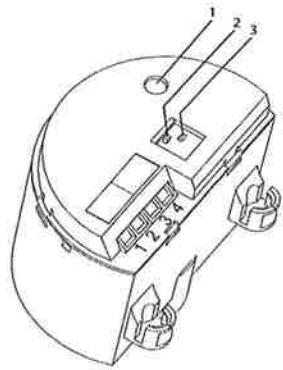


1 LED display

2 DIL switch - characteristics changeover

3 DIL switch - switching point adaptation

**Oscillator - SWING E60T**  
Transistor output



- 1 LED display  
2 DIL switch - characteristics changeover  
3 DIL switch - switching point adaptation

## 6.2 Function chart

The following chart provides an overview of the switching conditions depending on the adjusted mode and level.

	Level	Switching status SWING E60 C <sup>1)</sup>	SWING E60 R <sup>1)</sup>	SWING E60 T	Control lamp VEGASWING
Mode A		1 2 Switch closed	3 4 5 (6) (7) (8) Relay energised	Transistor conducts	 green
		1 2 Switch open	3 4 5 (6) (7) (8) Relay deenergised	Transistor blocks	 red
Mode B		1 2 Switch closed	3 4 5 (6) (7) (8) Relay energised	Transistor conducts	 green
		1 2 Switch open	3 4 5 (6) (7) (8) Relay deenergised	Transistor blocks	 red

Failure of the supply voltage (mode A/B)	any	1 2 Switch open	3 4 5 (6) (7) (8) Relay deenergised	Transistor blocks	
Failure	any	1 2 Switch open	3 4 5 (6) (7) (8) Relay deenergised	Transistor blocks	 flashes red

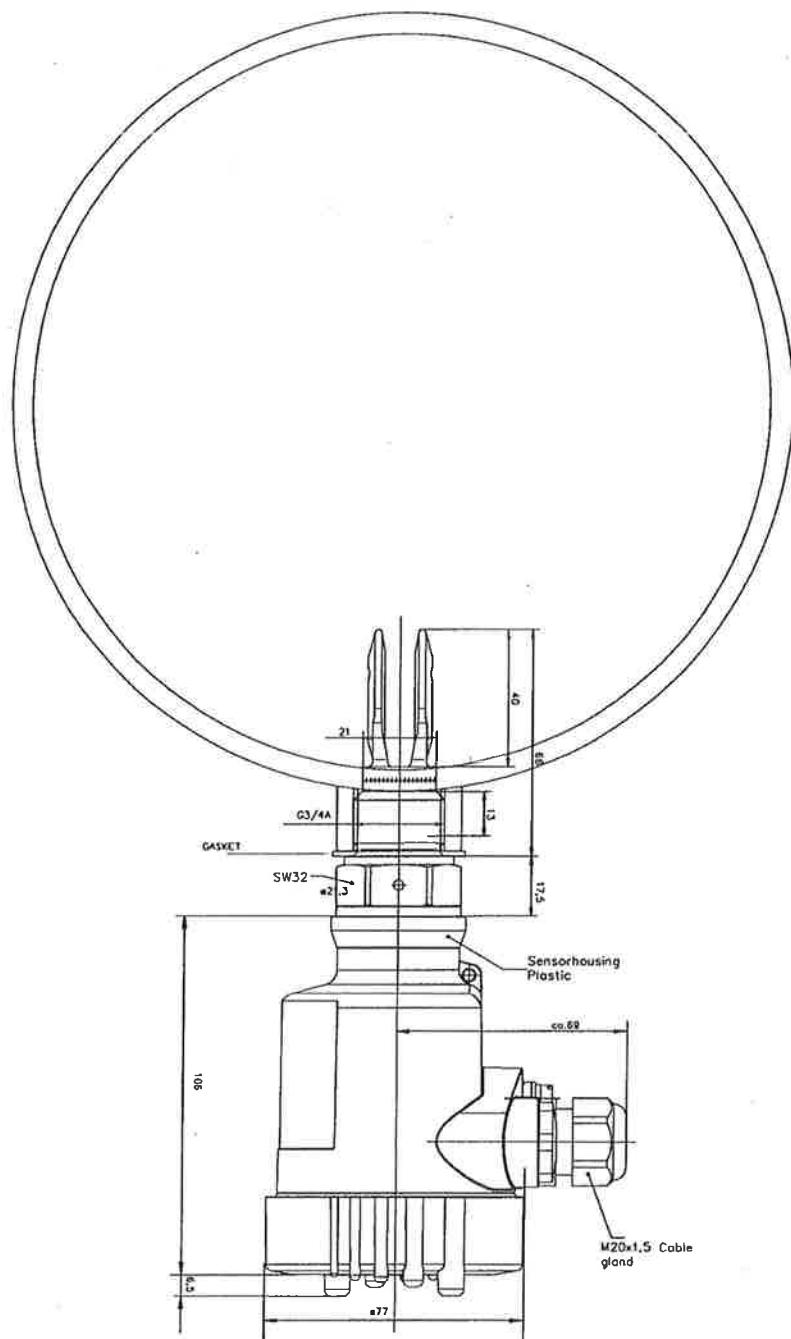
<sup>1)</sup> Switch in standby mode

## Plassering av tørrkjøringsvakt

-Tørrkjøringsvakten monteres nær pumpen i luftlommefritt område, helst nedenfra og opp, i en horisontal del av sugelinjen.

## Location of dry running protection

-It must be mounted near the pump where no air is trapped, preferably from underneath, and in a horizontal part of the suction line



Beschreibung	Urtypische		Änderung / changing				Datum Date	Urtypische
			Art-Nr. Art-Nr.	Alt.-Nr. Alt.-Nr.	Urtypische	Änderung Änderung		
 Fremstellersatz General Sollbr. SC 2768-ir			gründlich durchsucht ausgetestet abgestimmt Soll 12	Alt.-Nr. 17-0135	Urtypische HR	Bemerkung Sicherheit - 3/1 Sicherheitsstempel	Bestell-Nr. SW60-14	Urtypische
 Abweichen von der Urtypischen Fremstellersatz General Sollbr. SC 2768-ir						Auf Nr. / Art-Nr. Zeil-Nr. / Erweiterung: SW61	Bestell-Nr. 17-0136-1402	
						3°-Winkel	Winkel	
						Plan / Zeichn.	Zeichn. / Plan	
						Arbeits-Ausführ.		

**VEGA**  
VEG Sensors + Actuators  
Ingenierie  
Instrumentation  
Automation

Notes

**VEGA**

**VEGA**

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[www.vega.com](http://www.vega.com)

SAFETY  
VALVE



All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the latest information at the time of printing.

Technical data subject to alterations

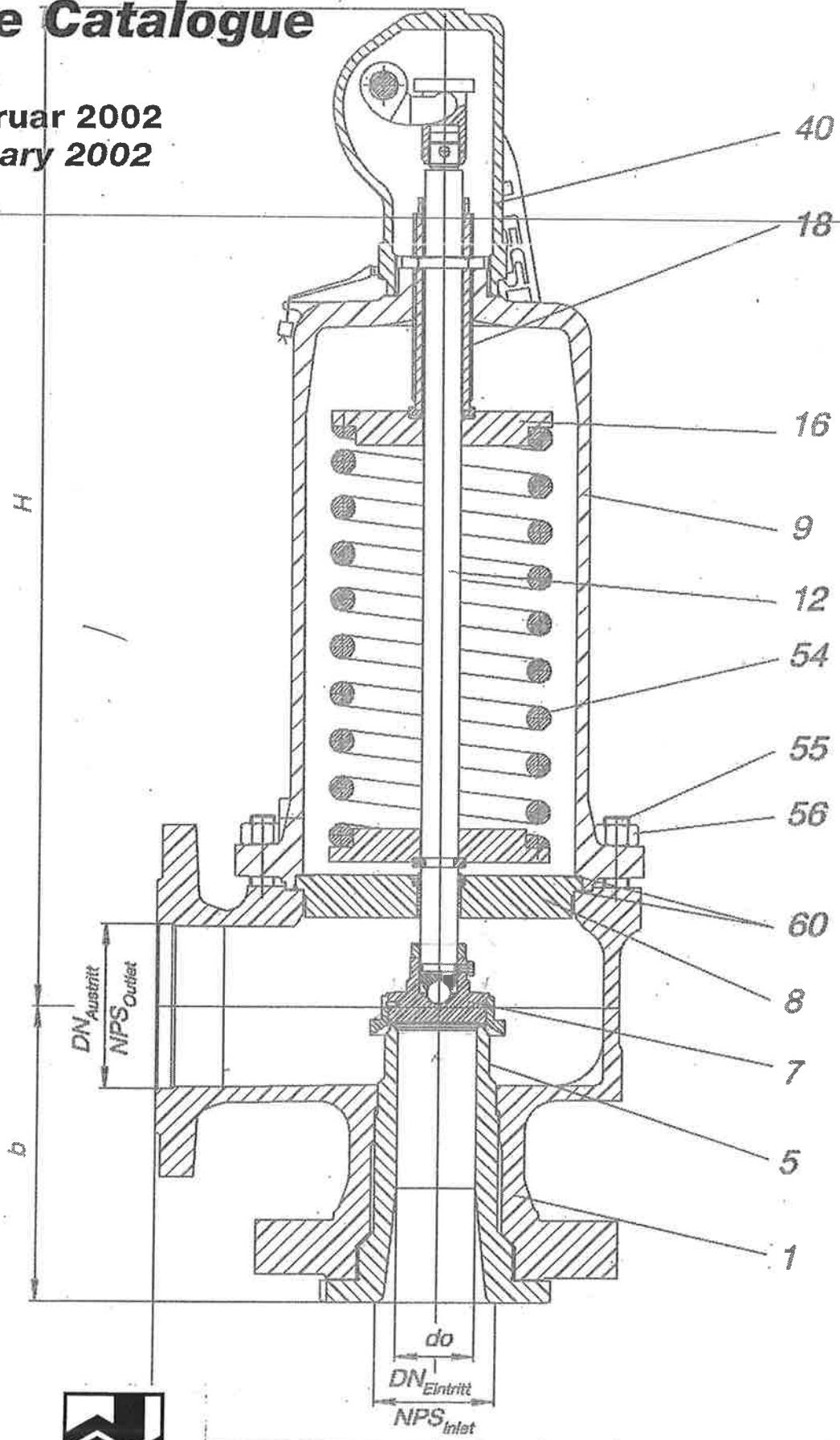
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2.25 483 / January 2002

# Gesamtkatalog

## Complete Catalogue

Ausgabe Februar 2002  
Edition February 2002



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Das Sicherheitsventil/The Safety Valve

# Behandlung, Kennzeichnung und Aufbau

## *Handling, Marking and Assembly*

3

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# Betriebsanleitung Operating Instructions

3

## 2 Allgemeines

Die nachfolgenden allgemeingültigen Hinweise beziehen sich auf direkt wirkende und gesteuerte (zusatzbelastete) Sicherheitsventile.

Damit ein Sicherheitsventil die ihm gestellten Aufgaben erfüllen kann, werden alle Einzelteile mit großer Präzision gefertigt. Diese Präzision ermöglicht erst das exakte Funktionieren. Sicherheitsventile müssen daher sorgfältig behandelt werden. Ein Ausfall kann die Gefährdung von Menschen, Tieren und Anlagen verursachen. Auch von ordnungsgemäß funktionierenden Sicherheitsventilen gehen Gefahren aus, die beachtet werden müssen.

Folgende Gefährdungen können auftreten:

- a.) Sicherheitsventil ohne Funktion oder falsch ausgelegt:  
Druckgerät birst. Gefahr durch das Bersten selbst, durch heißes, giftiges und aggressives Medium.
- b.) Sicherheitsventil spricht an: Medium strömt aus: Gefahr durch heißes, giftiges und aggressives Medium.
- c.) Sicherheitsventil ist undicht: Medium strömt aus: Gefahr durch heißes, giftiges und aggressives Medium.
- d.) Andere Gefahren, die durch den Umgang mit Sicherheitsventilen entstehen: dazu zählen z.B. Verletzungsgefahr durch scharfe Kanten, hohes Gewicht, ...

Um das Risiko dieser Gefahren zu minimieren, muss auf jeden Fall die Betriebsanleitung beachtet werden. Diese ist aus der Praxis und den Anforderungen von Regelwerken entstanden. Grundsätzlich gilt, dass die Regelwerke immer vorrangig zu den nachstehenden Empfehlungen und Hinweisen zu beachten sind.

Regelwerke:

Druckbehälter- und Dampfkesselverordnung  
TRD 421, 721,

TRB 403, 801 Nr. 45

AD-Merkblätter,

Druckgeräterichtlinie 97/23/EG,

ASME-Code,

API 526, 520

andere

Entsprechende produktbezogene Zertifikate sind vorhanden, um die Erfüllung der Regelwerke und damit die Sicherheit nachzuweisen.

LESER ist nach DIN EN ISO 9001 (Qualitätsmanagementsystem), nach DIN EN ISO 14000 (Umweltmanagementsystem) und nach Druckgeräterichtlinie Modul D (Qualitätssicherung Produktion) zertifiziert. So ist sichergestellt, dass alle Anforderungen an Qualität und Umwelt erfüllt werden.

## 2 General

The following general notes refer to directly loaded and controlled safety valves (with supplementary loading system).

In order for a safety valve to be able to fulfil the purpose for which it is installed, all components are manufactured to great precision. Only this precision allows precise functioning. Safety valves must therefore be handled with care. Failure could endanger people, animals and installations. Even a correctly functioning safety valve can cause hazards, and this has to be taken into account.

The following risks could ensue:

- a.) The safety valve does not work correctly or is dimensioned wrongly: the pressure equipment bursts. Hazard caused through the bursting itself and by the hot, poisonous and aggressive medium.
- b.) The safety valve operates correctly: medium escapes: danger from hot, poisonous and aggressive medium.
- c.) The safety valves leaks: danger from hot, poisonous and aggressive medium.
- d.) Other dangers caused through the handling of safety valves: these are e. g., risk of injury from sharp edges, heavy weight, ...

In order to minimise the risks from these hazards, the operating instructions must be adhered to at all times. They have been developed through practical experience and from the requirements dictated by the regulations. As a rule these regulations must always be adhered to with priority over the recommendations given below.

Sets of rules:

Pressure Vessel and Steam Boiler Ordinance

TRD 421, 721,

TRB 403, 801 No. 45,

AD-Merkblätter,

Pressure Equipment Directive 97/23/EC,

ASME Code,

API 526, 520

and others

We are in possession of the appropriate productrelated certificates to certify that the sets of rules are satisfied and therefore to certify safety.

LESER is certified pursuant to DIN EN ISO 9001 (quality management systems), pursuant to DIN EN ISO 14000 (environmental management system) and Module D of the Pressure Equipment Directive (quality assurance in production). This ensures that all quality requirements and the environment are complied with.

# 3

# Betriebsanleitung Operating Instructions

## 3 Prüfung/Kennzeichnung

Nach dem Einstellen und Prüfen wird jedes Sicherheitsventil durch LESER oder auf Kundenwunsch durch den Sachverständigen einer Abnahmeorganisation plombiert, (z.B. TÜV, Germanischer Lloyd, ...).

3

Wird die Kennzeichnung durch Schlagstempel o.ä. aufgebracht, darf das Sicherheitsventil nicht beschädigt werden. Verformungen können zu Undichtigkeiten oder Zerstörung des Sicherheitsventils führen. Insbesondere bei dünnen Wandstärken sollte auf Schlagstempel verzichtet werden.

Sicherheitsventile tragen ein Bauteilkennzeichen mit folgenden Daten:

- Auftragsdaten
- Technische Daten
- Einstelldruck
- VdTÜV-Bauteilprüfnummer
- CE-Kennzeichen mit Nr. der benannten Stelle
- weitere Daten, z.B. UV-Stamp bei ASME-zugelassenen Sicherheitsventilen

Bei Sicherheitsventilen ohne Bauteilprüfung werden nur die Auftragsdaten und technischen Daten eingetragen.

Weitere geforderte Kennzeichen sind entweder aufgegossen oder bei Sicherheitsventilen mit Gewindeanschluss eingeschlagen. Sicherheitsventile mit Heizmantel erhalten ein separates Bauteilprüfsschild für den Heizmantel.

Bei technischen Änderungen ist immer zu prüfen, ob die Kennzeichnung angepasst werden muss. Änderungen an Ventilen und Kennzeichnungen dürfen nur durch geschultes Personal durchgeführt werden (Siehe Abschnitt 11.14).

## 4 Druck

Definitionen:

- a.) Einstelldruck: Druck, auf den das Sicherheitsventil bei LESER eingestellt wird. Auf der Austrittseite des Sicherheitsventils wirkt Umgebungsdruck.
- b.) Ansprechdruck: Druck, bei dem das Sicherheitsventil auf der Anlage anspricht.
- c.) Öffnungsdruck: Druck, bei dem das Sicherheitsventil den zuerkannten Massenstrom abführt. (Angabe auch als Differenz vom Ansprechdruck in Prozent möglich → Öffnungsdruckdifferenz).
- d.) Schließdruck: Druck, bei dem das Sicherheitsventil vollständig schließt (Angabe auch als Differenz vom Ansprechdruck in Prozent möglich → Schließdruckdifferenz).
- e.) Betriebsdruck: Druck, mit dem die Anlage dauerhaft betrieben wird.
- f.) Eigengegendruck: Druckaufbau auf der Austrittseite durch Strömungsverluste beim Abblasen.
- g.) Fremdgegendruck: Druck in der Ausblasleitung, wenn diese Teil eines Systems mit Drücken größer als Umgebungsdruck ist.
- h.) Gegendruck: Summe aus Eigen- und Fremdgegendruck.

