

**These operating instructions contain fundamental information and precautionary notes. Please read the manual thoroughly prior to installation of unit, electrical connection and commissioning. It is imperative to comply with all other operating instructions referring to components of individual units.**



**Any work on the unit must only be carried out with the electrical connections (incl. control cable) disconnected (or unplugged). Make sure that the pump set cannot be switched on accidentally.**

**Design Details**
**1 Pump Casing**

Axially split volute casing with replaceable casing wear rings.

Suction and discharge nozzles in lower half of casing are at the same level (inline version).

**2 Impeller**

The double-entry radial impeller is manufactured for the operating data provided in each case. Also with impeller wear rings, if requested.

In double-entry radial impellers the axial thrust is largely balanced.

**3 Pump Shaft**

The shaft is fully sealed against the liquid being pumped. Shaft-protecting sleeves are fitted in the seal area.

**4 Shaft Seal**

The shaft seals at the drive end and non-drive end are gland packings or mechanical seals, as requested.

Due to the product-lubricated lower RESIDOR<sup>®</sup> bearing, one bottom shaft seal is omitted.

**5 Bearings and Lubrication**

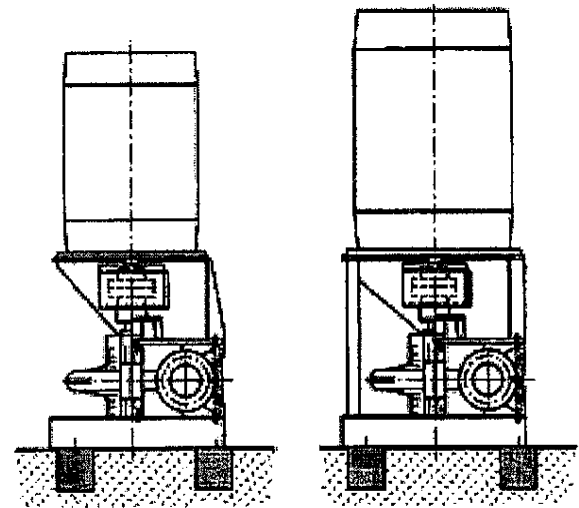
The pump is fitted on drive side with covered deep-groove ball bearings which are grease-lubricated for life.

This bearing is the fixed bearing.

On the non-driven end (bottom), there is the product-lubricated RESIDOR<sup>®</sup>-bearing.

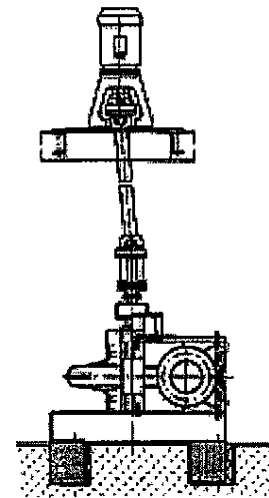
**Types of Installation**

The pump is installed vertically, direct-coupled, configuration DJ, DB and DK.

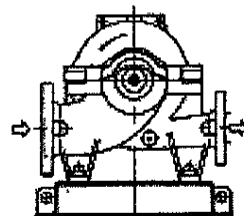
**Vertical**


Type of Installation DB  
<sup>\*)</sup> Depending of motor size

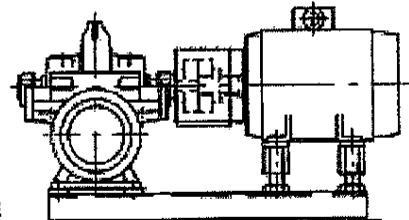
Type of installation DK



Type of installation DJ  
 Version with intermediate bearing

**Types of installation**
**Horizontal**


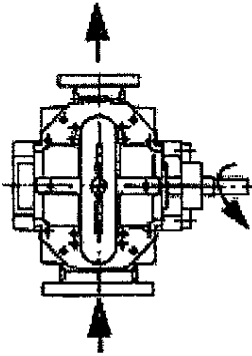
Type of Installation 3E



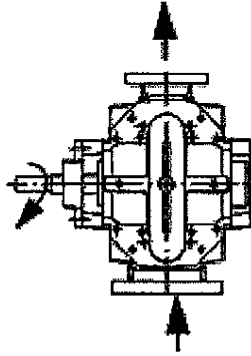
**Direction of rotation / flow direction**

**Horizontal**

Direction of rotation  
anticlockwise,  
viewed from the drive end

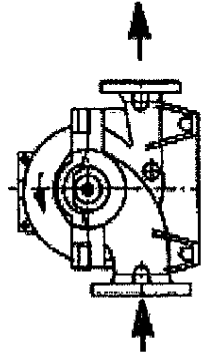


Direction of rotation  
clockwise, viewed  
from the drive end

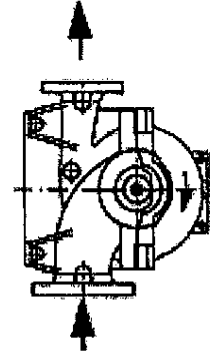


**Vertical**

Direction of rotation  
anticlockwise,  
viewed from the drive end



Direction of rotation  
clockwise, viewed from  
the drive end



### Installing the Pump / Unit

**Caution**

Before setting up the pump, check the operating data. Ensure that the data on the name plate matches the data in the order and the system data, e.g. operating voltage, frequency, pumped liquid temperature etc.

