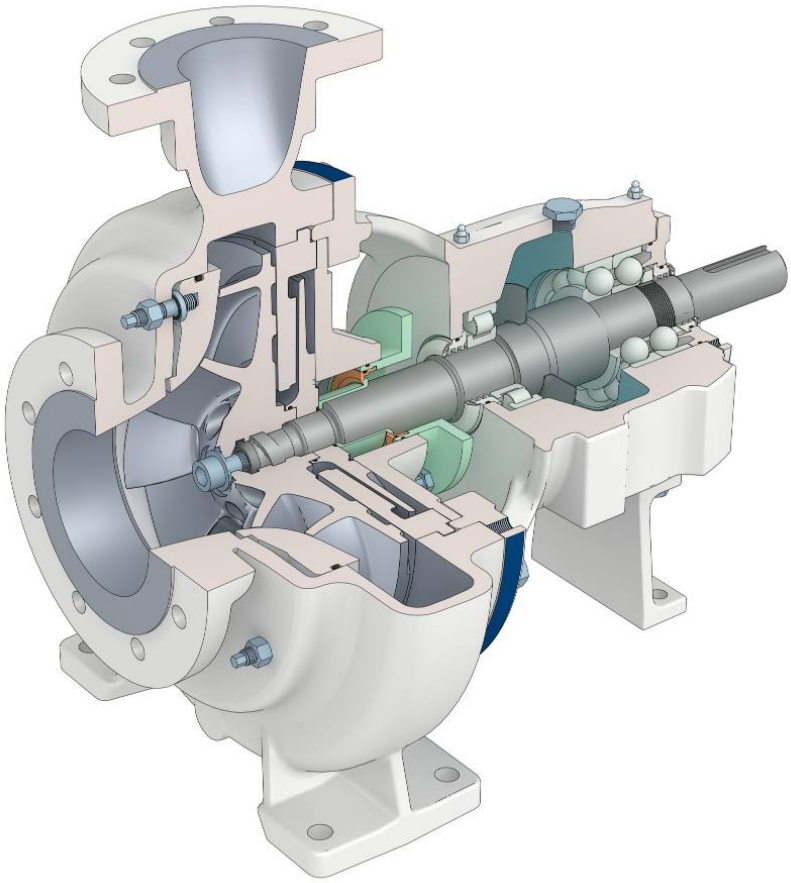
SULZER

SPP id: 120928 / Replaces 120601 / en / **N31566** / 3

AHLSTAR

PROCESS PUMPS



Installation, operation and maintenance instruction

Intended use
Safety instructions
Hoisting and transportation
Commissioning
Installation
Operation
Preventive maintenance
Corrective maintenance
Spare parts recommendation

Installation, operation and maintenance instruction

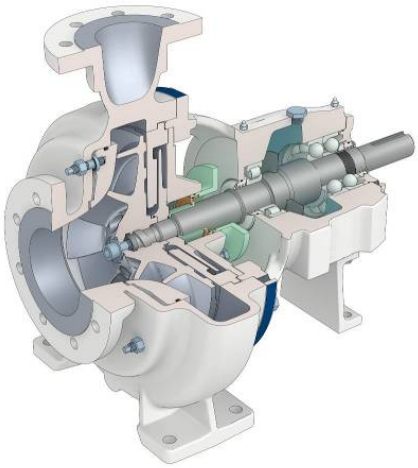
G	ISO	N31566	Cover	Jun - 12	
G	ISO		Table of contents		
G	ISO	N31567	Intended use	Sep - 11	
G	ISO	N31568	Safety instructions	Sep - 12	
G		N31569	Hoisting and transportation	Jun - 12	
G		N31570	Commissioning	Sep - 11	
G	ISO	N31571	Installation	Jun - 12	
G	ISO	N31572	Operation	Jun - 12	
G	ISO	N31573	Preventive maintenance	Jun - 12	
G	ISO	N31574	Corrective maintenance	Sep - 11	
G	ISO	N31575	Spare parts recommendation	Sep - 11	

SULZER

SPP id: 110901 / en / **N31567** / 1

AHLSTAR

PROCESS PUMPS



Intended use

1 General

WARNING

The pump and its accessories may only be used for the purpose for which they have been supplied.

The intended use is given in the order specification and in the following instructions concerning the main pumping parameters and mechanical durability. If the intended use changes, the user must make sure that the pump can be used in the new application and, if necessary, obtain the manufacturer's permission for the change.

Table 1, Intended use in the process

Application data:	**Sources:**
Pumped liquid and its properties (chemicals, solids, consistency, temperature etc.)	Product specification (under "Process data")
Main pumping parameters (capacity, head, speed etc.)	Product specification (under "Process data") and nameplate of the pump
Other necessary process data	Product specification (under "Process data")

Table 2, Delivery and design

Delivery and design data:	**Sources:**
Product scopes (modules)	Product specification
Product size	Product specification and nameplate of the pump
Other design alternatives (impeller type and size, materials, lubrication, flange drillings, shaft sealing type etc.)	Product specification
Dimensions (pump, accessories, flanges etc.)	Dimensional drawings
Weights and mass moments of inertia (bare pump, pump + baseplate etc.)	Dimensional drawings
Connections (lubrication, shaft seal, drainage etc.)	Location shown in the parts list and in the sectional drawings and dimensional drawings. Moreover, connections having importance in view of safety have been marked on the product.
Part details (maximum impeller diameter, bearing types, fastener sizes etc.)	Parts list (under heading "Parts")

This instruction set covers the process pump with the supplementary accessories included in the delivery. All supplied instructions are found in the parts list under the heading "Customer instructions".

Before commissioning, the operating staffs have to be instructed in the guidelines for correct and safe operation of the product as stated in these instructions. This product must be serviced by qualified personnel who are familiar with the design and operation of this product and the system with the essential safety aspects involved. The scope of responsibilities and supervision of the personnel must be exactly defined by the plant operator.

Our guarantee will be valid only if the installation, operation, maintenance and repairs of this pump are carried out in accordance with these instructions. The plant operator is to make sure that the contents of these instructions are fully understood by the operating personnel.

To assure a steady start-up, supervision or service from an authorized manufacturer representative is recommended. During operation, periodic inspections should be made to assure safe operation under the prevailing conditions.

Any modification may be made to the product only after consultation with the manufacturer. Using spare parts and accessories authorized by the manufacturer is a relevant safety aspect. Only genuine spare parts which are in accordance with the original delivery (in the parts list) are to be used. Use of other parts may exempt Sulzer from any liability.

If any assistance regarding the product or its instructions is required, please contact our local representative for a quick supply of the information you need.

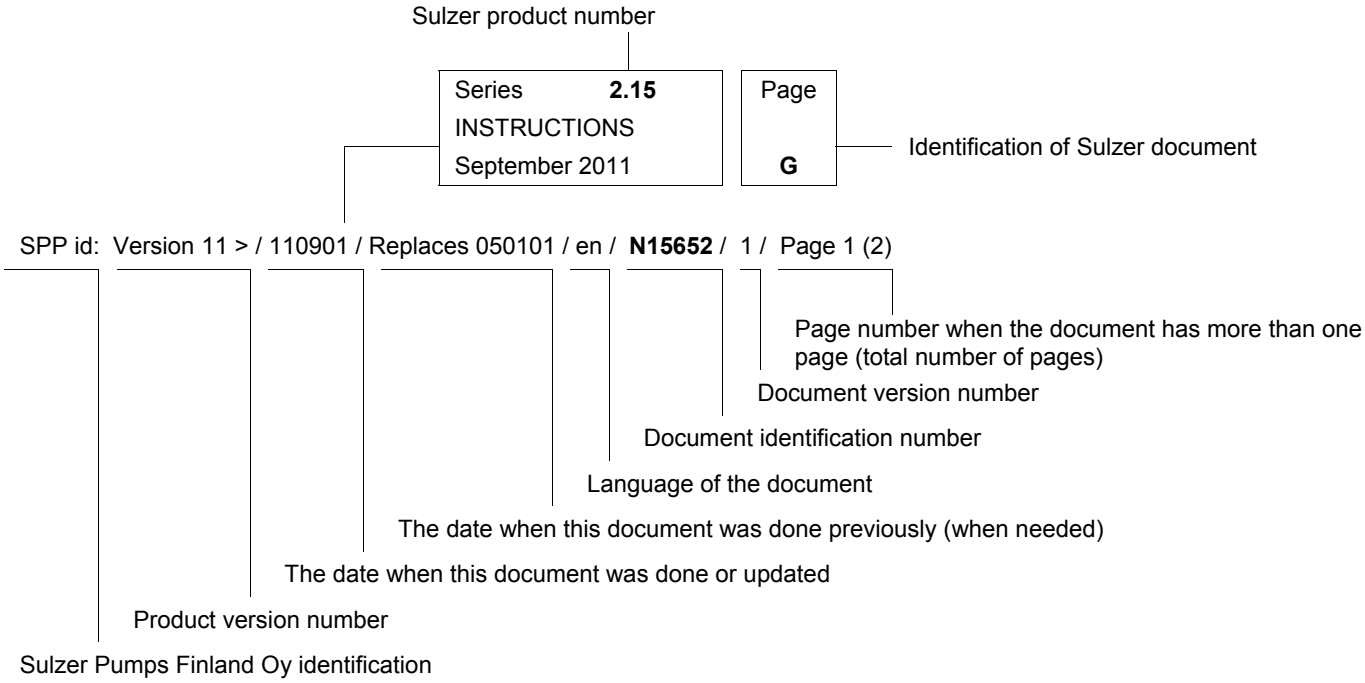
The enclosed instructions regarding a possible long-term storage (more than 3 months) must be observed.

All customer instructions regarding this product and its main components are also available in an electronic format for viewing and printing (depending on the end user's software & hardware). If electronic format is needed, please contact our local representative for further information.

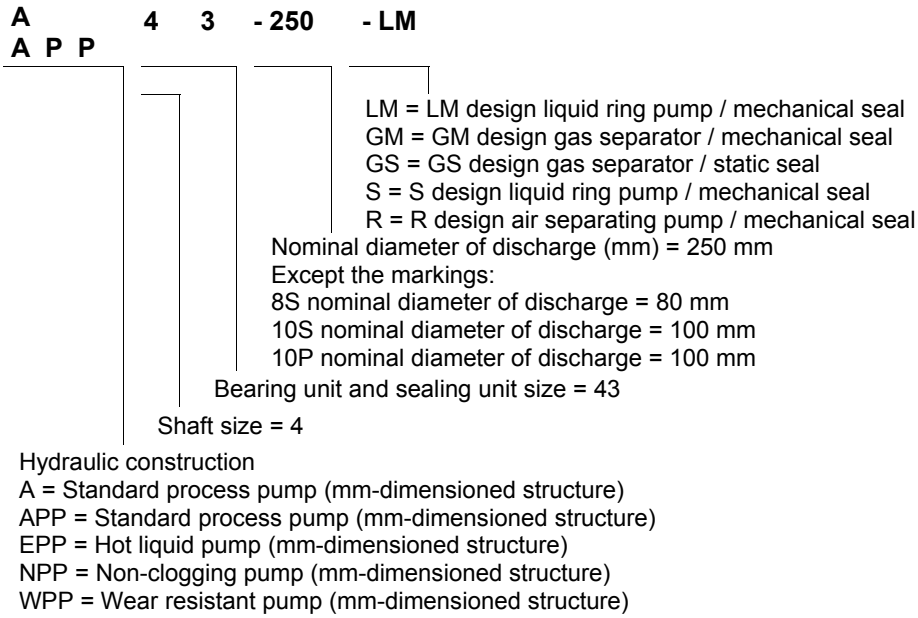
If the delivery includes customer instructions or other information in an electronic format which can be edited, we are only responsible for the contents of paper versions of these instructions and other information supplied by us.

Keep these instructions at the place of operation for further reference!

2 Document identification



3 Type designation



4 Parts number designation

4.1 Part numbers of modules

The delivery may include the entire pump product (PUPR.0) and/or pump spare parts. The installation-ready pump unit is divided into the following modules: pump (PUMP.0), assembly (ASSE.0), drive unit (DRUN.0), measuring instrumentation (MEIN.0), external degassing system (DESY.0) and documents (DOCU.0).

The pump (PUMP.0) is divided into the following modules: wet end (WEEN.1), sealing unit (SEUN.2) and bearing unit (BEUN.3). The assembly is divided into the following modules: sealing water equipment (SWEQ.4), coupling unit (COUN.5) and baseplate (BAPL.6). The drive unit (DRUN.0) is divided into two parts: motor (DRMO) and frequency converter (FRCO). Documents are divided into two categories: documents supplied with the delivery and documents supplied separately.

4.2 Part numbers of parts, connections and documents

Parts, which have part numbers consisting of a three/four-digit number plus two digits after a dot. The first digit after the dot shows the number of the delivery unit or module in question, while the second digit distinguishes parts of the same type from each other.

In the part number, the first digit after the dot is determined by the module. For instance, o-ring 412.11. If the module has many parts with the same name, the second digit after the dot distinguishes the parts from each other. For instance, 412.12 is the second o-ring in the wet end (WEEN.1).

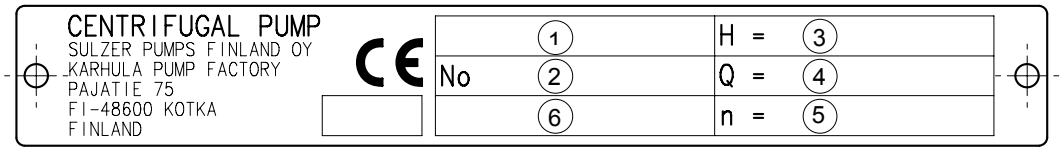
Connections, which have part numbers consisting of the initial letter C, a two-digit number plus two digits after a dot. The first digit after the dot shows the number of the delivery unit or module in question, while the second digit distinguishes connections of the same type from each other.

Documents, which have part numbers consisting of the initial letter D, a two-digit number plus two digits after a dot. The first digit after the dot shows the number of the delivery unit or module in question, while the second digit distinguishes documents of the same type from each other.

5 Nameplate designation

The following nameplates have been attached to the volute casing (102.11) of each pump:

- Nameplate (971.01), showing the pump's identification data and flow properties. Fig. 1.
- Patent nameplate, showing the patents protecting the product. Fig. 2.
- ATEX nameplate (982.01), if the product is designed for use in potentially explosive environments. Fig. 3 and Fig. 4.



Marking:
1 Pump type
2 Serial No. = Job No.
3 Head (m) (ft)
4 Capacity flow (l/s)
5 Speed of rotation (rpm)
6 Space for customer Pos. No.

Fig. 1

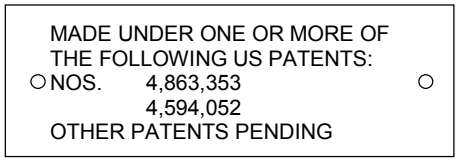


Fig. 2

c = The protection class used is constructional safety
T3 = Temperature class, indicates the maximum surface temperature (200ºC)
Ex = Explosion protection marking
II = Equipment group
2 = Equipment category
G = The equipment is used in explosive atmospheres caused by gases, vapours or mists
CE marking and the mark of the notified body.
0123 = TÜV Product service, München

Fig. 3

c = The protection class used is constructional safety
T3 = Temperature class, indicates the maximum surface temperature (200ºC)
Ex = Explosion protection marking
II = Equipment group
3 = Equipment category
G = The equipment is used in explosive atmospheres caused by gases, vapours or mists

Fig. 4

6 Capacity and head

The pump is always dimensioned according to the pumping values (flow, head) stated in the nameplate (971.01) of the pump. Flow and head values that can be reached with the specific impeller diameter and operating speed are given in the characteristic curve of the pump. The operating point on the curve can be changed by adjusting the pumping system resistance e.g. by throttling the flow with the valve in the discharge piping. If the impeller diameter or the rotational speed of the pump is changed, then the operating point will move totally to another head-flow curve.

The pump must not be used at other operating points without the following verifications:

- When the pump was selected in the original operating point, all factors affecting the mechanical durability (e.g pressure and temperature limits) and pump design (pump, impeller type, shaft sealing and lubrication etc.) were carefully considered. All these factors are to be checked also in the new operating point.
- The pump could temporarily operate even with the discharge valve closed. For continuous operation, a minimum flow is still required. The required suction head (NPSH required) curve presented in the characteristic curve always starts from the point of the minimum continuous flow allowed.
- The suction properties of the system (NPSH available) and drive motor power are always to be checked in a new operating point.
- The efficiency of a pump is a relevant factor when estimating the lifetime costs of the pump. Therefore its influence on the power need must be checked.
- The characteristic curve enclosed is always based on tests with clean water. Other types of pumped liquid can change the head, flow or power need values radically. These factors were recognized when the pump was originally selected and they must be considered also in the new operating point.

7 Decommissioning

Sulzer Pumps' products are designed so that their service would be as easy as possible by replacing worn or damaged parts with new, original Sulzer spare parts. Parts can also be re-used after reconditioning them at Sulzer Customer Support Service Centers. Sulzer Customer Support Service Centers must be used in the assessment of re-use and reconditioning. If you need additional instructions or guidance, please contact our representative.

The materials used in Sulzer Pumps' products are disclosed in the parts list supplied with the product.

At the end of the life cycle of a product or its parts, the appropriate materials and parts must be recycled or disposed of using methods which are acceptable in terms of environmental protection and which conform to local legislation and regulations. If a product or its part contains environmentally harmful substances, they must be removed and disposed of by following valid regulations.

Packaging materials must be recycled or disposed of using methods which are acceptable in terms of environmental protection and which conform to local legislation and regulations.

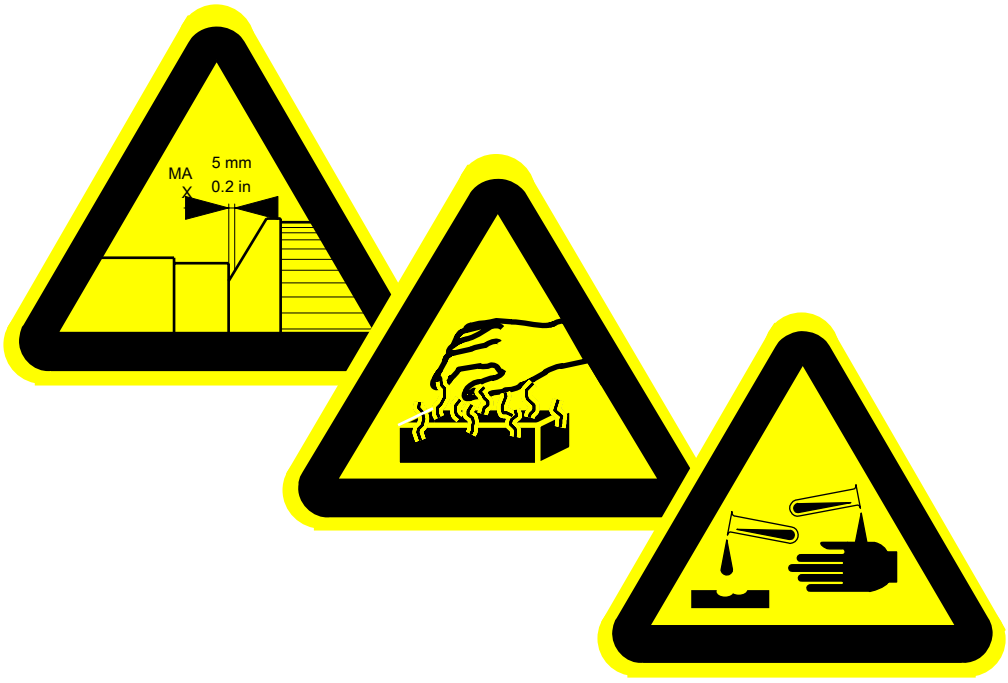
Make sure that hazardous substances are disposed of safely and that the personnel use appropriate personal protective equipment. Safety considerations must always meet the requirements of valid regulations.

SULZER

SPP id: Version 14 > / 120928 / Replaces 120601 / en / **N31568** / 3

AHLSTAR

PROCESS PUMPS



Safety instructions

1 General

This product is designed and tested for safe and reliable operation in the application for which it is specified and sold. Remember, a pump is a piece of equipment with pressure containing parts and rotating elements which can cause a hazard. Therefore, all the safety measures in the instructions are to be followed strictly. Personal injuries may result if the instructions are not observed and followed.

It is not only the general safety instructions contained under this main heading ”Safety instructions” which are to be observed, but also the specific safety information presented in other instructions relating to this delivery, relevant national safety regulations or any other safety information issued by the plant operator.

The exact and detailed process and application data is relevant for the safe and reliable operation of the product. Special environmental conditions at the place of installation should always be checked between the end user and manufacturer. Such conditions are e.g.

- Abnormal temperature
- High humidity
- Corrosive atmospheres
- Pressure fluctuations
- Falling below the minimum permissible flow, dry running
- Explosive and/or fire risk zones
- Dust, sandstorms
- Earthquakes

Special safety measures are also needed when the type of liquid to be pumped is e.g. the following:

- Flammable
- Corrosive, abrasive
- Poisonous
- Crystallizing
- Solid containing
- Gas containing

Non-compliance with the safety and specific operating instructions may produce a risk to the personnel as well as to the environment, e.g.

- Failure of important functions of the pump and/or plant
- Failure of specific procedures of maintenance and repair
- Exposure of people to electrical, mechanical and chemical hazards
- Endangering the environment owing to hazardous substances being released

2 Safety of machinery

2.1 General

Our delivery does not include the design of the operating environment of the machine, nor the power circuits, control circuits and controls for the machine required in the operation of the machine. However, the European Machinery Directive 2006/42/EC on safety of machines and/or corresponding national legislation of the country where the machine is used are mandatory in terms of essential health and safety requirements related to the operation of the process.

We require that the Customer has taken into account the essential requirements laid down in this instruction when designing, purchasing and starting up the process control systems, other controls and equipment related to the machine. Some of these requirements also concern the personnel in charge of the operation of the machine.

As far as the above is applicable, the Customer must also ensure that the valid legislation on electrical safety (such as low-voltage directive) or electromagnetic compatibility of equipment (EMC directive) is followed.

During the operation of the machine, valid occupational safety legislation of the country where the machine is used must also be followed.

2.2 Essential health and safety requirements

2.2.1 General remarks

2.2.1.1 Definitions

When necessary, the potential danger zones related to the machine and its operating environment, persons exposed within the danger zone and all operator groups of the machine must be specified jointly between the Customer and the Manufacturer, for example for the purpose of introductory training arranged for the operators of the machine.

2.2.1.2 Principles of safety integration

As a machine manufacturer, we have, in accordance with the contents of the delivery, followed the Machinery Directive and/or the national legislation of the country where the machine is used in order to ensure safety integration.

The installation, operating and safety instructions supplied with the machine must be followed on receipt of the machine, in installing it at the point of operation and in its operation. Prior to final start-up, it must be ensured that the machine, its controls and other equipment related to a safe use of the machine fulfill the requirements laid down in the Machinery Directive and/or in national safety legislation.

2.2.1.3 Materials and products

The products related to the use of the machine (liquids transferred in the process) must not endanger the exposed persons' safety or health. The process where the machine is used must be designed so that the use of liquids causes no hazard.

2.2.1.4 Lighting

Maintenance areas necessary for the regular inspections of the machine must be provided with appropriate lighting.

2.2.1.5 Design of machinery to facilitate its handling

The environment of the machine must be designed so that, in order to facilitate the handling of the machine or its various components, standard lifting gear can be attached above the machine if necessary. The environment must be designed so that the various components can be handled safely in other respects as well. The handling and lifting instructions supplied with the machine must be absolutely followed.

2.2.2 Controls

2.2.2.1 Control and stopping devices

The controls of the machine must be safe and constructed in a way that will prevent a dangerous situation arising.

When designing the controls, the specified requirements laid down in the Machinery Directive and/or in the national legislation of the country where the machine is used must be absolutely followed in terms of controls, starting devices, stopping devices (including emergency stop devices) and selection of control and operating modes for the machine and combinations of machinery.

The controls of the machinery must be designed so that fluctuations in energy supply or failures in the control circuit do not lead to dangerous situations. The interactive software used in the controls between the operator and the machine must be user-friendly.

2.2.3 Protection against mechanical hazards

2.2.3.1 Stability

Our delivery includes the appropriate accessories for securing the machine to the foundations. The installation instructions supplied with the machine must be absolutely followed in order to ensure sufficient stability of the machine/combination of machinery.

2.2.3.2 Risk of break-up during operation

The piping and hoses connected to the machine must be able to withstand the anticipated internal and external stresses, and they must be firmly secured and protected against all loading and stress.

The instructions concerning the purpose of the machine, limitations of use, allowable flange forces and support of piping, supplied with the machine, must be absolutely followed. During operation, there is always a risk of rupture in the piping connected to the machine (risk of high-pressure/hot/harmful liquid spray) if the supplied instructions are violated.

2.2.3.3 Risk due to falling or ejected objects

Necessary precautions must be taken to prevent risks from falling or ejected objects (e.g. tools used during installation).

2.2.3.4 Risks due to sharp edges or angles

Due to the purpose and design of the machine, its parts have sharp edges and/or angles. During installation and maintenance, the instructions supplied with the machine must be followed, and the appropriate personal protective equipment must be used.

2.2.3.5 Risks related to variations in the rotational speed

The instructions supplied with the machine show the intended rotational speed of the machine and its maximum rotational speed limits. The selection and adjustment of rotational speed must be performed so that these instructions are adhered to.

2.2.3.6 Prevention of risks related to moving parts

The fixed guards used for preventing risks related to moving parts in the machine must be absolutely kept in place while the machine is running. If a guard is not included in the delivery, it must be ensured prior to start-up that the rotating parts are provided with guards in accordance with the valid legislation. If rotating parts of the machine seize accidentally during operation, the machine must be stopped immediately and the cause of the fault must be ascertained in accordance with the instructions supplied with the machine.

2.2.4 Protection against other hazards

2.2.4.1 Electricity supply

The electrical drives of the machine must be designed, constructed and equipped so that all hazards of an electrical nature can be prevented. The specific rules and valid legislation in force related to electrical equipment must be absolutely followed.

2.2.4.2 Static electricity

The build-up of potentially dangerous electrostatic charges in the machine and its auxiliary equipment must be prevented or restricted.

2.2.4.3 Errors of fitting

Errors made when fitting parts of the machine can be a source of risk. For this reason, the instructions supplied with the machine must be absolutely followed during the installation and repairs of the machine.

Faulty liquid and electrical connections can also be a source of risk. With liquid connections, the instructions supplied with the machine must be followed. Faulty electrical connections must be made impossible by the design, or information on the risk must be given on cables and connectors.

2.2.4.4 Extreme temperatures

If necessary, the machine must be provided with warnings concerning high surface temperatures. In these cases, additional steps should be taken to eliminate any risk of injury caused by contact with or proximity to machinery parts. Maintenance requires the heating of some parts prior to installation. Carefulness is imperative during installation, and appropriate personal protective equipment must be used during installation.

2.2.4.5 Fire and explosion

Exact and detailed information on the process and the purpose for which the machine is used are essential in terms of safe operation of the machine. The specific circumstances prevailing at the point of use must always be checked between the Customer and Manufacturer when the machine is being selected.

With equipment intended for use in potentially explosive atmospheres (ATEX), see section 5 (Ignition hazard assessment.

2.2.4.6 Noise and vibration

The instructions supplied with the machine provide information on the emission of airborne noise and on the balancing of rotating parts of the machine. The data given must be taken into account and necessary steps must be taken in order to eliminate any risks caused by noise or vibration in accordance with the circumstances prevailing at the point of use.