## 3 Testing/marking

After setting and testing, each safety valve is sealed by LESER or by the expert of an official acceptance organisation at the customer's request (such as TÜV, Germanischer Lloyd, ...).

If the marking is brought up by means of an impact stamp, etc., the safety valve may not be damaged. Deformations may lead to leakage or the destruction of the safety valve. An impact stamp should not be used especially with thin walls.

Safety valves have a type test approval plate with the following data:

- data of order
- technical data
- test pressure
- VdTÜV type test approval number
- CE marking and identification number of the notified body
- further information such as the UV stamp with safety valves approved by ASME

For safety valves without type test approval, only the order data and technical data are included.

Further marks required are either cast in, or, for safety valves with threaded connections, punched in. Safety valves with a heating jacket receive a separate plate for the heating jacket.

If technical changes are made, it should always be checked to see whether the identification has to be adjusted. Only trained personnel may make changes on valves and identifications (refer to section 11.14).

## 4 Pressure

Definitions:

- a.) Test pressure: the pressure that LESER sets the safety valve at. There is ambient pressure on the outlet side of the safety valve.
- b.) Set pressure: the pressure at which the safety valve responds to the plant.
- c.) Opening pressure: the pressure where the safety valve drains the recognised mass flow (this may also be given as the difference from the set pressure in per cent → opening pressure difference).
- d.) Reseating pressure: the pressure where the safety valve closes complete. (this may also be given as the difference from the set pressure in per cent → blow down).
- e.) Operating pressure: the pressure that the plant is constantly run with.
- f.) Built-up back pressure: pressure built up on the outlet side by flow losses when blowing off.
- g.) Superimposed back pressure: the pressure in the discharge line when this is part of a system with pressures greater than the ambient pressure.
- h.) Back pressure: the total of built up and superimposed back pressure.

# Betriebsanleitung Operating Instructions

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Druckangaben erfolgen als Überdruck [bar g bzw. psig] über dem Umgebungsdruck.

Wenn nicht anders angegeben, stellt LESER den kundenseitig vorgegebenen Ansprechdruck immer bei Umgebungsdruck auf der Austrittseite ein (Einstelldruck = Ansprechdruck). Wirkt austrittsseitig ein Druck (Fremdgegendorck), ergibt sich eine Kraftwirkung auf die Rückseite des Tellers. Dadurch steigt der Ansprechdruck genau um den Wert dieses Druckes. Bei konstantem Fremdgegendorck ist eine Differenzdruckeinstellung möglich, indem der Einstelldruck um den Betrag des Gegendruckes reduziert wird (Einstelldruck ≠ Ansprechdruck). Liegt der Fremdgegendorck nicht an, sinkt der Ansprechdruck. Der vorgesehene Gegengedruck darf nicht überschritten werden, da der Ansprechdruck dann ebenfalls überschritten wird.

Der maximale Druck, mit dem ein Sicherheitsventil unabhängig vom Einstelldruck betrieben werden darf, hängt von vielen Faktoren ab. Dazu zählen:

- Werkstoffauswahl
- Medientemperatur
- Auslegungsdruck
- Flanschdruckstufen
- weitere

Diese sind bei der Auswahl der Sicherheitsventile zu beachten.

Der Betriebsdruck muss dauerhaft mindestens um den Wert der Schließdruckdifferenz zuzüglich 5 % unter dem Ansprechdruck liegen. Andernfalls kann ein sicheres Schließen nach dem Ansprechen nicht gewährleistet werden (Ausnahme: Ausrüstung mit einer Zusatzbelastung, s. Abschnitt 14).

## 5 Funktion des Sicherheitsventils

Ein Leistungsnachweis ist erforderlich, um sicherzustellen, dass vom Sicherheitsventil im Bedarfsfall der geforderte Massenstrom abgeführt werden kann.

Zuleitungen zu Sicherheitsventilen sind strömungsgünstig zu verlegen und Kanten am Stutzeinlauf sollen zumindest angestafft, besser noch gerundet werden. Auslegungshinweise in Regelwerken, Normen und Herstellerangaben sind zu beachten.

Sicherheitsventile dürfen nur dann durch Absperrelemente außer Funktion gesetzt werden, wenn sichergestellt ist, dass das dazugehörige Druckgerät durch weitere Sicherheitseinrichtungen gegen Überdruck geschützt oder außer Betrieb ist.

Eine einwandfreie Funktion wird bis zum Eigengegendorck auf der Austrittseite von max. 15 % des Einstelldruckes minus Fremdgegendorck (falls vorhanden) gewährleistet.

Eigen- und Fremdgegendorcke können bis zu 35 % des Ansprechdruckes mit einem dafür ausgelegten Edelstahlbalgenbalg kompensiert werden, da die Kraftwirkung auf die Rück-

Pressure shall be stated as overpressure [bar g or psig] above ambient pressure.

If not stated otherwise, LESER always sets the set pressure specified by the customer at ambient pressure on the outlet side (test pressure = set pressure).

If there is a pressure on the outlet side (superimposed back pressure), this produces a force exerted on the rear side of the disc. This increases set pressure by exactly the value of this pressure. If the superimposed back pressure is constant, it is possible to set the differential pressure by reducing the test pressure by the back pressure (test pressure ≠ set pressure). If there is no superimposed back pressure, the set pressure drops. The back pressure provided may not be exceeded because then it would also fall below the set pressure.

The maximum pressure that a safety valve may be operated with regardless of the test pressure depends upon a number of factors. Among them are:

- Selection of materials
- Medium temperature
- Design pressure
- Flange pressure stages
- Miscellaneous

This should be taken into consideration when selecting a safety valve.

The operational pressure must in the long term be at least 5 % below the reseating pressure. Otherwise it cannot be guaranteed that the valve will close securely after working (exception: if the valve is fitted with an supplementary loading system, refer to section 14).

## 5 Function of the safety valve

It is necessary to have a performance certificate to ensure that it is possible to drain the required mass flow from the safety valve if necessary.

Pipes going to the safety valves have to be fitted in such a way as to prevent large hydrodynamic losses, and the edges at the pipe inlet should be at least chamfered but preferably rounded. The notes on dimensioning given in the regulations, standards and manufacturer's information sheets must be adhered to.

The function of safety valves may only be switched off with shut-off elements if it is ensured that the appropriate pressure device is protected against overpressure by other safety equipment or is not in operation.

Flawless functioning is guaranteed to the built-up back pressure on the outlet side of a maximum of 15 % of the test pressure minus the superimposed back pressure (if available).

Built-up and superimposed back pressures may be compensated up to 35 % of the set pressure with a stainless steel bellows specially designed for it because the force exerting itself

seite des Tellers ausgeglichen wird. Funktion und Ansprechdruck bleiben konstant. Wenn unklar ist, ob der Faltenbalg gegendruckkompenzierend wirkt, ist LESER zu kontaktieren. Druck- und Temperatureinsatzgrenzen des Faltenbalges dürfen nicht überschritten werden (siehe Abschnitt 10).

3

Werden Abblaseleitungen mit Einrichtungen ausgerüstet, die ein Eindringen von Regenwasser oder Fremdkörpern verhindern, dann dürfen diese Einrichtungen nicht das freie und vollständige Abblasen von Sicherheitsventilen behindern.

Die Ausblaseleitung ist auf den maximal auftretenden Gegendruck und die entsprechende Temperaturauszulegen. Sie ist strömungsgünstig zu verlegen und soll nicht anderen Abzweigungen gegenüberliegen, um die Funktion nicht zu beeinträchtigen und keine Beschädigungen am Sicherheitsventil zu verursachen. Der Durchfluss und die Funktion von Sicherheitsventilen müssen auch bei Mehrfachverwendung von Abblasensystemen gewährleistet sein.

Beim Ablasen entstehen Reaktionskräfte, die vom Sicherheitsventil selbst, den angeschlossenen Leitungen und den Festpunkten aufgenommen werden müssen. Die Größe der Reaktionskraft ist vor allem für die Auslegung der Festpunkte von Bedeutung.

Folgendes ist zu berücksichtigen:

- statische, dynamische oder thermische Beanspruchungen aus den zu- oder abführenden Rohrleitungen dürfen nicht auf das Sicherheitsventil übertragen werden.
- Sicherheitsventile müssen nach den Zeichnungsvorgaben befestigt werden. Das Weglassen oder Entfernen von Befestigungselementen kann zu Schäden führen, weil unerlaubt hohe Kräfte oder Spannungen auftreten.
- Siehe auch Abschnitt 11.3

## 6 Funktionelle Dichtheit des Sicherheitsventils

Bei metallisch dichtenden Sicherheitsventilen ist mit einer leichten Undichtigkeit zu rechnen. Personen, Umwelt und Anlagenteile dürfen nicht durch austretendes Medium gefährdet werden.

Weichdichtende Sicherheitsventile dichten erheblich besser ab als metallisch dichtende Sicherheitsventile. LESER bietet verschiedene Elastomerwerkstoffe für unterschiedliche Einsatzbereiche an. Der Elastomerwerkstoff ist auf das Medium, den Druck und die Temperatur des Mediums abzustimmen.

Alle LESER-Produkte werden auf Beschädigungen und Undichtigkeiten kontrolliert. Um Beschädigungen während des Transports zu vermeiden, erhalten alle Produkte eine schützende Verpackung mit Protektoren auf Flanschdichtflächen, Dichtlippen und Gewinden. Diese sind vor der Montage zu entfernen (siehe Abschnitt 11.12).

Vor der Montage auf der Anlage ist eine Sichtprüfung vorzunehmen und die Dichtheit der Anschlüsse beim Hochfahren der Anlage zu kontrollieren.

*on the rear side of the disc is compensated for. The function and set pressure remain constant. If it is not clear whether the bellows compensates for back pressure, LESER should be contacted. The application limits of the bellows for pressure and temperature may not be exceeded (refer to Section 10).*

*If discharge lines have equipment that prevents rainwater or foreign matter from penetrating, this equipment may not obstruct the safety valves in freely and completely blowing off.*

*The blow-off pipe has to be dimensioned using the max. back pressure and the corresponding temperature. It should be laid in a streamlined fashion and should not be opposite other branches to ensure that it does not impair functioning or cause damage to the safety valve. The flowthrough and the functioning of safety valves have also to be guaranteed if blow-off systems have multiple uses.*

*During blowing-off, reaction forces work on the safety valve itself, the pipes connected to it and the fixed mounts. The size of the reactive force is particularly important for the dimensioning of the fixed mounts.*

*The following points have to be taken into consideration:*

- static, dynamic or thermal loads from the pipe leading to or from the safety valve must not act on the valve.*
- Safety valves must be fixed as defined in the drawing. Omitting or removing mounts can result in damage if as a result excessively high forces or tensions occur.*
- See also section 11.3.*

## 6 Functional tightness of the safety valve

*One has to expect a slight leakiness with all safety valves with metallic seals. Persons, the environment and installations must not be endangered by the escaping medium.*

*Safety valves with soft seals seal much more reliably than those with metallic seals. LESER offers a range of elastomer materials for different applications. The elastomers must be matched to the medium and its pressure and temperature.*

*All LESER products are inspected for damage and leaks. In order to prevent damage during transportation all products are packed with protectors on flange sealing surfaces, sealing lips and threads. They should be removed before assembly (refer to section 11.12).*

*Before mounting the valve in the installation it must be visually inspected and then its tightness should be checked while the installation is switched on.*

# Betriebsanleitung Operating Instructions

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Dichtflächen werden präzise bearbeitet. Die Dichtheit wird z.B. durch Härtung, Vergüten, Feinstschleifen und Läppen erreicht. Das macht Sicherheitsventile stoßempfindlich, da sie durch Erschütterungen undicht werden können.

Folgendes ist zu beachten:

- Sicherheitsventile müssen auf dem Transport, während der Montage und im Betrieb gegen Erschütterungen geschützt werden.
- Sicherheitsventile sind vorsichtig zu transportieren. Der Lüftehobel darf z. B. auf keinen Fall als Tragegriff missbraucht werden oder das Sicherheitsventil darf nicht umfallen..

Die Zuhaltkraft zwischen Sitz und Teller sinkt mit steigendem Betriebsdruck. Daher steigt auch die Wahrscheinlichkeit von Undichtigkeiten, je näher der Betriebsdruck am Ansprechdruck liegt (siehe Abschnitt 4). Insbesondere beschädigte oder verunreinigte Dichtflächen neigen dann verstärkt zu Undichtigkeiten.

## 7 Medium

Bewegliche Teile sind vor abrasiven/korrosiven Medien zu schützen, da Fress- und Klemmgefahr besteht. Das kann durch Wartung nach jedem Ansprechen oder durch Edelstahl/Elastomerfaltenbälge geschehen. Die Einsatzgrenzen von Faltenbälgen sind zu beachten.

Die Möglichkeit undichter Dichtflächen bei abrasiven Medien muss berücksichtigt werden. Gefährliche Medien dürfen nicht in die Umwelt gelangen. Im Zweifel ist das Sicherheitsventil nach dem Ansprechen auszutauschen.

Weichdichtende Teller können leichte Sitzbeschädigungen ausgleichen. Generell sind die Einsatzgrenze und Medienbeständigkeit des Elastomerwerkstoffes zu beachten.

Die Festigkeit einzelner Bauteile (z. B. Gehäuse, Spindel, Feder,...) kann durch Abrasion verringert werden. Dadurch kann es zu Undichtigkeiten oder zum Bersten des Druckgerätes kommen. Bei Absicherung abrasiver Medien sind entsprechend kürzere Wartungsintervalle vorzusehen.

Dichtflächen dürfen nicht verkleben. Vermeidbar ist das durch:

- Regelmäßiges Anlüften (siehe 11.2)
- Heizen oder Kühlen, so dass kein Verkleben der Flächen erfolgt.
- Andere Maßnahmen, die das Verkleben verhindern.

Korrosionsschäden von Gehäuse- und Innenteilen sind nicht immer erkennbar. Daher ist sicherzustellen, dass abzusichernde Medien die Werkstoffe des Sicherheitsventils nicht angreifen. Kann dies nicht ausgeschlossen werden, so sind Überwachung und Wartung entsprechend anzupassen. Auf Anfrage können spezielle Werkstoffe vorgesehen werden.

Sealing surfaces are precisely machined. The tightness is achieved, e. g., by hardening, tempering, precise grinding and lapping. This makes safety valves vulnerable to impact, so they may develop leaks as a result of vibrations.

The following notes are to be observed:

- During transportation, fitting and operation safety valves must be protected from vibrations.
- Safety valves must be transported with care. E. g., the lever must never be used as a carrying handle and the safety valve must not be dropped.

The force between the seat and the disc falls as a function of rising operating pressure. Therefore the probability of leaks also rises when the operating pressure is close to the set pressure (refer to section 4). Damaged or contaminated sealing surfaces in particular tend to develop leaks.

## 7 Medium

Any moving parts have to be protected from abrasive/corrosive media as then the danger develops of seizure or sticking. This can be done by servicing the valve each time it has operated or by the use of stainless steel/elastomer bellows. The limits of application for the bellows have to be observed.

The possibility of leaking sealing surfaces in the case of abrasive media must be considered. Dangerous media must not enter the environment. In doubt the safety valve must be replaced after it has operated.

Soft sealing discs can compensate for minor damage to the seat. In every case the limits of application and medium consistency for the elastomer material have to be observed.

The strength of individual components (e. g., body, spindle, spring,...) can be decreased through abrasion. This may lead to leaks or to the pressure equipment bursting. If abrasive media occur, shorter service intervals should be observed. The sealing surfaces must not stick together.

This can be prevented by:

- regular lifting operation (refer to section 11.2)
- heating or cooling to prevent the seat from sticking
- other measures which prevent sticking.

Corrosion damage to body components and internal components cannot be easily spotted in all cases. Therefore it must be ensured that the media to be secured do not attack the materials the safety valve is made from. If this possibility cannot be excluded, monitoring and servicing have to be adapted to this situation accordingly. Special materials can be selected on request.

Schmierstoffe auf Mineralölbasis werden als Montagehilfe benutzt, die ohne spezielle Vorkehrungen in Kontakt mit dem abzusichernden Medium kommen können.

Dabei ist zu beachten:

- Schmierstoffe/Hilfsmittel können in das Medium gelangen und dies verschmutzen oder chemische Reaktionen verursachen.
- Schmierstoffe können ausgewaschen werden und die Demontage des Sicherheitsventils erschweren.
- Sicherheitsventile können ölfrei ausgeführt werden. Hierfür werden Oberflächen von mineralölhaltigen Rückständen befreit und spezielle Schmierstoffe verwendet.
- Faltenbälge verhindern den Kontakt von Medium mit Schmiermitteln.

## 8 Temperatur des Mediums und Umgebungstemperatur

Für LESER-Sicherheitsventile werden Minimum- und Maximumtemperaturen angegeben. Diese beziehen sich immer auf die Medientemperatur, die auch gleichzeitig Umgebungs temperatur sein kann. Daher muss die Umgebungstemperatur unter extremen klimatischen Bedingungen berücksichtigt werden, z.B. in Skandinavien.

Der Einfluss der Medientemperaturen auf den maximal erlaubten Druck muss beachtet werden. Durch Streckgrenzen abfall bei erhöhten Temperaturen bzw. Versprödung neigung bei niedrigen Temperaturen verringern sich die maximale erlaubten Drücke. Die Vorschriften der entsprechenden Regelwerke und Herstellervorgaben müssen beachtet werden.

Falls eine Isolierung des Sicherheitsventils vorgesehen ist, müssen Federhaube und Kühlzone (falls vorhanden) frei bleiben, um eine unzulässige Erwärmung der Feder zu verhindern.

Sicherheitsventile können im kalten Zustand mit einem Korrekturfaktor auf höhere Temperaturen eingestellt werden. Damit wird die Druckeinstellung bei erhöhten Temperaturen eingespart (Methode: Kalteinstellung nach LESER-Werknorm LWN 001.78).