The designation of parts can be taken from these drawings (part No.)

While the installation type DJ can be independent of the size of the pump or the motor, the installation types DB and DK depend on the size of the pump and the motor according to the attachment "General Arrangement Drawing"

The site management must inform the installation personnel about the local safety regulations prior to beginning the installation.

For all work subsequently described, the pump must be set up so it cannot fall over, and must be secured accordingly.

The foot is to be bolted to the pump using the connecting elements supplied (see General Assembly Drawing and List of Components - Annex).

Furthermore, the motor stool and possibly the supports must be assembled. The motor stool must also be fixed with pins besides being bolted.

The foot must be bolted to the foundation blocks. Using adjusting screws, the pump must be aligned so that the machined motor connecting flange of the motor stool is horizontally level in all directions, i.e. the pump stands exactly in vertical position. Subsequently, the recesses arranged in the foundation for the foundation blocks are grouted carefully with a concrete mixture. It must be assured that the base structure is resistant to torsion and twisting. After the concrete mixture has set, the pump is to be connected to the piping without transmitting stresses or strains, and the motor installed. The shafts must be carefully aligned with respect to each other and the alignment of the coupling must be checked once again.



**Observe operating instructions of the coupling!**

Faulty alignment can lead to destruction of torque-transmitting coupling elements and to bearing damage at the pump and motor.

According to the regulations concerning technical working equipment, machines may only be operated with appropriate contact protection. For this reason a coupling guard must be installed prior to commissioning. Furthermore, the direction of rotation of the unit must be checked whether it corresponds to the rotational direction arrow on the pump casing.

Additional loads on discharge and suction nozzle, e.g. caused by:

1. Weight of water-filled pipes
2. Changes in length of piping due to temperature fluctuations
3. Reaction forces due to unbraced expansion joints,

### Unlocking Pump Rotor

Prior to commissioning or prior to the alignment of the pump and the motor, the pump rotor must be unlocked.

Loosen and unscrew hex. head bolt (901.17) from the non-drive end bearing cover (160).

Remove plug (916 - acc. to parts list) in the nipple joint (731) on the top casing half (105.02).

Mount flushing line (719.02) according to the drawing as well as the operating instructions "Barrier water/flushing line". Secure pipe unions with LOCTITE, type 221.

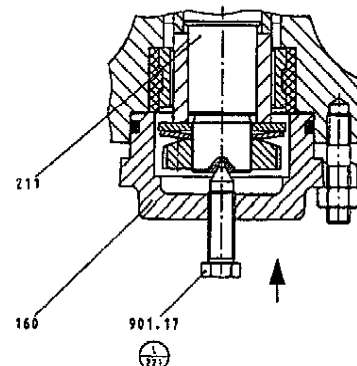


Fig. 6 Locking and unlocking the pump rotor

### Aligning the Pump / Drive



Improper alignment of the unit can cause damage to both the coupling and the unit itself!

A pump set in vertical installation types DB and DK is correctly aligned, if a straight-edge placed axially on both coupling halves is the same distance from each shaft at all points around the circumference. In addition, the distance between the two coupling halves must remain the same all around the circumference. Use a feeler gauge, a wedge gauge or a dial micrometer to verify (see fig. 7).

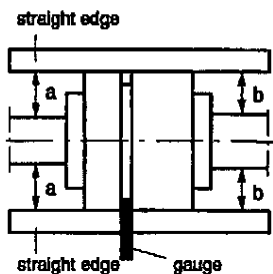


Fig. 7: Coupling alignment, using gauge and straight edge  
Special Instructions see appendix.

### Connecting the Piping

#### Caution

Never use the pump itself as an anchorage point for the piping.

Suction lift lines shall be laid with a rising slope towards the pump and suction head lines with a downward slope towards the pump. The pipelines shall be anchored in close proximity to the pump and connected without transmitting any stresses or strains. Their weight must not exert any load on the pump. With short pipelines, the nominal diameters shall be at least equal to the nominal diameters of the pump nozzles. For long pipelines the most economical nominal diameter has to be determined from case to case.

**Any additional loads on the discharge and suction nozzles, e.g. caused by:**

Weight of the water-filled pipes, changes in the length of pipes owing to temperature fluctuations, reaction forces due to unbraced expansion joints must not exceed the values stated in the installation plan.



An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where the medium handled can escape into the atmosphere.

**Danger of life when hot media are handled!**

The flange covers on the pump suction and discharge nozzles must be removed prior to installation in the piping.

### Auxiliary Connections

The locations of the auxiliary connections (sealing liquid, flushing liquid, etc.) are indicated on the installation plan or piping layout (see appendix).