2.2.4.7 Radiation

The instructions supplied with the machine provide information on the emission of radiation potentially involved in the measuring equipment of the machine. The operators of the machine must absolutely follow the safety instructions concerning the use of this equipment.

2.2.4.8 Emissions

The instructions supplied with the machine provide information on the control of leakages in the immediate proximity of the machine. If necessary, the following steps must be taken to eliminate harmful emissions involved in the process:

- account of the emissions and their potential consequences (e.g. possibility of fire, appropriate extinguishing equipment)
- preventing exposure of operators
- controlled containment and evacuation of emissions
- cleaning of emissions and machinery
- appropriate personal protective equipment and warnings

2.2.4.9 Slipping, stumbling and falling

When installing, servicing and repairing the machine, the instructions supplied with the machine, safety instructions applicable at the point of use and sufficient care and attention must be followed in order to prevent any slipping, stumbling or falling.

2.2.5 Maintenance

2.2.5.1 Machinery maintenance

The maintenance and repair instructions supplied with the machine must be absolutely followed. The instructions specify separately which measures require stopping and potential draining of the machine. Appropriate personal protective equipment as required by the work performed must always be used, e.g.:

- hearing protectors
- eye protectors
- breathing protectors
- safety gloves, safety footwear, protective clothing

When servicing and repairing the machine, principles of ergonomics (avoiding excessive use of muscular power, utilization of lifting gear, lifting positions, lighting of the area, cleanliness etc.) must also be taken into account.

2.2.5.2 Access to operating position and servicing points

Where the location design for the machine is not included in the delivery, steps must be taken to situate the machine at the point of operation in a manner that enables safe maintenance and repairs of the machine. Provision of sufficient maintenance space around the machine must be taken into account in the design of the operating environment.

2.2.5.3 Isolation of energy sources

The controls of the machine must be designed so that they include clearly identified devices that can be used to isolate the machine from all energy sources. These devices must be capable of being locked if reconnection of energy could endanger exposed persons. After the energy is cut off, it must be possible to dissipate any energy remaining or stored in the process (e.g. discharging pressure) without risk to exposed persons.

2.2.5.4 Operator intervention

The controls of the machine must be designed so that the need for operator intervention is limited.

2.2.5.5 Cleaning of (internal) parts of machine

The potential cleaning of the machine must take place in accordance with the instructions supplied with the machine and the safety instructions applicable at the point of use so that cleaning can be carried out as safely as possible.

2.2.6 Indicators

2.2.6.1 Information and warning devices

When designing the controls of the machine, the specified requirements laid down in the Machinery Directive and/or national legislation of the country where the machine is used must be absolutely followed in terms of information and warning devices used on the machine.

2.2.6.2 Warning of residual risks

The safety warnings related to the machine must be kept clean under all circumstances, and the warnings must be renewed when necessary. All operators of the machine must be warned of the residual risks involved in electricity or the controls in accordance with specified requirements laid down in the Machinery Directive and/or national legislation of the country where the machine is used.

2.2.6.3 Marking and instructions

The marking and instructions for the machine must be drawn up in accordance with the Machinery Directive and/or national legislation of the country where the machine is used. Steps must be taken to ensure that the marking and instructions for other equipment related to a safe use of this machine conform to valid legislation.

In particular, it must be ensured that the point of use is provided with instructions for emergencies, such as:

- how to give alarm
- location of rescue and fire extinguishing equipment
- availability of first aid and necessary first aid equipment

3 Definitions

The following words are used in the instructions to indicate issues which require special attention.

WARNING
There is a risk of personal injury if the instruction is not adhered to.

CAUTION
There is a risk of damaging or destroying the product or equipment if the instruction is not adhered to.

NOTE
Is used in the text for highlighting necessary information or requirements which are essential to observe.

4 Essential safety aspects

All of the following relevant safety aspects are to be instructed to the operators and maintenance personnel before putting the product into service.

General

- The product is meant only for the purpose for which it is sold - never operate beyond the intended use described in these instructions.
- Personal injuries may occur if personal protective equipment is not used when servicing the product.

- Pump units which convey hazardous media must be decontaminated before beginning any maintenance work.
- If there is a possibility that the pump or the pipeline contains explosive gases or vapours, it must be ventilated carefully before working on the pump.
- If there is a possibility that there are explosive gases or vapours in the atmosphere surrounding the pump, the pump's environment must be ventilated carefully before working on the pump.
- External heat must not be used when dismantling the pump, as any liquid, gas, vapour or their combination that remains in the pump may explode.
- All safety devices (e.g. coupling and shaft sealing guards) must be correctly installed before starting. For explosive areas, guards with a non-sparking material are to be used.

Wet end

- If there is a possibility of a dangerous return flow after the shutdown of the pump, a nonreturn device shall be installed in the outlet piping.
- The pump must be sufficiently filled with the pumped liquid before starting (with the exception of liquid ring pumps (-LM, -S), air separating pumps (-R) and pumps equipped with a gas separator (-GM, -GS)).
- The pump must run above the minimum recommended flow and never dry (with the exception of liquid ring pumps (-LM, -S), air separating pumps (-R) and pumps equipped with a gas separator (-GM, -GS)).
- The suction valve must be open during operation.
- If leakage of harmful or dangerous substances can occur - prepare proper means for a safe waste removal.
- The parts in contact with the pumped liquid can be dangerously hot.

Sealing unit

- The product must always be equipped with a shaft sealing system compatible with the pumped liquid.
- The parts in contact with the pumped liquid can be dangerously hot.

Bearing unit

- For delivery, the bearing housing of the pump has been emptied of oil. Remember to refill it before starting.
- There is no protection against contact in the shaft seal area.

Drive motor

- Always stop the drive unit before beginning any repair work on the pump. Make sure that the motor cannot be started by any means accidentally during the repairs.
- The correct rotating direction of the drive unit must be checked before starting and the pump must rotate freely (with coupling spacer removed).

Coupling unit

- The coupling must be properly aligned before starting.

Baseplate

- The pump baseplate must be properly installed before starting.

5 Ignition hazard assessment

5.1 General

1 Description of use

Group II category 2 Ex II 2 G c T1, T2, T3 and T4: The equipment is a centrifugal pump designed for use in environments in which the release of flammable materials will give rise to a zone 1 potentially explosive atmosphere (zone in which explosive atmospheres caused by mixtures of air and gases, vapours or mists are likely to occur occasionally during normal operation). The pump is designed for pumping various liquids in the process industry.

Group II category 3 Ex II 3 G c T1, T2, T3 and T4: The equipment is a centrifugal pump designed for use in environments in which the release of flammable materials will give rise to a zone 2 potentially explosive atmosphere (zone in which explosive atmospheres caused by mixtures of air and gases, vapours or mists are likely to occur occasionally during normal operation). The pump is designed for pumping various liquids in the process industry.

2 Construction

The pump is horizontally mounted and has a single-stage end-suction design. The pump shaft is mounted on antifriction bearings so that the bearing at the impeller end carries radial loads, while the bearings at the clutch end carry mainly axial loads. The pump is made from cast iron (for non-corroding liquids) or acid-resistant steel (for corroding liquids). The pump easily passes the required mechanical tests described in EN 13463-1. There are no light metal or plastic parts that need consideration, or other relevant restrictions as described in EN 13463-1.

The pump's design is such that it will not leak even in the event of a foreseeable malfunction. In normal operation, the pump contains the liquid being pumped. In a self-priming design, the pump is filled with air or a mixture of air and, for example, vapours or mists when the pump starts and before it is filled with the liquid that is to be pumped. This is a planned function and does not compromise the functioning of the pump. The pump is sealed either by a single-acting or double-acting slide ring seal or a dynamic seal, depending on the operating conditions. If a slide ring seal is used, the sliding faces are lubricated by either the liquid that is being pumped or an external sealing liquid.

The pump mounting has been designed to withstand the expected loads and vibration caused by the pump. The installation, operation and maintenance instructions include details of the support required by the pipes.

3 Ignition hazard assessment

The ignition hazard assessment according to 5.2 of EN 13463-1 + AC identifies that, because of its construction and on the basis of testing (temperature classification and shock resistance tests), no ignition sources exist in normal operation, during scheduled maintenance or repairs.

The table below lists all potential ignition sources that can be detected on the basis of experience, assesses the measures applied to prevent the source becoming effective and specifies the ignition protection methods used. This ignition hazard assessment document is placed in the manufacturer's technical file.

4 Marking with regard to ignition protection

EN 13463-1 requires the equipment to be marked with the symbol(s) of the ignition protection used. In this particular case, the pump complies with EN 13463-1 and EN 13463-5 and the symbol 'c' will therefore be included in the marking.

5.2 Group II category 2 (Ex II 2 G c T1, T2, T3 and T4)

Potential ignition source (1)			**Measures applied to prevent the source becoming effective (2)**	**Ignition protection used**
Normal operation (1a)	**Expected malfunction (1b)**	**Rare malfunction (1c)**		
Assembly				
Electrostatic discharge from the pump's external surfaces and subsequent arcing			Electrostatic charging is not possible, as the pump has no exposed plastic parts. Metal parts are attached to each other so that there are no differences in potential. There is no ignition source.	EN 13463-1 + AC 7.4 EN 13463-1 + AC 11. EN 13463-5 'c'
	The pump is driven at excess speed and is therefore damaged.		The design rotation speed for the pump is indicated on a label attached to the pump body.	EN 13463-5 'c'
Accumulation of an explosive mixture of gases or air in the pump			All air or gas mixtures are discharged from the pump when liquid enters. The pump is so designed that gases or air cannot accumulate outside the pump. There is no ignition source.	EN 13463-1 + AC 15. EN 13463-5 'c' IOM
The clutch cover makes contact with the clutch and causes frictional arcing or heat			The clutch cover is designed so that there is sufficient clearance to prevent contact between the rotating clutch and the clutch cover. There is no ignition source.	EN 13463-5 'c'
	The clutch cover is deformed because of a shock so that the clutch makes contact with the clutch cover, which causes frictional heat or arcing.		The strength of the clutch cover has been checked by shock resistance tests. There is no ignition source.	EN 13463-1 + AC 13.3.2
Clutch	The clutch is aligned or installed incorrectly, which leads to clutch breakage and arcing.	Clutch breakage because of a rare malfunction, such as jamming, a material defect in the clutch or excessive pipe strain on the pump. Not considered.	The installation, operation and maintenance manual contains instructions on the installation and alignment of the clutch. There is no ignition source.	EN 13463-5 'c' 8 IOM
Bearings				
Overheating of bearings	A bearing breaks and overheats		The bearings are dimensioned for continuous operation at rated values. The installation, operation and maintenance manual contains instructions on the maintenance and condition monitoring of bearings. The pump has vibration measurement fittings through which the condition of the bearings can be monitored. There is no ignition source.	EN 13463-5 'c' 6 IOM

Potential ignition source (1)			**Measures applied to prevent the source becoming effective (2)**	**Ignition protection used**
Normal operation (1a)	**Expected malfunction (1b)**	**Rare malfunction (1c)**		
	Insufficient lubrication of bearings, which leads to their overheating		Oil-lubricated bearings have a sight glass for monitoring the oil level. The installation, operation and maintenance manual contains instructions on the lubrication of bearings. There is no ignition source.	EN 13463-5 'c' 6 IOM
	Overheating of grease-lubricated bearings because of excessive grease		The installation, operation and maintenance manual contains instructions on correct lubrication to prevent the overheating of bearings. There is no ignition source.	EN 13463-5 'c' 6 IOM
		Ingress of water or other impurities into the bearings, which leads to insufficient lubrication, bearing failure and the overheating of bearings	The installation, operation and maintenance manual contains instructions on the maintenance and condition monitoring of bearings. Failure caused by the ingress of water is shown as increased vibration of the bearings, which can be detected during condition monitoring. The pump has vibration measurement fittings through which the condition of the bearings can be monitored. There is no ignition source.	EN 13463-5 'c' 6 IOM
		The metal part of the bearing's rotating ring rubs against the labyrinth static seal and arcs or overheats; a shock on a metal part deforms the rotating ring.	The rotating ring is protected with the shock-resistant clutch cover at the drive end. The rotating ring at the impeller end is located inside a socket, which is extremely unlikely to be subjected to shocks. Does not apply to categories 2 and 3. There is no ignition source.	EN 13463-5 'c'
Rotary shaft seals				
	Failure of the sealing face of a mechanical seal lubricated with the liquid being pumped due to insufficient lubrication, which leads to seal overheating.		Rotary shaft seals must always be selected on a case-by-case basis, depending on the liquid to be pumped and process conditions. The installation, operation and maintenance manual contains instructions on the condition monitoring of seals. There is no ignition source.	EN 13463-1 + AC 15. EN 13463-5 'c' IOM
	Failure of the sealing face of a mechanical seal lubricated with external sealing liquid due to insufficient lubrication, which leads to seal overheating.		Rotary shaft seals must always be selected on a case-by-case basis, depending on the liquid to be pumped and process conditions. The installation, operation and maintenance manual contains instructions on the condition monitoring of seals. There is no ignition source.	EN 13463-1 + AC 15. EN 13463-5 'c' IOM

Potential ignition source (1)			**Measures applied to prevent the source becoming effective (2)**	**Ignition protection used**
Normal operation (1a)	**Expected malfunction (1b)**	**Rare malfunction (1c)**		
Load-bearing parts				
		The impeller makes contact with the side plate, sealing ring or the casing cover, which leads to the overheating of the pump's external surface.	Does not apply to categories 2 and 3. There is no ignition source.	EN 13463-5 'c' 5.3
		A solid object blocks the gap between the impeller and the side plate or the casing cover, which leads to the overheating of the pump's external surface.	Does not apply to categories 2 and 3. There is no ignition source.	EN 13463-1 + AC 15. IOM
	The pump runs against a closed valve for a long time, which leads to pump breakage and overheating.		The installation, operation and maintenance manual contains instruction on the control and monitoring of operation. Long-term running against a closed valve is prohibited. There is no ignition source.	EN 13463-1 + AC 15. IOM
Components				
Clutch			The clutch delivered meets the requirements of the ATEX Directive. There is no ignition source.	EN 13463-1 + AC
Electric motor			The motor delivered meets the requirements of the ATEX Directive. There is no ignition source.	Ex requirements
Sealing liquid equipment			The sealing liquid equipment delivered meets the requirements of the ATEX Directive. There is no ignition source.	EN 13463-1 + AC
Repairs				
	The pump is repaired in the presence of an explosive mixture.		The installation, operation and maintenance manual contains instructions on the ventilation of the premises in which repairs are carried out. There is no ignition source.	EN 13463-1 + AC 15. IOM
	An explosive mixture remains in the pipeline.		The installation, operation and maintenance manual contains instructions on the ventilation of the pipeline that is connected to the pump. There is no ignition source.	EN 13463-1 + AC 15. IOM

IOM = **I**nstallation, **O**peration and **M**aintenance manual

5.3 Group II category 3 (Ex II 3 G c T1, T2, T3 and T4)

Potential ignition source (1)			**Measures applied to prevent the source becoming effective (2)**	**Ignition protection used**
Normal operation (1a)	**Expected malfunction (1b)**	**Rare malfunction (1c)**		
Assembly				
Electrostatic discharge from the pump's external surfaces and subsequent arcing			Electrostatic charging is not possible, as the pump has no exposed plastic parts. Metal parts are attached to each other so that there are no differences in potential. There is no ignition source.	EN 13463-1 + AC 7.4 EN 13463-1 + AC 11. EN 13463-5 'c'
Accumulation of an explosive mixture of gases or air in the pump			All air or gas mixtures are discharged from the pump when liquid enters. The pump is so designed that gases or air cannot accumulate outside the pump. There is no ignition source.	EN 13463-1 + AC 15. EN 13463-5 'c' IOM
The clutch cover makes contact with the clutch and causes frictional arcing or heat			The clutch cover is designed so that there is sufficient clearance to prevent contact between the rotating clutch and the clutch cover. There is no ignition source.	EN 13463-5 'c'
Bearings				
Overheating of bearings	A bearing breaks and overheats		The bearings are dimensioned for continuous operation at rated values. The installation, operation and maintenance manual contains instructions on the maintenance and condition monitoring of bearings. The pump has vibration measurement fittings through which the condition of the bearings can be monitored. There is no ignition source.	EN 13463-5 'c' 6 IOM
Load-bearing parts				
Components				
Clutch			The clutch delivered meets the requirements of the ATEX Directive. There is no ignition source.	EN 13463-1 + AC
Electric motor			The motor delivered meets the requirements of the ATEX Directive. There is no ignition source.	Ex requirements
Sealing liquid equipment			The sealing liquid equipment delivered meets the requirements of the ATEX Directive. There is no ignition source.	EN 13463-1 + AC

IOM = **I**nstallation, **O**peration and **M**aintenance manual

6 Safety signs affixed to the product

The following warnings and informative signs concerning the essential safety aspects are permanently fixed on the product. Safety signs must always be observed and kept clean and legible in any operating condition. The user must always check that the symbols or items presented in those are understood by all user groups before putting the product into service.

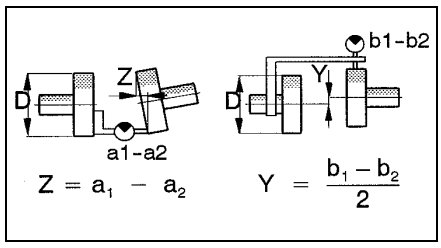
Wet end

Item no. 975.11. Hot surface, do not touch (to be fixed when the temperature of the pumped liquid is > 60°C)

Bearing unit

Item no. 975.31. Splashing of corrosive or irritative substances (this sign is delivered unattached and it is to be attached to both sides of the adapter if necessary)

Coupling unit



Item no. 976.51. Coupling alignment values

Item no. 975.51. Coupling guard jacket to be adjusted during assembly

7 Operating situations affecting product safety

The following inadequate operating situations always have consequences which have an immediate effect on the product safety and therefore they are not allowed in any operating conditions with this product.

Table 1, Typical inadmissible operating situations

Cause:	**Consequence:**
Discharge valve not opened. Inlet pressure or piping system resistance incorrectly estimated when the pump was originally selected. The pump is operated at too high a rotational speed.	Inadmissible pressure increase
Discharge valve not opened. Discharge valve throttled too much. Properties of the pumped liquid incorrectly estimated when the pump was originally selected.	High temperatures (Wet end)
Gland packing tightened too much. Adequate sealing water service neglected. - Sealing water pump not started - Sealing water valve not opened - Sealing water equipment incorrectly adjusted - Quality of the sealing water does not match our requirements. Inlet pressure incorrectly estimated when the pump was originally selected. Pump is not properly filled with the pumped liquid. - Suction valve not opened - Suction tank not properly filled - Suction piping resistance or air tightness improperly checked	High temperatures (Sealing unit)
Pump lubrication carried out inadequately. - Oil/grease filling neglected - Oil/grease quality incorrectly selected - Relubrication carried out inadequately Pump washdown carried out inadequately (sprayed water enters the bearing unit). Properties of the pumped liquid incorrectly estimated when the pump was originally selected.	High temperatures (Bearing unit)

8 Balance and vibration

The pump is normally balanced in accordance with grade G 6.3 of ISO 1940, in special cases with grade G 2.5 of ISO 1940. Vibration does not exceed the vibration severity limits given in Table 2 when measured at the manufacturer's test facilities. These values are measured radially at the bearing housing at rated speed and flow when operating without cavitation.

A pump equipped with a specially designed impeller may exceed the limits given in Table 2.

Table 2, Max. r.m.s values of vibration velocity

Pump installation	Shaft centerline height H1	
	≤ **225 mm**	> **225 mm**
Pump on a grouted baseplate or on a concrete baseplate	3 mm/s	4.5 mm/s
Pump on a baseplate without grouting	4.5 mm/s	7.1 mm/s

9 Wet end

9.1 Admissible forces and moments on pump flanges

Forces and moments acting on the pump flanges due to pipe loads can cause misalignment of the pump and driver shafts, deformation and overstressing of the pump casing, or overstressing of the fixing bolts between the pump and baseplate.

This is a simple method for checking that loads transmitted to a pump by its piping remain within acceptable limits. This is done by comparing the loads (forces and moments) calculated by the piping designer, with the maximum values allowed on the flanges, as a function of their size and the installation conditions.

The basic values given in Table 3 are applicable to each of the pump flanges, respecting the sign convention of the three axes through the flange. The values can be applied simultaneously in all directions with positive or negative signs, or separately on each flange (suction and discharge).

W A R N I N G

The basic values mentioned in Table 3 should be multiplied by: 0.15 white iron, 0.35 cast iron and 0.7 stainless steel. The values mentioned in the table apply to pumps equipped with a grouted baseplate or a concrete baseplate. A baseplate installed with machine feet should be multiplied by 0.25.

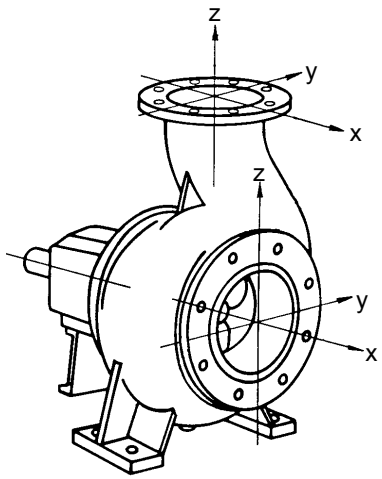


Fig. 1

Table 3, Basic values of forces and moments

Diameter DN	Top branch z-axis							
	Force (N)				Moment (Nm)			
	F_y	F_z	F_x	ΣF*	M_y	M_z	M_x	ΣM *
32	850	1050	900	1650	750	850	1100	1600
40	1000	1250	1100	1950	900	1050	1300	1900
50	1350	1650	1500	2600	1000	1150	1400	2050
65	1700	2100	1850	3300	1100	1200	1500	2200
80	2050	2500	2250	3950	1150	1300	1600	2350
100	2700	3350	3000	5250	1250	1450	1750	2600
125	3200	3950	3550	6200	1500	1900	2100	3050
150	4050	5000	4500	7850	1750	2050	2500	3650
200	5400	6700	6000	10450	2300	2650	3250	4800
250	6750	8350	7450	13050	3150	3650	4450	6550

Diameter DN	Top branch z-axis							
	Force (N)				Moment (Nm)			
	F_y	F_z	F_x	ΣF*	M_y	M_z	M_x	ΣM *
300	8050	10000	8950	15650	4300	4950	6050	8900
350	9400	11650	10450	18250	5500	6350	7750	11400
400	10750	13300	11950	20850	6900	7950	9700	14300
500	13450	16600	14950	26050	10250	11800	14450	21300
600	16150	19900	17950	31250	14400	16600	20200	29900
700	18800	23880	21540	37500	17280	19920	24240	35880

Diameter DN	End branch x-axis							
	Force (N)				Moment (Nm)			
	F_y	F_z	F_x	ΣF*	M_y	M_z	M_x	ΣM *
32	900	850	1050	1650	750	850	1100	1600
40	1100	1000	1250	1950	900	1050	1300	1900
50	1500	1350	1650	2600	1000	1150	1400	2050
65	1850	1700	2100	3300	1100	1200	1500	2200
80	2250	2050	2500	3950	1150	1300	1600	2350
100	3000	2700	3350	5250	1250	1450	1750	2600
125	3550	3200	3950	6200	1500	1900	2100	3050
150	4500	4050	5000	7850	1750	2050	2500	3650
200	6000	5400	6700	10450	2300	2650	3250	4800
250	7450	6750	8350	13050	3150	3650	4450	6550
300	8950	8050	10000	15650	4300	4950	6050	8900
350	10450	9400	11650	18250	5500	6350	7750	11400
400	11950	10750	13300	20850	6900	7950	9700	14300
500	14950	13450	16600	26050	10250	11800	14450	21300
600	17950	16150	19900	31250	14400	16600	20200	29900
700	21540	18800	23880	37500	17280	19920	24240	35880
* ΣF and ΣM are the vector sums of the forces and moments.								

Under the maximum allowance forces and moments, the lateral displacement of the shaft end, relative to the fixed point in space should not exceed the values indicated in Table 4.

Table 4, Lateral displacement

Shaft-end diameter (mm)	Displacement (mm) *
< 30	0.15
31 to 40	0.20
> 40	0.25
* The displacement values given are for reference in checking the stiffness of the pump and its supports and are not the same as the alignment requirements.	

9.2 Sound level charts

Noise emission values are stated according to ISO 4871 and the essential requirements in the Machinery Directive 2006/42/EC.

The noise values are given in accordance with standard EN12639.

Sound power levels have been determined according to EN ISO 9614 Part II using sound intensity measurements.

It is not possible to measure all different pump applications. Therefore, some values have been determined by calculations based on measurements with similar pumps and Europump's Guide 001/30/E, Forecasting the Airborne Noise Emission of Centrifugal Pumps.

LpA = A-weighted sound pressure level, dB re 20 μPa, at the relevant working station.

LwA = A-weighted sound power level, dB re 1 pW, if A-weighted sound pressure level exceeds 85 dB.