Während des Betriebes von Sicherheitsventilen können Medien erstarren, die das Öffnen bzw. Schließen verhindern. Das kann auftreten, wenn die Temperatur unter dem Gefrierpunkt des Mediums liegt, bei kalterstarrenden Medien die Viskosität stark abnimmt oder wenn gefrierende Dämpfe im Medium vorhanden sind. Verstärkt wird die Vereisung durch Entspannung von Gasen, da die Temperaturen dadurch weiter sinken. Besteht Vereisungsgefahr, müssen Maßnahmen getroffen werden, die die Funktion von Sicherheitsventilen gewährleisten.

Das Berühren heißer oder gefährlich kalter Sicherheitsventil Oberflächen muss durch geeignete Schutzmaßnahmen verhindert werden.

*Lubricants based on mineral oils are used as an aid during installation and without special precautions they will get in contact with the medium.*

*The following points have to be observed:*

- Lubricants/auxiliary media can reach the medium and contaminate it or cause a chemical reaction.
- Lubricants can be washed out and make the dismantling of the safety valve more difficult.
- Safety valves can be designed as oil and grease-free types. For these types the surfaces are cleaned from all residues containing mineral oil and specialist lubricants are used.
- Bellows prevent the contact of medium and lubricant.

## 8 Temperature of the medium and environmental temperature

*Minimum and maximum temperatures are given for LESER safety valves. They always refer to the medium temperature that may simultaneously be the ambient temperature. Therefore, the ambient temperature has to be taken into consideration under extreme climatic conditions such as in Scandinavia.*

*It is necessary to observe the influence of the medium temperatures on the maximum permitted pressure. If expansion limits drop at higher temperatures or if it tends to be brittle at low temperatures, this lowers the maximum permitted temperatures. Please observe the regulations in the appropriate sets of rules and the manufacturer's specifications.*

*If the safety valve is supposed to be insulated, the bonnet and the cooling zones (if there are any) have to be free to prevent the springs from heating up impermissibly.*

*In case of setting the pressure of safety valves and ambient temperature, they can be adjusted for working at an increased temperature by making use of a correction factor. This makes it unnecessary for the valve to be adjusted at the increased temperature (Procedure: Cold differential test pressure acc. to the LESER company standard LWN 001.78).*

*During the operation of safety valves, media can freeze, which prevents opening and closing. This can happen if the temperature falls below the freezing point of the medium with media that congeal in cold the viscosity may drop significantly or if there are freezing vapours contained in the medium. Icing-up is increased by the expansion of gases as this causes the temperature to fall further. If there is a danger of icing, measures must be taken to ensure that the safety valve works correctly.*

*Contact with hot or dangerously cold safety valve surfaces must be prevented by appropriate protective measures.*

# Betriebsanleitung Operating Instructions

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## 9 Auswahl der Feder

Die bei LESER verwendeten Federn sind für definierte Druckbereiche ausgelegt. Grundlage für die Federauswahl ist immer der Einstelldruck (siehe Abschnitt 4). Sind Auslegung und Betrieb regelwerkskonform, ist die Funktion der Federn gewährleistet.

Beim Zerlegen dürfen die Federn nicht vertauscht werden, da die Funktion bei Verwendung falscher Federn nicht mehr gegeben ist. Im Extremfall geht die Feder auf Block (die Windungen liegen aneinander) und das Sicherheitsventil ist ohne Funktion.

Bei einer Verstellung des Einstelldruckes muss kontrolliert werden, ob die Feder/Federn bei dem neuen Druck verwendet werden dürfen. Das kann anhand aktueller LESER-Federstabellen geschehen. Falls diese nicht vorliegen, muss LESER kontaktiert werden. Ist die Feder bei dem neuen Einstelldruck nicht erlaubt, muss die dafür gültige Feder eingesetzt werden. Geänderte Einstelldrücke machen immer auch eine Überprüfung der gesamten Sicherheitsventil-Auslegung erforderlich.

Die LESER-Federn sind eindeutig gekennzeichnet. Federn, die nicht mehr zugeordnet werden können, oder beschädigte Federn dürfen nicht mehr verwendet werden.

Federn, deren Lastwechselzahlen nicht abgeschätzt werden können, dürfen nicht mehr verwendet werden. Insbesondere bei Federn aus Sicherheitsventilen, die Schwingungen ausgesetzt waren, können die tatsächlichen Lastwechselzahlen kaum abgeschätzt werden.

Die Federn in LESER-Sicherheitsventilen sind werkstoffbezogen abgestimmt auf die Werkstoffe des Sicherheitsventils. In ungünstigen Fällen kann es zu erhöhten Temperatur- bzw. Korrosionseinflüssen kommen, die folgende Maßnahmen erforderlich machen:

### Temperaturinflüsse:

Da Federtemperaturen von vielen äußeren Bedingungen abhängen, kann keine generelle Medientemperatur als Einsatzgrenze angegeben werden. Daher ist immer anlagenspezifisch abzuschätzen, welche der folgenden Maßnahmen getroffen werden können:

- Verwendung warmfester oder kaltzäher Federwerkstoffe
- Einstelldruck mit Korrekturfaktor versehen, um sinkende Ansprechdrücke bei erhöhten Temperaturen auszugleichen (Kalteinstellung → siehe Abschnitt 8).
- Die Verwendung hochwarmfester Werkstoffe in Verbindung mit Kühlzonen, offenen Federhauben und Faltenbälgen verringert die Temperatureinwirkung auf die Feder.

### Korrosionseinflüsse

- Bei Sicherheitsventilen ohne Faltenbalg kann Medium in den Federraum gelangen. Korrosive/abrasive Medien setzen die Dauerfestigkeit herab. Das muss bei der Auswahl, Auslegung und Wartung berücksichtigt werden.
- Federwerkstoffe mit erhöhter Korrosionsbeständigkeit sind möglich (z.B. Edelstahl, Hastelloy, ...).

## 9 Choice of spring

The springs used by LESER are designed for defined pressure ranges. The test pressure is always the basis for selecting the spring (refer to section 4). The functioning of the springs is ensured if the spring is designed and used in conformity with the sets of rules. When dismantling the valves, the springs must not be swapped as the functioning will be impaired if the wrong spring is installed.

In extreme cases the spring will be fully compressed (the turns touch each other) and then the safety valve cannot work.

When changing the test pressure it must be checked whether the spring/springs can be used at the new pressure. This can be done by using actual LESER spring tables. If they are not available LESER has to be contacted. If the spring does not permit the new test pressure it must be replaced by a valid spring. Changed test pressures always require that the whole safety valve and its dimensioning are checked.

LESER springs are marked unambiguously. Springs which no longer can be identified or damaged springs must not be used.

Springs must not be reused if it cannot be estimated how many load changes they have experienced. This applies in particular to springs from safety valves which have been exposed to vibrations, as in this case the actual number of load changes is practically impossible to estimate.

The springs in LESER safety valves have been coordinated with the material in the safety valve with reference to the material. In unfavourable cases, there may be influences leading increased temperature or corrosion that make the following actions necessary:

### Temperature influences:

As spring temperatures can depend on many external conditions, no general temperature of the medium can be specified as the limit of application. They are always specific to the installation and a judgement has to be made as to which of the following measures need to be taken:

- Using spring materials that are heat resistant or tough at sub-zero temperatures
- Providing test pressure with a correction factor to compensate for dropping set pressures at higher temperatures (refer to section 8 for cold adjustment)
- By the utilisation of highly heat resisting materials in conjunction with cooling zones, open bonnets and bellows, the effect of the temperature on the spring is reduced.

### Corrosion effects:

- Medium may get into the spring spaces if safety valves do not have bellows. Corrosive/abrasive media reduce the fatigue strength. This should be taken into consideration with selecting, designing and servicing.
- Spring materials with increased corrosion resistance are possible (e. g., stainless steel, Hastelloy, ...).

## 10 Sicherheitsventile mit Faltenbalg

Druck- und Temperatureinsatzgrenzen von Faltenbälgen sind einzuhalten.

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Defekte Faltenbälge sind erkennbar durch Medienaustritt aus der offenen Federhaube bzw. aus der Entlastungsbohrung. Die Gefährdung durch austretendes Medium ist auszuschließen.

Maßnahmen gegen austretendes Medium:

- Ausrüstung mit Kontrollmanometer und Auffangbehälter.
- Bei offenen Federhauben kann ein Medienaustritt bei defektem Faltenbalg nicht verhindert werden. Gefahren sind auszuschließen, (z.B. durch genügend Sicherheitsabstand, Schutzvorrichtungen, Verwendung nur bei ungiftigen Medien, ...).

Defekte Faltenbälge müssen sofort getauscht werden, um die weitere Funktion des Sicherheitsventils sicherzustellen.

Edelstahlfaltenbälge, deren Lastwechselzahlen überschritten wurden bzw. nicht bekannt sind, müssen ausgetauscht werden. Faltenbälge sollten bei einer Demontage grundsätzlich getauscht werden.

Feuchtigkeit oder Schmutz dürfen nicht über die Entlastungsbohrung in die Federhaube eindringen. Entsprechende Schutzvorkehrungen (z. B. Anschlüsse, Rohrleitungen, ...) sind vorzusehen.

## 11 Sicherheitsventil auf der Anlage

### 11.1 Offene Federhaube

Bei offenen Federhauben bzw. bei Hebel-Sicherheitsventilen ist das Berühren der beweglichen Teile (z. B. Feder) durch geeignete Schutzmaßnahmen zu verhindern, da Klemmgefahr besteht.

Durch offene Federhauben oder offene Spindelführung von Hebel-Sicherheitsventilen kann Medium austreten. Es ist sicherzustellen, dass keine Gefährdungen durch Medien auftreten. Genügend Sicherheitsabstand ist einzuhalten.

### 11.2 Regelmäßiges Anlüften

Sicherheitsventile sind regelmäßig anzulüften, um die Funktion zu kontrollieren und Ablagerungen zu entfernen. Sie lassen sich daher spätestens ab einem Betriebsdruck von  $\geq 85\%$  des Ansprechdruckes zum Öffnen bringen. Ausnahmen bestehen nur, wenn die Funktion anderweitig geprüft wird, z.B. durch entsprechend kurze Wartungsintervalle. Die gültigen Vorschriften, nach denen das Sicherheitsventil eingesetzt wird, sind einzuhalten.

Nach dem Anlüften muss der Lüftehebel freigehen, d. h. die Lüftekabel in der Anlüftung steht nicht mit der Kuppelung im Eingriff.

## 10 Safety valves with bellows

The pressure and temperature application limits of bellows shall be complied with.

Defective bellows are recognisable by the medium leaking out of the open bonnet or the vent hole. Hazards from leaking medium must be prevented.

Measures against leaking medium:

- Equipping the valve with an inspection manometer and a drip container.
- In the case of open bonnets, the leaking of the medium cannot be prevented if the bellows are defective. Hazards have to be prevented (e. g., by a sufficient safety distance, protective installations, utilisation only for harmless media).

Defective bellows must be replaced immediately in order to secure the correct working of the safety valve.

Stainless steel bellows for which the number of load changes has been exceeded, or is unknown, must be replaced. As a rule bellows should be replaced whenever the valve is dismantled.

Moisture or dirt must not be allowed to enter into the bonnet via the vent hole. Appropriate protective measures (e. g., connections, pipes, ...) must be taken.

## 11 Safety valves built into installations

### 11.1 Open bonnet

For open bonnets or lever valves, appropriate measures must be taken to avoid contact with movable parts (e. g., the spring) as otherwise there is a danger of jamming. Medium can leak out of the open bonnets or open spindle guides of lever safety valves. It must be ensured that leaking medium cannot cause hazards. A sufficient safety distance has to be observed.

### 11.2 Regular lifting operation

Safety valves must be vented regularly in order to check their functioning and to remove any deposits. They can be opened if at least an operating pressure of  $\geq 85\%$  of the set pressure is present. Exceptions can only be allowed when the functioning is checked regularly in a different way, e. g., by appropriate short servicing intervals. The valid regulations for the application of safety valves have to be adhered to.

After venting, the lever must move freely, i. e. the lifting fork in the lifting device is not acting on the spindle cap.

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## 11.3 Kräfteeinleitung in das Sicherheitsventil

Aus den zu- und abführenden Rohrleitungen dürfen keine unzulässig hohen statischen, dynamischen oder thermischen Spannungen auf das Sicherheitsventil übertragen werden.

Diese können entstehen durch:

- Montage unter Spannung (statisch)
- Reaktionskräfte beim Abblasen (statisch)
- Schwingungen (dynamisch)
- Temperaturausdehnungen (thermisch)

Folgende Maßnahmen müssen getroffen werden:

- Schaffung von Dehnmöglichkeiten
- Befestigung der zu- und abführenden Leitungen auf der Anlage so, dass keine Spannungen auftreten.
- Nutzung der Spannpratzen des Sicherheitsventils zur sicheren Befestigung auf der Anlage.
- Vermeidung von Anlagenschwingungen.

## 11.4 Anschlüsse

Die Anschlüsse/Dichtungen zwischen Sicherheitsventil und Anlage sind ausreichend zu dimensionieren. Sie müssen nach den Regelwerken ausgeführt werden, um einen Ausfall der Verbindung zu vermeiden (siehe dazu auch Abschnitte 4 und 8).

LESER ist nicht für die korrekte Ausführung der Dichtungen verantwortlich, mit der Zu-, Abblaseleitungen oder andere Anschlüsse an Sicherheitsventilen abgedichtet werden. Daher kann keine Haftung übernommen werden. Auf eine ordnungsgemäße Ausführung und auf unbeschädigte Flanschdichtflächen ist bei der Montage der Sicherheitsventile zu achten.

## 11.5 Ausrichtung von Sicherheitsventilen

Bestätigung des TÜV Nord:

*Direkt wirkende Sicherheitsventile sind gem. AD-A2 „aufrecht unter Beachtung der Strömungsrichtung“ einzubauen.*

*Außerdem fordert AD-A2: „Sicherheitsventile müssen dem Stand der Technik entsprechen und für den Verwendungszweck geeignet sein.“*

*Unter folgenden Bedingungen ist eine Abweichung vom aufrechten Einbau möglich und aus unserer Sicht auch zulässig:*

*Die Sicherheitsventile sind z. B. mit waagerechtem Einbau einer Bauteilprüfung unterzogen worden und ein entsprechender Vermerk befindet sich im VdTÜV-Merkblatt.*

*Es liegen über einen längeren Zeitraum ausreichende Betriebserfahrungen mit vom aufrechten Einbau abweichen den Installationen vor, so kann in Abstimmung zwischen Betreiber, Hersteller und Sachverständigen dieser Einbau zugelassen werden. Ggf. müssen zusätzliche Maßnahmen bzgl. der Installation vorgenommen werden.*

Konsequenz: Sicherheitsventile dürfen nur unter Beachtung der o. g. Angaben anders als in AD-A2 angegeben ausgerichtet werden.

## 11.3 Forces acting on the safety valve

*No high static, dynamic or thermal tensions may be transmitted to the safety valves.*

*These tensions can be caused by:*

- Installation under tension (static)
- Reaction forces when blowing off (static)
- Vibrations (dynamic)
- Temperature expansion (thermal)

*The following measures have to be taken:*

- The System must be able to expand
- The Pipes of the installation must not be attached in such a way that tensions are created
- Utilisation of the safety valve brackets for secure attachment to the installation
- Preventing the installation from vibrating

## 11.4 Connections

*The connections/seals between the safety valve and the plant shall be sufficiently sized. They also have to be designed in accordance with the sets of rules to prevent the connection from failing (also refer to sections 4 and 8 for this).*

*LESER is not responsible for the correct fitting of seals for pipes leading into the valve and pipes for blowing-off or other connections to the safety valves. Therefore LESER will not accept any liability for these.*

*For the correct fitting one has to ensure that the flange sealing surfaces are not damaged during installation.*

## 11.5 Orientation of safety valves

*Confirmation by the TÜV Nord:*

*Directly-loaded safety valves are to be installed in accordance with AD-A2 "upright with respect to the flow direction":*

*In addition AD-A2 requires that "safety valves must correspond to the state-of-the-art and be suitable for the purpose for which they are deployed."*

*Under the following conditions it is possible to deviate from the upright installation direction, and in our view it is also permissible.*

*E. g., the safety valves have been granted type approval for horizontal installation and a note to this effect is found in the VdTÜV-Merkblatt.*

*Adequate experience of installation in applications in an orientation other than upright is available over an extended period. Therefore this type of installation can be allowed after discussion between operator, manufacturer and the technical inspector who authorises the installation. If applicable, additional measures may need to be taken with regard to this installation.*

*Therefore safety valves may, according to the information provided above, be installed in directions other than the one specified in AD-A2.*

Wenn die o. g. Vorgaben erfüllt werden, ist bei nicht aufrechtem Einbau Folgendes zu beachten:

- Entwässerungen sind vorzusehen, um ein Stehenbleiben von Medium oder Kondensat in funktionswichtigen Teilen zu verhindern.
- Die Wartung ist anzupassen, um z. B. die Funktion der Entwässerungen zu gewährleisten.
- LESER muss die Art der Montage kennen, um einer nicht aufrechten Ausrichtung zustimmen zu können.

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#### 11.6 Durchströmung

Die Strömungsrichtung muss bei der Montage beachtet werden. Diese lässt sich an folgenden Merkmalen erkennen:

Strömungspfeil auf dem Gehäuse

Darstellungen

- im Katalog,
- in der Betriebsanleitung
- auf Datenblättern und
- in der Montageanweisung

#### 11.7 Kondensat

Im Austrittsgehäuse von Sicherheitsventilen oder in funktionswichtigen Teilen (Bereich der Feder, des Faltenbalanges, ...) darf kein Medium oder Kondensat stehengeblieben, weil die Funktion von Sicherheitsventilen dadurch beeinträchtigt wird.