Please refer to the appendix for detailed assembly instructions.

#### Caution

These connections are required for proper functioning of the pump and are therefore of vital importance!

### Coupling Guard



In compliance with the accident prevention regulations the pump must not be operated without a coupling guard. If the customer specifically requests not to include a coupling guard in our delivery, then the operator must supply one.

### Final Check

Re-check the alignment.

It must be easy to rotate the shaft by hand at the coupling.

#### Caution

Check the integrity and proper functioning of all connections.

### Commissioning, Start-up / Shut down

#### Caution

Compliance with the following requirements is of paramount importance. Damage resulting from non-compliance shall not be covered by the scope of warranty.

### Commissioning

Before starting up the pump make sure that the following requirements have been checked and fulfilled:

- Has the pump been firmly bolted to the foundation?
- Have the coupling and pump unit been aligned as specified?
- Can the unit be easily rotated by hand at the coupling? (Carry out at least one full rotation)
- Are the pipes properly fitted?
- Has the coupling guard been fitted?
- Have staff been informed about sources of danger and measures been taken to comply with the accident prevention regulations?
- Correct start-up procedure for suction lift operation.

- Is the unit protected against overload (appropriate safety valve)?
- Have the seals been fitted as described in the appendix?
- Have any additional devices been prepared and fitted as specified in the appendix?
- Has the pump been vented?

### Venting

Before start-up, the pump and the pipes must be vented and filled with the liquid to be pumped. This is done at the vent plug on the casing (903). For suction lift operation, the pump must also be evacuated, i.e. a vacuum must be produced.

### Commissioning

#### Checking the Direction of Rotation

#### Caution

For trouble-free operation of the pump, the correct direction of rotation of the impeller is of paramount importance.

If running in the wrong direction of rotation, the pump cannot reach its duty point; vibrations and overheating will be the consequence. The unit or the shaft seal might be damaged.

#### Correct direction of rotation:

The direction of rotation must correspond to the direction indicated by the arrow on the pump. This can be verified by switching the pump on and then off again immediately.



Before checking the direction of rotation make sure that there is no foreign matter in the pump casing.

**Never put your hands or any other objects into the pump!**

### Start-up

#### Caution

Dry-running will result in increased wear and must be avoided.

If a non-return valve is not fitted at the discharge-side, close the discharge-side gate valve.

If a shut-off valve is fitted in the suction line, open it fully.

All additional connections for flushing or sealing liquid etc., if fitted, must be opened fully and the flow must be checked.

Switch on the motor.

As soon as the pump starts to deliver - this can be recognised by the rising gauge pressure - slowly open the discharge-side gate valve fully.

#### Caution

The pump may operate against the closed gate valve only during start-up and shutdown, as otherwise inadmissible temperature rise occurs resulting in damage.

### Pump Operating Range

The flow rate "Q" adjusts itself automatically to the delivery head according to the H-Q characteristic. The pump's permitted operating range is subject to limits, which have separate causes.

#### 1. Part load operating limit for low flow rate

This limit is indicated in the H-Q characteristic by  $Q_{min}$  or by the discontinuation of the characteristic curve.

#### Caution

It is not permissible to operate the pump in the range from  $Q=0$  to  $Q_{min}$ . Prolonged operation in this range causes greatly increased mechanical loads which the components cannot withstand.

Brief passage through the critical range is permissible, e.g. during start-up.

#### 2. NPSH-related limits in the part load and overload ranges

### Shut down

Close the shut-off element in the discharge line. If the discharge line is equipped with a check valve, the shut-off element may remain open, provided there is back pressure in the line.



The shut-off element in the suction line must not be closed when switching off the pump. Switch off the motor, making sure that the unit runs smoothly down to a standstill.

Depending on the system the pump shall have an adequate after-run period - with the heat source switched off - to allow the medium handled to cool down sufficiently to avoid any heat build-up within the pump.

In the case of prolonged shutdown, the shut-off element in the suction line has to be closed.

Close the auxiliary connections.

In the event of frost and / or prolonged shutdowns, the pump must be drained or otherwise protected against freezing.

**Maintenance / Repair**
**General Instructions**

The operator is responsible for ensuring that all maintenance, inspection and installation work is carried out by authorized, duly qualified staff who are thoroughly familiar with these operating instructions.

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump with a minimum of maintenance expenditure and work.



**Work on the pump and the motor must only be carried out with the electrical connections disconnected. Make sure that the pump set cannot be switched on accidentally (danger of life!).**



**Pumps handling liquids posing health hazards must be decontaminated. When draining the medium see to it that there is no risk to persons or the environment. All relevant laws must be adhered to (danger of life!).**

**Maintenance / Inspection**
**Supervision of Operation**
**Caution**

The pump shall run quietly and free from vibrations at all times. The pump must never be allowed to run dry.



**Prolonged operation against a closed shut-off element is not permitted in order to prevent the medium handled from heating up.**

At room temperatures of up to 30 °C (86 °F) the bearing temperature shall be below 90 °C (194 °F). At higher room temperatures, the bearing temperature shall be below 100 °C (212 °F).