Open, special open, low flow and vortex impellers

Table 5, Sound pressure level LpA / open impellers (dB)

Pump size	Pump types	Pump rot. speed (rpm)												
		3550	2950	1760	1480	1180	980	880	740	710	590	510	495	445
10-32	A	<70	<70	<70	<70									
10-50	A	<70	<70	<70	<70									
10-65	A	<70	<70	<70	<70									
11-32	A	<70	<70	<70	<70	<70								
11-40	A	<70	<70	<70	<70	<70								
11-50	A	72	<70	<70	<70	<70								
20-65	A	<70	<70	<70	<70									
20-80	A	<70	<70	<70	<70									
21-65	A	75	<70	<70	<70									
21-80	A	77	73	<70	<70	<70								
21-100	A		75	<70	<70	<70								
22-32	A		<70	<70	<70	<70	<70							
22-40	A	74	<70	<70	<70	<70	<70	<70						
22-50	A	76	73	<70	<70	<70	<70	<70						
22-65	A	79	75	<70	<70	<70	<70	<70						
22-80	A	81	77	<70	<70	<70	<70	<70						
23-40	A		75	<70	<70	<70	<70	<70						
23-50	A		77	<70	<70	<70	<70	<70						
31-100	A	83	79	<70	<70	<70	<70	<70						
31-125	A		81	73	<70	<70	<70	<70						
31-150	A			75	<70	<70	<70	<70						
32-65	A			72	<70	<70	<70	<70						
32-80	A			72	<70	<70	<70	<70						
32-100	A			74	<70	<70	<70	<70						
32-125	A			76	72	<70	<70	<70						
33-80	A			74	72	<70	<70	<70	<70					
33-100	A			76	74	<70	<70	<70	<70					
33-125	A			79	76	72	<70	<70	<70					
41-200	A			81	78	74	71	<70						
41-300	A				80	77	73	72	<70					
41-400	A				80	77	73	72	<70					
42-150	A			79	75	71	<70	<70						
42-200	A			81	78	74	71	<70						
43-250	A			88	85	81	78	76	73	72	<70			
43-350	A				86	82	79	77	74	73	<70			
43-500	A				86	82	79	77	74	73	<70			
44-150	A			81	78	74	71	<70	<70					
44-200	A			84	81	77	71	72	<70					
51-250	A			90	87	83	80	78	75	74	71			
51-300	A				88	84	81	79	76	75	72			
51-400	A				89	85	82	80	77	73	73			
51-500	A				89	85	82	80	77	76	73			
53-100	A			86	83	79	76	74	71	70	<70			
53-150	A			90	87	83	80	78	75	74	77			
53-200	A				89	85	82	80	77	76	73			
53-250	A				91	87	83	82	79	78	75			

Pump size	Pump types	Pump rot. speed (rpm)												
		3550	2950	1760	1480	1180	980	880	740	710	590	510	495	445
53-300	A					88	85	83	80	79	76			
53-400	A					88	85	83	80	79	76			
55-100	A				88	84	81	79	76	75	72			
55-200	A				92	88	85	83	80	79	76			
55-250	A					90	87	85	82	81	78			
55-300	A					91	88	86	83	82	79			
60-500	A				92	89	86	84	81	80	77			
60-600	A				92	89	86	84	81	80	77			
63-400	A						90	88	85	84	81			
63-500	A						91	89	85	85	82			
63-600	A						92	90	86	86	82			
63-700	A						92	90	86	86	82			
71-250	A					90	86	83	80	80	79	77	77	
71-300	A						86	84	81	80	79	77	77	
71-400	A						88	86	84	83	82	79	79	
71-500	A						90	89	85	85	84	81	81	
71-600	A						91	89	86	86	85	84	81	
72-300	A							88	84	84	82	81	79	79
72-400	A							89	85	85	85	81	81	79
72-500	A								87	86	85	84	83	81
72-600	A								89	88	86	85	85	84

Table 6, Sound power level LwA / open impellers (dB)

Pump size	Pump types	Pump rot. speed (rpm)												
		3550	2950	1760	1480	1180	980	880	740	710	590	510	495	445
43-250	A			96	93									
43-350	A				94									
43-500	A				94									
51-250	A			98	95									
51-300	A				96									
51-400	A				97	93								
51-500	A				97	93								
53-100	A			94										
53-150	A			98	95									
53-200	A				97	93								
53-250	A				99	95								
53-300	A					96	93							
53-400	A					96	93							
55-100	A				96									
55-200	A				100	95	93							
55-250	A					98	95	93						
55-300	A					99	96	94						
60-500	A				100	97	94							
60-600	A				100	97	94							
63-400	A						98	96	93					
63-500	A						99	98	95	95				
63-600	A						100	98	94	94				
63-700	A						100	98	94	94				
71-250	A					104	102							
71-300	A						102							
71-400	A						104	102						

Pump size	Pump types	Pump rot. speed (rpm)												
		3550	2950	1760	1480	1180	980	880	740	710	590	510	495	445
71-500	A						105	104						
71-600	A						105	104	101	101				
72-300	A							103						
72-400	A							104	102	101	99			
72-500	A								103	102	100			
72-600	A								104	104	101	99	99	

Closed impellers

Table 7, Sound pressure level LpA / closed impellers (dB)

Pump size	Pump types	Pump rot. speed (rpm)									
		3550	2950	1760	1480	1180	980	880	740	710	590
11-32	APP	<70	<70	<70	<70	<70					
11-40	APP	<70	<70	<70	<70	<70					
11-50	APP	72	<70	<70	<70	<70					
21-50	NPP		71	<70	<70	<70	<70	<70			
21-65	APP	75	<72	<70	<70	<70					
21-80, 8S	APP	77	74	<70	<70	<70					
21-80	NPP		75	<70	<70	<70		<70			
22-40	APP	75	71	<70	<70	<70	<70	<70			
22-50	APP, WPP	76	73	<70	<70	<70	<70	<70			
22-50	NPP		76	<70	<70	<70	<70	<70			
22-65	APP	79	75	<70	<70	<70	<70	<70			
22-80, 8S	APP	81	78	<70	<70	<70	<70	<70			
22-80	NPP			<70	<70	<70	<70	<70			
23-50	APP, WPP		77	<70	<70	<70	<70	<70			
31-65	EPP	81	78	<70	<70	<70					
31-100, 10S	APP	83	80	71	<70	<70	<70	<70			
31-100	EPP	84	81	<72	<70	<70	<70	<70			
31-100	NPP			<71	<70	<70	<70	<70			
31-125, 10P	APP		82	72	<70	<70	<70	<70			
31-150	APP			75	72	<70	<70	<70			
32-65	APP		79	71	<70	<70	<70	<70			
32-80, 8S	APP, WPP		81	<70	<70	<70	<70	<70			
32-80	NPP			74	71	<70	<70	<70			
32-100, 10S	APP, WPP		82	74	71	<70	<70	<70			
32-100	NPP			76	73	<70	<70	<70			
32-125, 10P	APP		85	73	73	<70	<70	<70			
32-200	EPP			77	74	<70	<70				
33-80	NPP			79	76	<72	<70	<70	<70	<70	
33-100, 10S	APP, WPP			74	74	<70	<70	<70	<70		
33-100	NPP			80	77	73	70	<70	<70	<70	
33-125, 10P	APP, WPP			79	76	<72	<70	<70	<70		
41-150	EPP			77	74	<70	<70	<70			
41-200	APP			80	77	72	<70	<70			
41-200	EPP			79	76	72	<70	<70			
41-300	APP			82	79	75	72	<70			
42-150	APP			79	76	71	<70	<70			
42-150	EPP			80	78	73	71	<70			
42-150	NPP			79	76	72	<70	<70			
42-200	APP			81	78	74	71	<70			

Pump size	Pump types	Pump rot. speed (rpm)									
		3550	2950	1760	1480	1180	980	880	740	710	590
42-200	EPP			83	80	76	72	<70			
42-200	NPP			80	77	73	70	<70			
42-250	EPP			85	82	78	75	71			
43-100	EPP			81	78	74	71	72			
43-150	EPP			84	81	77	74	72			
43-250	APP			85	82	78	75	73	<70		
43-300	APP				83	79	76	74	<70		
44-150	APP, WPP			81	78	74	71	74	<70		
44-150	NPP			83	80	76	73	71	<70	<70	
44-200	APP, NPP, WPP			84	81	77	74	<70	<70		
51-250	APP			88	85	81	78	76	73	72	
51-300	APP				87	83	80	78	74	73	
52-350	APP					84	81	79	76	75	
52-350	EPP					-	81	-	76		
52-400	APP					88	85	82	80	78	
53-100	APP, EPP, WPP			85	82	78	75	73	70	<70	
53-150	APP, WPP			87	84	80	77	75	72	71	
53-200	APP, EPP, WPP			89	86	82	79	77	74	73	
53-250	APP, WPP				88	84	81	79	76	75	
53-250	EPP			88	85	81	78	75	73	72	
53-250	NPP					81	83	77	78		
53-300	APP				89	85	82	80	77	76	
53-300	EPP			90	87	83	80	78	75	74	
54-300	EPP					84	84	79	79		
54-400	APP, WPP					87	87	82	82	78	78
54-500	APP					91	88	86	83	83	79
54-500	EPP					86	85	82	80	78	76
55-100	APP			90	87	83	80	78	75		
55-200	APP				89	85	82	80	77	76	73
55-250	APP				91	87	84	82	79	78	75
55-300	APP, EPP, WPP					89	86	84	81	80	77
61-600	EPP						92	91	87	86	83

Table 8, Sound power level LwA / closed impellers (dB)

Pump size	Pump types	Pump rot. speed (rpm)									
		3550	2950	1760	1480	1180	980	880	740	710	590
51-300	APP				95	83					
53-200	APP, EPP, WPP				94	82					
53-250	APP, WPP			89	96	84					
53-300	APP				97	85					
54-400	APP, WPP					90	95				
54-500	APP					91	96				
55-100	APP			90	95	83					
55-200	APP				97	85					
55-250	APP				99	87					
55-300	APP, EPP, WPP					89	94				
61-600	WPP					100	100	95	95		

Open, special open and low pulse impellers

Table 9, Sound pressure level LpA / open impellers (dB)

Pump size	Pump types	Pump rot. speed (rpm)									
		3550	2950	1760	1480	1180	980	880	740	710	590
11-32	APP	<70	<70	<70	<70	<70					
11-40	APP	<70	<70	<70	<70	<70					
11-50	APP	72	<70	<70	<70	<70					
21-65	APP	75	<70	<70	<70	<70					
21-80, 8S	APP	77	73	<70	<70	<70					
22-32	APP, WPP		<70	<70	<70	<70	<70				
22-40	APP	74	<70	<70	<70	<70	<70	<70			
22-50	APP, WPP	76	73	<70	<70	<70	<70	<70			
22-65	APP	79	75	<70	<70	<70	<70	<70			
22-80, 8S	APP	81	77	<70	<70	<70	<70	<70			
23-40	APP		75	<70	<70	<70	<70	<70			
23-50	APP, WPP		77	<70	<70	<70	<70	<70			
31-65	EPP			72	<70	<70	<70	<70			
31-100, 10S	APP	83	79	<70	<70	<70	<70	<70			
31-100	EPP			72	<70	<70	<70	<70			
31-125, 10P	APP		81	73	<70	<70	<70	<70			
31-150	APP			75	<70	<70	<70	<70			
32-65	APP			72	<70	<70	<70	<70			
32-80, 8S	APP, WPP			72	<70	<70	<70	<70			
32-100, 10S	APP, WPP			74	<70	<70	<70	<70			
32-100	EPP			77	74	<70	<70				
32-125, 10P	APP, WPP			76	72	<70	<70	<70			
33-100, 10S	APP, WPP			76	74	<70	<70	<70	<70		
33-125, 10P	APP			79	76	72	<70	<70	<70		
41-150	EPP			77	74	<70	<70	<70			
41-200	APP			79	76	72	<70	<70			
41-200	EPP			80	77	72	70	<70			
41-300	APP			82	79	74	<70	<70			
42-150	APP			79	75	71	<70	<70			
42-150	EPP			79	76	72	70	<70			
42-200	APP			81	78	74	71	<70			
42-200	EPP			83	80	75	73	71			
42-250	EPP			84	81	75	74	71			
43-100	EPP			81	78	74	71				
43-150	EPP			84	81	77	74	72			
43-250	APP			85	82	78	75	73	70		
43-300	APP				83	79	76	74	71		
44-150	APP, WPP			81	78	74	71	<70	<70		
44-200	APP, WPP			84	81	77	74	72	<70		
51-250	APP			88	84	80	77	76	72	<70	
51-300	APP				86	82	79	77	74	73	
52-350	APP					84	81	79	76	75	
52-400	APP					87	84	82	79	78	
53-100	APP, EPP, WPP			85	82	78	75	73	70	<70	
53-150	APP, WPP			87	84	80	77	75	72	<70	
53-200	APP, WPP			89	86	82	79	77	74	73	
53-200	EPP				85	81	78	77	73	72	
53-250	APP, WPP				88	84	80	79	75	75	

Pump size	Pump types	Pump rot. speed (rpm)									
		3550	2950	1760	1480	1180	980	880	740	710	590
53-250	EPP				83	78	76	73	71	<70	
53-300	APP				89	85	82	80	77	76	
53-300	EPP				85	81	78	76	73	72	
54-400	APP, WPP					90	87	85	82	82	78
54-500	APP						87	86	82	82	78
54-500	EPP					86	83	81	78	77	
55-100	APP			90	87	82	80	77	75		
55-200	APP					84	82	79	77	76	73
55-250	APP					86	84	82	79	78	75
55-300	APP, EPP, WPP					88	86	84	81	80	77
61-500	APP, EPP						93	91	88	87	84
61-600	APP, WPP						92	91	87	86	83
62-400	APP						91	90	86	85	82

Table 10, Sound power level LwA / open impellers (dB)

Pump size	Pump types	Pump rot. speed (rpm)									
		3550	2950	1760	1480	1180	980	880	740	710	590
51-300	APP			96	94						
53-200	APP, WPP				94	95					
53-250	APP, WPP			95	96						
53-300	APP			97	97						
54-400	APP, WPP					98	95				
54-500	APP						95	94			
55-100	APP			98	95						
55-300	APP, EPP, WPP					94	94				
61-500	APP, EPP					96	101		96		
61-600	APP, WPP						100	99	95		
62-400	APP						99	99	94		

Vortex impellers

Table 11, Sound pressure level LpA / vortex impellers (dB)

Pump size	Pump types	Pump rot. speed (rpm)									
		3550	2950	1760	1480	1180	980	880	740	710	590
21-50	NPP	76	72	<70	<70						
21-80	NPP		76	<70	<70						
22-50	NPP, WPP		77	<70	<70	<70	<70	<70			
22-80	NPP			71	<70	<70	<70	<70			
31-100	NPP			73	71	<70	<70	<70			
32-80	NPP, WPP			76	73	<70	<70	<70			
32-100	NPP, WPP			77	75	<70	<70	<70			
32-125	WPP			79	77	72	<70	<70			
33-80	NPP			79	77	72	<70	<70	<70	<70	
33-100	NPP, WPP			80	79	72	70	<70	<70	<70	
42-150	NPP			81	79	74	71	<70			
42-200	NPP			82	80	75	72	<70			
44-150	NPP, WPP			84	82	78	74	72	<70	<70	
44-200	NPP, WPP				82	78	75	72	<70		
53-100	WPP						79	72	74	<70	
53-150	WPP						81	74	76	72	
53-200	WPP						82	75	77	73	

Pump size	Pump types	Pump rot. speed (rpm)									
		3550	2950	1760	1480	1180	980	880	740	710	590
53-250	NPP, WPP						84	77	79	76	

9.3 Maximum size of solid particles

The maximum sizes of solid spherical particles which can flow through the pump (casing/impeller) are presented in Table 12 (A, Process Pump) and Table 13 (APP, EPP, NPP, WPP).

Table 12, Max. size of solid particles (Ø mm) (A, Process Pump)

Pump size	Pump types	Impeller type					
		Open1	Open2	Special open1	Special open2	Low flow1	Vortex1
10-32	A	10	-	-	-	3	-
10-50	A	14	-	-	-	-	-
10-65	A	11	-	-	-	-	-
11-32	A	12	-	-	-	5	-
11-40	A	16	-	-	-	-	19
11-50	A	21	-	-	-	-	22
20-65	A	16	-	-	-	-	-
20-80	A	17	-	34	-	-	-
21-65	A	17	-	-	-	-	24
21-80	A	19	-	36	-	-	26
21-100	A	29	-	36	-	-	37
22-32	A	12	-	-	-	4	-
22-40	A	15	-	-	-	-	18
22-50	A	18	-	-	-	-	22
22-65	A	23	-	-	-	-	26
22-80	A	20	-	37	-	-	29
23-40	A	16	-	-	-	5	18
23-50	A	21	-	-	-	-	24
31-100	A	25	-	43	-	-	30
31-125	A	29	-	50	-	-	35
31-150	A	28	-	39	-	-	42
32-65	A	21	-	-	-	-	21
32-80	A	26	-	40	-	-	30
32-100	A	24	-	42	-	-	35
32-125	A	29	-	50	-	-	-
33-80	A	25	-	35	-	-	30
33-100	A	30	-	44	-	-	-
33-125	A	30	-	54	-	-	-
41-200	A	34	-	38	-	-	48
41-300	A	44	-	51	-	-	-
41-400	A	44	46	49	51	-	-
42-150	A	27	-	54	-	-	-
42-200	A	32	-	44	-	-	-
43-250	A	43	-	48	-	-	-
43-350	A	53	-	61	-	-	-
43-500	A	52	54	58	60	-	-
44-150	A	31	-	59	-	-	48
44-200	A	33	-	60	-	-	45
51-250	A	43	-	51	-	-	-
51-300	A	47	-	53	-	-	-

Pump size	Pump types	Impeller type					
		Open1	Open2	Special open1	Special open2	Low flow1	Vortex1
51-400	A	58	-	68	-	-	-
51-500	A	58	60	64	66	-	-
53-100	A	24	-	31	-	-	-
53-150	A	33	-	42	-	-	-
53-200	A	46	-	50	-	-	-
53-250	A	47	-	55	-	-	-
53-300	A	50	-	60	-	-	-
53-400	A	55	-	62	-	-	-
55-100	A	28	-	37	-	-	-
55-200	A	39	-	50	-	-	-
55-250	A	54	-	59	-	-	-
55-300	A	56	-	65	-	-	-
60-500	A	68	-	79	-	-	-
60-600	A	67	70	74	77	-	-
63-400	A	60	-	72	-	-	-
63-500	A	66	-	75	-	-	-
63-600	A	82	-	94	-	-	-
63-700	A	81	84	90	93	-	-
71-250	A	-	-	68	-	-	-
71-300	A	-	-	75	-	-	-
71-400	A	-	-	81	-	-	-
71-500	A	-	69	-	-	-	-
71-600	A	-	-	107	-	-	-
72-300	A	-	-	75	-	-	-
72-400	A	-	-	85	-	-	-
72-500	A	-	-	93	-	-	-
72-600	A	-	79	-	-	-	-

Table 13, Max. size of solid particles (Ø mm) (APP, EPP, NPP, WPP)

Pump size	Pump types	Impeller type							
		Closed1	Closed2	Open1	Open2	Special open1	Special open2	Vortex1	Low pulse1
11-32	APP	4	-	8	-	-	-	-	-
11-40	APP	8	-	12	-	-	-	-	-
11-50	APP	10,5	-	16	-	-	-	-	-
21-50	NPP	25	-	-	-	-	-	35	-
21-65	APP	16	-	22	-	-	-	-	-
21-80, 8S	APP	23	-	30	-	-	-	-	-
21-80	NPP	45	-	-	-	-	-	50	-
22-32	APP	-	-	7	-	-	-	-	-
22-32	WPP	-	-	7	-	-	-	-	-
22-40	APP	5	-	10	-	-	-	-	-
22-50	APP	8	-	14	-	-	-	-	-
22-50	NPP	25	-	-	-	-	-	35	-
22-50	WPP	10	-	18	-	-	-	22	-
22-65	APP	12	-	18	-	-	-	-	-
22-80, 8S	APP	18	-	24	-	24	-	-	-
22-80	NPP	45	-	-	-	-	-	50	-
23-40	APP	-	-	9	-	-	-	-	-
23-50	APP	6	-	12,5	-	-	-	-	-

Pump size	Pump types	Impeller type							
		Closed1	Closed2	Open1	Open2	Special open1	Special open2	Vortex1	Low pulse1
23-50	WPP	9	-	20	-	-	-	-	-
31-65	EPP	9	-	9	-		-	-	-
31-100, 10S	APP	25	-	32	-	-	-	-	-
31-100	EPP	14	-	15	-		-	-	
31-100	NPP	55	-	-	-	-	-	60	-
31-125,10P	APP	32	-	36	-	-	-	-	-
31-150	APP	40	-	41	-	-	-	-	-
32-65	APP	9	-	16	-	-	-	-	-
32-80, 8S	APP	13	-	22	-	33	-	-	-
32-80	NPP	45	-	-	-	-	-	50	-
32-80	WPP	16	-	27	-	-	-	30	-
32-100, 10S	APP	18	-	24	-	24	-	-	-
32-100	EPP	18	-	18	-	-	-	-	-
32-100	NPP	55	-	-	-	-	-	60	-
32-100	WPP	18	-	32	-	-	-	35	-
32-125, 10P	APP	26	-	32	-	32	-	-	-
32-125	WPP	26	-	42	-	-	-	40	-
33-80	NPP	45	-	-	-	-	-	50	-
33-100, 10S	APP	13	-	18	-	29	-	-	6
33-100	NPP	55	-	-	-	-	-	60	-
33-100	WPP	16	-	30	-	-	-	34	-
33-125, 10P	APP	22	-	29	-	29	-	-	11
41-150	EPP	36	-	35	-	-	-	-	-
41-200	APP	43	-	47	-	54	-	-	-
41-200	EPP	47	-	42	-	-	-	-	-
41-300	APP	46	-	56	-	70	-	-	-
42-150	APP	34	-	38	-	38	-	-	-
42-150	EPP	30	-	28	-	-	-	-	-
42-150	NPP	75	-	-	-	-	-	80	-
42-200	APP	35	-	48	-	49	-	-	-
42-200	EPP	39	-	39	-	-	-	-	-
42-200	NPP	85	-	-	-	-	-	85	-
42-250	EPP	54	-	54	-	-	-	-	-
43-100	EPP	16	-	16	-	-	-	-	-
43-150	EPP	24	-	27	-	-	-	-	-
43-250	APP	54	-	62	-	63	-	-	-
43-300	APP	53	-	54	-	71	-	-	-
44-150	APP	27	-	27	-	27	-	-	10
44-150	NPP	75	-	-	-	-	-	75	-
44-150	WPP	30	-	44	-	-	-	50	-
44-200	APP	41	-	46	-	46	-	-	19
44-200	NPP	85	-	-	-	-	-	80	-
44-200	WPP	41	-	54	-	-	-	60	-
51-250	APP	52	-	54	-	54	-	-	23
51-300	APP	48	-	69	-	69	-	-	30
52-350	APP	65	-	63	-	84	-	-	-
52-350	EPP	63	-	63	-	63	-	-	-
52-400	APP	73	-	95	-	95	-	-	-
53-100	APP	17	-	27	-	-	-	-	10
53-100	EPP	17	-	24	-	-	-	-	-

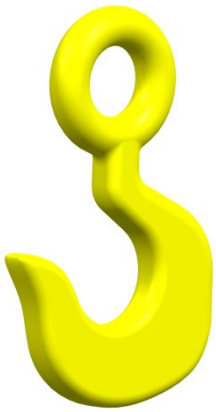
Pump size	Pump types	Impeller type							
		Closed1	Closed2	Open1	Open2	Special open1	Special open2	Vortex1	Low pulse1
53-100	WPP	18	-	37	-	-	-	40	-
53-150	APP	29	-	39	-	-	-	-	15
53-150	WPP	33	-	52	-	-	-	58	-
53-200	APP	35	-	35	-	35	-	-	13
53-200	EPP	32	32	32	32	32	-	-	-
53-200	WPP	38	-	55	-	-	-	61	-
53-250	APP	49	-	49	-	49	-	-	20
53-250	EPP	47	-	48	-	-	-	-	-
53-250	NPP	113	-	-	-	-	-	113	-
53-250	WPP	52	-	70	-	-	-	77	-
53-300	APP	62	-	64	-	64	-	-	27
53-300	EPP	65	65	55	-	-	-	-	-
54-300	EPP	66	-	66	-	-	-	-	-
54-400	APP	74	-	74	-	94	-	-	-
54-400	WPP	105	-	110	-	-	-	-	-
54-500	APP	113	-	113	-	113	-	-	-
54-500	EPP	80	-	-	-	-	-	-	-
55-100	APP	30	-	30	-	-	-	-	-
55-200	APP	34	-	46	-	-	-	-	-
55-250	APP	43	-	43	-	43	-	-	-
55-300	APP	67	-	68	-	68	-	-	-
55-300	EPP	61	-	67	-	-	-	-	-
55-300	WPP	61	-	79	-	-	-	-	-
61-500	APP	-	-	86	86	107	107	-	-
61-500	EPP	-	-	107	107	107	107	-	-
61-600	APP	-	-	132	132	132	132	-	-
61-600	WPP	133	-	150	-	-	-	-	-
62-400	APP	-	-	132	132	132	132	-	-

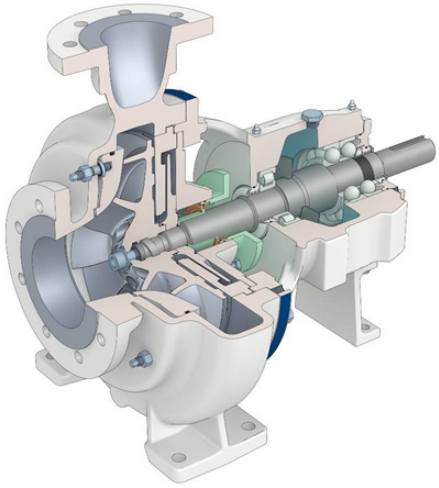
SULZER

SPP id: 120601 / Replaces 110901 / en / **N31569** / 2

AHLSTAR

PROCESS PUMPS





Hoisting and transfers

1 Safety measures

The total gross and net weights of the delivery are always found in the packing list affixed to the product or packing.

WARNING

Hoisting and transfers instructions must be strictly followed to avoid dropping of crates or individual assemblies.

Special attention is to be paid to the stability of

- Pump
- Pump and baseplate with or without motor
- Spare parts

The center of gravity with these items should always be checked before hoistings and transfers.

Personal protective equipment such as helmet, safety shoes and gloves is to be used.

If suitable lifting equipment is not available, heavy assemblies must be transferred by using skids etc. on the ground level.

Lifting accessories must bear the identification of the manufacturer, material and the maximum working load.

Lifting ropes used directly for lifting or supporting the pump or pump unit must not include any splicing other than at their ends. Textile ropes and slings must not include any knots, connections or splicing other than at the ends of the sling, except in the case of an endless sling.

The lifting accessories must always be able to adequately support the hoisted assembly.

The lifting ropes must be adequate, and they must be adjusted so that the product is not damaged during hoisting. A lifting chain must not be in contact with the product during hoisting (if it is, painted and machined surfaces may be damaged).

WARNING

Make sure that accepted and undamaged ropes and lifting accessories are available. The lifting capacity of the lifting accessories and ropes must correspond to the weight of the goods lifted.

WARNING

Never stand under a hanging load.

2 Hoisting and transfers

The figures are for reference only, and the actual product and lifting equipment may differ from those presented.

N O T E
If the ordered assembly contains: - an API baseplate, follow the enclosed lifting instruction N31478, or - a Heavy Duty baseplate, follow the enclosed lifting instruction N31481.

The crates or individual assemblies must never be dropped to the ground during transfer. Refer to Figures 1 - 12 for examples of proper lifting techniques.

Fig. 1 .....The transportation crate is hoisted according to figure 1. The permissible lifting points are marked on the crate.

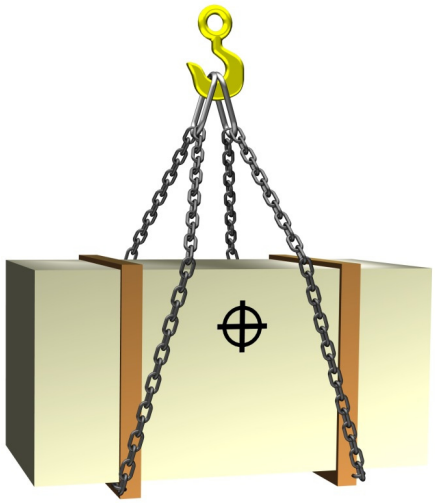


Fig. 1

Fig. 2.....The pump-motor-baseplate assembly is hoisted from under the suction case of the pump and from under the motor.

Fig. 3.....With tangential pumps, also ensure the balance of hoisting by means of a lifting eye fastened to the discharge flange.

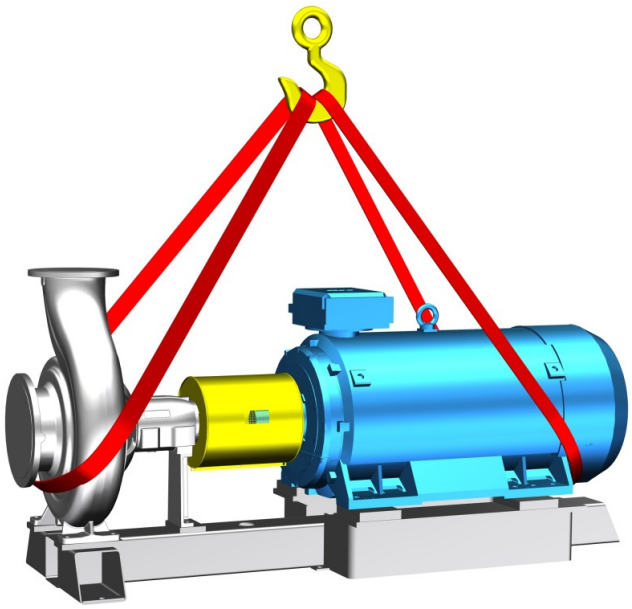


Fig. 2

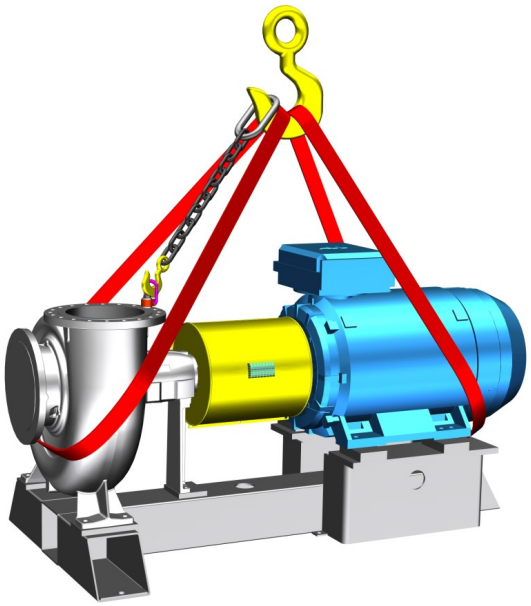


Fig. 3

Fig. 4.....The pump-baseplate assembly is hoisted from under the suction flange of the pump and from the lifting eyes fastened to the baseplate.