Folgendes ist zu beachten:

- Entwässerung immer über Ausblasleitung, die hinter dem Sicherheitsventil mit einem Gefälle bis zur Entwässerung verlegt ist (Bild 3).
- Direkt hinter dem Sicherheitsventil darf kein nach oben gerichteter Bogen folgen, da keine korrekte Entwässerung erfolgen kann (Bild 4).
- Die Ausblasleitung muss mit einer ausreichend dimensionierten Kondensatableitung versehen werden, die am tiefsten Punkt der Ausblasleitung anzubringen ist. Ab Leitungsröße > DN 40 Entwässerung mind. DN 25 (bei Dampfanwendungen sind evtl. größere Durchmesser erforderlich, dazu sind die einschlägigen Regelwerke zu beachten).
- LESER-Sicherheitsventile werden nicht mit einer Entwässerungsbohrung versehen, weil die Entwässerung über die Abblasleitung erfolgen muss.

Ausnahmen: Bestimmte Regelwerke fordern eine Entwässerungsbohrung (z. B. auf Schiffen mit variabler Wasserlage und nicht definiertem Leitungsgefälle). Sicherheitsventile, die dafür vorgesehen sind, erhalten eine Entwässerungsbohrung. Diese Ausführung erfolgt nur, wenn sie bei LESER bestellt wird.

- Eine nachträgliche Entwässerungsbohrung ist an der dafür vorgesehenen Stelle möglich.  
Vorsicht: Späne können Schäden verursachen, die zu Unidichtigkeit oder Ausfall von Sicherheitsventilen führen können.

If the conditions mentioned above have been fulfilled, the following points have to be observed if the valve is installed in a direction other than the upright direction.

- Drainage has to be built in, in order to prevent medium or condensation from remaining in parts which are important for the function of the valve.
- The servicing has to be modified, e. g. the functioning of the drainage has to be guaranteed.
- LESER must be informed of the type of installation in order to be able to agree to an orientation deviating from upright.

#### 11.6 Flow-through

The flow direction must be observed during installation. It can be recognised by the following features:

Flow direction arrow on the body;  
diagrams

- in the catalogue
- in the operating instructions
- in the data sheets and
- in the installation instructions

#### 11.7 Condensation

In the outlet chamber of safety valves or in parts which are important to their functioning (spring area, bellows area, ...) no medium or condensation may remain as this might impair the functioning of the safety valves.

The following points have to be observed:

- the drainage should always be carried out via the blow-off pipe, which has to be laid sloping downwards, downstream of the safety valve so that it can drain itself (figure 3).
- immediately downstream of the safety valve, no upwards bend may be installed as then correct drainage is not possible (figure 4).
- the blow-off pipe must be provided with a sufficiently large condensation drainage pipe, which must be attached to the lowest point of the pipe. For pipes larger than nominal diameter 40 the drainage pipe must be at least of a nominal diameter 25. (In the case of steam applications even larger diameters may be necessary. In such cases the regulations must be observed).
- LESER safety valves are not provided with a drainage hole as the drainage must take place via the blow-off pipe.

Exceptions: Certain regulations require drainage holes (e. g., on ships with varying orientation on the water and indefinable pipe slope). Safety valves which are intended for such purposes are equipped with a drainage hole. Such designs are only manufactured if they are specifically ordered from LESER.

- It is possible to drill a drainage hole later at the place intended for this purpose.
- Caution: swarf can cause damage which may lead to leaks or to the failure of safety valves.

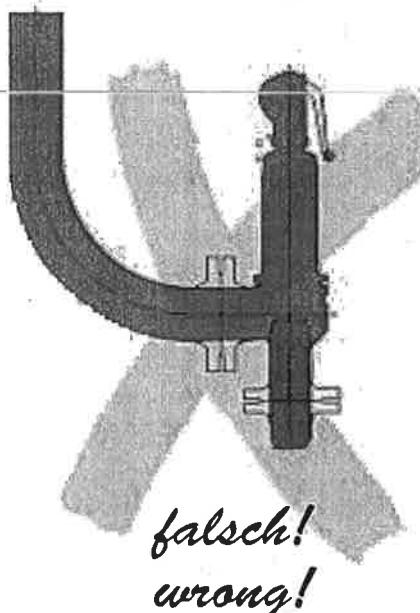


Bild 4/Figure 4

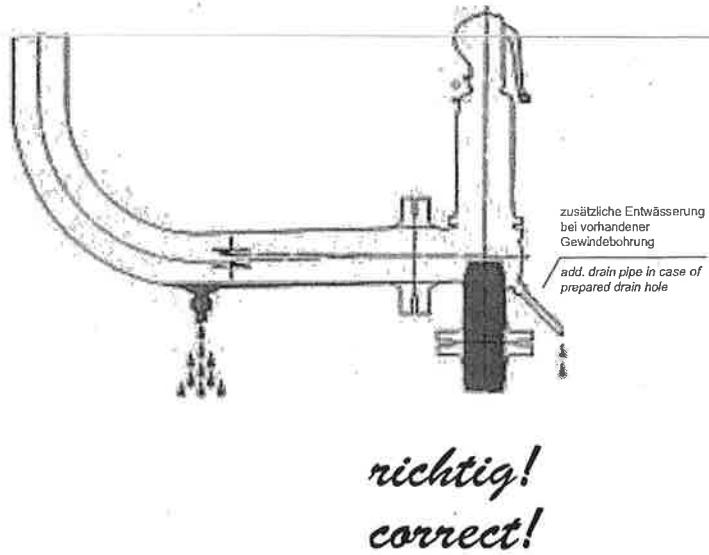


Bild 3/Figure 3

- Entwässerungsleitungen sind ohne Einschnürung mit Gefälle zu verlegen. Der Austritt muss frei zu beobachten sein, Gefährdungen durch austretendes Medium müssen ausgeschlossen werden (z. B. durch Kondensatöpfe, Auffangbehälter, Filter, ...).
- Enwässerungsbohrungen ohne Funktion müssen verschlossen werden.

#### 11.8 Schwingungen übertragen aus der Anlage

Schwingungen, die auf das Sicherheitsventils übertragen werden können, sind zu verhindern. Ist das nicht möglich, sollten Sicherheitsventile von der Anlage entkoppelt werden, z. B. über Faltenbälge, Rohrbögen, ... Druckschwankungen oder -stöße im Medium können ebenfalls zu schädlichen Schwingungen des Sicherheitsventils führen. Auch das ist zu vermeiden. Wenn Schwingungsübertragung nicht vermeidbar ist, können Dämpfungssysteme vorgesehen werden, z. B. O-Ring-Dämpfer.

#### 11.9 Ausblasleitung

Beim Abblasen von Sicherheitsventilen treten zusätzlich zu den allgemeinen Gefahren (siehe Abschnitt 2) durch Medien folgende Gefahren auf:

- Hohe Strömungsgeschwindigkeiten
- Hohe Temperaturen
- Schallemission

Dazu ist Folgendes zu beachten:

- Bei Dämpfen oder Gasen soll die Ausblasleitung nach oben zeigen, um gefahrloses Abblasen zu ermöglichen.

- Drainage pipes must be laid sloping downwards and without waisting. It must be possible to observe the outlet freely, any risks the leaking medium may cause must be prevented. (E. g., through condensation steam traps, drip container, filters, ...)
- Drainage holes without function must be closed.

#### 11.8 Transfer of vibrations from the installation

Any vibrations which might be transferred to the safety valve must be prevented. Where this is not possible the safety valve must be decoupled from the installation, e. g., via bellows, pipe bends, ... Pressure variations or surges in the medium also can lead to dangerous vibrations of the safety valve. This also has to be avoided.

Where the transfer of vibrations cannot be prevented, damping systems can be built in, e. g., o-ring dampers.

#### 11.9 Discharge pipe

When a safety valve is blowing off, in addition to the general hazards from the medium, the following hazards have to be expected (refer to section 2):

- High flow rates
- High temperatures
- Noise emissions

In this context the following has to be observed:

- For steam or gases the blow-off pipe should point upwards in order to allow blowing off without danger.

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- Bei Flüssigkeiten soll die Ausblaseleitung nach unten zeigen, damit das Medium komplett aus dem Ausblaseraum abfließen kann.
  - Der Austrittsflansch von Sicherheitsventilen bzw. die Ausblaseleitung müssen so gerichtet sein, dass keine Gefährdungen von austretenden Medien ausgehen können. Möglichkeiten dazu:
    - Abblasen in Auffangbehälter
    - Sicherheitsventil und Ausblaseleitung ohne direkten Zugang
    - Ausführung mit Schalldämpfer.

#### 11.10 Ungünstige Umgebungsbedingungen

Alle nicht rostfreien LESER-Sicherheitsventile erhalten ab Werk einen Schutzanstrich, der das Sicherheitsventil während der Lagerung und während des Transportes schützt. Bei korrosiven äußeren Bedingungen ist weiterer Korrosionsschutz erforderlich (siehe Abschnitt 11.13). Unter extremen Bedingungen sind Edelstahl-Sicherheitsventile zu empfehlen. Die Zusatzbelastung darf nicht mit einem Schutzanstrich versehen werden!

Fremdmedien (z. B. Regenwasser oder Schmutz/Staub) in der Ausblaseleitung und im Bereich funktionswichtiger Teile (z. B. Führungen bei offener Federhaube) sind zu vermeiden. Es gelten die in Abschnitt 7 getroffenen Aussagen sinngemäß.

Einfache Abhilfemaßnahmen sind möglich:

- Schutz des Ausblaseraumes vor Eintritt von Fremdmedium und Schmutz
- Schutz der funktionswichtigen Teile vor Fremdmedium und Schmutz

#### 11.11 Undichtigkeiten durch Fremdkörper

Fremdkörper dürfen nicht in der Anlage verbleiben, (z. B. Schweißperlen, Dichtungsmaterial wie Hanf/Teflonband, Schrauben, usw.). Eine Möglichkeit zum Vermeiden von Fremdkörpern in der Anlage ist das Spülen der Anlage vor Inbetriebnahme.

Bei Undichtigkeit durch Verunreinigung zwischen den Dichtflächen kann das Sicherheitsventil zur Reinigung durch Anlüften zum Abblasen gebracht werden. Ist die Undichtigkeit nicht zu beseitigen, liegt wahrscheinlich eine beschädigte Dichtfläche vor. Die Wartung des Sicherheitsventils ist dann erforderlich.

#### 11.12 Schutz für Lagerung und Transport

Alle Schutzeinrichtungen bei Transport und Handhabung müssen vor der Montage des Sicherheitsventils entfernt werden.

Nach der Montage muss die Sicherung des Lüftehabels an der Federhaube entfernt werden, da sonst das Sicherheitsventil nicht angelüftet wird. Der Hebel muss freigehen, d.h. er muss in seiner Ausgangsposition und die Kupplung an der Spindel nicht im Eingriff mit dem Hebel stehen.

- For liquids the blow-off pipe should point downwards so that the medium can completely drain out of the blow-off chamber.
- The outlet flange of safety valves or the blow-off pipe must point in such a direction that no danger is caused by the medium blowing out.  
These are the options:  
  - Blowing off into a container
  - Safety valve and blowing-off pipes without direct access
  - Design with silencer

#### 11.10 Unfavourable environmental conditions

All LESER safety valves which could corrode are painted with a protective coating during manufacture which protects the safety valve during storage and transportation. In corrosive environments a further corrosion protection is required (refer to section 11.13). Under extreme conditions, we recommend stainless steel safety valves. The supplementary loading system may not be given a protective coating.

Media from outside (e. g., rain water or dirt/dust) in the blowing-off pipe and near components important for the operating (e. g., guides with open bonnets) have to be avoided. By analogy, the statements made in section 7 apply. Simple preventive measures are possible:

- Protection of the blow-off chamber from extraneous media and dirt
- Protection of the parts important to operating from extraneous media and dirt.

#### 11.11 Leaks caused by impurity

Impurities must not remain in the installation (e. g., welding beads, sealing material such as hemp/Teflon tape, screws, etc.). One option for avoiding extraneous bodies in the system is to rinse the system before commissioning.

In the case of leaks caused by contamination between the sealing surfaces, the safety valve can be vented to clean the surfaces. If this does not remove the leak, one of the sealing surfaces is probably damaged. In this case the safety valve has to receive maintenance.

#### 11.12 Protection during storage and transportation

All protective devices for transportation and handling have to be removed before installing the safety valve.

After installation, the protection for the lever must be removed from the bonnet as otherwise the safety valve cannot be vented. The lever must move freely, i. e. it must be in its initial position and the coupling at the spindle must not be connected to the lever.

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Bei Hebel-Sicherheitsventilen ist der Holzkeil zu entfernen, der die Dichtflächen beim Transport vor Beschädigungen schützt.

In the case of lever safety valves, the wooden wedge, which protects the sealing surfaces from damage during transportation, has to be removed.

## 11.13 Korrosionsschutz

Bewegliche und funktionswichtige Teile dürfen nicht beeinträchtigt werden. Z. B. dürfen Ausblaserraum und Spindelführung nicht lackiert werden.

Die Zusatzbelastung darf nicht mit einem Schutzanstrich versehen werden (siehe auch Abschnitt 14).

## 11.13 Corrosion protection

Moving parts and parts important to the operating must not be impaired. E. g., the blowing-off chamber and the spindle guide must not be varnished.

The additional load must not be coated with protective paint (refer also to section 14).

## 11.14 Wartung

Die Wartung von Sicherheitsventilen darf nur durch geschultes Personal durchgeführt werden.

Aussagen zu Wartungsintervallen kann LESER nicht machen, da diese von zu vielen Faktoren abhängen:

- Korrosive, aggressive, abrasive Media bewirken einen frühzeitigen Verschleiß mit verkürzten Wartungsintervallen.
- Häufiges Ansprechen verkürzt die Wartungsintervalle.
- Die Wartungsintervalle sind vom Betreiber, Sachverständigen und Hersteller einvernehmlich festzulegen. Prüfungen sind spätestens anlässlich der wiederkehrenden äußeren und inneren Prüfungen durchzuführen.

## 11.14 Maintenance

Safety valves may only be serviced by skilled staff.

LESER cannot specify the maintenance intervals as they depend on many factors:

- Corrosive, aggressive and abrasive media lead to rapid wear and shortened maintenance intervals
- Frequent operating shortens the maintenance intervals
- The Maintenance intervals have to be agreed between the operator, the inspector and the manufacturer. Inspections must be carried out at the time of the regular outside and inside examinations of the pressure equipment.

## 11.15 Identifizierung von Sicherheitsventilen

Vor der Montage von Sicherheitsventilen ist anhand von Unterlagen zu kontrollieren, ob das richtige Sicherheitsventil für die Montage ausgewählt wurde.

## 11.15 Identification of safety valves

Before fitting safety valves the documentation must be checked in order to ensure that the correct valve has been selected for fitting.

## 11.16 Bei Hebel-Sicherheitsventilen bestimmen Position und Masse des Gewichtes den Ansprechdruck. Beides darf nicht verändert werden. Das Anbringen eines zusätzlichen Gewichtes ist nicht erlaubt. Der Hebel darf nicht als Aufhängehaken für Gegenstände verwendet werden.

11.16 The set pressure of valves with levers is defined by the mass and the position of the loading weights. It is not allowed to change them. Additional loading weights must not be added. It is not allowed to use the lever to hang on any parts, e. g. clothes ...

## 12 Einstellanleitung für Feder-Sicherheitsventile

Die folgende Anleitung gilt nur für Ventile ohne Zusatzausrüstungen. Sind Zusatzausrüstungen (z. B. O-Ring-Dämpfer, Näherungsinitiator, Faltenbalg, ...) vorhanden, müssen die entsprechenden Montageanleitungen beachtet werden.

## 12 Setting instructions for spring loaded safety valves

The following operating instructions only apply to valves without additional equipment. If there is additional equipment (such as O-ring dampers, proximity switches, bellows, ...), please refer to the corresponding assembly instructions.

### 12.1 Anlüftung H3

Bolzen (45) entfernen.  
Lüfthebel (43) seitlich herausziehen.  
Sechskantschraube (84) lösen.  
Lüfthaube (41) abschrauben.  
Gegenmutter (19) lösen.

<sup>1)</sup> Druckschraube (18) entsprechend dem Ansprechdruck verstehen. Zulässigen Verstellbereich der Feder beachten! Durch Rechtsdrehen der Druckschraube wird die Federspannung größer, d. h. der eingestellte Ansprechdruck wird höher. Durch Linksdrehen der Druckschraube wird die Feder entspannt, und der eingestellte Druck wird niedriger. Zusammenbau und Absichern der Federeinstellung in umgekehrter Reihenfolge.

### 12.1 Lifting device H3

Remove shaft (45).  
Pull lever (43) out to the side.  
Loosen hexagonal head screw (84).  
Unscrew and remove lever cover (41).  
Loosen lock nut (19).

<sup>1)</sup> Turn adjusting screw (18) to the required set pressure. Pay attention to the admissible pressure range of the spring! Clockwise turning of adjusting screw increase the spring tension, giving a higher set pressure. Anticlockwise turning of adjusting screw reduces the spring tension, giving a lower set pressure.

Reassemble in reverse order and lock at the set pressure.