**During pump operation the shut-off element in the inlet line must not be closed.**

Any stand-by pumps installed shall be switched on and then immediately off again once a week to keep them operational.

Attention shall be paid to the correct functioning of the auxiliary connections.

**Caution**

If the flexible coupling elements begin to show signs of wear, they must be replaced in due time. See section "Coupling".

If an external supply of sealing, flushing or lubricating liquid is used, make sure supply pressure is higher than pressure at the suction nozzle.



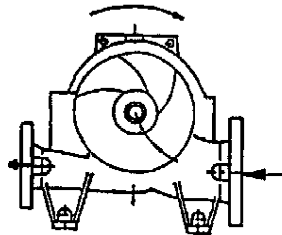
**The pump rotor must be locked whenever the pump is transported.**

O-rings and V-rings must be replaced and their seats on the shaft must be cleaned. In addition, all the sealing elements must be fitted into the respective components before installation.

For assembling the rotor, position the pump shaft (211) securely. All fits, threads and sliding fits of the shaft must be cleaned and coated with assembly paste.

Insert the keys required for assembly into the pump shaft (211).

Mount the impeller (234), which has a sliding fit. When fitting the impeller, observe the direction of rotation (see diagram below).



Put the casing wear rings onto the running surfaces of the impeller. Ensure that the bezels of the rings are on the outside (towards the bearing). Insert the pins required for fixing the casing wear rings.

The remaining components are fitted first on the movable bearing side (i.e. the drive side) of the pump shaft.

Push the shaft protecting sleeve (524.01) onto the pump shaft (211). Ensure that the groove provided engages in the key of the impeller.

Push the shaft seal housing (441) onto the shaft and install the shaft seal as described in "Gland packing". Slip on V-ring (411.01).

Insert the radial shaft seal ring (421.02) into the bearing cover (360) and push the bearing cover over the shaft.

Heat the deep-grooved ball bearing (321) and fit it onto the pump shaft (211). It is essential to avoid one-sided pressure or hammer blows on the outer races. The bearing is secured by the disc (550.01) and the circlip (932).

To fit the shaft protecting sleeve (524.01), shaft seal housing (441), V-ring (411.01) and bearing cover (360) at the non-drive end, proceed as described above for the drive side.

Heat the deep-grooved ball bearing (321) and fit it onto the sleeve (520).

Push the sleeve (520) with deep-groove ball bearing (321) onto the pump shaft (211) with key (940.01) inserted. Tension the rotor parts elastically with keywayed nut (920) and cup spring (950). For this purpose tension the cup spring (950) to blocking point and then undo the keywayed nut (920) again by half a turn (180°).

**Caution**

This measure is essential to compensate for differences in thermal expansion between the pump shaft (211) and the components fitted on it.

Rotor assembly is now complete.

Insert the rotor into the pump casing.

Apply Loctite 574 to the casing wear ring surfaces and the sealing surfaces of the casing.

Install the rotor, making sure that the direction of rotation is correct.

Align the rotor and ensure that the fixing pins are correctly seated in the casing.

The pins (561.01) must be positioned as shown in the diagram below.

The bearing housings (350.01) must be fastened to the bearing brackets by means of the screwed connections (901.04), with the sealing cap (580) inserted at the non-drive end. The seating positions are determined by the recesses.

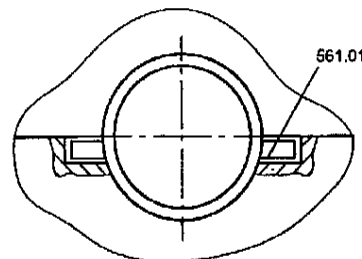
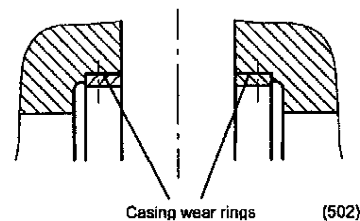
Fit the bearing covers.

To assemble the casing cover, apply Loctite 574 to the casing joint surface of the lower casing half.

Tighten the flange bolts diagonally from the inside towards the outside.