Fig. 5.....With tangential pumps, also ensure the balance of hoisting by means of a lifting eye fastened to the discharge flange.

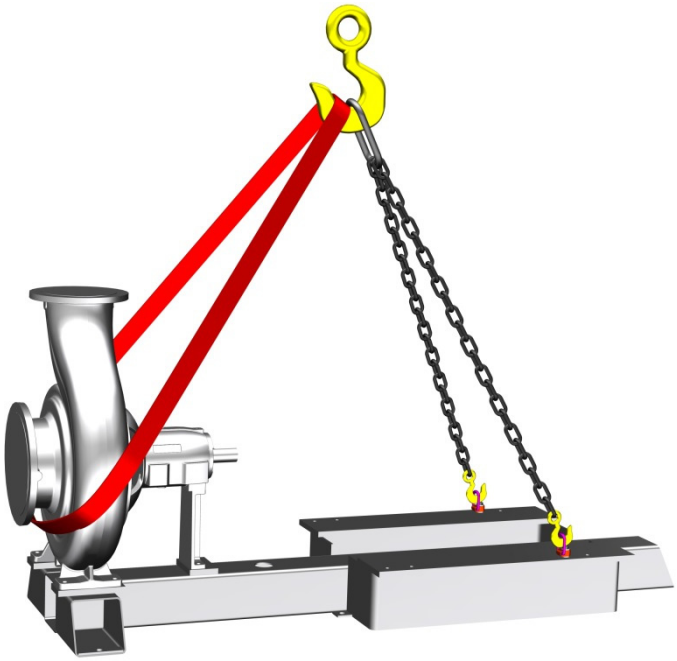


Fig. 4

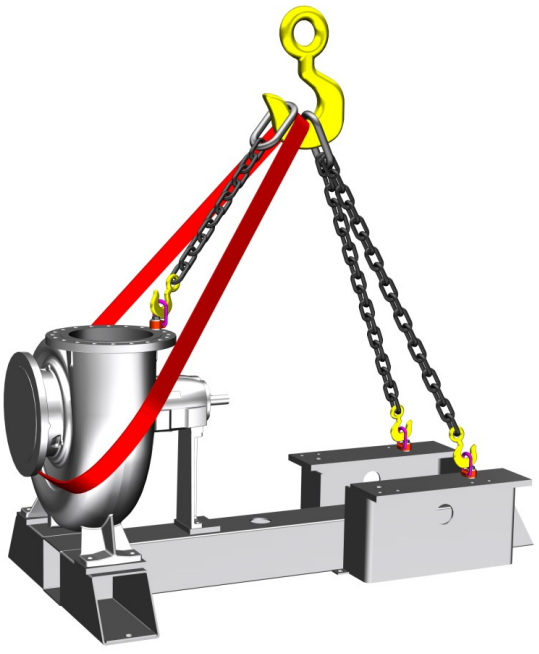


Fig. 5

Fig. 6 .....The radial pump is hoisted from the lifting eyes fastened to the discharge flange of the pump.

Fig. 7 .....The tangential pump is hoisted from the lifting eyes fastened to the suction and discharge flanges of the pump and to the end of the shaft. Pay attention to the centre of gravity.

Fig. 6

Fig. 7

Wet end

Fig. 8 .....The radial volute case is hoisted from the lifting eyes fastened to the discharge flange.

Fig. 9 .....The tangential volute case is hoisted from the lifting eyes fastened to the discharge flange. It is recommended to place the lifting eyes symmetrically with respect to the division plane of the volute case and as close to each other as possible. Pay attention to the centre of gravity.

Fig. 8

Fig. 9

Spare parts and coupling

Fig. 10 .....Heavy (> 25 kg) individual components can be lifted for example on a pallet.

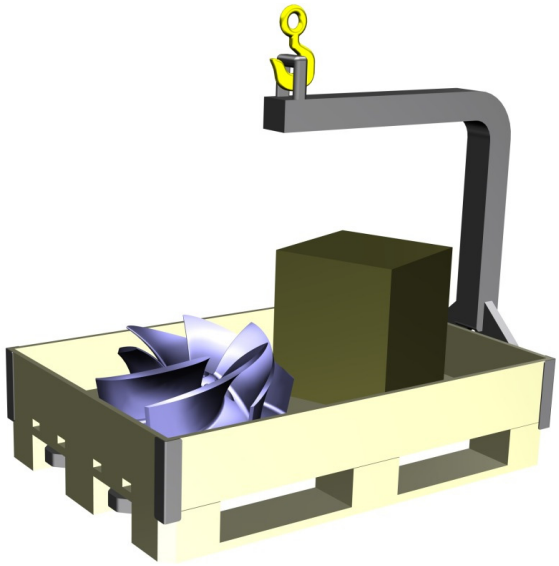


Fig. 10

Bearing parts

Fig. 11 .....The bearing is hoisted from the openings in the bearing housing and from the shaft.

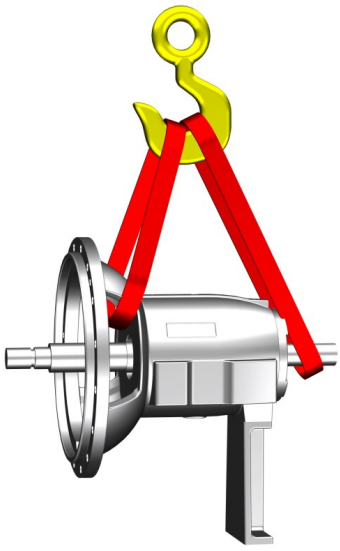


Fig. 11

Baseplate

Fig. 12.....The baseplate is hoisted from the lifting eyes fastened to the mounting holes.

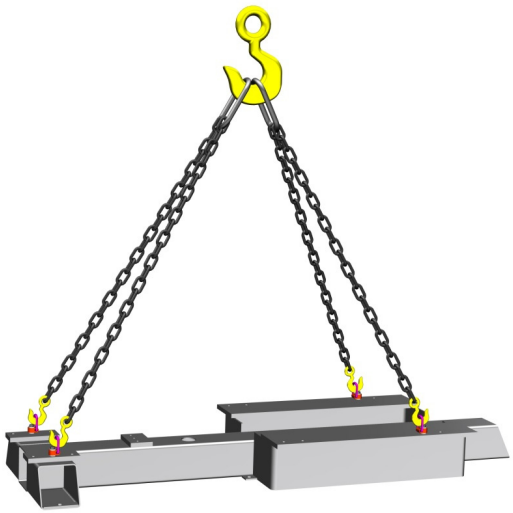


Fig. 12

2.1 Motor, gear and other accessories

When hoisting the motor, gear and other accessories, the instructions provided by the relevant manufacturer must always be followed.

2.2 Accessories

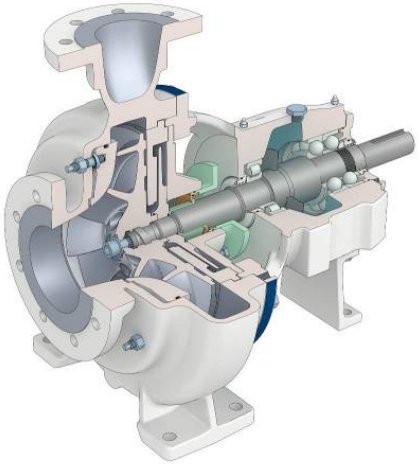
If the assembly includes accessories such as a noise cover, the cover may have to be removed before hoisting the assembly in order to prevent the cover from being damaged.

SULZER

SPP id: 110901 / en / **N31570** / 1

AHLSTAR

PROCESS PUMPS



Commissioning

1 Purchase inspection

Check carefully that the delivery meets your order and is in accordance with the packing list and parts list of the pump. Inform the supplier immediately about any defects or damage observed.

Do not remove the cover plates or plugs protecting the openings before the installation of pipes. Foreign particles inside the pump may damage it at starting.

Examine the crate and wrapping before discarding them since parts and accessories are sometimes wrapped individually or fastened into the crate.

If the pump unit is not installed immediately, it should be stored under conditions that will prevent deterioration due to damage and/or corrosion. The long-term storage requirements should always be specified in the purchase order.

2 Storage

2.1 Short-term (less than 3 months)

When it is necessary to store a pump for a short term before the installation, it must be stored in a dry location where it cannot be affected by dirt or corrosion. Protection plates on the pump openings should not be removed.

The pump bearings and drive elements must be properly protected against any foreign matter. To prevent rusting or seizing, lubricate the pump unit before storing and turn the pump shaft by hand at least once every two weeks.

2.2 Long-term

N O T E
The grease/oil lubricants must be changed before the pump is taken into use.

W A R N I N G
The rust preventives must be cleaned off carefully before the pump is taken into use. Solvents containing rust preventives can cause irritation to the skin and/or the respiratory system. Prolonged physical contact and breathing of vapor are to be avoided.

If the pump or pump unit is stored for more than 3 months, the following procedures must be observed:

- Store the product in a dry place.
- Drain any liquid from the pump.
- Rotate the pump shaft by hand at least once every month to prevent bearing damage.
- With cast iron pumps equipped with gland packing, remove the gland packings (461.21) from the stuffing box and apply rust preventives in the stuffing box.
- With oil lubrication, the bearing unit is emptied of oil before the delivery. Fill the bearing unit with oil or coat the interior of the unit with a rust preventing film.
- Apply rust preventing agents to the unprotected parts, such as the shaft end, pump flanges and coupling. If necessary, protect the volute casing and shaft sealing with volatile corrosion inhibitors.

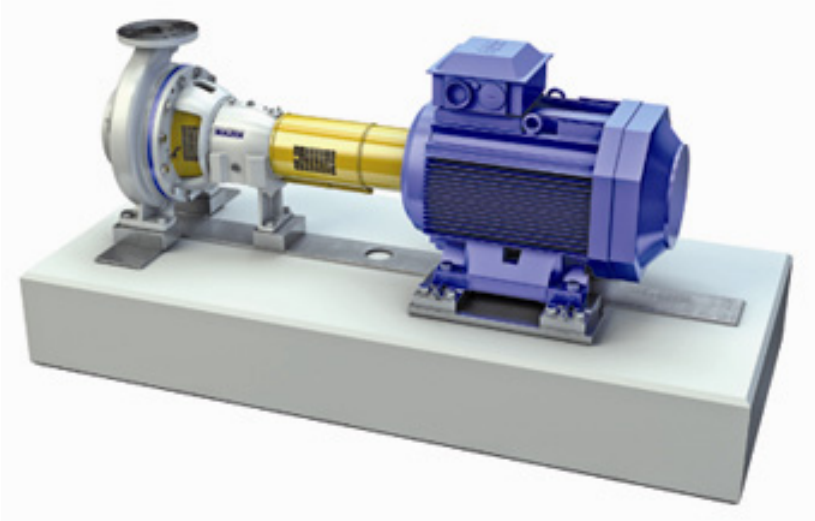
- Observe the storage instructions of any accessory equipment (e.g. electric motors) included in the delivery.
- If the pump unit is covered with a plastic sheet, the bottom should remain open to allow for ventilation.

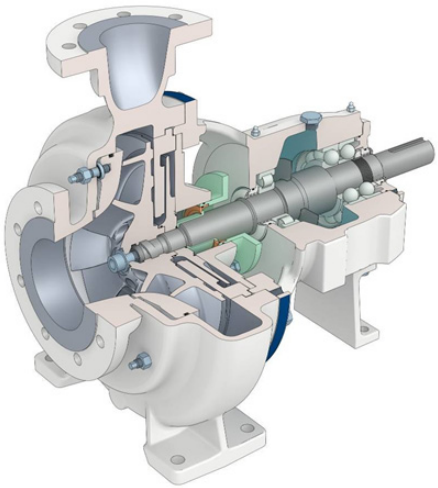
SULZER

SPP id: Version 14 > / 120601 / Replaces 110901 / en / **N31571** / 2

AHLSTAR

PROCESS PUMPS





Installation

1 Safety procedures before installation

N O T E
A pump should have adequate space for proper installation and maintenance actions.

All parts for the installation must be thoroughly cleaned before the installation. All traces of antirust agents should be cleaned off from the pump flanges, shaft assembly and drive elements. Avoid any damage to installed parts when handling them.

Personal protective equipment such as helmet, safety shoes and gloves are to be used.

Fastener information

Table 1 shows the rated and maximum moments of torque for fasteners presented in these instructions. Note the special values for the titanium screws. These shown values are only valid for fasteners where the moment values are not separately given.

Table 1, Fastener information

Screw size	Moments (Nm)		Titanium screws (76) Moments (Nm)	
	Rating	Max. value	Rating	Max. value
M5	3.5	4.0	2.1	2.7
M6	6.0	7.0	3.6	4.5
M8	14	18	8.9	11
M10	30	35	18	22
M12	50	60	30	38
M16	130	160	70	92
M20	250	300	140	180
M24	420	520	250	310
M30	800	1000	490	615

2 Wet end

2.1 Pipework

Supporting

The pipes must be mounted and supported so that the piping does not exert on the pump forces which exceed the values given under item “Safety instructions/Admissible forces and moments on pump flanges”. When planning the support locations remember the allowance for thermal expansion. Fig. 1.

Fit the pipe flanges accurately to the pump flanges. Flanges which have not been properly aligned must not be forced to position.

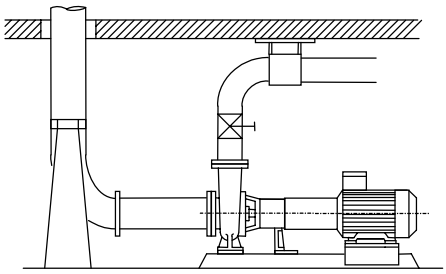


Fig. 1

Suction pipe below the pump

The suction pipe must be made as short as possible. Avoid points where air pockets or turbulence may be formed.

If the liquid level is below the pump, the suction pipe must gradually rise towards the pump. A sufficient length of the pipe end must be under the liquid level so that air cannot enter the pump. Fig. 2.

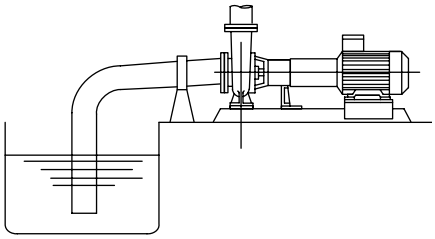


Fig. 2

Suction pipe above the pump

The suction pipe must descend gradually towards the pump. Fig. 3.

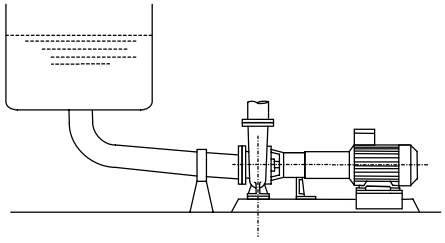


Fig. 3

Extension piece

The cones must be eccentric and in such a position that the upper level will be horizontal, alternative A in Fig. 4. If extension pieces are used, they must be formed so that gathering of gases cannot occur. At higher consistencies (c > 4 %), conical pipe parts must be avoided, alternative B in Fig. 4.

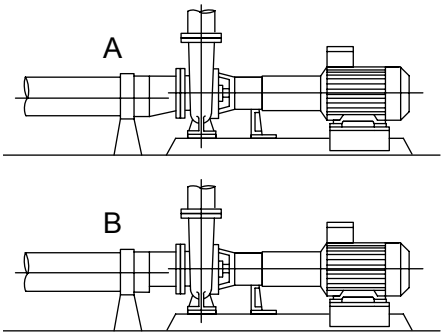


Fig. 4

Suction pipe design

WARNING

If there is a possibility of a dangerous return flow after the shutdown of the pump, a nonreturn device shall be installed in the outlet piping.

CAUTION

Never use the pump as a support for the piping system.

If the suction pipe has branches, they must be located as far from the pump as possible, and they must be formed advantageously with regard to the flow. The suction pipe must always be made as short as possible. Fig. 5.

A shut-off valve must be placed in the discharge pipe after the potential check valve. Before commissioning, clean the piping and suction pit carefully. Tools or other things left inside the pump will damage the pump already at testing.

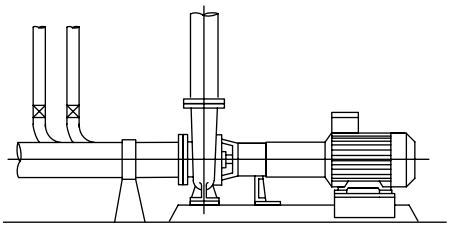


Fig. 5

3 Sealing unit

3.1 Auxiliary piping

Piping for shaft seal

In order to ensure trouble-free operation of the shaft seal, it must be provided with sealing, flushing or cooling liquid in certain applications in accordance with the sectional drawing and the parts list. The nominal sizes of the connections are also given in the parts list and dimensional drawing of the pump.

The nominal pressure of the sealing liquid must be as high as the nominal pressure of the pump, and its maximum temperature must be as high as the maximum temperature of the pump.

The sealing water equipment is installed in the pump. In certain sealing systems, the sealing liquid equipment contains a back-pressure valve; see sectional drawing.

Clean the sealing liquid piping carefully before installation and commissioning.

The reservoir of the seal pot sealing water equipment must be installed in a vertical position at least 500 mm above the center line of the shaft seal. Install the pipes as short as possible so that the shaft seal is the lowest point.

Piping for degassing in a gas separator (-GM, -GS)

The piping for degassing is connected to the degassing outlet (C50.21) of the pump. The degassing outlet is on the right-hand side when seen from the drive. The precise size and direction of the connection are shown in the dimensional drawing.

If a separate degassing pump (vacuum pump) is used, there is also a separate vacuum relief valve.

The size of the degassing pipe is determined by the amount of gas, the length of the pipe, the risk of clogging, etc. The pipe size generally suitable is shown in Table 2.

Table 2, Suitable pipe sizes for degassing

Sealing unit size	Outlet size C50.21	Suitable pipe size
10	Rp 1/2	DN25 or DN32
11	Rp 1	DN25 or DN32
20	Rp 1/2	DN40 or DN50
21, 22, 23	Rp 1	DN40 or DN50
31, 32, 33	Rp 1	DN40 or DN50
41, 42, 43, 44	Rp 1 1/4	DN40 or DN50
51, 52, 53, 54, 55	Rp 1 1/4	DN50 or DN65
60, 61, 62, 63	Rp 1 1/4	DN80 or DN100

Piping for degassing in an air separating pump (-R)

The piping for degassing is connected to the degassing outlet (C50.21) of the pump, Fig. 6. The degassing outlet can be on the left or right side of the pump depending on the design alternative, Fig. 6. The precise size and direction of the connection are shown in the dimensional drawing.

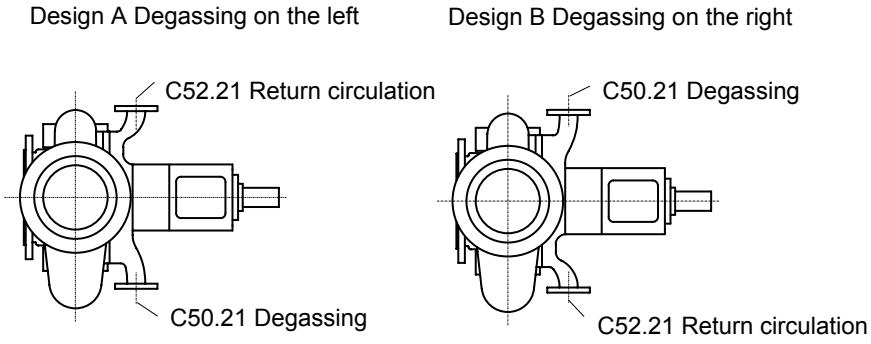


Fig. 6

In order to prevent the pumped liquid from flowing out while the pump is not running, the piping is often supplied with a shut-off valve (ball valve) equipped with an open-closed actuator. The control of the valve must be arranged so that the valve is open while the motor of the pump is running and otherwise closed.

If a separate degassing pump (vacuum pump) is used, there is also a separate vacuum relief valve.

The size of the degassing pipe is determined by the amount of gas, the length of the pipe, the risk of clogging, etc. The pipe size generally suitable is shown in Table 3.

Table 3, Suitable pipe sizes for degassing and return circulation

Sealing unit size	Outlet size C50.21 and C52.21	Suitable pipe size
11	DN25	DN25 or DN32
21, 22, 23	DN40	DN40 or DN50
31, 32, 33	DN40	DN40 or DN50
42, 43, 44	DN40	DN40 or DN50
51, 52, 53, 54, 55	DN50	DN50 or DN65
61, 62	DN80	DN80 or DN100

Return circulation piping in an air separating pump (-R)

The piping for the return circulation connects the return circulation outlet (C52.21) of the air separating design (-R) with the suction pipe of the pump, Fig. 7.

The piping for the return circulation should be installed so as to minimize friction losses. Table 3 shows the suitable pipe size. The return circulation pipe can be equipped with a shut-off valve and sight glass if necessary.

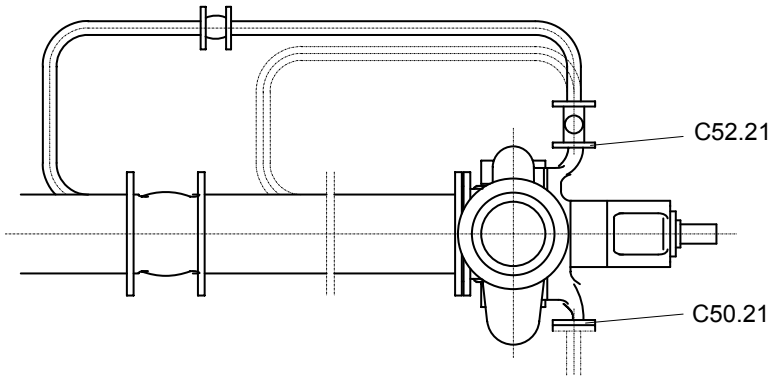


Fig. 7

Piping for degassing in a liquid ring pump (-LM, -S)

Connect the degassing piping to the degassing connection (C50.21) of the pump. The degassing connection of the -LM design liquid ring pump is on the right-hand side when seen from the drive. The degassing connection of the -S design liquid ring pump can be either on the right or left side of the pump. The precise size and direction of the connection are shown in the dimensional drawing.

W A R N I N G

Some of the pumped liquid will run out of the degassing connection during pumping. Lead and handle this liquid appropriately.

The mixture of gas and liquid discharging from the degassing connection is normally led back into the process, see examples in Figures 8, 9 and 10.

The suitable pipe size for the degassing piping is determined on the basis of pipe length, clogging risk etc. Normally, the suitable pipe size is one corresponding to the size of the degassing connection or the following larger size.

A vacuum relief valve and a pressure gauge, connected to the connection (C34.21) opposite the degassing connection, are usually included in the degassing piping.

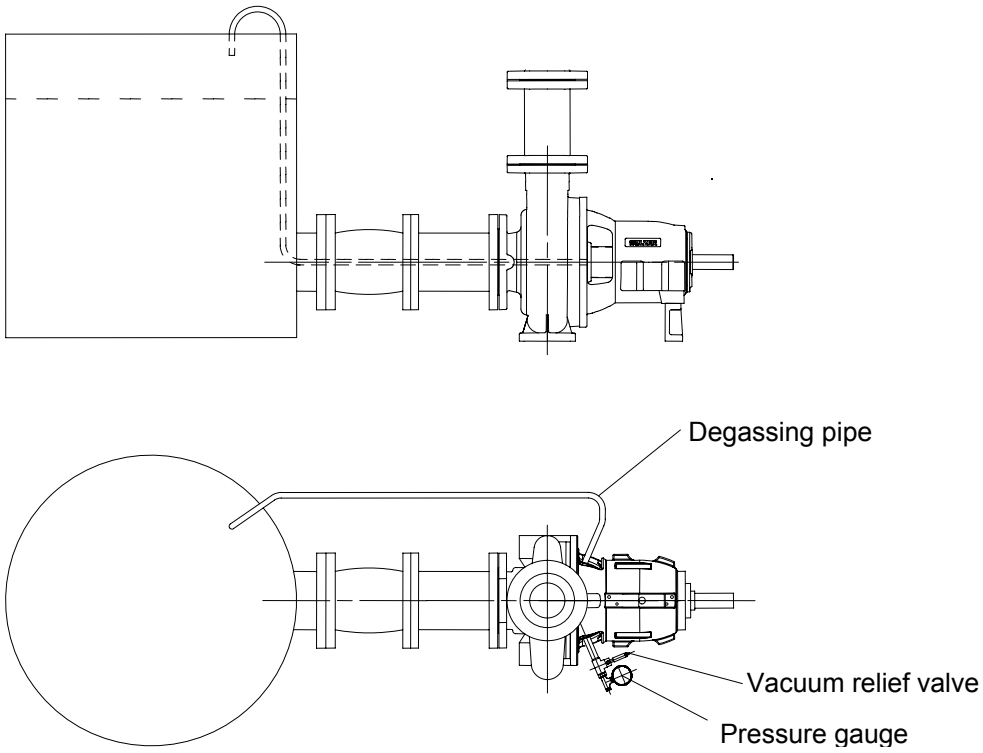


Fig. 8

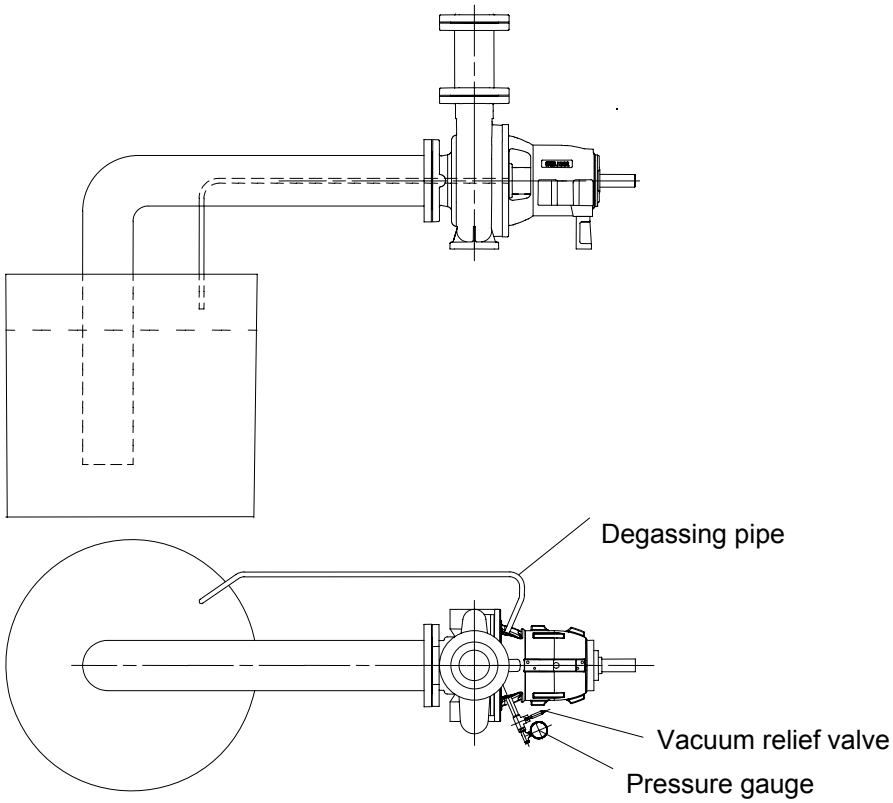


Fig. 9

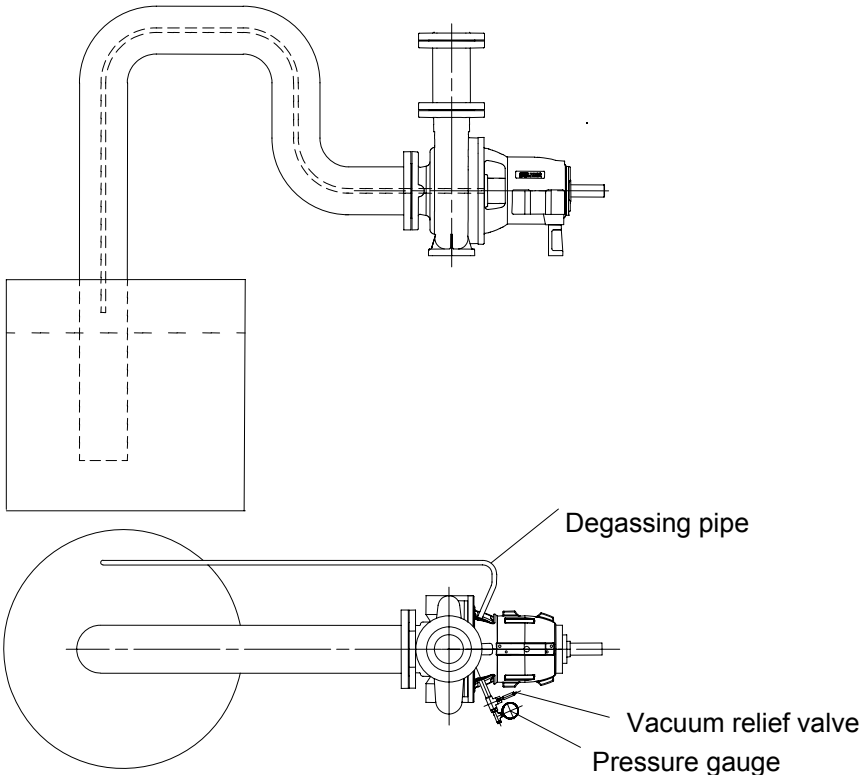


Fig. 10

4 Coupling unit

4.1 Installation and alignment of coupling

W A R N I N G
Before beginning any installation or alignment procedures, make sure the drive motor cannot be started by any means.