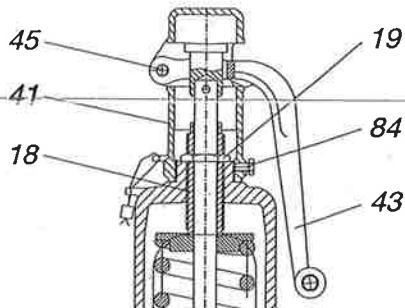


Bild 1/Figure 1

## 12.2 Anlüftung H4

Lüftheube (41) abschrauben und gleichzeitig Lüfthebel (43) in Richtung Federhaube drücken, so dass die Lüftegabel (44) freiliegt.  
Lüftheube (41) abziehen.  
Gegenmutter (19) lösen.  
<sup>1)</sup> Druckschraube (18) verstellen wie Anlüftung H3. Zulässigen Verstellbereich der Feder beachten!  
Zusammenbau und Absichern der Federeinstellung in umgekehrter Reihenfolge.

## 12.2 Lifting device H4

Loosen the spring cover (41) and simultaneously press the lever (43) in the direction of the bonnet so that the lifting fork (44) comes free.  
Remove the lever cover (41).  
Loosen the lock nut (19).  
<sup>1)</sup> Turn adjusting screw (18) as described in lifting device H3. Pay attention to the admissible pressure range of the spring!  
Reassemble in reverse order and lock at the set pressure.

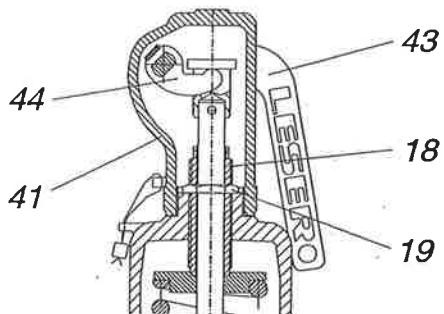


Bild 2/Figure 2

## 12.3 Auswechseln der Feder

Die nachfolgend angezogenen Positionen beziehen sich auf die Darstellungen der Seiten 3/40 – 3/42 im LESER-Gesamtkatalog.

1. Vorhandene Plombe lösen.
2. Lüfthebel (43) zur Mitte bis Anschlag drücken, damit die Lüftegabel (44) die Kupplung (46) freigibt.
3. Lüftheube (41) abschrauben.
4. Kupplung (46) von der Spindel (12) lösen, Sprengring (91) und Stift (74) entfernen.
5. Gegenmutter (19) der Druckschraube (18) lösen.
6. <sup>1)</sup> Druckschraube (18) hochschrauben.
7. Muttern (56) am Flansch der Federhaube (9) abschrauben.
8. Federhaube (9) abziehen.
9. Oberen Federteller (16) abziehen.

## 12.3 Spring replacement

The following items refer to the figures shown on pages 3/40 – 3/42 of the LESER complete catalogue.

1. Loosen the existing lead seal.
2. Press the lever (43) towards the middle until it reaches the stop so that the lifting fork (44) no longer holds the spindle cap (46).
3. Loosen and remove the lever cover (41).
4. Loosen the spindle cap (46) from the spindle (12), remove the securing ring (91) and the pin (74).
5. Loosen the lock nut (19) of the adjusting screw (18).
6. <sup>1)</sup> Turn the adjusting screw (18) anticlockwise to remove all spring tension.
7. Remove the hex. nuts (56) from the flange of the bonnet (9).
8. Lift off the bonnet (9).

# Betriebsanleitung

## Operating Instructions

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10. Feder (54) herausnehmen. Unteren Federteller (16) und Halbringe (14) entfernen.
  11. Spindel (12) mit Führungsscheibe (8) und Teller (7) herausnehmen.
  12. Sitz (5) und Teller (7) reinigen, evtl. das Ventilgehäuse innen reinigen.
  13. Spindel (12) mit Führungsscheibe (8) und Teller (7) einsetzen.
  14. Unteren Federteller (16) einsetzen, geteilten Ring (14) mit dem Sprengring (59) in die Nut der Spindel (12) hineinlegen und unteren Federteller (16) herüber schieben.
  15. Feder (54) einsetzen.
  16. Oberen Federteller (16) auf die Spindel (12) schieben.
  17. Spindel (12) durch Druckschraube (18) stecken, Federhaube (9) aufsetzen.
  18. Muttern (56) am Haubenflansch festziehen.
  19. Feder (54) spannen und auf gewünschten Druck einstellen. Zulässigen Verstellbereich der Feder beachten! Durch Rechtsdrehung der Druckschraube (18) steigt der Druck. Durch Linksdrehung der Druckschraube (18) sinkt der Druck.
  20. Gegenmutter (19) der Druckschraube (18) festziehen.
  21. Kupplung (46) auf die Spindel (12) setzen und mit Stift (74) und Sprengring (91) sichern.
  22. Lüftehaube (41) aufschrauben.
  23. Hebel (43) zur Mitte ziehen, damit die Lüftegabel (44) unter die Kupplung (46) greift.
  24. Anlüftung probieren, ob richtig montiert ist.
- Diese Anleitung gilt für Normal-, Proportional- und Vollhub-Feder-Sicherheits-Ventile.
9. Remove the upper spring plate (16).
  10. Lift off the spring (54) and remove lower spring plate (16) and split rings (14).
  11. Remove spindle (12) with guide (8) and disc (7).
  12. Carefully clean seat (5) and disc (7), and if required body internals.
  13. Refit spindle (12) with guide (8) and disc (7).
  14. Fit the split rings (14) into spindle groove and retain with the securing ring (59); slip on lower spring plate (16) to locate on split rings (14).  
Replace spring (54).
  15. Slip on the upper spring plate (16) onto the spindle (12).
  16. Align adjusting screw (18), and bonnet (9), over the spindle (12) and refit.
  17. Fit and tighten the hex. nuts (56).
  18. <sup>1)</sup> Load the spring (54) to obtain the required set pressure. Clockwise rotation of adjusting screw (18) increases pressure. Anticlockwise rotation of adjusting screw (18) reduces pressure.
  19. Tighten the lock nut (19) onto the adjusting screw (18).
  20. Refit and secure spindle cap (46) by pin (74) and securing ring (91).
  21. Screw-on the lever cover (41).
  22. Pull the lever (43) towards the middle so that the lifting fork (44) is pushed under the spindle cap (46).
  23. Test spindle will lift correctly by pulling lever.

These instructions are applicable for relief valves, safety valves and safety relief valves.

- 1) **Achtung:** Bei allen Arbeiten ist unbedingt die Spindel gegen Verdrehen zu sichern, um Beschädigung der Dichtflächen zu vermeiden.

### Zu beachten ist:

Die Sicherung gegen unbefugtes Verstellen des Einstelldruckes erfolgt durch eine Plombe. Gemäß einer Übereinkunft mit dem TÜV dokumentiert der Hersteller durch Anbringen des vollausgefüllten Bauteilprüfchildes die Übereinstimmung der technischen Daten des Ventils mit denen der Beschriftung; daher kann der Hersteller nach Änderung des Einstelldruckes oder anderer Veränderungen am Ventil durch Dritte nicht mehr haften. Ist eine Änderung dennoch notwendig, so empfiehlt es sich, diese in unserem Werk, durch eine von uns autorisierte Werkstatt oder unter Hinzuziehung des TÜV oder einer zuständigen Aufsichtsbehörde vornehmen zu lassen.

### To be observed:

The pressure setting is wire-locked and sealed against unauthorized alteration. The rules of the TÜV, agreed by the manufacturer, require the fitting of a type test approval plate stating the correct valve data. The manufacturer cannot be held responsible for any changes to set pressure or other alterations after despatch from our factory. In case of necessary modifications we recommend returning the valve to our supervision of the TÜV or any suitable inspecting authority.

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# Betriebsanleitung Operating Instructions

## 13 Handhabung

Es besteht Verletzungsgefahr durch scharfe Kanten und Grate. Teile sind immer vorsichtig zu greifen und zu bewegen.

Verletzungsgefahr besteht weiterhin durch umfallende Sicherheitsventile. Diese sind immer ausreichend zu sichern.

Bei der Demontage darf die Feder nicht unter Vorspannung stehen (Verletzungsgefahr durch umherfliegende Teile). Die Montageanleitungen für die entsprechenden Sicherheitsventile sind zu beachten!

Vor der Demontage ist immer zu kontrollieren, ob und welches Medium sich in der Federhaube befindet bzw. befinden könnte.

**Hochgradige Verletzungs-, Verätzungs- oder Vergiftungsgefahr besteht, falls sich Restmedium im Sicherheitsventil befindet.**

Handelsübliches Qualitätswerkzeug sollte verwendet werden, um Verletzungen durch mangelhaftes oder nicht passendes Werkzeug zu vermeiden. Erforderliche Spezialwerkzeuge werden in den entsprechenden Montageanweisungen angegeben:

Sicherheitsventile dürfen nur durch geschultes Personal zerlegt und montiert werden.

Geschult werden kann:

- in den Werkstätten durch erfahrenes Personal
- Bei LESER in Seminaren
- Unter Zuhilfenahme von LESER-Unterlagen, z. B. Videofilme, Betriebsanleitungen, Kataloge, Montageanleitungen

Wartungspersonal muss über die Gefahren beim Zerlegen und Montieren von Sicherheitsventilen informiert werden.

Verschmutzungen und Beschädigungen des Sicherheitsventils müssen vermieden werden. Geeignete Kartons, Flanschschutzkappen, Transportfolien, Transportpaletten usw. sind zu verwenden. Diese sind vor der Montage komplett zu entfernen, da die Funktion des Sicherheitsventils sonst nicht gewährleistet werden kann.

Mit Sicherheitsventilen ist vorsichtig umzugehen, da sonst die empfindlichen Dichtflächen beschädigt werden oder das Sicherheitsventil vollständig funktionsuntüchtig wird.

Sicherheitsventile müssen trocken gelagert werden. Optimale Lagertemperatur ist 2 °C bis 40 °C. Minusgrade sind bei O-Ring-Tellern möglichst zu vermeiden. Die Temperaturbeständigkeit besonderer O-Ring-Werkstoffe ist zu berücksichtigen.

Obergrenze für die Lagerung: 50 °C

Untergrenze für die Lagerung: -10 °C

## 14 Zusatzbelastung

Beim Ausfall der Fremdenergie (Druckluft) hat das direkt wirkende Sicherheitsventil eine ungehinderte Funktionsfähigkeit. Die Funktion ist dann die des LESER-Standard-Sicherheitsventils ohne Zusatzbelastung.

Der Druckluftfilter muss regelmäßig gewartet werden. Das geschieht im Rahmen der Wartungsvorschriften.

## 13 Handling

*There is a risk of injury from sharp edges and burrs. For this reason all parts have to be handled with caution.*

*There is a risk from safety valves falling over. They always have to be secured adequately.*

*During dismantling the spring must not be tensed. Otherwise there is the danger of injury from flying parts. Observe the installation instructions for the relevant safety valves!*

*Before dismantling it must always be checked whether there is, or could be, any, and if it is the case which, medium there is inside the bonnet.*

***High risk of injury, chemical burns or poisoning if there is any remaining medium inside the safety valve.***

*One should use conventional high quality tools in order to minimise the risks arising from bad quality or mismatched tools. Any necessary special tools are indicated in the installation instructions*

*Safety valves may only be dismantled and assembled by skilled staff.*

*The training can be carried out:*

- In the workshop by experienced staff
- At LESER in training seminars
- By means of LESER documentation, e. g., videos, operation instructions, catalogues, installation instructions

*The maintenance staff must be informed about the risks during dismantling and installing the safety valves.*

*Contamination and damage to the safety valve must be avoided. Suitable cartons, protective covers for the flanges, transportation foil, transportation palettes, ... are to be used. The packaging must be completely removed before installation as otherwise the function of the safety valve cannot be guaranteed.*

*The safety valves have to be handled with caution as otherwise the vulnerable sealing surfaces can be damaged or the safety valve might even be rendered useless.*

*Safety valves must be stored in a dry place. The optimum storage temperature is 2 °C to 40 °C. In the case of o-ring discs temperatures below freezing should if possible be avoided. The temperature resistance, in particular of the o-ring materials, has to be taken into account.*

*Upper limit for storage: 50 °C*

*Lower limit for storage: -10 °C*

## 14 Supplementary loading system

*Even if the external energy supply (compressed air) fails, the direct-loaded safety valve is still fully functional. In this case the function is equivalent to the LESER standard safety valve without supplementary loading system.*

*The compressed air filter must be serviced at regular intervals. This is carried out as specified in the maintenance specifications.*

# Betriebsanleitung

## Operating Instructions

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Ein Lufttrockner ist vorzusehen. Die Druckluft soll einen Taupunkt von mind. + 2 °C haben.

Max. Druck der Luftversorgung ist 10 bar, minimaler Druck ist 3,5 bar. Unter- bzw. Überschreitung kann zu einer vorübergehenden oder dauerhaften Fehlfunktion der Zusatzbelastung führen.

Konsequenz: Das Sicherheitsventil hat keine Funktion oder arbeitet ohne Zusatzbelastung als Standardventil.

Zusatzbelastungen sind mindestens einmal jährlich durch speziell geschultes Personal zu warten und zu überprüfen. LESER bietet für die erforderlichen Arbeiten einen Wartungsservice an, der auch im Rahmen eines Wartungsvertrages durchgeführt werden kann. Schulungen und Erfahrung im Umgang mit den Zusatzbelastungen kombiniert mit Sicherheitsventilen sind unbedingt erforderlich.

Die Zusatzbelastung ist nach den Vorgaben in den Regelwerken und von LESER auszuführen. Bei ordnungsgemäßer Wartung ist ein Ausfall wegen Verschmutzung der Druckentnahmee- und Steuerleitungen ausgeschlossen.

Der Steuerschrank ist vor Verschmutzung zu schützen. Es ist dafür zu sorgen, dass er immer geschlossen ist. Für besondere Einsatzbedingungen bietet LESER einen gekapselten Schalschrank an, der den Steuerschrank dicht abschließt.

Der Antrieb auf dem Sicherheitsventil selbst ist analog zu den gleitenden Teilen bei offener Federhaube vor Verschmutzung zu schützen. Ansonsten besteht die Gefahr des Klemmens.

### Temperaturen:

Die Steuerungen und Antriebe sind für einen Einsatz zwischen 2 °C und 60 °C ausgelegt.

- Bei Temperaturen über 60 °C sind die Druckentnahmeeleitungen möglichst lang und mit Wasservorlage auszuführen.
- Steuerschrank und Antriebe sind so zu platzieren, dass 60 °C nicht überschritten werden.
- Bei Temperaturen unter 2 °C besteht u. U. Vereisungsgefahr, daher ist eine Beheizung des Schalschrankes und der Druckentnahmeeleitungen erforderlich.

Der Zusatzbelastungsantrieb ist über eine Kupplung mit dem Sicherheitsventil verbunden. Die Kupplung darf nicht mit Gegenständen blockiert werden. Ein Schutzanstrich des Antriebes ist nicht erforderlich und nicht erlaubt.

Die Druckentnahmeeleitungen dürfen nicht abgesperrt werden. Wenn Absperrelemente vorhanden sind, sind diese so auszuführen, dass sie nicht geschlossen werden können, z. B. mit Verriegelungsschienen oder Plombierungen.

Die LESER Schalschränke besitzen Absperrelemente für die Wartung. Diese sind mit einer Verriegelungsschiene gegen Absperrungen gesichert. Diese Verriegelungsschiene darf nicht entfernt werden.

The installation should contain an air dryer. The compressed air should have a dew-point of min. +2 °C.

The maximum pressure of the air supply is 10 bar, the minimum pressure is 3.5 bar. If the pressure rises above or falls below that specified interval, this may lead to temporary or permanent faulty operating of the additional load. Result: the safety valve does not function or it will work as a standard valve without the supplementary loading system.

The supplementary loading system should be serviced and checked at least once a year by specially trained staff. For this essential work LESER offers a maintenance service which may be incorporated in a service agreement. Training and experience with handling the additional load in combination with the safety valves are absolutely necessary.

The supplementary loading system has to be fitted in accordance to the regulations and specifications distributed by LESER. If correctly serviced, failures due to contamination of the pressure and control lines are impossible.

The control unit is to be protected from contamination. It has to be ensured that it is always closed. For special applications LESER offers an encapsulated box enclosing the control unit.

The actuator on the safety valve itself must be protected from contamination like the sliding parts inside an open bonnet. Otherwise there is the danger of jamming.

### Temperatures:

The controls and drives are designed for application between 2 °C and 60 °C.

- At temperatures above 60 °C the compressed air connections must be as long as possible and equipped with a water seal.
- The control unit and the actuator have to be positioned in such a location that their temperature will not exceed 60 °C.
- At a temperature below 2 °C there may be the danger of icing up, therefore it may be necessary to heat the control unit the control lines and tapping lines.

The supplementary loading system is connected to the safety valve via a coupling. The coupling must not be blocked by objects. It is neither necessary nor permitted to apply a protective coating to the drive.

The pressure tapping lines must not be blocked. If there are locking devices they have to be designed in such a way that they cannot be closed, e. g., by means of locking bars or seals.

LESER control units are equipped with a locking device for maintenance purposes. They are secured against locking by means of a locking bar. This locking bar must not be removed.

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Die Druckschalter werden plombiert. Diese Plombe zeigt an, dass die Einstellung nicht verändert wurde. Manipulationen an Druckschaltern sind verboten (z. B. Zerstören der Plombe und verändern der Einstellung, brechen der Steuerfahnen, ...)

3 Wenn eine Blockierschraube während des Abdrückens der Anlage benutzt wird, muss diese nach dem Abdrücken entfernt werden.

### 15 Sicherheitsventil und Berstscheibe in Kombination

Mit der Bauteilprüfung der Kombination von Berstscheiben eines bestimmten Herstellers mit LESER-Sicherheitsventilen ist sichergestellt, dass sowohl die Funktions- als auch die Leistungsanforderungen erfüllt werden. Welche Kombinationen bauteilgeprüft sind, kann bei LESER erfragt werden.