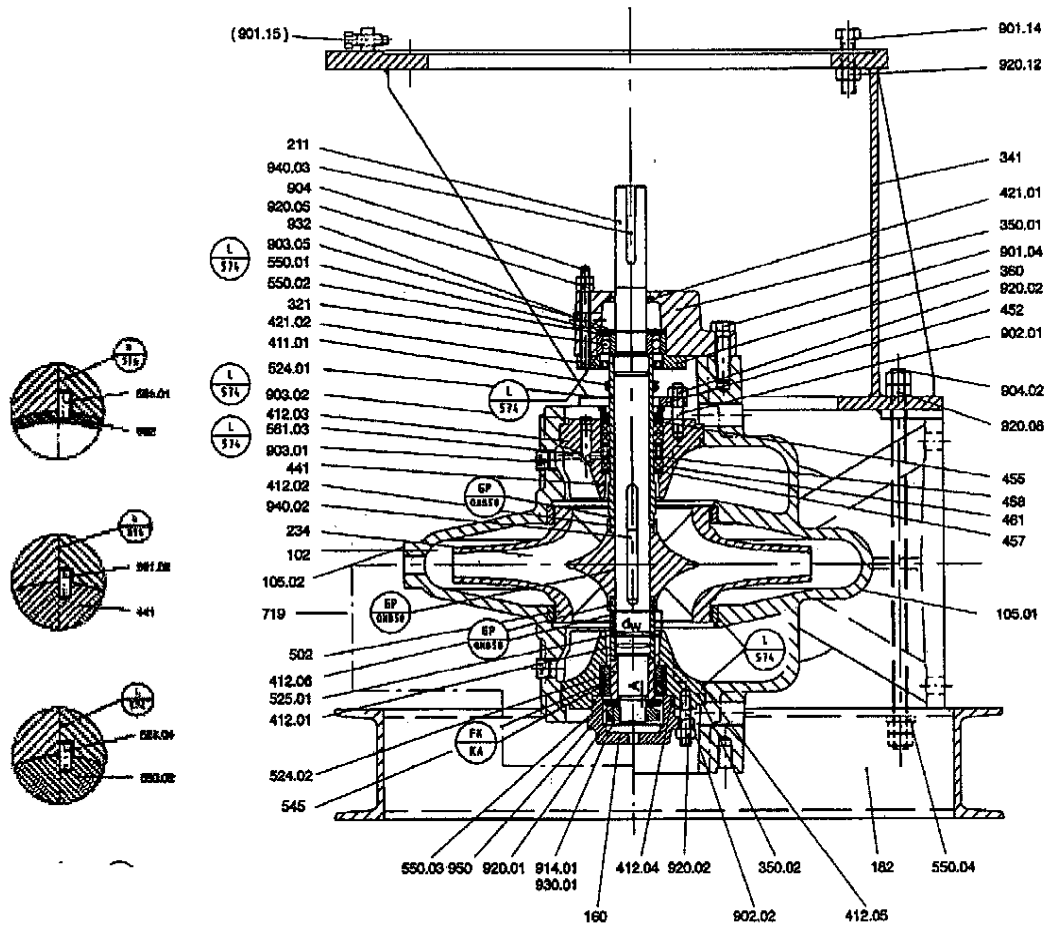
Insert the key for fitting the coupling into the pump shaft (211).

When fitting the coupling and accessories, refer to the relevant section of the operating instructions.



General drawing of pump with parts list

Shaft seal: Gland packing / DB



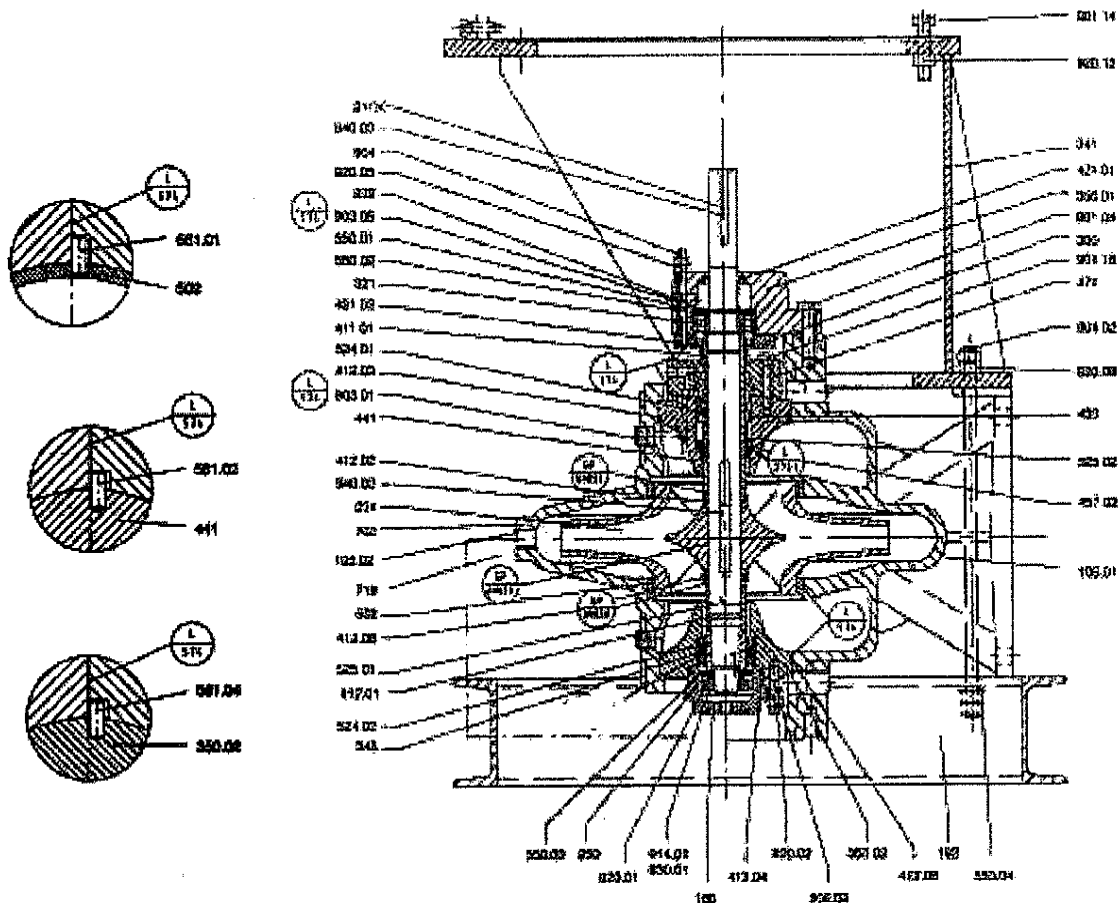
Part no.	Description
102	Volute casing
105.01	Lower casing half
105.02	Upper casing half
160	Cover
182	Foot
211	Pump shaft
234	Impeller
321	Deep groove ball bearing
341	Motor stool
350	Bearing housing
360	Bearing cover
411	V-ring
412	O-ring