N O T E
Satisfactory performance of the coupling depends on correct installation and alignment.

When applicable, the coupling has already been installed and prealigned at the factory. However, the alignment may change due to faulty hoistings, baseplate support, piping support, thermal expansion or the like. Therefore check the shaft alignment of the coupling and re-align during the following stages:

1 After supporting of piping and before starting the pump, tighten the fixing screws of the pump and align the coupling to the required accuracy. Fig. 12.

2 After running the pump with water, look for changes caused by the water run. Correct the changes by altering the supporting of the piping. Tighten the fixing screws of the pump and align the coupling.

3 Carry out hot alignment if the temperature of the pumped liquid is higher than 100°C. The alignment is carried out during production run immediately after the pump is stopped while the pump and the motor are still at the operating temperature. The need for hot alignment depends on the extent of temperature differences and the coupling type chosen.

Alignment is checked by measuring the angular and parallel misalignments in vertical (6 and 12 o'clocks) and horizontal (3 and 9 o'clocks) directions. During the alignment, the coupling halves have to be locked together so that they do not move against each other. If needed, correct the alignment by adding and removing shims from under the feet of the motor and shifting the motor horizontally, until the shafts are aligned within the given tolerances. Fig. 12.

Optional alignment blocks can be used to shift the motor horizontally, see Fig. 11.

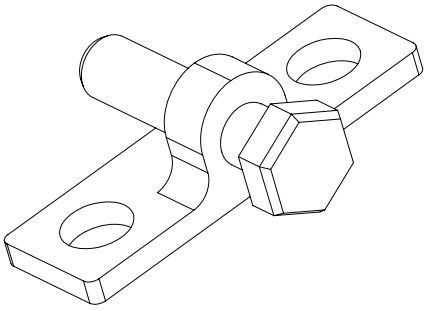
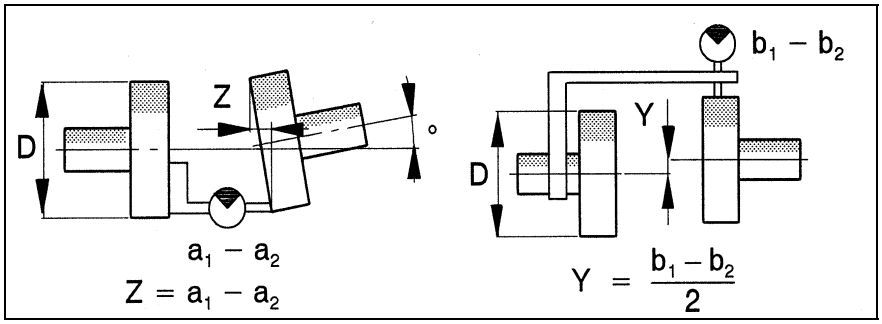


Fig. 11

4.2 Maximum tolerances for coupling alignment

The maximum tolerances for angular and parallel alignments are given in Fig. 12.



D (mm)	Z max				Y max	
	≤1500 rpm		>1500 rpm		≤1500 rpm	>1500 rpm
	mm	°	**mm**	°	**mm**	**mm**
- 100	0.08	0.06	0.05	0.04	0.10	0.06
101 - 200	0.11	0.05	0.06	0.03	0.15	0.10
201 - 300	0.15	0.03	0.10	0.02	0.20	0.15
301 - 400	0.20	0.03	0.10	0.02	0.25	0.15

Fig. 12

5 Baseplate

5.1 Installation at the site

N O T E
If the ordered assembly contains an API or Heavy Duty baseplate, follow the enclosed installation at the site instruction N31664.

N O T E
When welding the foundation screws, connect the earth clamp to the baseplate, never to the pump!

The pump base must be sturdy enough to endure vibration, stress and potential forces caused by the piping.

If there are grounds to suspect that the base is not suitable for installation, the base must be strengthened by making a concrete support stand or in some equivalent manner. Also note the bottom beams in the foundation or cavities for the different types of foundation screws.

5.2 Grouted baseplate of steel

Installation using welded foundation screws

The bottom beams in the foundation are cast in advance according to the dimensional drawing of the pump. The strength requirements for the bottom beams are given in Table 4. In order to facilitate the alignment of the beams, a so-called concrete frame can be used. The recommended accuracy for the installation of the beams is ±10 mm in all directions. The actual installation becomes much easier, if the upper surfaces are horizontal.

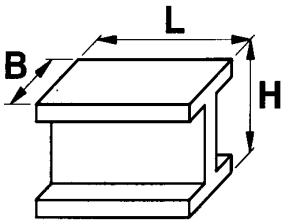
Place foundation screws (918.61) in the fixing holes of the baseplate. The distance between the foundation and the lower edge of the baseplate must be at least 50 mm. Each foundation screw is fixed to the baseplate by means of hexagonal nuts (2 pcs/foundation screw). Fig. 13 - 14.

Lower the pre-installed pump-motor-baseplate-assembly onto the floor so that the foundation screws are above the beams and the pump is in its position in the lateral and longitudinal direction. Now the foundation screws can be welded to the beams.

Adjust the position of the baseplate before grouting by turning the hexagonal nuts of the foundation screws, until the assembly lies horizontally and at the correct height.

Table 4, Welded foundation screw

Foundation screw	The capacity of the bottom beam (min.)		e.g. I-beam H x B x L
	Fv tension N	Fh sheat N	min. dimensions (mm)
M16 x 160	8600	7500	100 x 100 x 100
M20 x 160	17300	14400	100 x 100 x 150
M24 x 200	28100	23300	120 x 120 x 200
M30 x 200	39000	32200	140 x 140 x 250



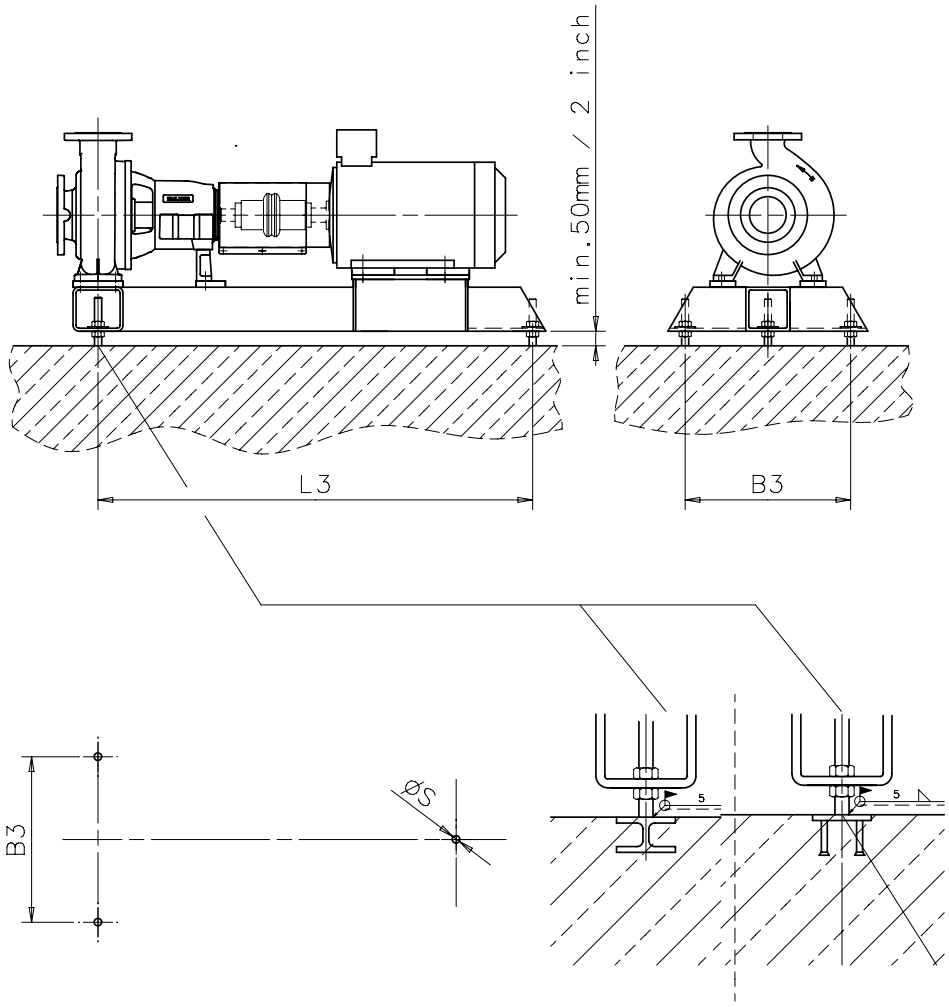


Fig. 13, Baseplate for pump and motor, T-base (STD,SLP)
Pump mounting sizes 11, 12, 13, 21, 22, 23, 24, 25, 26, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45, 46, 47, 48, 49, 4A, 51, 52, 53, 54, 55, 56, 57, 58, 59, 5A, 5C, 5D, 5E, 5F, 5G, 5H, 61, 62

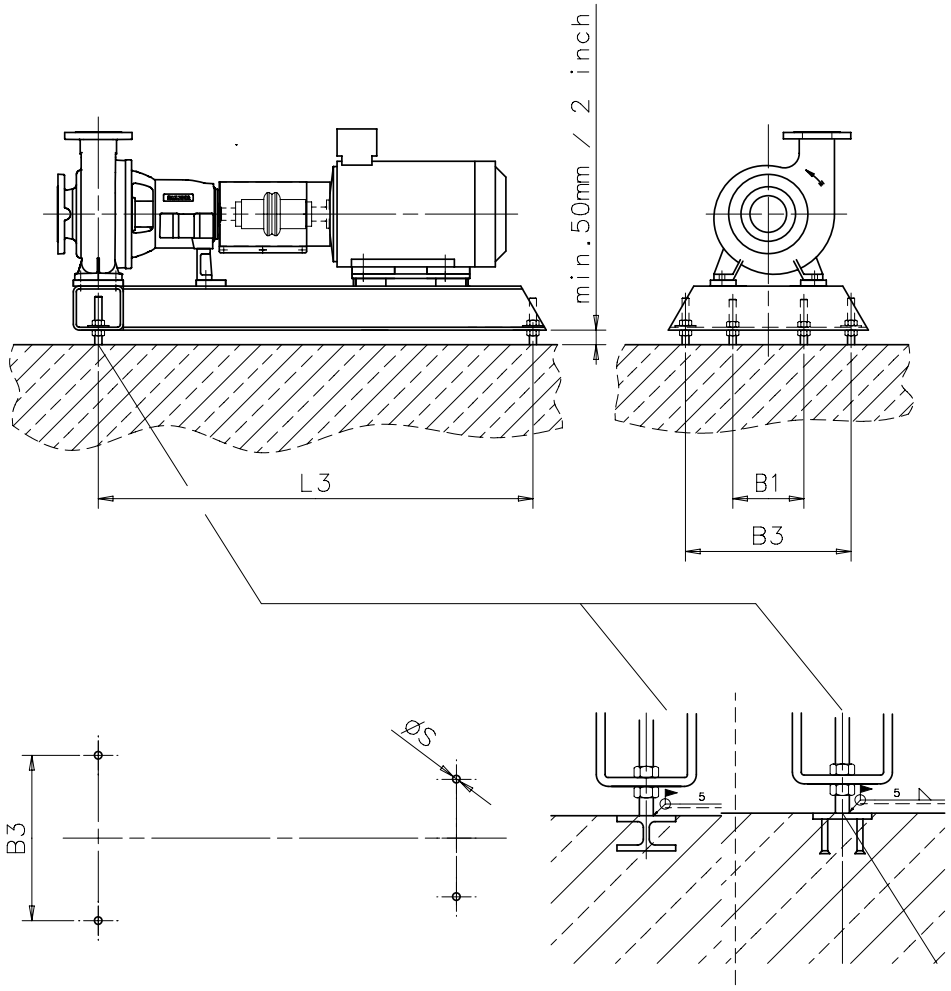


Fig. 14, Baseplate for pump and motor, Rectangular (STD)
Pump mounting sizes 5J, 5K, 5L, 63, 64, 65, 66, 67, 68, 74, 75, 77, 78, 79, 7A, 7B, 7C, 7D

Installation using chemical foundation screws

The foundation screw holes are drilled according to the dimensional drawing of the pump. The recommended accuracy for the location of the holes is +10 mm. Roughen the holes. Clean the holes well by brushing and blasting. Install the ampules into the holes. Install the foundation screws (918.61) by hammering to the bottom of the holes and turn them a couple of rounds. Let the glue of the ampules harden. The screws can be loaded according to the following table.

Table 5, Chemical foundation screws

Ambient temperature °C	Time of hardening	Time for load
> +20	10 min	2 h
+10	20 min	4 h
0	60 min	10 h
min -5	5 h	28 h

Lift the preinstalled pump and baseplate and fix it into the foundation screws by two nuts (2 pcs). Adjust the position of the baseplate before grouting by turning the hexagonal nuts of the foundation screws until assembly lies horizontally and at the correct height.

Installation using grouted foundation screws

The foundation screw cavities are made in advance (by pouring of concrete, drilling) in the concrete frame according to the dimensional drawing of the pump, Table 6 and Fig. 15 or 16. The recommended accuracy for the location of the cavities is ±10 mm.

Place the foundation screws (918.61) in the fixing holes of the baseplate, taking into account the distance between the foundation and the lower edge of the baseplate which must be at least 50 mm and the minimum dimension U2 according to Table 6. Each foundation screw is fixed to the baseplate by means of hexagonal nuts (2 pcs/foundation screw).

Lift the pre-installed pump and baseplate onto the mounting blocks so that the distance between the foundation and the lower edge of the baseplate is at least 50 mm and so that the foundation screws fit into their cavities and the pump is in its position in the lateral and longitudinal directions.

Grout the foundation screws. Use only non-shrinking solder concrete of high quality. Allow the concrete to set for about 1 or 2 days.

Remove the mounting blocks and adjust the position of the baseplate by turning the hexagonal nuts until the assembly lies horizontally and at the correct height.

Table 6, Grouted foundation screws

Size	Foundation screw (mm)		
	~e	**U_{min}**	**$U2_{min}$**
M16 x 250	100	200	160
M20 x 320	125	250	200
M24 x 400	125	300	240
M30 x 450	160	400	300

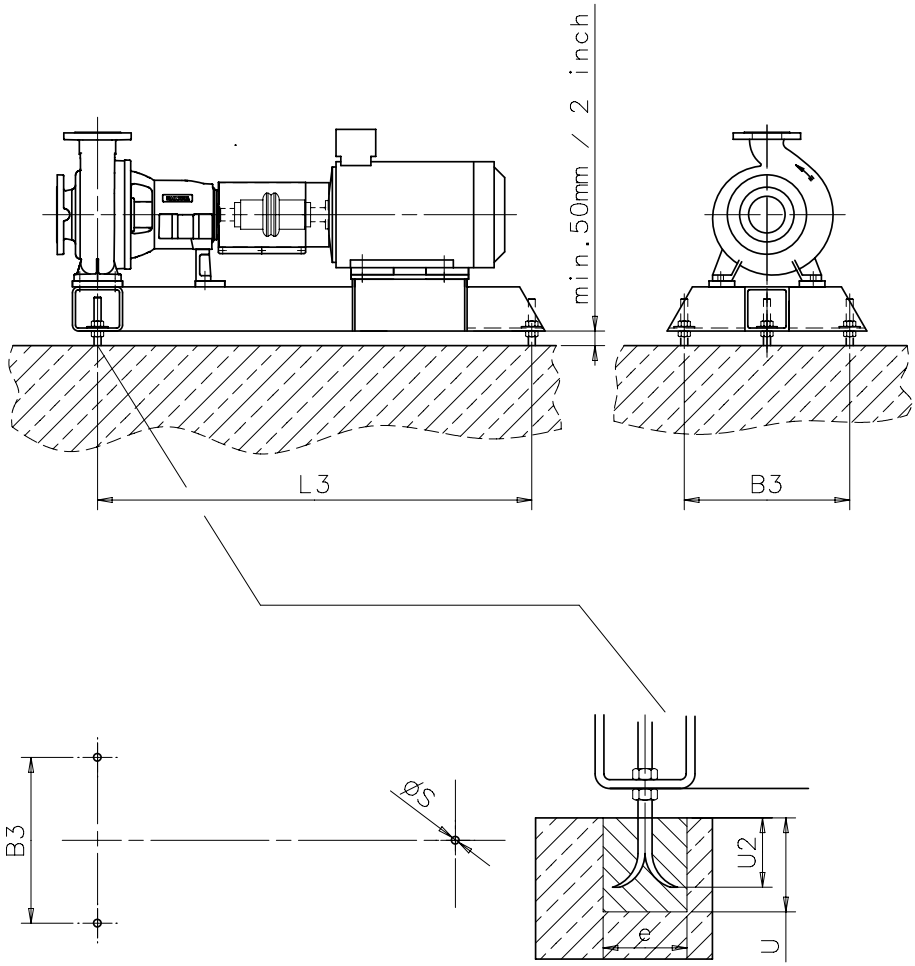


Fig. 15, Baseplate for pump and motor, T-base (STD, SLP)
Pump mounting sizes 11, 12, 13, 21, 22, 23, 24, 25, 26, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45, 46, 47, 48, 49, 4A, 51, 52, 53, 54, 55, 56, 57, 58, 59, 5A, 5C, 5D, 5E, 5F, 5G, 5H, 61, 62

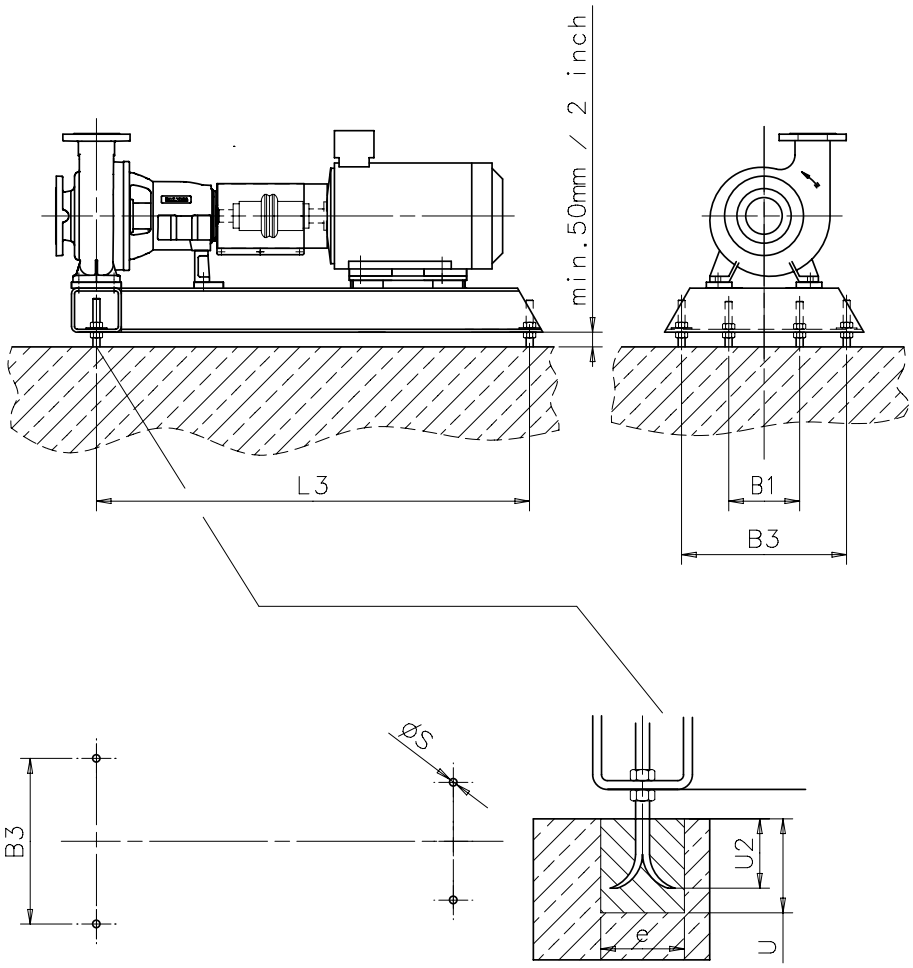


Fig. 16, Baseplate for pump and motor, Rectangular (STD)
Pump mounting sizes 5J, 5K, 5L, 63, 64, 65, 66, 67, 68, 74, 75, 77, 78, 79, 7A, 7B, 7C, 7D

Foundation

The recommended dimensioning for the foundation is given in Fig. 17 and 18. The dimensions for the baseplate are given in the dimensional drawing Baseplate for pump and motor.

The suitable concrete reinforcement is recommended because of the concrete shrinkage and the loads of the foundation. The amount of the concrete reinforcement depends on the size and the loads of the foundation and must be carefully calculated by the local civil engineer according to local standards and regulations.

Pour concrete into the mold. The recommended strength grade for the concrete is about 35 MPa (design strength K 35).

The upper surface of the foundation is leveled so that it is slanting in accordance with Fig. 17 or 18. In pump mounting sizes 5J, 5K, 5L, 63, 64, 65, 66, 67, 68, 74, 75, 77, 78, 79, 7A, 7B, 7C and 7D, the casing remaining under the motor can be covered with concrete up to the mounting level surface of the motor. Water the grouting during its drying to prevent cracking.

Recheck the alignment of the coupling after the grouting according to section ”Installation and alignment of coupling”.

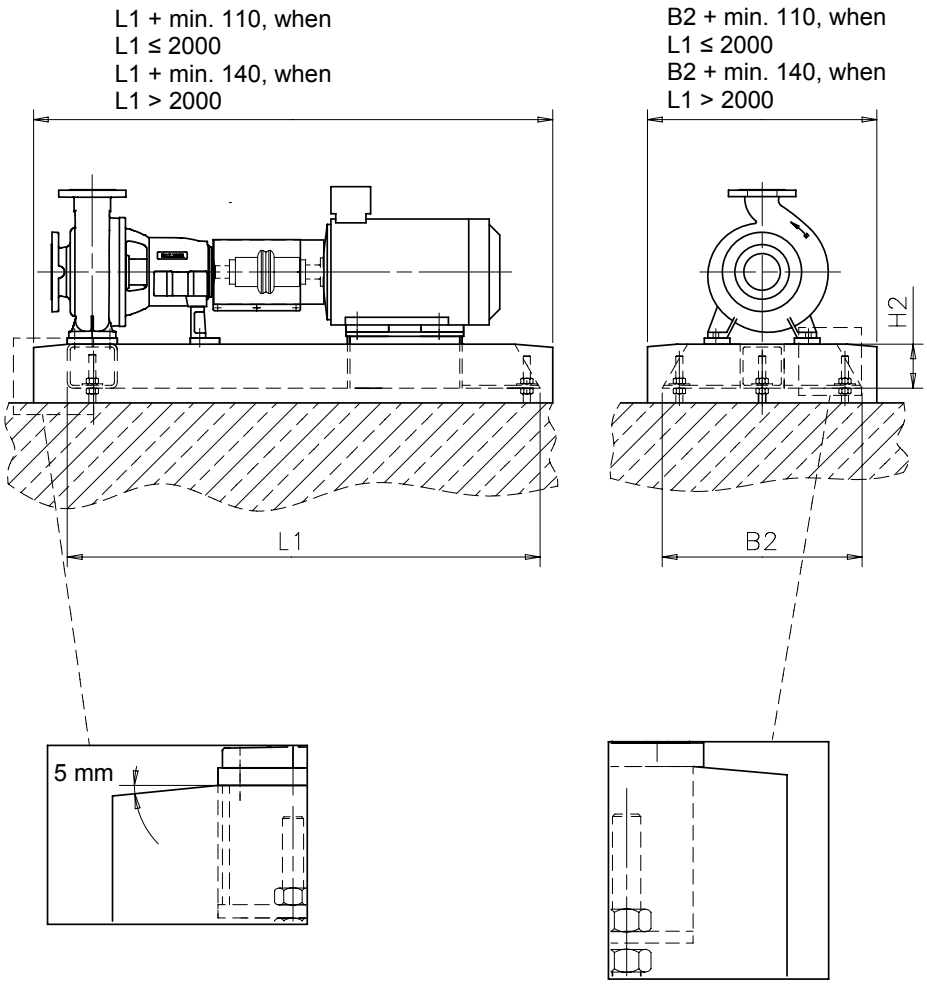


Fig. 17, Baseplate for pump and motor, T-base (STD, SLP)
Pump mounting sizes 11, 12, 13, 21, 22, 23, 24, 25, 26, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45, 46, 47, 48, 49, 4A, 51, 52, 53, 54, 55, 56, 57, 58, 59, 5A, 5C, 5D, 5E, 5F, 5G, 5H, 61, 62

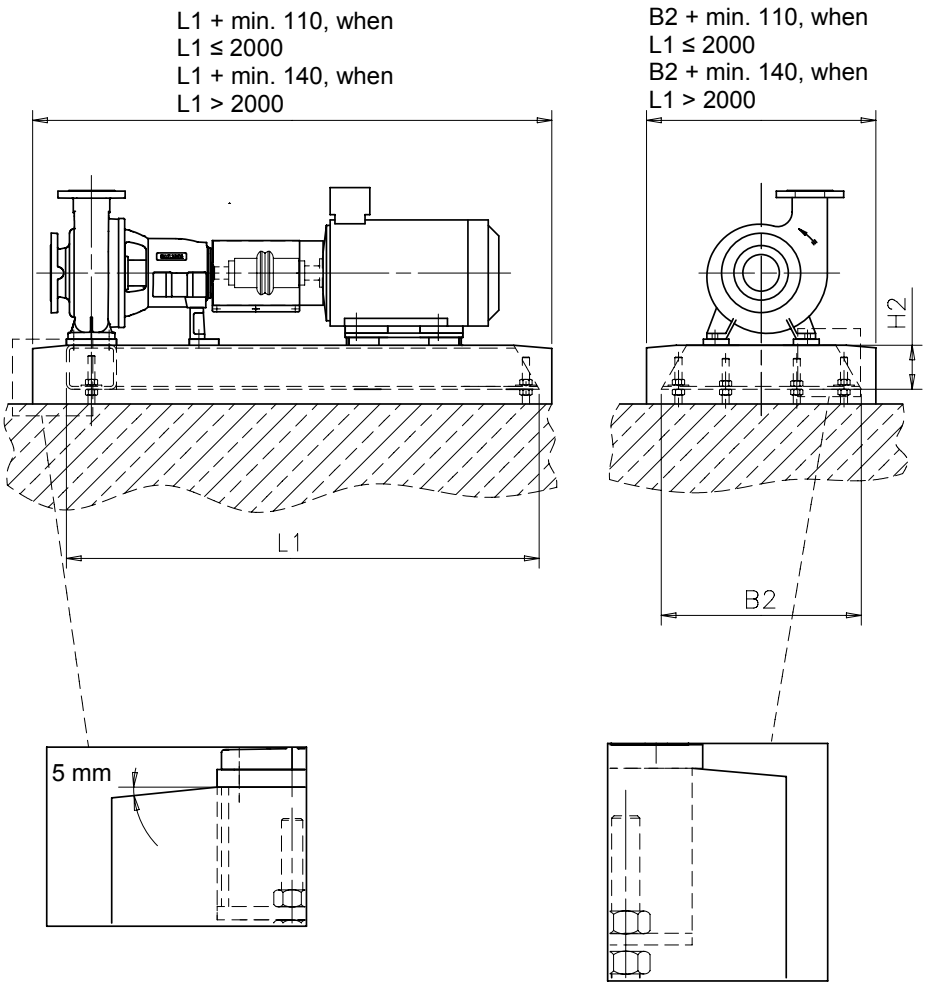


Fig. 18, Baseplate for pump and motor, Rectangular (STD)
Pump mounting sizes 5J, 5K, 5L, 63, 64, 65, 66, 67, 68, 74, 75, 77, 78, 79, 7A, 7B, 7C, 7D

5.3 Steel baseplate installed with mechanical feet

Place each machine base (898.61) in the fixing holes in the baseplate. There are 3, 4, 5 or 6 fixing holes. Use the hexagonal nuts (920.61) (2 pcs) in the mechanical feet to adjust the baseplate so that it is at the correct height and horizontal.