Wenn der Nachweis erbracht wird, dass Kombinationen zwischen LESER-Sicherheitsventilen und Berstscheiben anderer Hersteller die sicherheitstechnischen Anforderungen erfüllen, so sind auch diese zulässig. Der Nachweis ist hier im Einzelfall zu erbringen.

Insbesondere ist zu beachten:

- Betriebsanleitung Berstscheibe
- Sicherheitsventile dürfen durch Vorschalten der Berstscheibe nicht unwirksam gemacht werden
- Überwachung des Zwischenraumes von Berstscheibenrückseite und Sicherheitsventileintritt
- Ausrichtung der Berstscheibe: die Konstruktion sollte so ausgelegt werden, dass eine falsche Ausrichtung unmöglich wird
- Die Berstscheibe muss fragmentfrei öffnen, Berstscheibenteile dürfen nicht in den Eintrittsstutzen des Sicherheitsventils gelangen und dadurch die Funktion beeinträchtigen
- Regelwerke bezüglich Berstscheiben (AD-A1, ASME, ...)

### 16 Unvorhergesehene Bedingungen

Fehler lassen sich nicht immer zu 100 % vermeiden.

Auswirkungen müssen abgeschätzt und reduziert werden durch:

- Gefahrenanalyse der Gesamtanlage
- Risikoabschätzung mit Schadenshöhe
- Anweisungen, welche Maßnahmen im Schadensfall getroffen werden
- Personalschulung beim Hersteller und Betreiber
- Schutzmaßnahmen für Menschen und Umwelt

### 17 Produktübersicht

Siehe Abschnitt 18 „Konformitätserklärung“.

Der Hersteller behält sich alle Rechte technischer Änderungen und Verbesserungen jederzeit vor. Im Einzelnen sind die typenspezifischen Montageanweisungen zu beachten.

The pressure switches are wire-locked and sealed. This seal indicates that the setting has not been changed. All manipulations of the pressure switches are not permitted (e. g., opening the seal and modifying the adjustment, destroying the switching contacts, ...)!

If a locking screw called "test gag" is used during the pressure testing of the installation it must be removed after the pressure test.

### 15 Combined Safety Valve and Bursting Disc

The type test approval of the combination of bursting discs of a certain manufacturer with LESER safety valve ensures that both the functional and performance requirements are complied with. You may enquire at LESER which combinations are tested.

If it has been certified that combinations of LESER safety valves and bursting discs of other manufacturers satisfy the safety requirements, they are permissible. This shall be certified in each individual case.

The following should especially be observed:

- Operating instructions for the bursting disc.
- Safety valves may not be switched off by placing the bursting disc upstream.
- The intermediate space between the rear side of the bursting disc and safety valve inlet should be monitored.
- The alignment of the bursting disc: It should be designed in such a fashion that it is not possible for it to be improperly aligned.
- The bursting disc has to be free of fragments, bursting disc components may not get into the inlet connecting pieces of the safety valve thus impairing functioning.
- Sets of rules with reference to bursting discs (AD-A1, ASME, ...)

### 16 Unexpected conditions

Not all errors can be always prevented up to 100 %.

However, their consequences must be estimated and reduced by:

- A risk analysis for the complete installation
- An estimate of the risk with the possible damage that can be caused
- Instructions about the measures to be taken in the case of a fault occurring
- Staff training at the manufacturer's and at the operator's
- Protective measures for people and for the environment.

### 17 Product overview

Refer to section "Declaration of conformity".

The manufacturer reserves the right of technical changes and improvements at any time. In detail the type-specific assembly instructions have to be observed.

# Betriebsanleitung Operating Instructions

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**LESER**

Das Sicherheitsventil/The Safety Valve

3

## Declaration of Conformity/Konformitätserklärung in acc. to the pressure equipment directive 97/23/EC nach Druckgeräterichtlinie 97/23/EG



LESER GmbH & Co. KG  
Wendenstrasse 133-135  
D-20537 Hamburg/Germany

Name and address of the manufacturer/Name und Anschrift des Herstellers

Type*	Nominal size/ Nennweite	EC-type examination no. EG-Bauteilprüfnummer	Type*	Nominal size/ Nennweite	EC-type examination no. EG-Bauteilprüfnummer
411	25 - 150 / 1" - 6"	07 202 011120006002	462	15 - 20 / 1" - 1"	07 202 011120006014
421	25 - 100 / 1" - 4"	07 202 011120006013	532 + 534	20 - 50 / 1" - 6"	07 202 011120006015
424	25 - 200	07 202 011120006004	538	19 / 1"	07 202 011120006016
427 + 429	15 - 150 / 1" - 6"	07 202 011120006015	539	19 - 15 / 1" - 10"	07 202 011120006017
431 + 433	15 - 150 / 1" - 6"	07 202 011120006008	543 + 544	50 - 100 / 2" - 4"	07 202 011120006018
440	20 - 150	07 202 011120006007	548	25 - 100 / 1" - 4"	07 202 011120006019
441 + 442	20 - 400 / 1" - 16"	07 202 011120006006	483, 484, 485	25 - 40 / 1" - 2"	07 202 011120006020
447	25 - 100 / 1" - 4"	07 202 011120006009	437, 438, 481	19, 30, 32"	07 202 011120006021
448	25 - 100 / 1" - 4"	07 202 011120006010	700	-	07 202 011120006022
455 + 456	25 - 100 / 1" - 4"	07 202 011120006011	532	50-100 / 2" - 4"	07 202 011120006023
457 + 458	25 - 150 / 1" - 6"	07 202 011120006012	499/500	15-20 / 1" - 1"	07 202 011120006024
459	10 - 20 / 1" - 1"	07 202 011120006013	488	25-100 / 1" - 4"	07 202 011120006025

Description of the pressure equipment/Herstellung des Druckgerätes

\* See nameplate/Prüftafel

### Kategorie IV/Category IV

Applied category/In acc. to article 3 and annex V/Applizierte Kategorie nach Artikel 3 und Anhang V

Module/Modul	Conformity assessment procedures/ Konformitätsbewertungsverfahren	Certificate number/ Bescheinigungsnummer
B	EC-type examination/EG-Bauteilprüfung	See table/Sehe Tabelle
001	Product quality assurance/Qualitätsabsicherung Produktion	07 202 0111200060/01

Conformity assessment procedures/In acc. to article 10/Applizierte Konformitätsbewertungsverfahren nach Artikel 10

TÜV CERT - Zertifizierungsstelle für Druckgeräte der TÜV NORD GRUPPE,  
Identification number: 0045, Große Bahnhofstraße 31, D-22525 Hamburg/Germany

Name and address of the notified body (monitoring e.m. conformity assessment procedures)/Name und Anschrift der benannten Stelle (Zertifizierung, Überwachung nach z.B. Maßnahmen)

The signing manufacturer confirms by this declaration that the design, manufacturing and inspection of this pressure equipment meet the requirements of the pressure equipment directive.  
Der unterzeichnende Hersteller bescheinigt hiermit, dass Konstruktion, Herstellung und Prüfung dieses Druckgerätes den Anforderungen der Druckgeräterichtlinie entspricht.

At the moment no harmonized standards available/zurzeit keine harmonisierten Normen verfügbar  
Applied harmonized standards/Applizierte harmonisierte Normen

TRB 801-45, AD-Merkblatt A2, TRB 403, TRD 421, TRD 721, DIN 3320, DIN 3840, VeCTÜV 100  
AD 2000/Merkblatt A2, AD 2000-Merkblatt A4

Other applied standards or technical rules/Andere angewandte Normen oder technische Spezifikationen

**LESER** GmbH & Co. KG  
Wendenstr. 133-135, 20537 Hamburg

14.12.2001

Date

Manufacturer stamp

*[Signature]*  
Authorized subscriber

LESER 2001-12-14-01

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LESER

Das Sicherheitsventil/The Safety Valve

3

**Declaration of Conformity/Konformitätserklärung**  
 in acc. to the pressure equipment directive 97/23/EC  
 nach Druckgeräterichtlinie 97/23/EG



LESER GmbH &amp; Co. KG

Wendenstrasse 133-135  
D-20537 Hamburg/Germany

Name and address of the manufacturer/Name und Anschrift des Herstellers

Type*	Material/ Werkstoff	Nominal size/ Henn- weite	Description of pressure equipment/ Benennung des Druckgerätes	Applied category in acc. to article 3 and annex II/ Angewandte Kategorie nach Artikel 3 und Anhang II	Conformity assessment procedures in acc. to article 10/ Angewandte Konformitäts- bewertungsverfahren nach Artikel 10	CE- marking/ CE-Kenn- zeichnung
S10	Q, Q235 GG-25/ GL-250	DN15- DN50	Pressure Reducer Druckminderer	Art. 3 Par. 3 Art. 3 Abz. 3	Not necessary Nicht erforderlich	No Nein
		DN55- DN100		Kat. I Cat. I	A	Yes Ja
	1.0519 GG-C 25/ GP 240 GH	DN15- DN32		Art. 3 Par. 3 Art. 3 Abz. 3	Not necessary Nicht erforderlich	No Nein
		DN40- DN100		Kat. I Cat. I	A	Yes Ja

Description of the pressure equipment/Beschreibung des Druckgerätes:

\* See name plate/Seite Prüfplatte

Module/Modul	Conformity assessment procedures/ Konformitätsbewertungsverfahren	Certificate number/ Bescheinigungsnummer
D1	Production quality assurance/Qualitätsicherung Produktion	07 202 6111200093/01

Certificate number of module D1/Zertifikatenummer Modul D1

**TÜV CERT - Zertifizierungsschule für Druckgeräte der TÜV NORD GRUPPE**  
 Identification number: 0045, Große Bahnhofstraße 31, D-22525 Hamburg/Germany

Name and address of the notified body (notifying a.m. conformity assessment procedures)

Name und Anschrift der benannten Stelle (Zertifizierung Überwachung nach a.m. Modulen)

The signing manufacturer confirms by this declaration that the design, manufacturing and inspection of this pressure equipment meet the requirements of the pressure equipment directive.

Der unterzeichnende Hersteller bescheinigt hiermit, dass Konstruktion, Herstellung und Prüfung dieses Druckgerätes den Anforderungen der Druckgeräterichtlinie entsprechen.

**DIN EN 1503-1, DIN EN 1503-3, DIN EN 10219-1, DIN EN 10213-2**

Applied harmonized standards/Angewandte harmonisierte Normen

**DIN 3840, DIN 1891, DIN EN 1561**

Other applied standards/technische Normen/Andere angewandte Normen oder technische Spezifikationen

**LESER** GmbH & Co. KG  
 Wendenstr. 133-135, 20537 Hamburg

14.12.2001

Manufacturer stamp

Authorized subscriber

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# Betriebsanleitung Operating Instructions

3

**LESER**

Das Sicherheitsventil/The Safety Valve

3

## Declaration of Conformity/Konformitätserklärung in acc. to the pressure equipment directive 97/23/EC nach Druckgeräterichtlinie 97/23/EG



LESER GmbH & Co. KG  
Wendenstrasse 133-135  
D-20537 Hamburg/Germany

Name and address of the manufacturer/Name und Anschrift des Herstellers

Type*	Material/ Werkstoff	Nominal size/ Nominal- weite	Description of pressure equipment/ Bemerkung des Druckgerätes	Applied category in acc. to article 3 and annex II Angewandte Kategorie nach Artikel 3 und Anhang II	Conformity assessment procedures in acc. to article 10/ Angewandte Konformitäts- bewertungsverfahren nach Artikel 10	CE- marking/ CE-Kenn- zeichnung
S10	1.0919 GS-C 25 GP 240 GH	DN25	Charge-over Valve  DN40, DN50 Wichschw.1	Art. 3 Par. 3 Art. 3 Abs. 6  Cat. II Kat. II	Not necessary Nicht erforderlich	No Nein
	1.4408 XS DIN/M19-11-2	DN40, DN50 Wichschw.1			DI	Yes Ja

Description of the pressure equipment/Beschreibung des Druckgerätes:

See name plate/see Plakette

Module/Modul	Conformity assessment procedure/ Konformitätsbewertungsverfahren	Certificate number/ Bescheinigungsnummer
D1	Production quality assurance/Qualitätsicherung Produktion	07 202 0111200088/01

Certificate number of module D1/Qualitätszertifikatnummer Modul D1:

TÜV CERT - Zertifizierungsstelle für Druckgeräte der TÜV NORD GRUPPE  
Identification number: 0045, Große Baumstrasse 31, D-22525 Hamburg/Germany

Name and address of the notified body (notifying a.m. conformity assessment procedures)  
Name und Anschrift der benannten Stelle (Zertifizierung Überwachung nach a.m. Modulen)

The signing manufacturer confirms by this declaration that the design, manufacturing and inspection of this pressure equipment meet the requirements of the pressure equipment directive.

Der unterzeichnende Hersteller bescheinigt hiermit, dass Konstruktion, Herstellung und Prüfung dieses Druckgerätes den Anforderungen der Druckgeräterichtlinie entsprechen.

DIN EN 1503-1, DIN EN 10213-1, DIN EN 10213-2, DIN EN 10213-4

Applied harmonized standards/Angewandte Harmonisierte Normen

DIN 2840

Other applied standards or technical/Anwendbare angewandte Normen oder technische Spezifikationen

**LESER** GmbH & Co. KG  
Wendenstr. 133-135, 20537 Hamburg

14.12.2001

Date

Manufacturer stamp

Authorized subscriber:

LWN 21615 + 1101

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Hamburg, HRB 38 577  
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Postanschrift/Postal address  
D-20506 Hamburg, P. O. Box 28 16 51

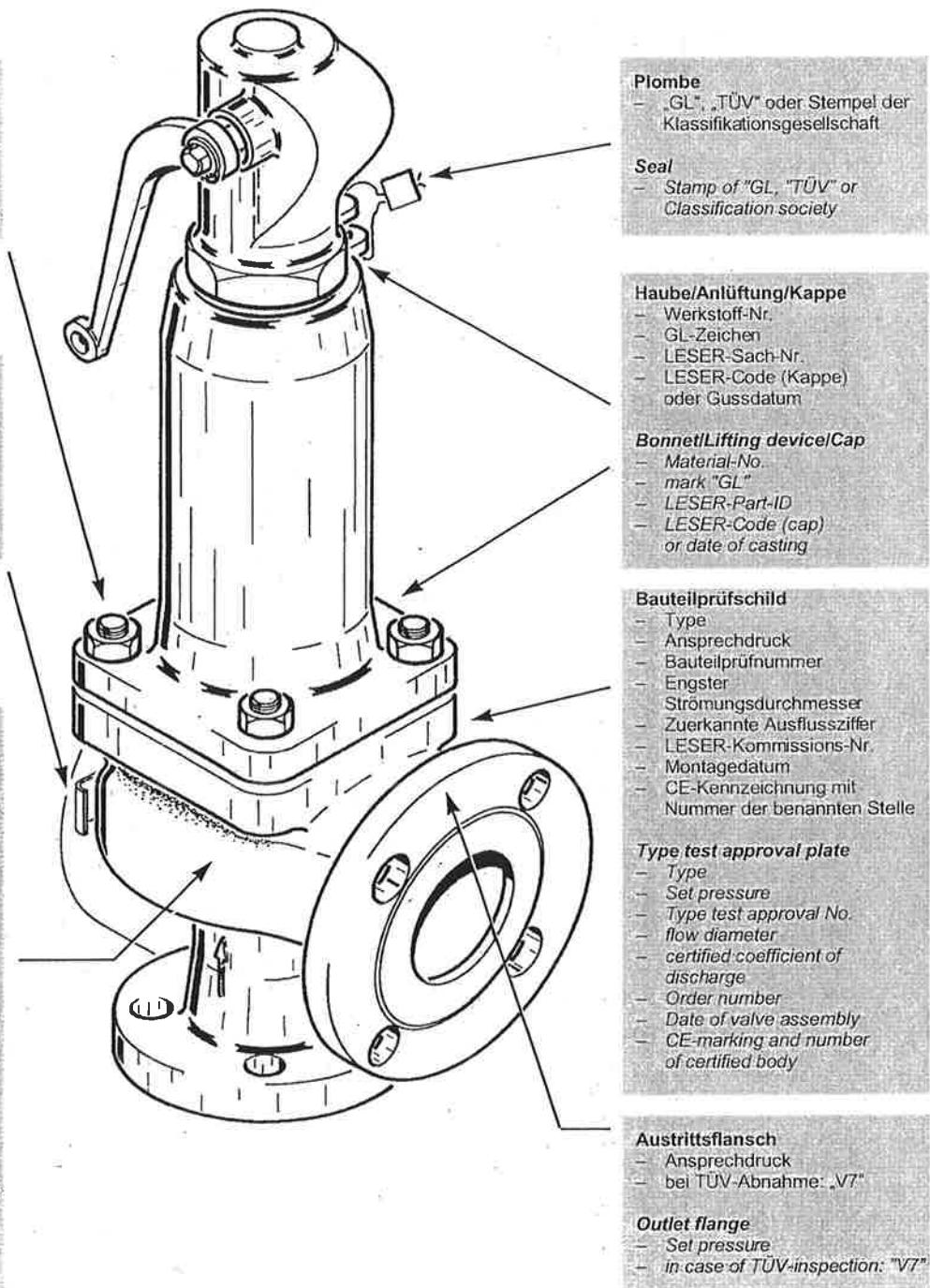
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# 3