Part no.	Description
421	Radial shaft seal ring
441	Housing for shaft seal
452	Gland cover
455	Stuffing box insert
457	Neck ring
458	Lantern ring
461	Gland packing
502	Casing wear ring
503	Impeller wear ring
524	Shaft protecting sleeve
525	Spacer sleeve
531	Locking sleeve
545	Bearing bush

Part no.	Description
550	Washer
561	Grooved pin
719	Hose
901	Hexagon head bolt
902	Stud
903	Screwed plug
904	Grub screw
914	Socket head cap screw
920	Nut
930	Safety device
932	Circlip
940	Key
950	Cup spring

General drawing of pump with parts list

Shaft seal: Mechanical seal / DB

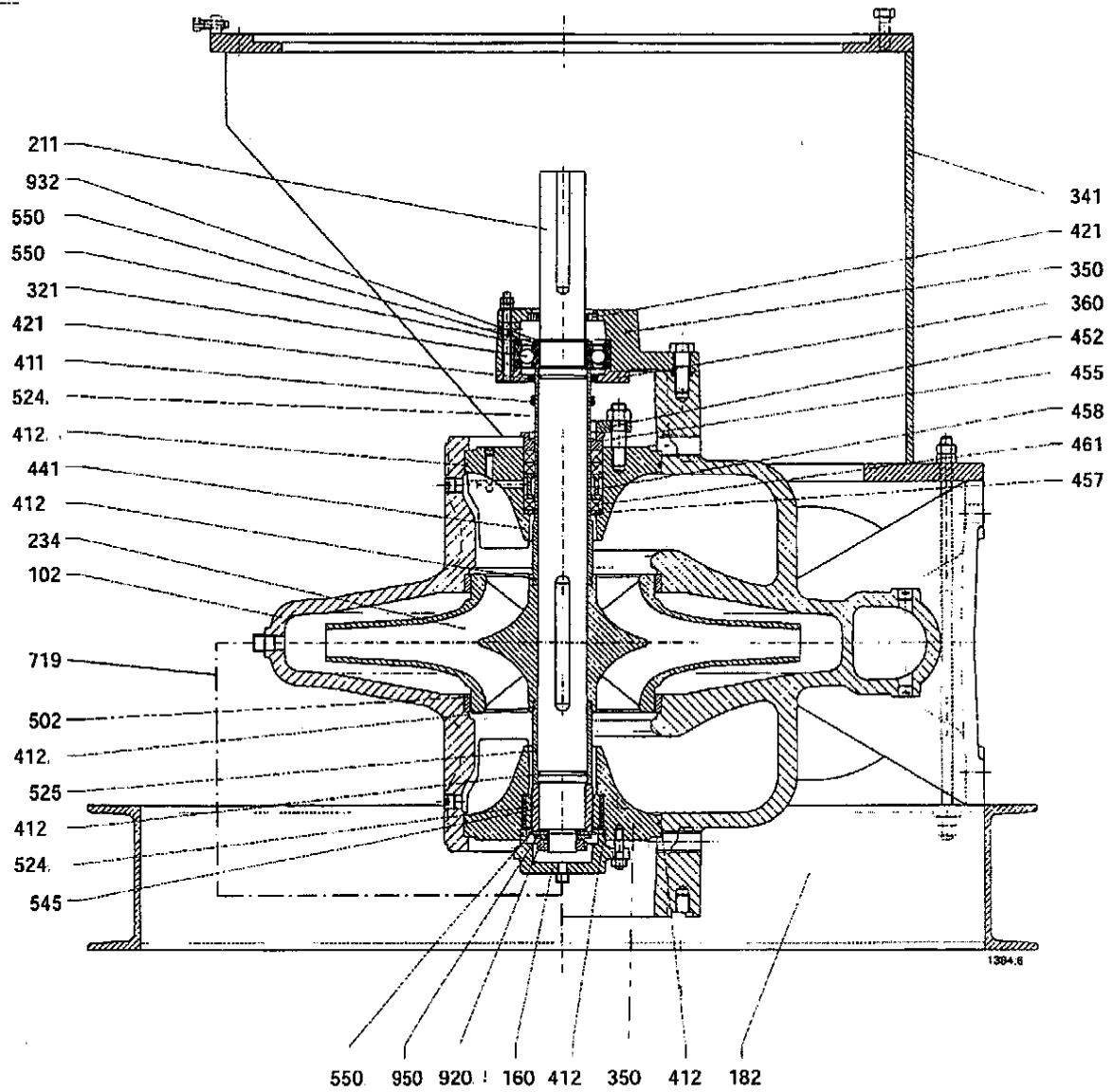


Part no.	Description
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Part no.	Description
421	Radial shaft seal ring
433	Gland packing
441	Housing for shaft seal
457	Neck ring
458	Lantern ring
502	Casing wear ring
503	Impeller wear ring
524	Shaft protecting sleeve
525	Spacer sleeve
531	Locking sleeve
545	Bearing bush
550	Washer
561	Grooved pin

Part no.	Description
719	Hose
901	Hexagon head bolt
902	Stud
903	Screwed plug
904	Grub screw
914	Socket head cap screw
920	Nut
930	Safety device
932	Circlip
940	Key
950	Cup spring

**General drawing**  
Vertical installation





## MATERIAL OF CONSTRUCTION

ITEM#	DESCRIPTION	CONDSTRUCTION MATERIALS
102	Volute Casing	Cast Iron JL1040
160	Cover	Cast Iron JL1040
182	Foot	Structural Steel
211	Pump shaft	Quenched and tempered steel
234	Impeller	Cast Bronze G-CuSn10
321	Deep groove ball bearing	Long life Bearing sealed for life
341	Motor Stool	Cast Iron JL1040
350	Bearing housing	Cast Iron JL1040
360	Bearing cover	Cast Iron JL1040
411	V-Ring	Cast Iron JL1040
412	O-Ring	Viton
421	Radial shaft seal ring	Bonze GZ-CuSnPb
441	Housing for shaft seal	Cast Iron JL1040
452	Gland	Bonze GZ-CuSnPb
461	Gland packing	Cast Iron JL1040
455	Stuffing box insert	Bonze GZ-CuSnPb
457	Neck ring	Bonze GZ-CuSnPb
458	Lantern ring	Bonze GZ-CuSnPb