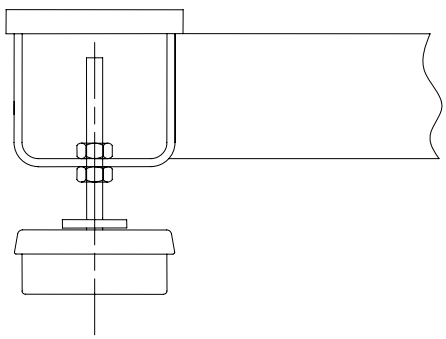


Fig. 19

5.4 Concrete baseplate installed with mechanical feet

Mount each machine base (898.61) with a stud bolt (3 pcs) on the bottom of the baseplate. Use the nut in the mechanical feet to adjust the baseplate so that it is horizontal and at the correct height.

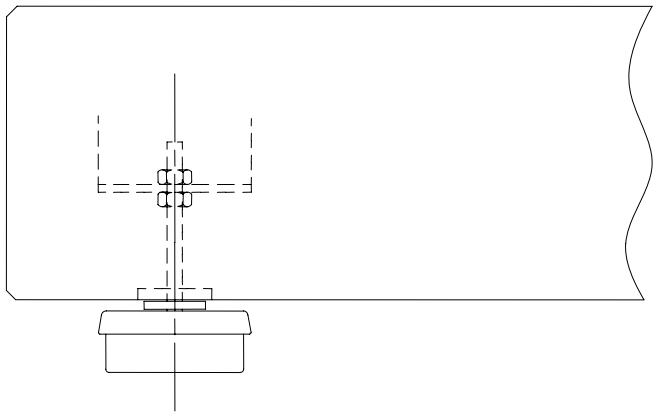


Fig. 20

6 Drive motor

6.1 Installation of the motor on the baseplate

If the motor has not been installed on the baseplate by the pump manufacturer, the installation should be carried out as follows:

The coupling half on the motor side is warmed up to approx. 100°C and pushed onto the motor shaft in such a way that the space between the ends of the shafts is according to the dimensional drawing (usually the front face of the coupling is even with the end of the shaft).

When installing the coupling, also see instructions supplied by the coupling manufacturer.

The coupling spacer is fastened to the coupling half of the motor without the flexible element.

Check that the pump is aligned as accurately as possible to the middle of the fixing holes of the motor. Lift the motor onto the riser blocks on the baseplate.

The coupling is aligned according to Section ”Installation and alignment of couplings”. The alignment is carried out by moving the motor vertically by means of the riser blocks or shims which are placed under the feet of the motor and laterally by moving the motor and the riser blocks sideways. Please note that there is an additional lateral adjustment allowance of 3 mm in the holes of the screws in the riser block.

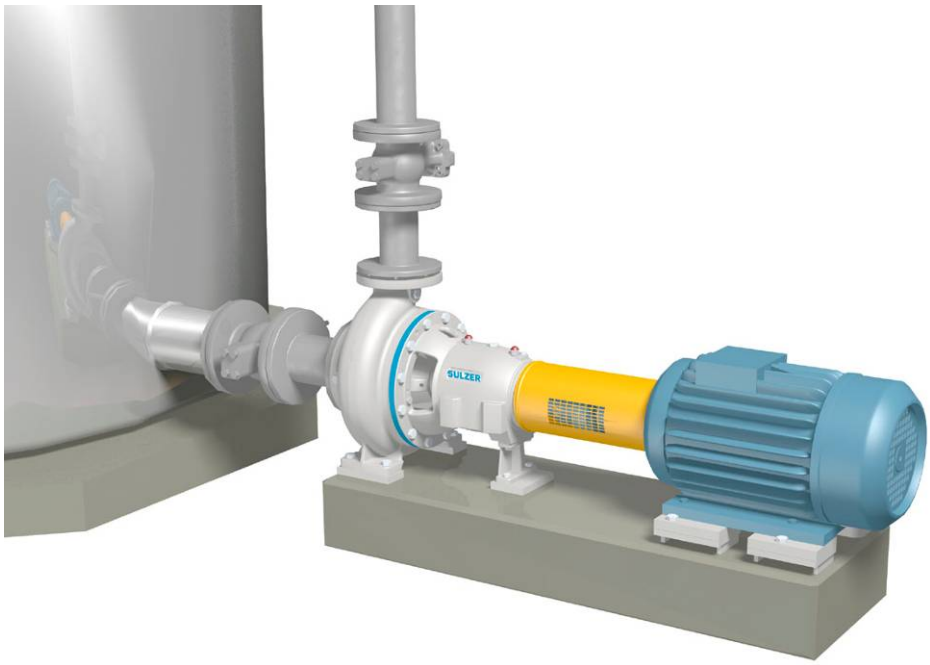
When installing the motor, special attention should be paid to the clearance of the coupling spacer, so that the spacer can be removed without detaching the motor.

SULZER

SPP id: Version 14 > / 120601 / Replaces 110901 / en / **N31572** / 2

AHLSTAR

PROCESS PUMPS



Operation

1 Safety procedures before start-up

Before starting the pump for the first time and after service repairs, the following precautionary measures are always to be checked carefully to prevent any accidents and to guarantee a trouble-free operation of the pump.

WARNING

Make sure that the motor cannot be started by any means accidentally during the following procedures.

WARNING

Make sure that the fixing screws of the pump and the motor are tightened according to the instructions.

WARNING

During operation - leakage of hazardous substances can occur - prepare proper means for a safe waste removal.

NOTE

Pressure containing pump parts are not pressure vessels within the meaning of the regulations for pressure vessels.

CAUTION

The pump will be damaged if run in the wrong direction.

1.1 Wet end

Leakage test

The pump parts and the piping shall be able to withstand a leakage test before the start-up. Leakage, particularly in the suction piping, can seriously reduce the performance of the pump and make it impossible to prime the pump before the start-up.

1.2 Sealing unit

Shaft seal and sealing water

Depending on the shaft seal fitting used, make sure that the shaft seal piping has been mounted correctly and that the sealing liquid pressures, liquid volumes and service intervals correspond to the table below.

Table 1, Sealing unit types (dynamical seal, mechanical seal, gland packing)

Sealing unit type	Shaft seal fluid						
	N	FR	FC	FE	QF	BF	G
DS11	X			X			
DS12	X			X			
DS13	X			X			
DS14	X			X			
MS11	X						X
MS12		X		X			
MS21					X	X	
MS31	X						
MS32		X		X			
MS35			X				
MS41					X	X	
MS33	X				X		
MS34		X		X			
MS42					X	X	
MS51	X						X
MS52		X		X			
MS61					X		
MS71	X				X		X
MS72		X		X			
MS81					X	X	
MS91	X						
PG11	X	X		X		X	

Table 2, Sealing unit types (liquid ring pump, gas separator, air separating pump)

Sealing unit type	Shaft seal fluid								
	N	FR	FE	QF	BF	QFFR	BFFR	QFFE	BFFE
LM11		X							
LM11			X (*						
LM21						X			
LM21							X		
LM21								X (*	
LM21									X (*
SM11		X							
SM11			X (*						
SM21						X			
SM21							X		
SM21								X (*	
SM21									X (*
RM11			X (*						
GM11		X							
GM11			X						
GM12		X							
GM12			X						
GM21				X	X				
GM22				X	X				
GS11	X								
GS12	X								

N = No sealing liquid

FR = Internal circulation

FC = Circulation closed loop

FE = External flushing liquid; P_T + 0.05 MPa, 3 l/min
*) For high vacuum level external flushing must be doubled or tripled.

BF = Pressurized external flowing sealing liquid; P_T + 0.05 MPa (minimum), 3 l/min
Except with the seal pot sealing water equipment, the needed sealant fluid flow is generated by the pumping effect of the shaft seal. The sealant fluid can be water (T_{amb}>0ºC) or a suitable water glycol mixture (T_{amb}< 0ºC) or some other liquid depending on the process application. Sealing fluid T_{max} = 100ºC, P_{max} = 1.6 MPa.

QF = Non-pressurized (max 0.05 MPa), 3 l/min

G = Grease once a week. Grease must be suitable for the elastomers of mechanical seal.

QFFR = Quench sealing fluid, Recirculation flushing fluid

BFFR = Barrier sealing fluid, Recirculation flushing fluid

QFFE = Quench sealing fluid, External flushing fluid; P_T + 0.05 MPa, 3 l/min
*) For high vacuum level external flushing must be doubled or tripled.

BFFE = Barrier sealing fluid, External flushing fluid; P_T + 0.05 MPa, 3 l/min
*) For high vacuum level external flushing must be doubled or tripled.

Impellers with balancing holes

$p_T = p_0$-0.005 MPa

Where p_T = pressure behind the impeller (MPa)
p_0 = inlet pressure (MPa)

Atmospheric pressure used as reference pressure = 0 MPa

Impellers without balancing holes

$$p_T = p_0 + 0.7 \times 10^{-6}\varrho g H - 1.1103 \times 10^{-9}\varrho n^2\left[(d_2/2)^2 - (d_b/2)^2\right] - 4.4413 \times 10^{-9}\varrho n^2\left[(d_b/2)^2 - (d_5/2)^2\right] \text{ MPa}$$

Where p_T = pressure behind the impeller (MPa)
p_0 = inlet pressure (MPa)
ρ = density of the liquid being pumped (kg/m3)
H = pump head at the operating point in question (m)
n = rotating speed of the pump (r/min)
d_2 = impeller back plate diameter (m)
d_b = impeller back vane diameter (m)
d_5 = impeller hub diameter is 0.04 m in bearing unit no. 1,
in bearing unit no. 2 0.05 m, in bearing unit no. 3 0.06 m,
in bearing unit no. 4 0.07 m, in bearing unit no. 5 0.09 m,
in bearing unit no. 6 0.10 m and in bearing unit no. 7 0.12 m.

Atmospheric pressure used as reference pressure = 0 MPa

The flushing liquid and sealing liquid must fulfill the following quality requirements:

- maximum particle size 50 µm
- maximum solid material content 2 mg/l.

1.3 Bearing unit

Lubrication

W A R N I N G

A pump unit operating without proper lubrication will damage the bearings and cause a pump seizure. Use grease lubrication always when the pump is mounted in an inclined position.

Check the oil or grease used for the lubrication of both the pump and motor bearings before start-up. Condensation or ingress of dirt and water may occur if the pump unit is stored for a long time before installation and start-up.

1.4 Drive motor

Direction of rotation

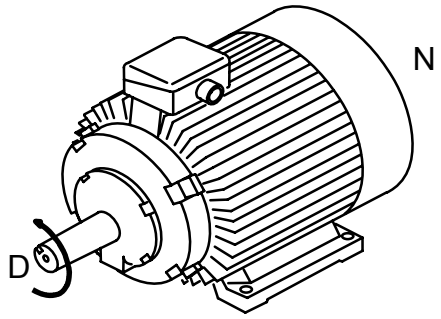


Fig. 1

- Before commissioning, always check the motor for correct rotation.
- It is imperative to detach the coupling spacer before checking the rotation direction of the motor.

The motor rotation must be counter-clockwise when viewed from the coupling end (D-end, Fig. 1) of the motor. (The pump rotation is clockwise when viewed from the coupling end.)

The direction of rotation must correspond to the arrow sign (972.31) on the bearing housing (330.31).

1.5 Coupling unit

Free rotation

Rotate the coupling by hand with the coupling spacer detached.

Coupling alignment

Check that the coupling has been properly aligned according to the instructions in Section ”Installation and alignment of coupling”.

WARNING

Before starting - all safety devices (e.g. coupling guards) must always be correctly installed. For explosive areas, guards with non-sparking materials are to be used.

1.6 Baseplate

Vibration of the baseplate should be monitored by means of regular measurements, especially if the baseplate is equipped with mechanical feet. If the vibration values exceed the highest permissible values, the cause of vibration should be determined.

2 Starting the pump

WARNING

The product is meant only for the purpose for which it is sold - never operate beyond the intended use described in these instructions.

WARNING

If your pump has no gas separator (-GM, -GS), liquid ring (-LM, -S) or air separating (-R) pump in the sealing unit, make sure that the pump is sufficiently filled with the pumped liquid before starting.

CAUTION

Observe immediately after start-up the instrumentation showing the discharge pressure. If the pressure is not quickly reached, stop the motor and check causes for the low pressure.

CAUTION

If it is necessary to adjust the amount of pumped liquid, do it by adjusting the discharge valve. Never use the suction valve for flow adjustment.

2.1 Pumps equipped with gland packings, mechanical seals or dynamic sealing units

- Open the valves for sealing water if any, and adjust suitable pressure and flow according to Table 1.
- Check that there is abundant leakage at the gland packing. If there is no continuous leakage, slacken the stuffing box gland. If this does not help, remove the packings and re-pack the stuffing box less tight.

- Fill the pump so that at least the suction pipe and pump casing are filled with liquid. Let the air come out of the upper part of the tangential volute casing by opening the screwed plug (903.13) in connection (C54.11).
- Check that the suction valve is fully open and discharge valve closed.
- Start the motor.
- Open the discharge valve gradually until the desired amount of liquid is reached.
- Check that the gland packing leakage is still abundant. If not, slacken the stuffing box gland immediately. If this does not help and the gland packing becomes hot, stop the pump and find out the reason for the disturbance. When the gland packing has been operating trouble-free for 10 minutes it may be tightened. Tighten it by turning the hexagonal nuts approx. 1/6 turns at a time at 5 - 10 minutes' intervals until the leakage is at least 30 - 80 drops a minute. While tightening, make sure that the stuffing box gland remains perpendicular to the shaft.
- Follow the instructions given by the manufacturer of the sealing water equipment for filling, bleeding and operation setup.

2.2 Pumps equipped with liquid ring pumps (-LM, -S)

- Open the sealing liquid and/or flushing liquid valves and adjust the pressure and the flow rate to a suitable level in accordance with Table 2.
- Let the flushing liquid flow for about 1 to 2 minutes so that all necessary spaces are filled with the liquid.
- Make sure that the suction valve is fully open and that the discharge valve is closed.
- Start the motor.
- Adjust the desired vacuum by means of the vacuum relief valve (Fig. 2):

  Undo the locking nut (6) which locks the valve spindle (2).

  Turn the valve bushing (3) to the desired direction while holding the valve spindle (2) in place. When you turn the bushing (3) clockwise, the vacuum grows as the force of the spring (4) closing the valve spindle (2) increases. When you turn the bushing (3) counterclockwise, the vacuum reduces as the force of the spring (4) decreases.

  When the desired vacuum is reached, lock the valve spindle (2) to the bushing (3) with the locking nut (6).

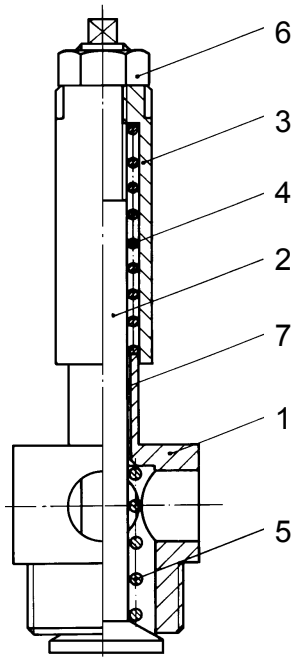


Fig. 2

C A U T I O N

There is a risk of destroying the suction impeller of a liquid ring pump by cavitation, if the vacuum level has been adjusted too high or the vacuum relief valve has been taken off and the connection has been plugged.

- When the pump starts to pump and the pressure on the discharge side rises, open the discharge valve until the desired liquid volume is reached. If the pump and suction pipe are full of liquid, the pressure will rise immediately after starting. If the pump is empty when being started, it takes some time for the pressure to rise.

2.3 Pumps equipped with gas separators (-GM, -GS) or air separating pumps (-R)

- Open the sealing liquid valves of the pump and of the potential degassing pump and adjust the flow rate to a suitable level in accordance with Table 2.
- Make sure that the suction valve is fully open and that the discharge valve is closed.
- Start the motor of the degassing pump if there is one.
- Adjust the desired vacuum by means of the vacuum relief valve (see pumps equipped with liquid ring pumps).
- Start the motor.
- Open the degassing valve between the pump and the potential degassing pump.
- Open the discharge valve carefully until the desired liquid volume is reached.
- If the pump is used as a self-priming pump, do not open the discharge valve until the degassing pump has sucked the pump full of liquid, the pump starts to pump and the pressure starts to rise on the discharge side.
- Make sure that the pumped liquid does not flow out through the degassing connection. If it does, reduce the vacuum created by the degassing pump by means of a potential vacuum relief valve. The sealing liquid may flow out through the degassing connection.

3 Controls during the first run

W A R N I N G

Personal injuries may occur if personal protective equipment is not used when servicing the product. When pumping hazardous liquids, skin and eye protection are required.

C A U T I O N

Do not operate the pump below the minimum recommended flow or with the discharge valve closed. Cavitation or recirculation can lead to a quick pump failure.

By controlling the pump operation and output regularly, the possible need for service and repair can be anticipated. In this way, the pump efficiency is kept high, the process is trouble-free and the maintenance costs are low.

Control the temperature of the gland packing and maintain the leakage at 30 - 80 drops/minute by adjusting the stuffing box gland.

The flow and pressure of sealing water must be kept at the enclosed values given by the seal manufacturer.

When the seal pot sealing water equipment is operating, check that the sealing fluid is flowing in the correct direction – the return hose must be warm.

Check the temperature and vibration of bearings through regular measuring. If one or the other increases, it may be a sign of incorrect lubrication or bearing damage. The measuring studs (SPM, M8 x 24) are in the bearing housing for controlling the bearings.

Also, any noises from the pump and its vibration have to be controlled and the reasons for unusual noises or vibration detected.

The condition of the coupling can be monitored with a stroboscope through the perforation in the coupling guard.

4 Shut-down procedure

- Close the discharge valve to prevent the pumped liquid from flowing back.
- Close the degassing valve between the pump equipped with a gas separator (-GM, -GS) or air separating pumps (-R) and the potential degassing pump.
- Stop the motor.
- Stop the motor of a potential degassing pump.
- Close the suction valve if there is reason to doubt that the pumped liquid will flow out of the suction piping.
- Close the cooling and flushing liquid valves, if any.
- If the pump has a sealing liquid valve, it cannot be closed until the pump has been drained or until at least the pressure has been relieved from the pump.

During longer shut-downs, the pump must be checked every now and then. Turn the shaft manually a few times. If the pumped liquid congeals or solidifies easily, if it is corrosive, or if the pump is exposed to freezing, drain the pump and suction piping for the shut-down period. At the same time, flush the pump with clean water.

5 Controls after the first run

N O T E
The correct final alignment of the coupling is important for the pump operation.

When the pump unit has run for a sufficient length of time to bring the pump and motor up to the normal operating temperature, check the coupling alignment according to Section ”Installation and alignment of coupling”.

With hot liquid pumps, check the tightness of the casing cover fixing screws. Adjust torque in accordance with the reference values.

With pumps equipped with gland packing, check proper leakage from the stuffing box.

With pumps equipped with mechanical seals, ensure that the flushing or cooling supplies are functioning adequately.

Make sure that the sealing water system is working properly.

Check that there is no overheating in the pump or motor bearings.

6 Trouble-shooting - operation

During the start-up period, problems are mostly caused by pump selection mistakes, poor process design, operational mistakes or foreign objects in the process.

During the long-term operation of a pump unit, problems are mostly caused by random failures, process changes or corrosion and wear.

Problems can normally be traced to either poor maintenance or exceeding the limitations for the intended use of the pump.

The following problem tracing analysis includes the most common malfunctions and their possible causes. If the pump does not function properly, it is important to trace the actual reasons, so that the repairs and required modifications can be done without delay. Table 3 - Table 10.

Table 3, Symptom: Pump not delivering liquid

Probable cause:	Remedy:
Wrong direction of rotation	Change the direction of rotation acc. to the arrow sign on the bearing unit
Pump not adequately primed or a vapor lock in the suction pipe	Reprime the pump and suction piping
Flushing liquid is not on (liquid ring pumps (-LM, -S))	Open the flushing liquid valve
Difference between inlet pressure and vapor pressure too small	Check the suction piping arrangements
Air leakage in suction opening, suction piping or shaft seal	Check the suction piping. Readjust the shaft seal
Suction piping, suction valve or impeller clogged	Check the suction piping and the pump for any obstructions
Rotational speed too low	Check the speed requirements/limitations
Flow resistance of the piping higher than the head generated by the pump	Check resistancies and reduce losses
Unexpected air/gas content in the pumped liquid	Consult manufacturer for further instructions
Suction tank level low	Check the required inlet/suction head

Table 4, Symptom: Insufficient head

Probable cause:	Remedy:
Unexpected air/gas content in the pumped liquid	Consult manufacturer for further instructions
Unexpected viscosity of the pumped liquid	Consult manufacturer for further instructions
Suction piping, suction valve or impeller clogged	Check the suction piping and the pump for any obstructions
Rotational speed too low	Check the speed requirements/limitations
Wrong direction of rotation	Change the direction of rotation acc. to the arrow sign on the bearing unit
Flow resistance of the piping higher than the head generated by the pump	Check resistancies and reduce losses
Pressure containing pump parts worn/damaged/clogged	Check the pump and replace defective parts, if necessary
Suction tank level low	Check the required inlet/suction head

Table 5, Symptom: Insufficient (or irregular) flow

Probable cause:	Remedy:
Vapor lock in the suction pipe	Reprime the pump and suction piping
Suction head too high	Check that the suction valve is fully open and that the suction line is unobstructed
Difference between inlet pressure and vapor pressure too small	Check the suction piping arrangements
Air leakage in suction opening, suction piping or shaft seal	Check the suction piping and readjust the shaft seal
Unexpected air/gas content in the pumped liquid	Consult manufacturer for further instructions
Unexpected viscosity of the pumped liquid	Consult manufacturer for further instructions

Probable cause:	Remedy:
Suction piping, suction valve or impeller partially clogged	Check the suction piping and the pump for any obstructions
Rotational speed too low	Check the speed requirements/limitations
Flow resistance of the piping higher than the head generated by the pump	Check resistancies and reduce losses
Pressure containing pump parts worn/damaged/clogged	Check the pump and replace defective parts, if necessary

Table 6, Symptom: High power consumption

Probable cause:	Remedy:
Rotational speed too high	Check the speed requirements/limitations
Wrong direction of rotation	Change the direction of rotation acc.to the arrow sign on the bearing unit
Flow resistance of the piping much higher/lower than the head generated by the pump	Check the piping arrangements
Unexpected specific gravity of the pumped liquid	Consult manufacturer for further instructions
Unexpected viscosity of the pumped liquid	Consult manufacturer for further instructions
Pump and motor incorrectly aligned	Realign the pump and motor assembly, make sure there is no strain on the pump.
Crooked or eccentric shaft	Reassemble the pump and renew the shaft and bearings, if necessary
Rotating objects or pump parts chafing inside the pump	Reassemble the pump and check the clearances
Pressure containing pump parts worn/damaged/clogged	Check the pump and replace defective parts, if necessary
Mechanical tightness of pump components	Reassemble the pump and check the clearances

Table 7, Symptom: Excessive noise and/or vibration

Probable cause:	Remedy:
Difference between inlet pressure and vapor pressure too small (cavitation)	Check the suction piping arrangements
Unexpected air/gas content in the pumped liquid	Consult manufacturer for further instructions
Air leakage in suction opening, suction piping or shaft seal	Check the suction piping/readjust the shaft seal
Suction piping, suction valve or impeller clogged	Check the suction piping and the pump for any obstructions
Rotational speed too low	Check the speed requirements/limitations
Flow resistance of the piping higher than the head generated by the pump	Check resistancies and reduce losses
Pump functioning below the recommended minimum flow (cavitation)	Check the pumping system requirements
Pump foundation not rigid enough	Strengthen the foundation
Inadequate piping support exerting strain on the pump	Check the piping support requirements
Pump and motor incorrectly aligned	Realign the assembly, make sure there is no strain on the pump.
Crooked or eccentric shaft	Reassemble the pump and renew the shaft and bearings, if necessary
Rotating objects or pump parts chafing inside the pump	Reassemble the pump and check the clearances
Pressure containing pump parts worn/damaged/clogged	Check the pump and replace defective parts, if necessary
Mechanical tightness of pump components	Reassemble the pump and check the clearances
Bearings worn or loose	Reassemble the pump and replace the bearings, if necessary
Inadequate or excessive lubrication	Check the pump for proper lubrication
Impeller damaged or out of balance	Reassemble the pump and replace the impeller, if necessary

Table 8, Symptom: Bearings wear rapidly

Probable cause:	Remedy:
Pump and motor incorrectly aligned	Realign the pump assembly, make sure there is no strain on the pump. Replace the bearings, if necessary.
Crooked or eccentric shaft	Reassemble the pump and straighten or replace the shaft

Probable cause:	Remedy:
Rotating objects or pump parts chafing inside the pump	Reassemble the pump and check the clearances
Impeller damaged or out of balance	Reassemble the pump and replace the impeller, if necessary
Inadequate or excessive lubrication	Check the pump for proper lubrication
Badly installed and/or dirty bearings	Renew bearings, if necessary. Check the quality and amount of lubricant

Table 9, Symptom: Pump overheats/seizes

Probable cause:	Remedy:
Pump not adequately primed	Reprime the pump and suction piping
Flushing liquid is not on (liquid ring pumps (-LM, -S))	Open the flushing liquid valve.
Difference between inlet pressure and vapor pressure too small	Check the suction piping arrangements. The pump may operate below the recommended minimum flow (cavitation)
Pump functioning below the recommended minimum flow (cavitation)	Check the pumping system requirements
Pump and motor incorrectly aligned	Realign the assembly, make sure there is no strain on the pump
Bearings worn	Reassemble the pump and replace the bearings, if necessary
Crooked or eccentric shaft	Reassemble the pump, straighten or renew the shaft
Impeller damaged or out of balance	Reassemble the pump and replace the impeller, if necessary
Rotating objects or pump parts chafing inside the pump	Reassemble the pump and check the clearances
Discharge valve closed	Open the discharge valve
Discharge valve clogged	Check the pipe and flush it if necessary

Table 10, The liquid pumped flows out through the degassing connection (pumps equipped with gas separators (-GM, -GS) and air separating pumps (-R))

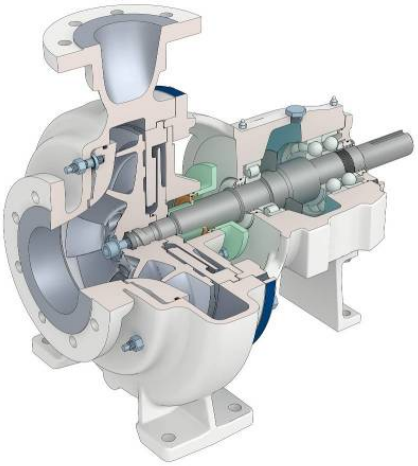
Probable cause:	Remedy:
Inlet height too high	Check the suction height limits
Pump speed too small	Check the speed requirements and restrictions
Degassing vacuum too high	Adjust the degassing vacuum by means of the vacuum relief valve

SULZER

SPP id: Version 14 > / 120601 / Replaces 110901 / en / **N31573** / 2

AHLSTAR

PROCESS PUMPS



Preventive maintenance

1 General

N O T E
Refer to the sectional drawings when reading through these instructions.