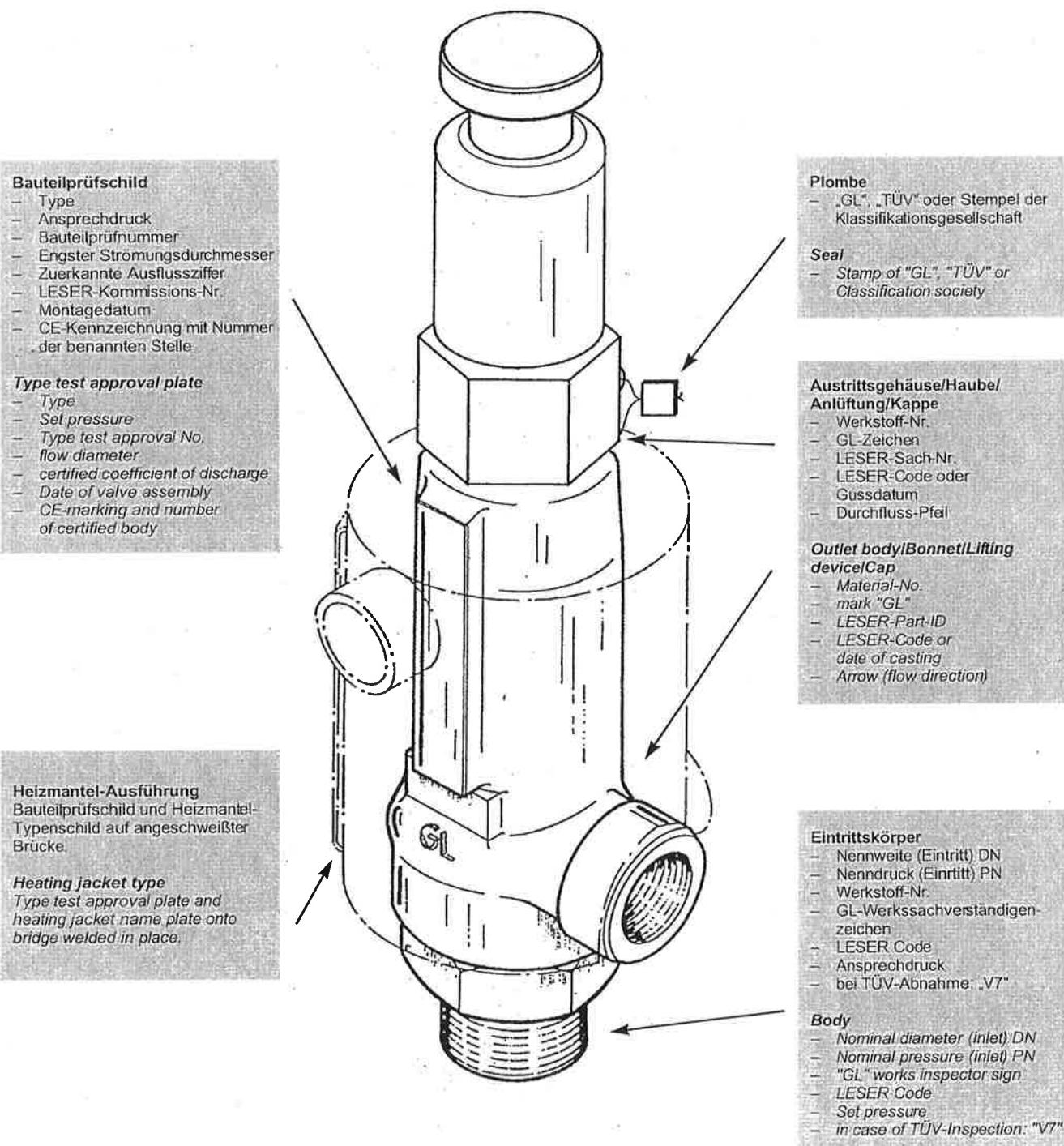
## Kennzeichen an Flansch-Feder-Sicherheitsventilen Markings on Flanged Safety Valves



# Kennzeichen an Gewinde-Feder-Sicherheitsventilen

## Markings on Screwed Safety Valves

3

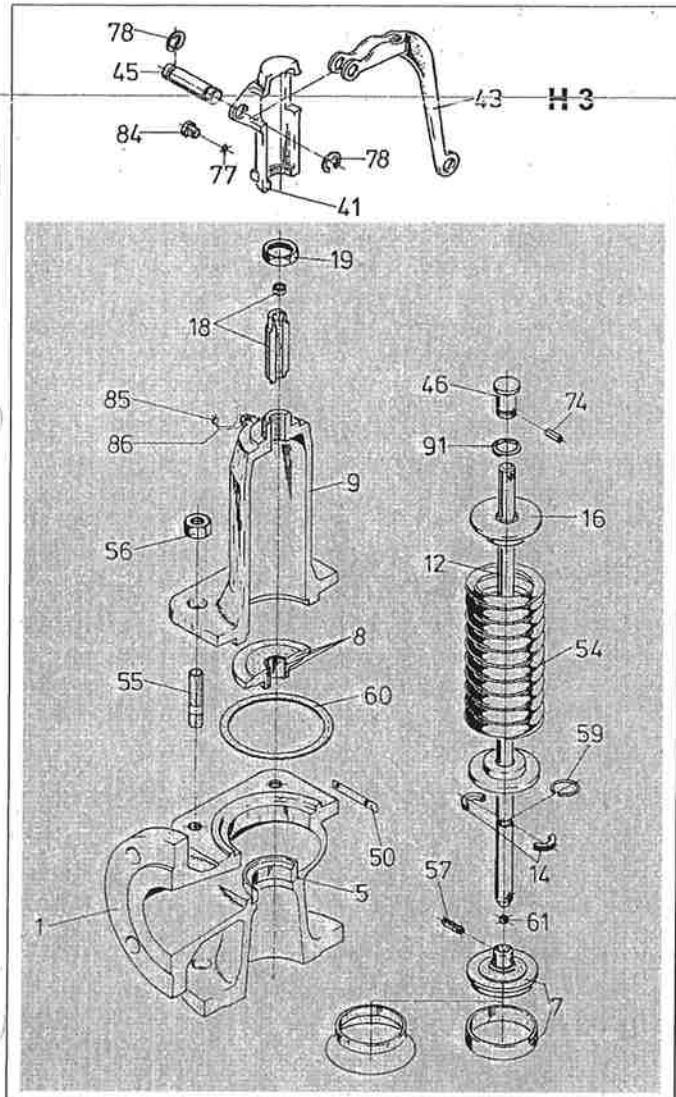


## 3

# Aufbau des Flansch-Feder-Sicherheitsventils

## Assembly of Flanged Spring Loaded Safety Valve

3



Mit Anlüftung H 3, offen (alternativ mit H 2, H 4 siehe unten)  
 With Lifting device H 3, open (alternative with H 2, H 4 see below)

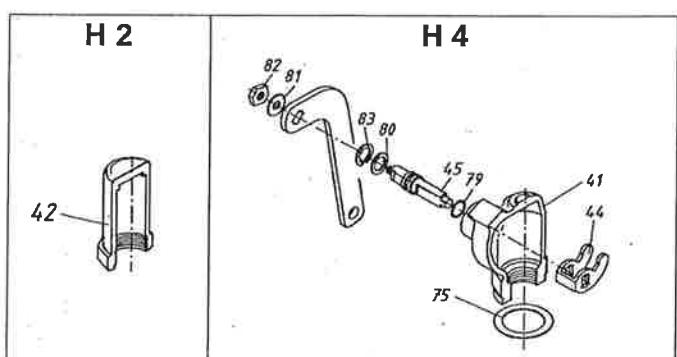
Empf. Verschleißteile Recommended Maintenance Parts	Pos. Item	Benennung	Part Name
	1	Gehäuse	Body
●	5	Sitz	Seat
	7	Teller (Kegel)	Disc
	8	Führungscheibe, kompl.	Guide
	9	Federhaube	Bonnet
	12	Spindel	Spindle
	14	Halbring	Split ring
	16	Federteller	Spring plate
	18	Druckschraube	Adjusting screw
	19	Gegenmutter	Lock nut
	46	Kupplung	Spindle cap
●	74	Stift	Pin
●	91	Sprengring	Securing ring
●	50	Bauteilprüfchild	Type test approval plate
●	54	Feder	Spring
	55	Stiftschraube	Stud
	56	Sechskantschraube	Hex. nut
●	57	SchwerSpannhülse	Rollpin
	59	Sprengring	Securing ring
●	60	Dichtring	Gasket
●	61	Kugel	Ball
	41	Lüftheube H 3	Lever cover H 3
	43	Lüfthebel H 3	Lever H 3
	45	Bolzen	Bolt
	77	Kugel	Ball washer
	78	Sicherungscheibe	Retaining clip
	84	Sechskantschraube	Hex. screw
	85	Plombe	Lead seal
	86	Plombendraht	Seal wire

Kappe H 2, gasdicht  
 Cap H 2, gastight

42 Kappe H 2 Cap H 2

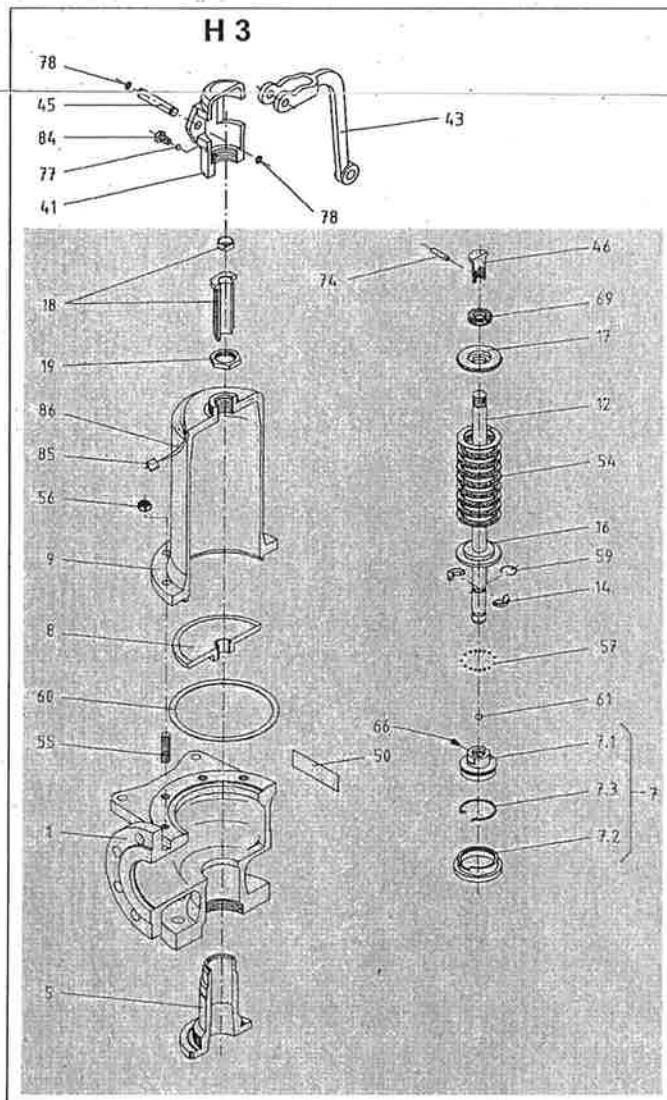
Anlüftung H 4, gasdicht  
 Lifting device H 4, gastight

41	Lüftheube H 4	Lever cover H 4
43	Lüfthebel H 4	Lever H 4
44	Lüftekabel	Lifting fork
45	Lüftewelle	Shaft
75	Distanzring	Spacer
79	O-Ring	O-ring
80	Stützscheibe	Support ring
81	Scheibe	Washer
82	Sechskantschraube	Hex. nut
83	Sicherungsring	Circlip



Montagezeichnungen für Zusatzausrüstungen siehe Teil 13  
 Assembly drawing for accessories refer to section 13

**Aufbau des Flansch-Feder-Sicherheitsventils  
mit Sitzbuchse**  
**Assembly of Flanged Spring Loaded Safety Valve**  
**Full Nozzle Type**

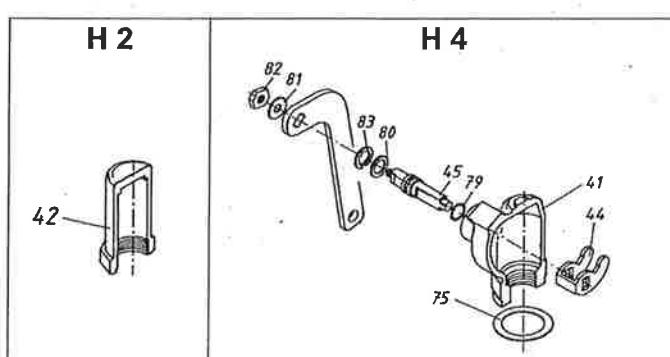


Mit Anlüftung H 3, offen (alternativ mit H 2, H 4 siehe unten)  
With Lifting device H 3, open (alternative with H 2, H 4 see below)

Empf. Vorschreibstelle Recommended Maintenance Parts	Pos. Item	Benennung	Part Name
●	1	Gehäuse	Body
●	5	Sitzbuchse	Full Nozzle
●	7	Teller, kompl.	Disc
	7.1	Tellerkörper	Disc body
	7.2	Hubglocke	Lifting aid
	7.3	Sprengring	Securing ring
	8	Führungsscheibe, kompl.	Guide
	9	Federhaube	Bonnet
	12	Spindel	Spindle
	14	Halbring	Split ring
	16	Federteller, unten	Lower spring plate
	17	Federteller, oben	Upper spring plate
	18	Druckschraube	Adjusting screw
	19	Gegenmutter	Lock nut
	41	Lüftheube H3	Lever-Cover H3
	43	Lüftetrieb H3	Lever H3
	45	Bolzen	Bolt
	46	Kupplung	Spindle cap
	50	Bauteilprüfchild	Type test approval plate
●	54	Feder	Spring
	55	Stiftschraube	Stud
●	56	Sechskantmutter	Hex. nut
●	57	Kugel	Ball
	59	Sprengring	Securing ring
	60	Dichtring	Gasket
●	61	Kugel	Ball
	66	Sechskantschraube	Hex. screw
	69	Axial-Rillenkugellager	Thrust ball bearing
	74	Stift	Pin
	77	Scheibe	Lead washer
	78	Sicherungsscheibe	Retaining clip
	84	Sechskantschraube	Hex. screw
	85	Plombe	Lead seal
	86	Plombendraht	Seal wire

Kappe H 2, gasdicht  
Cap H 2, gastight

[42] Kappe H 2 [Cap H.2]



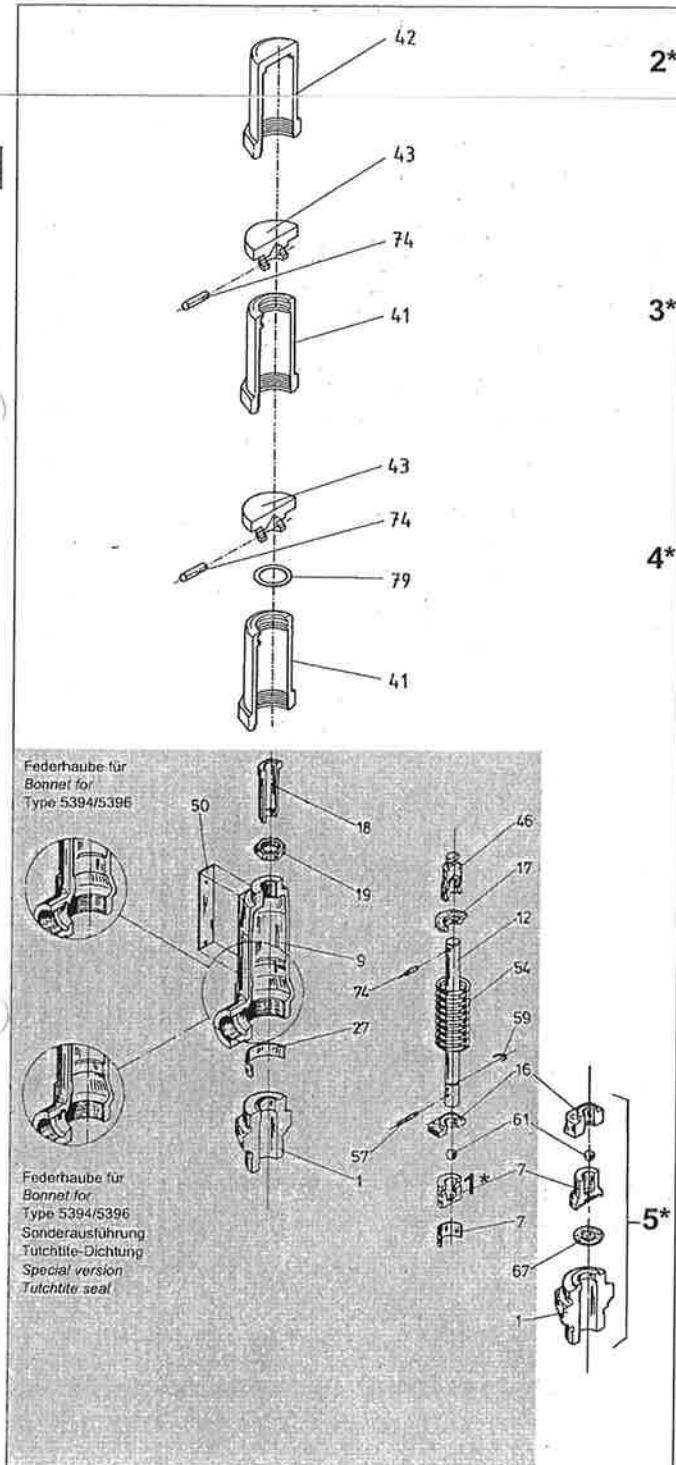
Anlüftung H 4, gasdicht  
Lifting device H 4, gastight

41	Lüftheube H 4	Lever cover H 4
43	Lüftetrieb H 4	Lever H 4
44	Lüftekabel	Lifting fork
45	Lüftewelle	Shaft
75	Distanzring	Spacer
79	O-Ring	O-ring
80	Stützscheibe	Support ring
81	Scheibe	Washer
82	Sechskantmutter	Hex. nut
83	Sicherungsring	Circlip