502	Casing wear ring	Bonze GZ-CuSnPb
524	Shaft protecting sleeve	Duplex steel
525	Spacer sleeve	316 stainless steel
545	Bearing bushing	316 Stainless steel
550	Washer	Cast Iron JL1040
719	Cap	Cast Iron JL1040
920	Nut	Steel AISI 1045
932	Circlip	Steel AISI 1045
950	Spring	Stainless Steel

Only on pumps with packed stuffing box.

**Mechanical Seal**
**Caution**

Dry-running of the seal must be avoided at all costs!

**Installation**

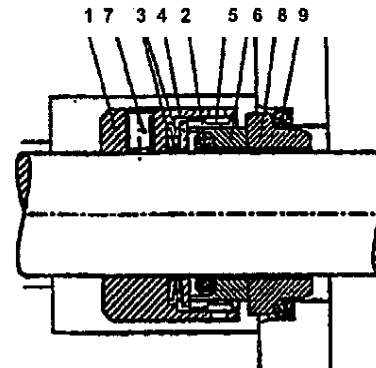
For the installation of the total seal assembly (mechanical seal, seal housing) see operating instructions for the pump.

The shaft protection sleeves and also the surfaces of the casing are subjected to accurate finishing processes with regard to the O-ring seats. In order to achieve a complete and reliable seal. Care must be taken during installation to keep these parts absolutely clean, to avoid the surfaces from being damaged and prevent entry of foreign particles.

The seat ring (8) together with the relevant O-ring (9), is fitted into the seal cover (see general drawing). The O-ring can be lubricated for easy sliding movement. Special attention must be given to ensure that pressure is applied evenly. The contact surfaces are generally fitted dry.

rotating assembly is supplied as one unit, consisting of a housing and pin ( 1 + 5), fitted spring loaded ring (6), O-ring (2), spring (3), thrust plate (4) and grub screws (7). The grub screws (7) must be loosened so far as to prevent them from protruding from the housing (1) at the inner diameter. The O-ring (2) can be slightly lubricated to facilitate assembly.

The complete rotating assembly is pushed onto the shaft protection sleeve in compliance with the installation dimensions which are given in the mech. seal drawing, or until it reaches the stop on the shaft protection sleeve. Finally the grub screws are tightened and secured with LOCTITE.