N O T E
Preventive maintenance is also a relevant safety factor.

N O T E
If the pump performance does not fulfill the process requirements, the pump is to be disassembled and inspected. All worn parts should be changed to new genuine spare parts.

Regular and systematic preventive and predictive maintenance can extend the product lifetime and requires fewer repairs and spare parts. Monitoring of instrumentation and physical examinations are a vital part of today's quality maintenance. We recommend that the maintenance system includes a historical record kept for each pump, its condition and performance. This will help to prevent sudden failures and aid in case of possible fault tracing analyses. In the process industries, one process downtime caused by a pump normally costs much more than the price of the pump.

Preventive maintenance consists of the following actions:

- Bearing lubrication
- Temperature, noise, vibration monitoring and inspections
- Monitoring the discharge pressure, capacity and power demand
- Inspections regarding corrosion and wear
- Shaft seal monitoring
- Regular pump washdowns
- Monitoring the pump and pipings for leakage
- Quarterly checks of the tightness of critical fasteners, such as foundation screws and pump & motor fasteners onto the baseplate

General measuring instruments for pump operation are presented in Table 1.

Table 1, Measuring instruments

Fixed instruments:	Portable instruments:
Pressure gauges & indicators	Vibration analysers
Flow meters	Tachometers
Ammeters / wattmeters / voltmeters	Thermometers
Speed indicators	Noise level indicators
Temperature detectors	Ultrasonic indicators (wall thickness)
Vibroswitches	
Any fixed or portable instruments may in themselves create a possible failure and require regular monitoring to ensure their correct functioning.	

1.1 Temperatures

During operation, the following surface temperatures are to be observed regularly:

- volute casing (102.11)
- bearing housing (330.31)
- shaft sealing, measured from the casing cover (161.21) or from the stuffing box housing (451.21)
- casing (100.21) measured at both the suction impeller and mechanical seal (liquid ring pumps (-LM, -S))
- motor (800.41)

The reasons for any deviations in temperatures are to be checked immediately to prevent further and more serious damage.

1.2 Noise and vibration analysis

A regular follow-up of the pump noise and vibration gives a good view regarding the condition and wear of bearings and also other wearing parts of the pump. This enables timely predictive maintenance routines and reduces the potential for unexpected shut-downs. Admissible vibration severity values are presented in Section ”Safety instructions/Balance and vibration”.

1.3 Discharge pressure

A regular control of the pressure generated by the pump, the rated flow and the power need of the drive unit gives a good view regarding the condition and wear of the hydraulic parts of the pump. The follow-up enables such preventive maintenance actions as clearance adjustments or parts renewals to be scheduled accordingly.

1.4 Pump washdown

The pump is designed to prevent external liquids from entering the bearing unit. However, direct spraying of high-pressure water to the labyrinth rings (423.31 and 423.32) must be avoided.

2 Wet end

2.1 Corrosion and wear

When the pumps are operating under corrosive and/or abrasive conditions, a regular follow-up of wall thicknesses in the case and case cover is necessary. When the wall thickness has worn more than the permitted corrosion allowance of 3.0 mm, the mechanical durability (pressure limits) stated in these instructions is no longer guaranteed.

Due to the casting tolerances (ISO 8062-3: 2007), the nominal wall thicknesses stated in the casting drawings cannot be used for assessing excessive corrosion and wear. If corrosion and wear are expected, the wall thicknesses of the volute case and case cover should be measured at specific points before the first start-up. These values serve later as reference values for assessing excessive corrosion and wear.

2.2 Adjustment of clearance between sideplate and impeller

If the pump has an adjustable sideplate (135.11), the clearance between the impeller and sideplate is adjusted without disassembling the pump as follows (Fig. 1):

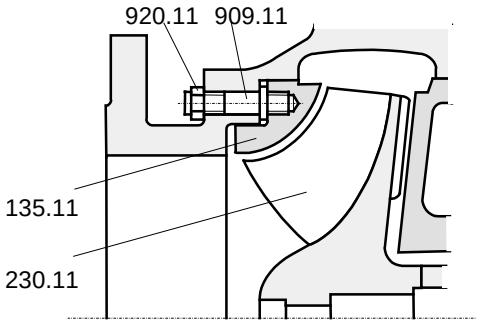


Fig. 1

- Slacken the hexagonal nuts (920.11) of the adjusting screws (909.11).
- If your pump is provided with a vortex impeller, use the adjusting screws to move the sideplate so that the clearance between the sideplate and the impeller is 5 mm (A11-40: 4 mm) (pump type: A).
- If the pump is provided with a vortex impeller, move the sideplate using the adjusting screws so that there is a minimum of stagger between the volute casing and sideplate (pump type: NPP, WPP).
- If your pump is provided with an impeller other than a vortex impeller, turn each adjusting screw alternately counter-clockwise until the sideplate touches the impeller. Then turn the adjusting screws clockwise 1/3 turns to obtain a 0.5 mm clearance between the sideplate and impeller.
- After the adjustment, tighten the hexagonal nuts, whereby the adjusting screws will be locked. The adjusting screw must not turn during tightening.
- By turning the coupling by hand, check that the pump can rotate freely.
- The sideplate can be adjusted altogether 3 - 4 mm towards the impeller. If further adjustment is needed, change the impeller and sideplate in order to keep the right clearance.

3 Sealing unit

W A R N I N G

Always stop the motor before any of the following maintenance actions to the pump. Make sure that the motor cannot be started by any means accidentally during the repairs.

W A R N I N G

Always drain the pump before disassembling the shaft seal. When pumping hazardous liquids, make sure that there is no trapped liquid remaining in pump parts.

3.1 Gland packing

Gland-packed pumps must be checked regularly to ensure that there is a slight leakage from the gland. An excessively tight gland causes wear to the shaft sleeve and increased power demand. Refer to the instructions in Section ”Operation/Controls during the first run”.

W A R N I N G

Never use gland packing material containing asbestos. It may cause a health hazard.

Maintenance of shaft seals

- Remove the used gland packing from the stuffing box housing by using a flexible extraction tool (Fig. 2). Clean the stuffing box housing and open any clogged sealing liquid holes.

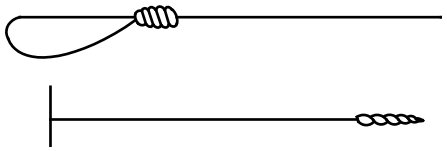


Fig. 2

- If there are scratches or wearing marks on the shaft wearing sleeve (part 524.21 in Table 2) or in the stuffing box housing, replace the damaged parts.
- We recommend the use of precompressed gland packings. However, if you need to cut the packings from a sealing band, proceed as follows: turn four rounds of the sealing band around a wooden pattern having the same thickness as the shaft wearing sleeve (part 524.21 in Table 2) and use a sharp knife to cut the packing rings straight and axially without overdimensioning or underdimensioning, Fig. 3. The dimensions of the stuffing box housing and the total length of the band to be cut without working allowances are given in Table 2.

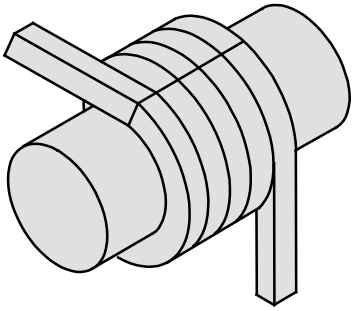
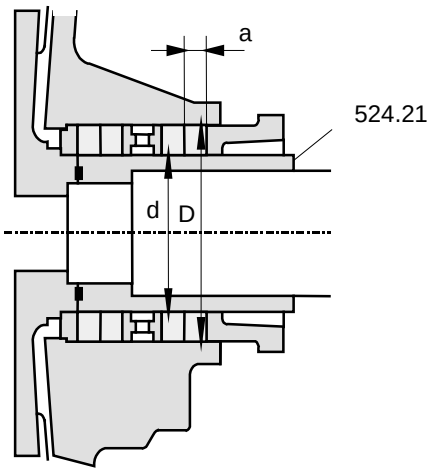


Fig. 3

- When packing new packing rings, be very precise, and keep the parts clean.
- Lubricate the shaft sleeve and packing rings lightly with oil.
- Push the first packing ring tightly against the neck bush. The ends of the rings must be exactly against each other.
- The second ring is placed against the first one so that the joints are at 180° angle to each other, Fig. 4.
- Next put the lantern ring into the seal chamber.
- Fit also the last two rings with the joints at 180° angle to each other.
- After all the packing rings and the lantern ring have been fitted, tighten the nuts of the stuffing box gland by hand.
- The shaft seal is taken into use according to Section ”Operation/Controls during the first run”.

Table 2, Dimensioning of stuffing box



Shaft size	Stuffing box Ød x ØD x a (mm)	Total length of the packing ring (mm)
1	40 x 60 x 10	640
2	50 x 70 x 10	770
3	60 x 85 x 12.5	930
4	70 x 95 x 12.5	1050
5	90 x 122 x 16	1350
6	100 x 132 x 16	1460

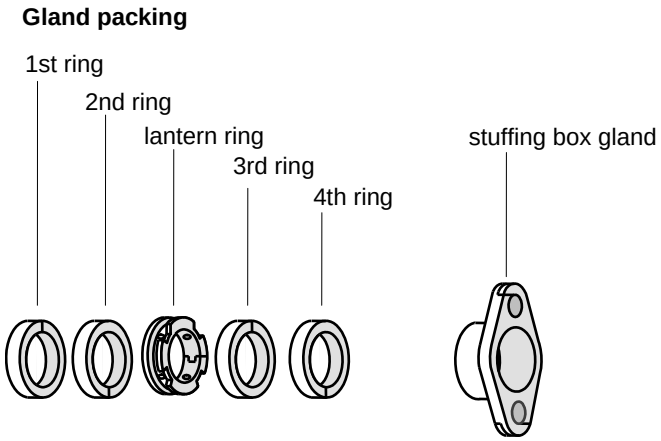


Fig. 4

3.2 Mechanical seal

Mechanical seals are normally installed and adjusted at the factory before the delivery. The general principle is that the mechanical seal does not leak at all. The lifetime of a mechanical seal depends on the cleanliness and lubricating properties of the pumped liquid and the sealing liquid. If the mechanical seal leaks, stop the pump and replace the mechanical seal.

C A U T I O N
The dry running of mechanical seals will damage the sliding surfaces and cause leakage of pumped liquid.

Maintenance of shaft seals

Mechanical seals do not normally require any preventive maintenance actions during their operation. If any problems occur, the whole seal package is normally renewed. For longer-term shutdown, it is recommended that the sealing space be flushed, preferably using clean water, if possible.

3.3 Dynamic seal

Dynamic seal, ring type (DS11, DS12)

The expeller (604.21) design of the dynamic seal prevents the leakage of pumped liquid through the stuffing box during operation. During shut-down, the leakage is prevented by the static seal design (435.21).

Maintenance of shaft seals

Dynamic seals do not normally require any preventive maintenance actions. During the first years of operation, the static seal (435.21) can yet wear so much that some leakage can occur during stoppages. The static seal is again functional when sliding the thrust ring (475.21) towards the volute casing so long that the leakage stops. The thrust ring must always be secured with the hexagonal screws (920.21) during operation. This adjustment can be done several times during the lifetime of the static seal. The wear allowance of the static seal is about half of its thickness. If the seal has worn more or otherwise damaged, it must be replaced with a new one.

Dynamic seal, plate type (DS13, DS14)

The expeller (604.21) design of the dynamic seal prevents the leakage of pumped liquid through the stuffing box during operation. During shut-down, the leakage is prevented by the static seal design (435.21).

Maintenance of shaft seals

Dynamic seals do not normally require any preventive maintenance actions. During the first years of operation, the static seal (435.21) can yet wear so much that some leakage can occur during stoppages. The static seal is again functional when sliding the thrust ring (475.21) towards the volute casing so long that the leakage stops. The thrust ring must always be secured with the grub screws (904.21) during operation. This adjustment can be done several times during the lifetime of the static seal. The wear allowance of the static seal is about half of its thickness. If the seal has worn more or otherwise damaged, it must be replaced with a new one.

4 Bearing unit

4.1 Grease lubrication

All the grease-lubricated bearings have been lubricated before the shipment. The pump has one cylinder roller bearing unit (deep groove ball bearing on shaft size 7) and two single row angular contact ball bearings (O-system, Table 3).

Table 3, Pump bearings

Shaft size	Impeller side	Coupling side
1	NUP 307 ECJ	7308 BECBM
2	NUP 309 ECJ	7310 BECBM
3	NUP 311 ECJ	7312 BECBM
4	NUP 313 ECJ	7314 BECBM
5	NUP 317 ECJ	7318 BECBM
6	NUP 320 ECJ	7322 BECBM
7	6324	7326 BCBM
SKF designation. If bearings by other manufacturers are used, the corresponding bearing types are required.		

Amounts of lubricants and re-lubrication intervals are described in Table 4 and in Table 5 depending on the speed of rotation.

Table 4, Initial and re-lubrication (50 Hz speeds of rotation)

Shaft size	Initial lubrication (g)		Re-lubrication (g)		Re-lubrication interval [1] (hours, bearing housing temperature ≤ +55 °C)					
	Impeller side	Coupling side	Impeller side	Coupling side	495 rpm	590 rpm	740 rpm	980 rpm	1480 rpm	2950 rpm
1	30	50	10	15	-	-	16000	12000	8000	3500
2	55	85	15	25	-	-	14000	10000	6500	3000
3	85	135	20	30	-	-	12000	8000	5500	2500
4	145	210	25	40	-	-	10000	7500	4500	-
5	220	390	40	60	-	-	8500	6000	3500	-
6	250	450	50	70	-	-	8500	6000	-	-
7	350	600	70	140	12000	10000	8500	6000	-	-
[1] Every 15 °C rise in the surface temperature shortens the lubrication interval to a half.										

Table 5, Initial and re-lubrication (60 Hz speeds of rotation)

Shaft size	Initial lubrication (g)		Re-lubrication (g)		Re-lubrication interval [1] (hours, bearing housing temperature ≤ +55 °C)							
	Impeller side	Coupling side	Impeller side	Coupling side	445 rpm	510 rpm	590 rpm	710 rpm	890 rpm	1180 rpm	1780 rpm	3540 rpm
1	30	50	10	15	-	-	-	-	15000	10000	7000	3000
2	55	85	15	25	-	-	-	-	13000	8500	5500	2500
3	85	135	20	30	-	-	-	-	11000	7000	4500	2000
4	145	210	25	40	-	-	-	-	9000	6500	3500	-
5	220	390	40	60	-	-	-	-	7500	5000	2500	-
6	250	450	50	70	-	-	-	-	7500	5000	-	-
7	350	600	70	140	13000	12000	10000	8500	7500	4500	-	-
[1] Every 15 °C rise in the surface temperature shortens the lubrication interval to a half.												

Grease grades

C A U T I O N

Never mix different grease grades (consistency, thickeners). The mixed grease becomes softer and does not lubricate the bearings properly.

N O T E

All greasing equipment and fittings used must be clean to prevent any impurities from entering the bearing housing.

N O T E

The surface temperature of the bearing unit can temporarily rise after regreasing due to an excess amount of grease.

For normal conditions when the bearing housing surface temperature is below +80 °C, we recommend lithium or lithium-calcium-based mineral greases for roller bearings, such as:

- Shell Alvania EP2
- Mobil, Mobilgrease XHP 222

The first re-lubrication should be done before the initial commissioning of the pump.

If the bearings run hotter and the surface temperatures are above +80 °C, we recommend the use of the following special greases:

- Shell Limona LX1
- Mobil, Mobilgrease XHP 461

These special greases can also be used with surface temperatures below +80 °C.

Always consult the pump manufacturer about the use of any special greases (not mentioned in these instructions).

4.2 Oil lubrication

C A U T I O N

For delivery, the bearing housing of the pump has been emptied of oil. Remember to refill it before starting.

Bearing unit 1-6 (Oil splash lubrication, Oil bath lubrication)

For lubrication, use only high-quality mineral oils, the viscosity of which is ISO VG 46.

E.g.

- Shell Tellus Oil S46
- Mobil DTE Oil Medium

Viscosity of oil at the operating temperature must not be below 12 cSt (65 SSU). The operating temperature is ca 15 °C higher than the surface temperature of the bearing housing.

- ISO solid contaminant code of oil: -/17/14 (ISO 4406)

Bearing unit 7 (Oil splash lubrication)

For lubrication, use only lubrication oils of a good quality the viscosity of which in normal conditions is ISO VG 100 - ISO VG 150.

E.g.

- Shell Tellus Oil S 100
- Mobil DTE Oil Heavy

The viscosity of the oil at operating temperature must not be lower than 16 cSt (84 SSU).The operating temperature is about 15 °C higher than the surface temperature of the bearing housing.

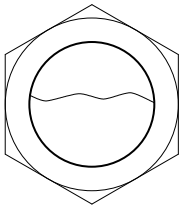
First oil filling (Oil splash lubrication)

- Remove the venting device (672.31) and add oil so that the level reaches the middle of the sight glass (642.31).

- Loose the socket head screw (914.31) and remove the constant level oiler (638.31). Fill it with oil and put it back.

First oil filling (Oil bath lubrication)

Without using the constant level oiler



642.31

Fig. 5

Unscrew the venting device (672.31) and add oil up to the middle of the sight glass (642.31), Fig. 5. When pump is running oil level in the sight glass can be little variable. With lower speed oil level can go little bit lower and higher speed go little up (air is mixing into oil. Screw the venting device (672.31) back in place. See the oil volumes in Table 8.

With using the constant level oiler

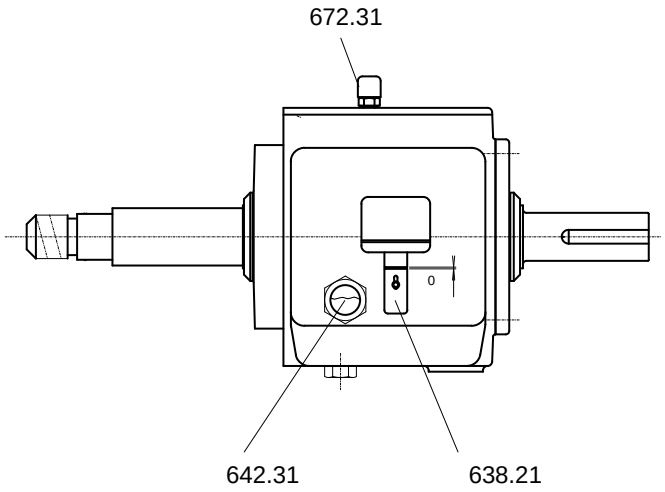


Fig. 6

Install the constant level oiler (638.31) in the bearing unit. Adjust the constant level oiler (638.31) to the correct height (0 mm) and tighten the locking screw. Unscrew the venting device (672.31), add oil up to the middle of the sight glass (642.31) and screw the venting device (672.31) back in place. Undo the glass cup of the constant level oiler (638.31) and fill it with oil, and place the glass cup of the constant level oiler (638.31) back in place.

Oil change

After commissioning, oil should be changed for the first time after about 100 hours of operation and thereafter according to Table 6 and more often if the operating conditions cause contamination or change in other properties of the oil used.

Table 6, Oil changes

Surface temperature of bearing housing	Oil change interval
65 °C	1 year
75°C	6 months

Table 7, Oil volumes (Oil splash lubrication)

Shaft size	Oil volume (ml)		
	Bearing housing	Constant level oiler	Glass cup
1	~140	140	100
2	~350	140	100
3	~460	140	100
4	~1030	140	100
5	~1500	140	100
6	~2500	140	100
7	~3900	140	100

Table 8, Oil volumes (Oil bath lubrication)

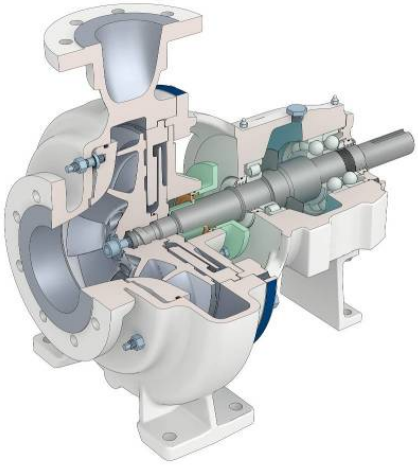
Bearing unit	Oil volume (l)
1	0.2
2	0.5
3	0.6
4	0.9
5	2.2
6	3.7

SULZER

SPP id: Version 14 > / 110901 / en / **N31574** / 1

AHLSTAR

PROCESS PUMPS



Corrective maintenance

1 General

NOTE
Refer to the sectional drawings when reading through these instructions.

1.1 Safety instructions and environmental aspects to be noted before corrective maintenance

WARNING
When pumping hazardous liquids, secure that there is no trapped liquid remaining in pump parts. Pumps which convey hazardous media must be carefully decontaminated before any repairs. Skin and eye protection are required during decontamination. Precautions are needed for personal or environmental safety. Some of the disassembled parts and assemblies are heavy, unstable and due to design requirements they contain sharp edges (e.g. impeller, sideplate, casing cover). Use proper hoistings and supports to prevent personal injury.

WARNING
Hazardous substances must be kept away from the environment. These substances should be collected and sent for proper handling. All recyclable components should be taken to a proper recycling system.

1.2 Necessary equipment / tools

Normally available working tools

- Hoisting accessories. Note the safety requirements!
- Wrenches for hexagonal screws, sizes (mm): 13, 14, 16, 18, 19, 22, 24, 30
- Allen wrenches for socket head screws, sizes (mm): 2,5, 4, 5, 6, 8, 10, 14
- Torque wrenches for moments (Nm): 30, 50, 130, 250, 420, 800
  - for hexagonal, sizes (mm): 18, 24, 30, 36
  - for socket head, sizes (mm): 8, 10, 14, 17, 19, 22, 27
- Hooked wrenches, sizes (SKF): HN8, HN10, HN12, HN14, HN18, HN22, HN26
- Extractors
- Bearing heater
- Dial indicators
- Cleaning agents & equipment
- Lubricating agents & equipment

Special tools

- Detachment tool for the casing wear ring/sideplate. Fig. 1.
- Pipe punch series for roller bearings and lubrication rings. Fig. 7.
- Securing tool for impeller head screw. Fig. 3.

2 Pump unit

2.1 Disassembly

N O T E
Ensure that all eventual spare parts are available before the disassembly.

Preliminaries

1 Close the discharge valve.
2 Stop the motor. Make sure that the motor cannot be started by any means during the repair.
3 Close the suction valve.
4 Drain the pump carefully. For this, use the threaded plug (903.11) potentially situated at the bottom of the volute case (102.11).
5 Disconnect potential guards, pipes and sealing water equipment relating to degassing and shaft seal.
6 Remove the guard jackets (686.51 and 686.52) and coupling (840.51) spacer.
7 Drain oil from an oil-lubricated bearing housing by unscrewing the threaded plug (903.32).

Detachment of exchange unit

1 Unscrew the hexagon head screws (901.11) and the hexagon head screws (901.62) of the support foot from the baseplate (890.61).
2 Suspend the exchange unit by a hoist at the maintenance opening of the adapter or underneath the adapter.
3 Pull out the exchange unit by using the hexagon head screws (901.11).

2.2 Reassembly

Preliminaries

- Clean all gasket surfaces and fittings from rust and layers.
- Inspect for unusual erosion, pitting and wear in parts.
- Inspect keyways and bores for damage.
- Inspect the pump and baseplate for cuts and cracks.

Installation of exchange unit

1 Fix the support foot of the bearing unit by means of the hexagon head screws (901.32).

2 Heat the coupling flange to approx. +100°C and push it on the shaft with the front surface at the shaft end level.

3 Suspend the exchange unit with a hoist at the maintenance opening of the adapter or underneath the adapter.

4 Fit the gasket (400.21) into the case cover (161.21).

5 Install the exchange unit in its place, lubricate the hexagon head screws (901.11) with Molycote Ti 1200 lubricant and tighten them in a cross bolt pattern little by little; first 30% of moment in Table 1, then 60% of moment in Table 1 and then 100% of moment in Table 1. Finally tighten the screws screw by screw clockwise with 100% of moment given in Table 1.

Table 1, Exchange unit fastening screws (901.11)

Screw size	Moment (Nm)	
	Rating	Max. value
M12	50	60
M16	130	160
M20	250	300
M24	420	520

6 Check the impeller clearance according to the Section ”Preventive maintenance”.

7 Place adjusting plates under the support foot. The plates must have the same thickness as the gap under the support foot. Do not close the gap by tightening.