Montagezeichnungen für Zusatzausrüstungen siehe Teil 13  
Assembly drawing for accessories refer to section 13

# 3

## Aufbau des Gewinde-Normal-Feder-Sicherheitsventils Assembly of Screwed Safety Relief Valve



1\* = Grundausstattung des Ventils,  
kombinierbar mit 2\*, 3\* und 4\*  
Basic valve assembly fitted with 2\*, 3\* and 4\*

Empf. Vorschaltteile Recommended Maintenance Parts	Pos. Item	Benennung	Part Name
●	1	Eintrittskörper	Inlet body
●	7	Teller kompl.	Disc compl.
	9	Federhaube	Bonnet
	12	Ventilspindel	Spindle
	16	Federteller, unten	Lower spring plate
	17	Federteller, oben	Upper spring plate
	18	Druckschraube	Adjusting screw
	19	Gegenmutter	Lock nut
	27	Führungsbuchse	Guide
	50	Bauteilprüfchild	Type test approval plate
	54	Feder	Spring
●	57	Stift	Pin
●	59	Sprengring	Securing ring
●	61	Kugel	Ball

2\* = Kappe H 2, gasdicht  
Cap H 2, gastight

42	Kappe H 2	Cap H 2
85	Plombe	Lead seal
86	Plombendraht	Seal wire

3\* = Anlüftung H 3, offen  
Lifting device H 3, open

41	Lüftehaube H 3	Lever cover H 3
43	Lüfteknopf	Lever H 3
46	Kupplung	Spindle cap
74	Stift	Pin
85	Plombe	Lead Seal
86	Plombendraht	Seal wire

4\* = Anlüftung H 4, gasdicht  
Lifting device H 4, gastight

41	Lüftehaube H 4	Lever cover H 4
43	Lüfteknopf	Lever H 4
46	Kupplung	Spindle cap
74	Stift	Pin
79	O-Ring	O-ring
85	Plombe	Lead seal
86	Plombendraht	Seal wire

5\* = Ausführung mit Tutchtite-Dichtung  
Version with Tutchtite seal

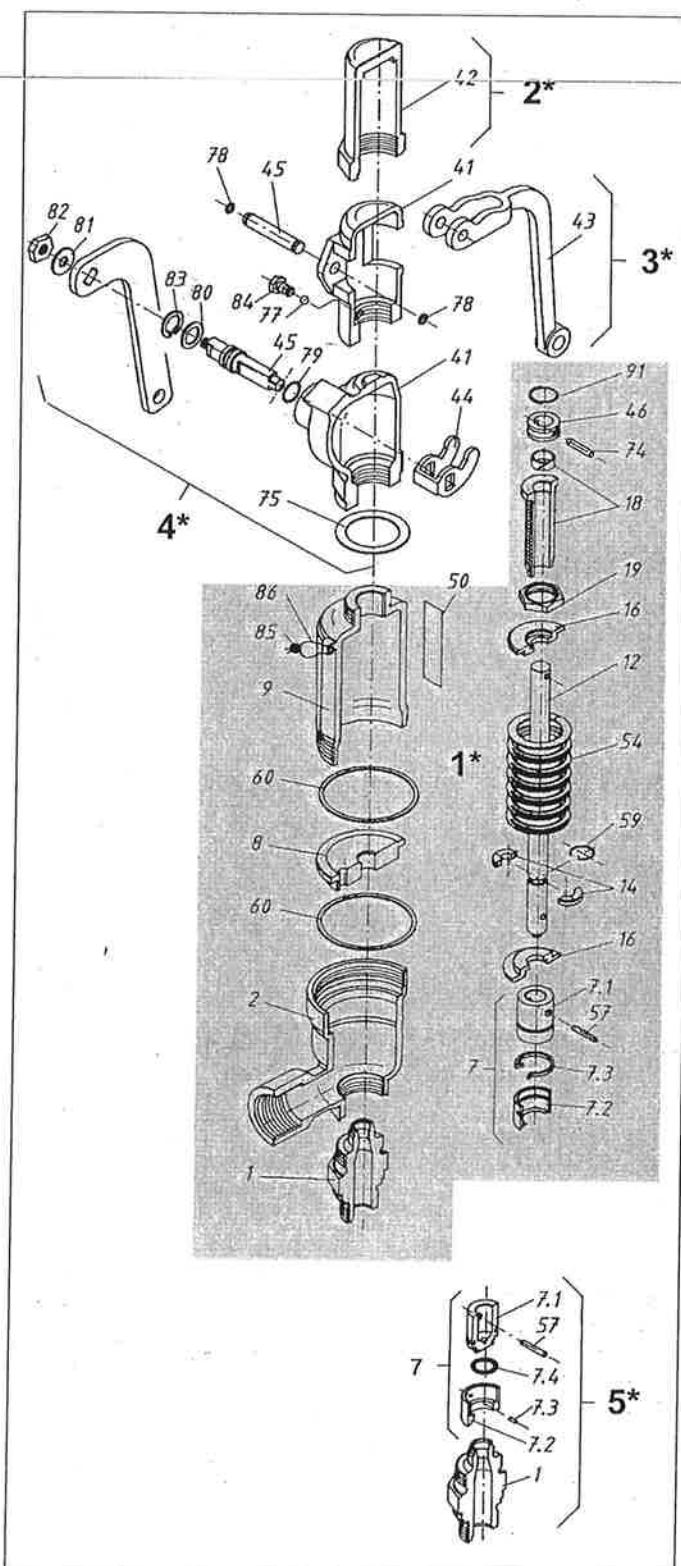
1	Eintrittskörper	Inlet body
7	Teller	Disc
67	Tutchtite-Dichtung	Tutchtite seal

Montagezeichnungen für Zusatzausrüstungen siehe Teil 13  
Assembly drawing for accessories refer to section 13

# Aufbau des Gewinde-Vollhub-Feder-Sicherheitsventils

## Assembly of Screwed Full Lift Safety Valve

3



Montagezeichnungen für Zusatzausrüstungen siehe Teil 13  
Assembly drawing for accessories refer to section 13

1\* = Grundausstattung des Ventils,  
kombinierbar mit 2\*, 3\* und 4\*  
Basic valve assembly fitted with 2\*, 3\* and 4\*

Empf. Verschleißteile Recomm. der Maintenance Parts	Pos. Item	Benennung	Part Name
●	1	Eintrittskörper	Inlet body
●	2	Austrittgehäuse	Outlet body
●	7	Teller kompl.	Disc compl.
7.1	7.1	Tellerkörper	Disc body
7.2	7.2	Hubglocke	Lifting aid
7.3	7.3	Sprengring	Securing ring
8	8	Führungsscheibe	Guide
9	9	Federhaube	Bonnet
12	12	Ventilspindel	Spindle
14	14	geteilter Ring	Split ring
16	16	Federsteiler	Spring plate
18	18	Druckschraube	Adjusting screw
19	19	Gegenmutter	Lock nut
50	50	Bauteilprüfchild	Type test approval plate
54	54	Feder	Spring
57	57	Stift	Pin
59	59	Sprengung	Securing ring
60	60	Dichtring	Gasket
78	78	Sicherungsscheibe	Retaining clip

1\*

2\*

3\*

4\*

5\*

2\* = Kappe H 2, gastight  
Cap H 2, gastight

42	Kappe H 2	Cap H 2
75	Distanzring	Spacer
85	Plombe	Lead seal
86	Plombendraht	Seal wire

3\* = Anlüftung H 3, offen  
Lifting device H 3, open

41	Lüftheade H 3	Lever cover H 3
43	Lüfthebel H 3	Lever H 3
45	Bolzen	Pin
46	Kupplung	Spindle cap
74	Stift	Pin
77	Kugel	Ball washer
78	Sicherungsscheibe	Retaining clip
84	Sechskantschraube	Hex. screw
85	Plombe	Lead seal
86	Plombendraht	Seal wire
91	Sprengung	Securing ring

4\* = Anlüftung H 4, gastight  
Lifting device H 4, gastight

41	Lüftheade H 4	Lever cover H 4
43	Lüfthebel H 4	Lever H 4
44	Lütfegabel	Lifting fork
45	Lütfewelle	Shaft
46	Kupplung	Spindle cap
74	Stift	Pin
75	Distanzring	Spacer
79	O-Ring	O-ring
80	Stützung	Support ring
81	Scheibe	Washer
82	Sechskantschraube	Hex. nut
83	SEEGER-Ring	SEEGER-ring
85	Plombe	Lead seal
86	Plombendraht	Seal wire
91	Sprengung	Securing ring

5\* = Ausführung mit O-Ring-Dichtung  
siehe Type 460 und 462  
Version with O-ring seal refer to Type 460 and 462

1	Eintrittskörper	Inlet body
7	Teller kompl.	Disc compl.
7.1	Tellerkörper	Disc body
7.2	Hubglocke	Lifting aid
7.3	Sprengring	Securing ring
7.4	O-Ring	O-ring

**INSTALLATION, OPERATION AND MAINTENANCE MANUAL**  
**FOR PRESSURE GAUGES TYPE IT 316/316 420 N2 AND E2 100.**

HDD

Make sure the wetted parts of the instrument (AISI 316) are suitable for use with the media.

Make sure the instrument range is appropriate to whatever is to be measured.  
Max pressure should be 2/3 of instrument range.

The instrument must be mounted in a position with as little vibration as possible.

The instrument must not be exposed to higher or lower ambient temperatures than intended. The calibration temperature for the instruments is 20°C unless otherwise is indicated in the order or packing list. Deviation from the calibration temperature will cause incorrect indication, depending on the extent of the deviation.

Unless otherwise indicated in the order or packing list, the instrument must be mounted in vertical position.

Instruments must be mounted free of mechanical tension. Wall mounted instruments must be mounted on plain surfaces. When connecting, hexagonal flats must be used. Instrument housing must not be used as a conterforce. Always use the hexagon for support when mounting connection tube.

It is important to mount the connection pipes so they do not cause mechanical tension. For instance, they can be made of an annealed material and laid in a loop before they are attached to the pressure gauge.

The application of pressure to the pressure gauge and its release must be effected without abrupt changes in pressure. Rapid changes in pressure must be avoided. It must be made sure that the columns of liquid that can form between instruments and the point of measurement do not cause significant errors in measurements.

Look for tags or instruction on the instruments.

Instruments with capillary tube and chemical seal:

Gauge and seal must be mounted at the same level to avoid inaccuracy.

Do not disassemble instrument or chemical seal from capillary tube.

Do not use instrument or capillary system as an earthing point for welding equipment.

Electrical connections to be connected according to drawing 401776.

Use shielded cable, twisted pair. Shield to be connected in one end. (Power supply end)  
Instrument has reverse polarity protection. No damage, but also no function.

Power supply 12-36 VDC  
Accuracy  $\pm 1,0\%$  F.S. (gauge) 0,5% F.S (el. signal)  
Max resistance (ohm) (Ub-12)/0,02 A  
Insulation resistance >100Mohm  
Process temperature -20+70°C  
Ambient temperature -20+70°C  
Storage temperature -40+125°C

MAINTENANCE:

No maintenance required besides calibration when out of range or by request from customer.



# BROADY

FLOW CONTROL

## TYPE 180 PRESSURE RELIEF VALVE

The 180/180-S pressure relief valves are suitable for use on compressed air, gases, water, oil and steam.

The 180 is available in sizes from  $\frac{1}{2}$ " to 3" in Bronze. The 180-S is available in sizes from  $\frac{1}{2}$ " to 2", both have screwed BSP ends male inlet x female outlet, although other end connections are available on request.

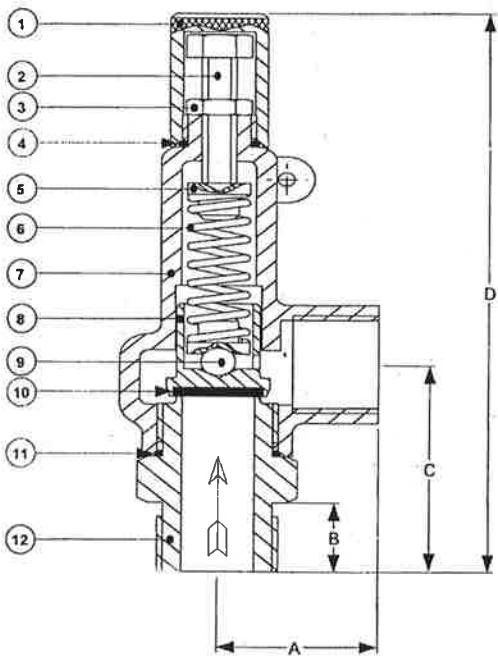
Both relief valves are available with the option of metal to metal precision lapped seats or Viton soft seats.

**Installation :** The relief valve should be mounted

with the body in the vertical position, this is to ensure the valve reseats correctly. Ensure that the pipe work is clear of system debris.

**Maintenance :** Periodically the valve lid and seat should be examined, if the contact faces are marked they should be refaced and lapped in, if the soft seat is damaged it should be replaced. The spring should be examined for any deterioration, such as cracking, thinning of the coils or reduction in length. The spring should be replaced if any defect is found. All parts should move freely in their respective guides.

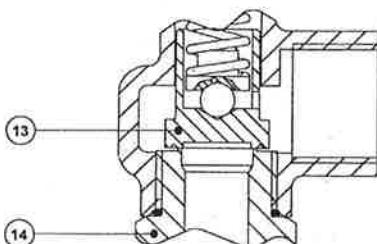
Valve for Air, Gas and Water Applications



Item	Description	Material (180)	Material (180-S)
1	Bonnet	Brass	Stainless Steel
2	Adjusting Screw	Stainless Steel	Stainless Steel
3	Locknut	Stainless Steel	Stainless Steel
4	O-Ring	Nitrile	Nitrile
5	Spring Carrier	Brass	Stainless Steel
6	Spring	Carbon Steel	Stainless Steel
7	Body	Gunmetal	Stainless Steel
8	Disc Holder	Brass	Stainless Steel
9	Ball	Stainless Steel	Stainless Steel
10	Disc	Viton	Viton
11	O-Ring	Nitrile	Nitrile
12	Inlet (disc)	Aluminium Bronze	Stainless Steel
13	Valve Lid	Aluminium Bronze	Stainless Steel
14	Inlet (metal to metal)	Aluminium Bronze	Stainless Steel

Size	A	B	C	D	Weight (kg)
15NB	28	15	45	122	0.30
20NB	34	15	48	130	0.50
25NB	38	19	59	160	1.00
32NB	47	23	68	171	1.50
40NB	52	24	80	197	2.50
50NB	62	28	84	214	3.00
65NB	90	33	117	313	8.00
80NB	90	35	130	325	9.00

Valve for Steam Applications



Colour Code	Pressure Range		Size Limitations	
	Bar g	Psi g	Type 180	Type 180-S
Red	0.35 - 1.79	5 - 25	15NB to 80NB	15NB to 50NB
Blue	1.80 - 5.50	26 - 80		
Green	5.51 - 10.34	81 - 150		
Orange	10.35 - 13.79	151 - 200		
Purple	13.80 - 17.24	201 - 250	15NB to 50NB	
Yellow	17.25 - 20.69	251 - 300		
White	20.70 - 24.00	301 - 350		

These items are recommended spares.

## TYPE 180 DISCHARGE CAPACITY TABLES

*Saturated Steam Capacities in kg/hr with 10% Accumulation*

Set Pressure (Bar g)	Valve Size							
	15	20	25	32	40	50	65	80
0.7	10	23	42	65	94	166	260	378
1.0	13	29	52	81	118	208	325	472
2.0	19	45	78	123	177	297	498	715
3.0	26	59	103	164	234	415	657	944
4.0	31	71	129	200	293	512	812	1155
6.0	44	102	180	282	410	716	1144	1630
8.0	53	129	229	358	500	902	1430	2040
10.0	70	157	280	440	631	1135	1748	2495
12.0	86	188	331	501	758	1338	-	-
18.0	123	270	482	763	1080	1900	-	-
24.0	160	363	641	1022	1427	2557	-	-

*Air Capacities in Nm<sup>3</sup>/hr with 10% Accumulation*

Set Pressure (Bar g)	Valve Size							
	15	20	25	32	40	50	65	80
0.7	10	22	40	63	91	154	251	359
1.0	12	25	46	74	106	180	295	423
2.0	17	40	71	111	161	271	449	644
3.0	23	52	94	149	213	364	593	848
4.0	30	66	118	184	268	454	742	1070
6.0	41	90	162	257	367	635	1032	1465
8.0	51	115	206	322	466	814	1270	1864
10.0	63	144	255	393	575	983	1584	2270
12.0	75	168	300	466	676	1152	-	-
18.0	110	244	429	702	982	1662	-	-
24.0	144	319	576	935	1259	2248	-	-

*Water Capacities in l/min with 25% Accumulation*

Set Pressure (Bar g)	Valve Size							
	15	20	25	32	40	50	65	80
0.7	4	11	20	32	46	79	126	183
1.0	6.4	14	25	40	57	99	158	230
2.0	9.5	20	36	57	86	145	231	331
3.0	11	25	45	70	99	179	277	404
4.0	13	29	51	80	115	204	320	463
6.0	16	34	61	97	143	249	393	572
8.0	18	41	72	114	163	290	455	657
10.0	21	46	80	129	184	325	504	730
12.0	22	50	88	138	199	356	-	-
18.0	27	60	109	168	243	348	-	-
24.0	31	69	125	195	281	504	-	-

### Disclaimer

The information, specifications and technical data contained in this catalogue are subject to change without notice. The user should verify all technical data and specifications prior to use. Broady Valves does not warrant that the material and information contained herein is current or correct and assumes no responsibility for the use or misuse of any such material and information by the user.



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