Item	Description	Material	No. of Items
1	Housing	Cr-Ni-Mo steel	1
2	O-ring	Viton	1
3	Spring	Cr-Ni- Mo steel	1
4	Thrust plate	Cr-Ni- Mo steel	1
5	Pin	Cr-Ni- Mo steel	2
6	Spring-loaded ring	Si-SiC	1
7	Grub screw	Cr-Ni- Mo steel	2
8	Seat ring	Si-SiC	1
9	O-ring	Viton	1

**Special instructions for mechanical seal assembly**

- The contact faces must only be cleaned with propyl alcohol and paper tissue.
  - Never use cleaning rags or cloth.
  - Clean carefully to remove any smears.
- Do not touch the contact faces with bare fingers.
- Never use force during mechanical seal assembly.
- Never put the spring-loaded ring and the seat ring face down on the contact faces without the protective wrapping.
- Cover the contact face with a cardboard washer and press the seat ring into its position slowly and evenly, lubricating it with a generous amount of water or alcohol. Use a spacer sleeve, if necessary. Verify that the seat ring position is normal to the shaft axis.
- In the mechanical seal area, the shaft shall be slightly lubricated with water, alcohol or silicone grease. Sealing elements made of EP rubber must never come into contact with mineral oil base lubricants (swelling, possibly decomposition).



## SERIES 4800

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### Commissioning

Flood the pump and the seal chamber with the medium to be handled and vent carefully. The seal is operational now.

On **single-acting** mechanical seals, the **pressure in the seal chamber** of the pump (stuffing box) must always **exceed ambient pressure**, to prevent any **air intake** at the seal faces, which would result in dry running and thus **failure of the mechanical seal**.

In **all operating conditions**, the product to be sealed off must be available in **liquid state** at the mechanical seal, particularly during pump start-up and shutdown. This must be ensured by appropriate facilities on the pump (e.g. heating).

Should the mechanical seal fail, the liquid to be sealed off may **spurt out**. Take suitable precautions to prevent hazards to persons and the environment, e.g. install splash guards, wear safety goggles, etc. **Proper disposal** of leakage shall be arranged for and supervised by the operator.

### Maintenance

Mechanical seals operated in compliance with the manual are **maintenance-free** in their entire service life.

The mechanical seal should be inspected in accordance with the plant inspection schedule.

During planned plant outage periods the spring-loaded rings and the seat rings should be checked for visible damage in installed condition.

If the mechanical seal is inspected during plant outage, the contact faces should be re-worked.

### Dismantling

For dismantling of the mechanical seal assembly please refer to section 7.3 "Dismantling". Grub screws (7) and joint rings (2+9) shall be replaced whenever the mechanical seal has been dismantled!

### Repair

If the seal needs to be repaired, always return the **complete seal** to the manufacturer. The manufacturer will know best which parts can be re-worked and which parts have to be replaced to ensure an optimum sealing effect.

**Trouble-shooting**
**General**

The faults listed below shall serve as orientation only when determining failure causes.

In a complex plant system, all other components will have to be included in the search for possible failure causes.

The coupling shall give low-noise and vibration-free operation in all phases of operation. Any other operating behaviour shall be considered a fault which must be remedied immediately.

**Trouble-shooting list**

Fault	Possible causes	Remedy
Sudden change in noise level and/or sudden vibrations	Misalignment	Shut down the unit.  Eliminate cause for misalignment, if any. (E.g. re-tighten the foundation bolts).  Inspect for wear, proceed as described in section "Coupling – Maintenance and Repair"
	Flexibles are worn	Shut down the unit.
	Torque transmission by metal-to-metal contact durch Metallkontakt	Dismantle the coupling and remove what is left of the flexible coupling blocks.
		Inspect the coupling parts and replace any damaged components.
		Coupling blocks shall always be replaced by complete sets of new coupling blocks; only use coupling blocks with identical markings.
		Verify alignment and correct, if necessary.
Check the tightening torques of the screwed connection between parts 2 and 3.		



Before commencing any maintenance, repair or other work on the coupling, the operator must shut down the entire driving mechanism. The drivers, in particular, must be secured against inadvertent start-up

Also, the accident prevention regulations in force at the installation site shall be complied with.

**Maintenance and repair**
**General**

The torsional play between the two coupling parts shall be checked in acc. with the maintenance schedule of the plant, but at least once a year.

If torsional play must not be limited for extremely smooth coupling operation, the plastic flexibles can be allowed to wear down to approx. ¼ of their original thickness before they have to be replaced. To assess the wear condition of the coupling blocks, the table below indicates the permissible torsional play as indicated by the chord dimension  $\Delta S_v$  on the outside coupling diameter.

To determine the chord dimension  $\Delta S_v$ , rotate one coupling part by hand up to the stop and mark the coupling parts (see illustration). Hand-rotate one coupling part into the opposite direction up to the stop. The two marks will diverge. The distance between the marks is the chord dimension  $\Delta S_v$ . If  $\Delta S_v$  exceeds the value given in the table, the flexible coupling blocks have to be replaced.

**Caution**

Coupling blocks shall always be replaced by complete sets of new coupling blocks; only use coupling blocks with identical identification numbers.