8 Fix the support foot (183.31) to the baseplate (890.61) with the hexagon head screws (901.62).

9 Lubricate the bearing unit with oil or grease according to lubricating instructions in Section ”Operation”.

10 Install the coupling spacer according to the coupling manufacturer’s instructions.

11 Fix the coupling guard jackets (686.51and 686.52). The coupling guard must be adjusted so that the space between the coupling guard and motor is approx. 5 mm.

12 Install the auxiliary pipings, guards, accessories and sealing unit equipment according to sectional drawings.

W A R N I N G

Proper adjustment of the coupling guard jacket is a relevant safety factor.

3 Wet end

3.1 Disassembly

Detachment of casing wear ring (pump types: APP and EPP / closed impeller)

The casing wear ring (502.11) between the closed impeller and volute casing and also the casing wear ring (502.12) between the impeller and casing cover in the pump type EPP can be removed with a suitable tool by using the three notches situated under the casing wear ring, Fig. 1.

Detachment of sideplate

1 Unscrew the three nuts (920.11).

2 Turn the potential adjusting screws (909.11) counter-clockwise. As a result the sideplate protrudes out.

3 The sideplate can now be removed with a proper tool from the volute casing. Fig. 1.

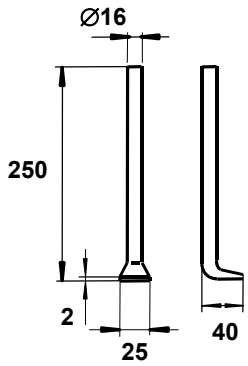


Fig. 1

Detachment of impeller

1 Fasten the exchange unit firmly to a vice.

2 Unscrew the cap screw socket head (914.11) of the impeller (230.11).

3 Prevent the shaft (210.31) from rotating at the coupling (840.51) end.

4 Detach the impeller by turning it counter-clockwise. Push e.g. pieces of wood between the impeller vanes to ease the detachment. Never use metal bars or the like, because they might damage the impeller vanes. Fig. 2.

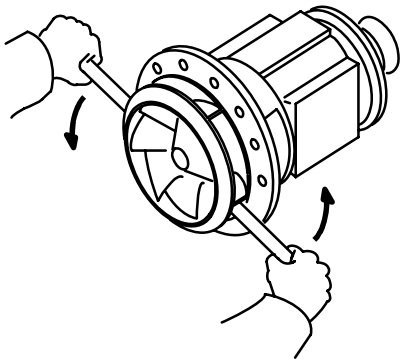


Fig. 2

3.2 Reassembly

Installation of impeller

WARNING

The socket head screw (914.11) must be secured to avoid loosening of the impeller.

1 Make sure that the o-rings behind the impeller are properly installed.

2 Prevent the shaft from rotating from the coupling end and insert the impeller (230.11) into its place. The clearance between the impeller and case cover (161.21) is about 1.0 mm.

3 Lock the impeller with the socket head capscrew (914.11) onto which the o-ring (412.14) has been fitted.

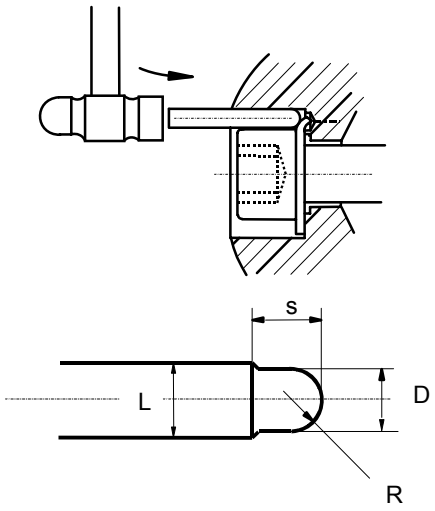
4 Tighten the socket head screw to the torque value given in Table 2. Note the special values for the titanium screws.

Table 2, Impeller locking screw 914.11

Shaft size	Screw size	Torque (Nm)		Titanium screws (76) Torque (Nm)	
		Rating	Max. value	Rating	Max. value
1	M10	30	40	18	22
2	M12	50	60	30	38
3	M16	130	140	70	92
4	M20	250	260	140	180
5	M24	420	440	250	310
6	M30	800	820	490	615
7	M36	1450	1500	850	1070

Secure the socket head capscrew (914.11) by bending its flange into one hole on the impeller. Use a tool with the head shape and dimensions shown in Fig. 3.

The same socket head screw can be used many times. There are two extra holes on the impeller for securing later on.



Shaft size	L (mm)	Ø D (mm)	R (mm)	S_{min} (mm)
1, 2	6.5 $^{0}_{-0.5}$	4	2	6
3, 4	7.5 $^{0}_{-0.5}$	6	3	7
5, 6, 7	9.0 $^{0}_{-0.5}$	8	4	8

Fig. 3

Installation of sideplate

APP, NPP, WPP

1 Grease the o-rings (412.11 and 412.13) lightly and fit them into the grooves of the sideplate (135.11).
2 Screw the adjusting screws (909.11) all the way into the sideplate.
3 Install the sideplate into the volute case (102.11).
4 Fix the nuts (920.11) to the adjusting screws.

A, Process pump

1 Grease the o-ring (412.11) lightly and fit it into the groove of the sideplate (135.11).
2 Grease the o-ring (412.12) lightly and fit it into the groove of the adjusting screws (909.11).
3 Screw the adjusting screws (909.11) all the way into the sideplate.
4 Install the sideplate into the volute case (102.11).
5 Spread Loctite 577 paste (400.13) on the sideplate (135.11) of the low flow impeller just before the installation of the exchange unit. Push the sideplate (135.11) against the case cover (161.21) by the adjusting screws (909.11) and tighten the nuts (920.11).
6 Fix the nuts (920.11) to the adjusting screws.

Fixed sideplate of pump type EPP (open impeller)

1 Screw the studs (902.11) tightly into place in the sideplate.
2 Push the back-up rings (516.11) and o-rings (412.12) onto the studs against the sideplate.
3 Install the sideplate into place in the volute case (102.11).
4 Mount and tighten the nuts (920.11).

Installation of casing wear ring (pump types: APP and EPP / closed impeller)

Tap the casing wear ring (502.11) into the volute case (102.11) (and the wear ring (502.12) into the case cover (161.21) of an EPP pump) with a soft hammer. Check that the wear ring is tightly against the bottom of its groove at each side.

4 Sealing unit

4.1 Disassembly

C A U T I O N
The threaded hole in the casing cover is only meant for lifting the casing cover.

Dynamic seal, ring type (types DS11 and DS12)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Unscrew the hexagon head screws (901.21).
3 Detach the case cover (161.21) by levering from the slot between the case cover and adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. Detach the gasket (400.22) or o-ring (412.23).
4 Remove the expeller (604.21) from the shaft.
5 By using the hexagon head screws (901.21) as extractors, pull the stuffing box housing (451.21) out of the guideway in the adapter. The stuffing box housing (451.21) with its incorporated parts will also come out.
6 Remove the shaft wearing sleeve (524.21) from the shaft.
7 Unscrew the nuts (920.21) and detach the thrust ring (475.21) from the stuffing box housing (451.21). Detach the o-ring (412.24) from the thrust ring.
8 Remove the static seal (435.21) and o-rings (412.25) from the shaft wearing sleeve (524.21).

9 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Dynamic seal, plate type (types DS13 and DS14)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Uncrew the hexagon head screws (901.21).
3 Detach the case cover (161.21) by levering from the slot between the case cover and adapter (344.31). In heavier case covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw.
4 Detach the expeller (604.21) from the shaft.
5 By using the hexagon head screws (901.21) as extractors, draw the stuffing box housing (451.21) out of the guiding in the adapter.
6 The cover plate for seal (471.21) and the static seal (435.21) can be detached by unscrewing the nuts (920.21).
7 Unscrew the grub screws (904.21) and detach the thrust ring (475.21) from the shaft.
8 Unscrew the hexagonal screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, standard integrated single (types MS11 and MS12)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Uncrew the hexagon head screws (901.21).
3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. The components of the mechanical seal (433.21) come off the shaft.
4 Unscrew the hexagon head screws (901.22) of the case cover (161.21) and remove the seal ring (411.21).
5 The mechanical seal can now be removed from the case cover (161.21) and dismantled according to the seal manufacturer's instructions.
6 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, standard integrated double (type MS21, pump types A, APP, NPP and WPP)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Uncrew the hexagon head screws (901.21).
3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. The components of the mechanical seal (433.21) come off the shaft.
4 Unscrew the hexagon head screws (901.22) of the case cover (161.21) and remove the seal ring (411.21).
5 The mechanical seal can now be removed from the case cover (161.21) and dismantled according to the seal manufacturer's instructions.
6 Remove the rotating part on the atmospheric side of the mechanical seal (433.21) from the shaft by opening the hexagonal retainer screws.
7 Unscrew the hexagonal screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, standard integrated double (type MS21, pump type EPP)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Unscrew the hexagon head screws (901.21).

3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. The components of the mechanical seal (433.21) come off the shaft.

4 Unscrew the nuts (920.21) of the case cover (161.21).

5 The mechanical seal can now be removed from the case cover (161.21) and dismantled according to the seal manufacturer's instructions.

6 Remove the rotating part on the atmospheric side of the mechanical seal (433.21) from the shaft by opening the hexagonal retainer screws.

7 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, cartridge single on the shaft without shaft sleeve (types MS31, MS32 and MS35)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).

2 Unscrew the hexagon head screws (901.21).

3 Unscrew the nuts (920.21).

4 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. All parts belonging to the mechanical seal (433.21) will remain on the shaft.

5 The mechanical seal can now be removed from the shaft and from the casing cover and dismantled according to the seal manufacturer's instructions.

6 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, cartridge single on the shaft sleeve (types MS33 and MS34)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).

2 Unscrew the hexagon head screws (901.21).

3 Unscrew the nuts (920.21).

4 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier case covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. All parts belonging to the mechanical seal (433.21) will remain on the shaft.

5 The mechanical seal can now be removed from the shaft and from the casing cover and dismantled according to the seal manufacturer's instructions.

6 Remove the shaft wearing sleeve (524.21) from the shaft with an extractor.

7 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, cartridge double on the shaft without shaft sleeve (type MS41)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).

2 Unscrew the hexagon head screws (901.21).

3 Unscrew the nuts (920.21).

4 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier case covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. All parts belonging to the mechanical seal (433.21) will remain on the shaft.

5 The mechanical seal can now be removed from the shaft and from the casing cover and dismantled according to the seal manufacturer's instructions.

6 Unscrew the hexagonal screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, cartridge double on the shaft sleeve (type MS42)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Unscrew the hexagon head screws (901.21).
3 Unscrew the nuts (920.21).
4 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. All parts belonging to the mechanical seal (433.21) will remain on the shaft.
5 The mechanical seal can now be removed from the shaft and from the casing cover and dismantled according to the seal manufacturer's instructions.
6 Remove the shaft wearing sleeve (524.21) from the shaft with an extractor.
7 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, element single (types MS51 and MS52)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Unscrew the hexagon head screws (901.21).
3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. The components of the mechanical seal (433.21) come off the shaft.
4 Unscrew the nuts (920.21) of the case cover (161.21).
5 The mechanical seal can now be removed from the case cover (161.21) and dismantled according to the seal manufacturer's instructions.
6 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, element double (type MS61)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Unscrew the hexagon head screws (901.21).
3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. The components of the mechanical seal (433.21) come off the shaft.
4 Unscrew the nuts (920.21) of the case cover (161.21).
5 The mechanical seal can now be removed from the case cover (161.21) and dismantled according to the seal manufacturer's instructions.
6 Remove the rotating part on the atmospheric side of the mechanical seal (433.21) from the shaft by opening the hexagonal retainer screws.
7 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, ready-fitted single (types MS71 and MS72)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).
2 Unscrew the hexagon head screws (901.21).

3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. The components of the mechanical seal (433.21) come off the shaft.

4 Unscrew the nuts (920.21) of the case cover (161.21).

5 The mechanical seal can now be removed from the case cover (161.21) and dismantled according to the seal manufacturer's instructions.

6 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, ready-fitted double (type MS81)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).

2 Unscrew the hexagon head screws (901.21).

3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier casing covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. The components of the mechanical seal (433.21) come off the shaft.

4 Unscrew the nuts (920.21) of the case cover (161.21).

5 The mechanical seal can now be removed from the case cover (161.21) and dismantled according to the seal manufacturer's instructions.

6 Remove the rotating part on the atmospheric side of the mechanical seal (433.21) from the shaft by opening the hexagonal retainer screws.

7 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Mechanical seal, US, outside single (type MS91)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).

2 Unscrew the hexagon head screws (901.21).

3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier case covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw.

4 The rotating part of the mechanical seal (433.21) will remain on the shaft.

5 The cover plate for seal (471.21) and the static part of the mechanical seal can be detached from the case cover by unscrewing the screws (914.21).

6 The rotating part can now be removed from the shaft and dismantled according to the seal manufacturer's instructions.

7 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Gland packing (type PG11)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).

2 Unscrew the hexagon head screws (901.21) of the case cover (161.21).

3 By using the said screws as extractors, draw the case cover (161.21) out of the adapter (344.31). In heavier case covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. All parts belonging to the gland packing, except the shaft wearing sleeve (524.21), will stay in the casing cover.

4 Unscrew the nuts (920.21) and remove the two-piece stuffing box gland (452.21). The neck bush (456.21), gland packing (461.21) and lantern ring (458.21) can now be drawn out of the casing cover.

5 Remove the shaft wearing sleeve (524.21) from the shaft with an extractor.

6 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Liquid ring pump, standard integrated single (type LM11)

1 Detach the pipe (700.23) with the peripheral equipment from the case (100.21) if a vacuum relief valve (695.21) is included in the delivery.
2 Unscrew the hexagon head screws (901.21).
3 Remove the case cover (161.21) by levering from the slot between the case cover and adapter (344.31).
4 Remove the o-ring (412.23) from the case (100.21).
5 Remove the suction impeller (231.21) from the shaft. Notice the compressor rings (487.21) between the suction impeller and mechanical seal (433.21).
6 Remove the o-rings (412.21 and 412.22).
7 Remove the rotating part on the product side of the mechanical seal from the shaft.
8 Pull the case (100.21) out of the guideway in the adapter (344.31) with the help of hexagon head screws (901.21).The static parts of the mechanical seal (433.21) will follow.
9 Unscrew the hexagon head screw (901.22) of the case (100.21). Remove the seal ring (411.21).
10 The mechanical seal can now be removed from the case (100.21) and dismantled according to the seal manufacturer's instructions.
11 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Liquid ring pump, standard integrated double (type LM21)

1 Detach the pipe (700.23) with the peripheral equipment from the case (100.21) if a vacuum relief valve (695.21) is included in the delivery.
2 Unscrew the hexagon head screws (901.21).
3 Remove the case cover (161.21) by levering from the slot between the case cover and adapter (344.31).
4 Remove the o-ring (412.23) from the case (100.21).
5 Remove the suction impeller (231.21) from the shaft.
6 Remove the o-rings (412.21 and 412.22).
7 Remove the rotating part on the product side of the mechanical seal from the shaft.
8 Pull the case (100.21) out of the guideway in the adapter (344.31) with the help of hexagon head screws (901.21). The static parts of the mechanical seal (433.21) will follow.
9 Unscrew the hexagon head screw (901.22) of the case (100.21). Remove the seal ring (411.21).
10 The mechanical seal can now be removed from the case (100.21) and dismantled according to the seal manufacturer's instructions.
11 Remove the rotating part on the atmospheric side of the mechanical seal (433.21) from the shaft by opening the hexagonal retainer screws.
12 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Liquid ring pump, element single (type SM11)

1 Detach the pipe (700.23) with the peripheral equipment from the case (100.21) if a vacuum relief valve (695.21) is included in the delivery.
2 Unscrew the hexagon head screws (901.21).
3 Remove the case cover (161.21) by levering from the slot between the case cover and adapter (344.31).
4 Remove the o-ring (412.23) from the case (100.21).

5 Remove the suction impeller (231.21) from the shaft. Pull the shaft wearing sleeve (524.21) from the shaft. The rotating part of the mechanical seal (433.21) will come off, too, and the static part will remain in the cover plate for seal. Notice the compressor rings (487.21) between the suction impeller and shaft wearing sleeve.

6 Pull the case (100.21) out of the guideway in the adapter with the help of hexagon head screws (901.21). Detach the cover plate for seal (471.21) by unscrewing the socket head capscrews (914.21).

7 The rotating part of the mechanical seal can now be removed from the shaft wearing sleeve and the static part from the cover plate for seal. Make sure not to damage the sliding surfaces.

8 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Liquid ring pump, ready-fitted double (type SM21)

1 Detach the pipe (700.23) with the peripheral equipment from the case (100.21) if a vacuum relief valve (695.21) is included in the delivery.

2 Unscrew the hexagon head screws (901.21).

3 Detach the case cover (161.21) by levering from the slot between the case cover and adapter (344.31).

4 Remove the o-ring (412.23) from the case (100.21).

5 Remove the suction impeller (231.21) from the shaft. The rotating part on the product side of the mechanical seal (433.21) will come off, too, and the static part will remain in the case. Notice the compressor rings (487.21) between the suction impeller and mechanical seal.

6 Pull the case (100.21) out of the guideway in the adapter (344.31) with the help of hexagon head screws (901.21).

~~7~~ The static part of the mechanical seal is detached from the case (100.21) by unscrewing the socket head capscrews (914.21).

8 The rotating part on the atmospheric side of the mechanical seal can be removed from the shaft by opening the hexagonal retainer screws.

9 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Air separating pump, element single (type RM11)

1 Open the two hexagon head screws (901.21) of the case cover (161.21).

2 By using the above mentioned screws as extractors, push the case cover (161.21) and cover (160.21) out of the stuffing box housing (451.21).The gasket (400.23) may be replaced if needed.

3 The case cover and cover may be detached from each other, so that the condition of the o-ring (412.23) and the gasket (400.23) may be checked and replaced if needed.

4 Pull the expeller (235.21) off the shaft by levering against the stuffing box housing. The rotating parts of the mechanical seal (433.21) follow with the expeller.

5 Special care should be taken not to damage the sliding surfaces of the mechanical seal. The mechanical seal can be removed from the expeller by detaching the locking screws of the seal.

6 Unscrew the nuts (920.22) of the stuffing box housing (451.21) and lever the stuffing box housing out of the bearing housing (330.31) guide using the two slots at the interface of the bearing housing.

7 The stationary seat of the mechanical seal (433.21) can be removed from the stuffing box housing. Special care should be taken not to damage the sliding surfaces of the seal.

Gas separator, standard integrated single (types GM11 and GM12)

1 Unscrew the hexagon head screws (901.21).

2 Detach the case cover (161.21) by levering from the slot between the casing cover and adapter (344.31). In heavier case covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. Detach the gasket (400.22) or o-ring (412.23).

3 Remove the expeller (604.21) from the shaft.

4 By using the hexagonal screws (901.21) as extractors, pull the stuffing box housing (451.21) out of the guideway in the adapter. The stuffing box housing (451.21) with its incorporated parts will also push all components off the shaft.

5 Unscrew the hexagon head screw (901.22) of the stuffing box housing (451.21). Remove the seal ring (411.21).

6 The static parts of the mechanical seal (433.21) can now be removed from the case cover (161.21).

7 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Gas separator, standard integrated double (types GM21 and GM22)

1 Unscrew the hexagon head screws (901.21).

2 Detach the case cover (161.21) by levering from the slot between the case cover and adapter (344.31). In heavier case covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. Detach the gasket (400.22) or o-ring (412.23).

3 Remove the expeller (604.21) from the shaft.

4 By using the hexagon head screws (901.21) as extractors, pull the stuffing box housing (451.21) out of the guideway in the adapter. The stuffing box housing (451.21) with its incorporated parts will also push all components off the shaft.

5 Unscrew the hexagon head screw (901.22) of the stuffing box housing (451.21). Remove the seal ring (411.21).

6 The static parts of the mechanical seal (433.21) can now be removed from the stuffing box housing (451.21).

7 Remove the rotating part on the atmospheric side of the mechanical seal (433.21) from the shaft by opening the hexagonal retainer screws.

8 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

Gas separator, static seal (types GS11 and GS12)

1 Loosen the hexagon head screws (901.21) and remove the guards (683.21 and 683.22).

2 Unscrew the hexagon head screws (901.21).

3 Detach the case cover (161.21) by levering from the slot between the case cover and adapter (344.31). In heavier case covers, there is a threaded hole (size M8) for lifting the cover by using an eye screw. Detach the gasket (400.22) or o-ring (412.23).

4 Remove the expeller (604.21) from the shaft.

5 By using the hexagon head screws (901.21) as extractors, pull the stuffing box housing (451.21) out of the guideway in the adapter. The stuffing box housing (451.21) with its incorporated parts will also come out.

6 Remove the shaft wearing sleeve (524.21) from the shaft.

7 Unscrew the nuts (920.21) and detach the thrust ring (475.21) from the stuffing box housing (451.21). Detach the o-ring (412.24) from the thrust ring.

8 Remove the static seal (435.21) and o-rings (412.25) from the thrust ring (475.21).

9 Unscrew the hexagon head screws (901.33) of the adapter and draw the adapter out by using the same screws as extractors.

4.2 Reassembly

Dynamic seal, ring type (types DS11 and DS12)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Grease the o-ring (412.25) slightly and place it into the groove of the static seal (435.21). Push the static seal (435.21) to the thrust ring (475.21).

3 Grease the o-ring (412.24) slightly and place it into its proper groove in the thrust ring (475.21). Place the thrust ring (475.21) on the stuffing box housing (451.21) and fix it with the studs (902.21) and nuts (920.21). Do not tighten the nuts.

4 Push the shaft wearing sleeve (524.21) onto the shaft against the shoulder.

5 Push the stuffing box housing with its parts into its place in the adapter (344.31).

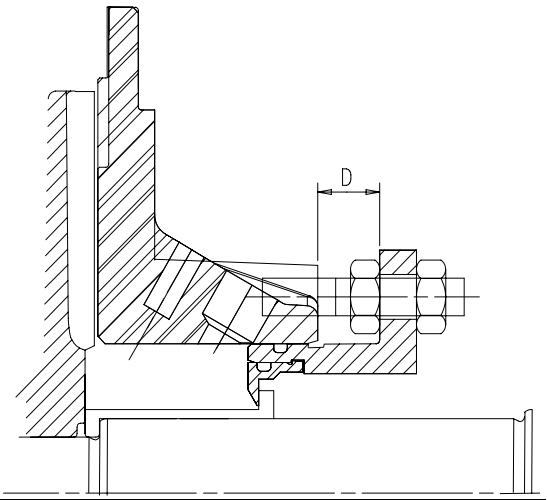
6 Grease the o-ring (412.22) slightly and place it into its proper groove in the expeller (604.21). Place the o-ring (412.21) in the middle of the expeller and push the expeller onto the shaft.

7 Mount the gasket (400.22) or o-ring (412.23) into its place in the stuffing box housing (451.21).

8 Push the case cover (161.21) into its place in the adapter (344.31) and fasten the hexagon head screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

9 When the exchange unit is fully assembled, pull the thrust ring (475.21) and the static seal (435.21) against the shaft wearing sleeve (524.21). The assembly groove (3 mm x 0.5 mm) in the thrust ring comes out 0.5 mm from the stuffing box housing end. Tighten the nuts (920.21) by hand so that the thrust ring is precisely aligned with the shaft. Tighten the locking nuts. The distance between the face of the case cover and the thrust ring is according to Fig. 4.

10 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.



Shaft size	D (mm)
1	17
2	17
3	20
4	20
5	24
6	24

Fig. 4

Dynamic seal, plate type (types DS13 and DS14)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Slide the thrust ring (475.21) with its o-ring (412.25) and grub screws (904.21) along the shaft to a preliminary position up to the hindmost shoulder.

3 Install the o-ring (412.24), static seal (435.21) and cover plate for seal (471.21) into the stuffing box housing (451.21) by using studs (902.21) and nuts (920.21). Observe that the static seal must be placed in the right way and centrally in its guiding slot in the stuffing box housing.

4 Push the stuffing box housing with its parts into its place in the adapter.

5 Push the expeller (604.21) with the o-rings (412.21, 412.22) fitted in its hub onto the shaft.

6 Install the gasket (400.22) into the stuffing box housing or the o-ring (412.23) into the case cover (161.21).

7 Push the case cover into its place in the adapter and fasten the hexagon head screws (901.21). Continue the assembly according to the following section "Installation of impeller".

8 When the exchange unit is fully assembled, place the thrust ring (475.21) at the right position on the shaft and fasten the grub screws (904.21). The distance between the face of the cover plate for seal and the shoulder of the thrust ring must be 10 mm. Fig. 5.

9 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

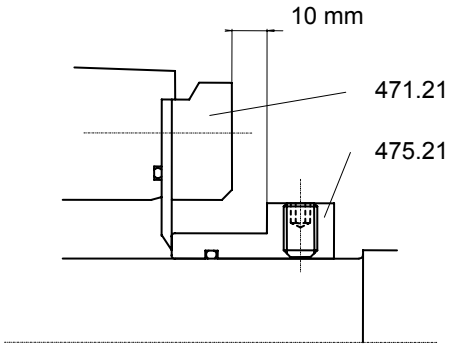


Fig. 5

Mechanical seal, standard integrated single (types MS11 and MS12)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Push the static part of the mechanical seal (433.21) into the case cover (161.21) by means of the installation sleeve.

3 Push the seal ring (411.21) onto the hexagon head screw (901.22).

4 Mount the static part of the mechanical seal (433.21) with the hexagon head screw (901.22).

5 Push the case cover (161.21) together with the incorporated parts onto the adapter (344.31). Fix the screws (901.21, 901.22).

6 Push the rotating part of the mechanical seal onto the shaft against the shoulder. Continue the assembly according to the following section ”Installation of impeller”.

7 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, standard integrated double (type MS21, pump types A, APP, NPP and WPP)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the rotating part on the atmospheric side of the mechanical seal (433.21) onto the shaft against the shoulder.

3 Push the static part of the mechanical seal (433.21) into the case cover (161.21) by means of the installation sleeve.

4 Push the seal ring (411.21) onto the hexagon head screw (901.22).

5 Mount the static part of the mechanical seal (433.21) with hexagon head screw (901.22).

6 Push the case cover (161.21) together with the incorporated parts onto the adapter (344.31). Fix the screws (901.21).

7 Push the rotating part of the mechanical seal (433.21) onto the shaft against the shoulder. Continue the assembly according to the following section ”Installation of impeller”.

8 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, standard integrated double (type MS21, pump type EPP)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the rotating part on the atmospheric side of the mechanical seal (433.21) onto the shaft against the shoulder.

3 Install the static part of the mechanical seal (433.21) into the case cover (161.21).

4 Mount the static part of the mechanical seal (433.21) with studs (902.21), washers (554.21) and nuts (901.21).

5 Push the case cover (161.21) together with the incorporated parts onto the adapter (344.31). Fix the screws (901.21).

6 Push the rotating part of the mechanical seal (433.21) onto the shaft against the shoulder. Continue the assembly according to the following section ”Installation of impeller”.

7 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, cartridge single on the shaft without shaft sleeve (types MS31, MS32 and MS35)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the mechanical seal (433.21) into the case cover (161.21). Follow the instructions provided by the seal manufacturer.

3 Push the case cover (161.21) together with the incorporated parts onto the shaft. Follow the instructions provided by the seal manufacturer. Fix the screws (901.21). Tighten the nuts (920.21).

4 Complete all the lockings, fixings and other seal-related jobs as described in the seal manufacturer's instructions. Continue the assembly according to the following section ”Installation of impeller”.

5 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, cartridge single on the shaft sleeve (types MS33 and MS34)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the mechanical seal (433.21) into the case cover (161.21). Follow the instructions provided by the seal manufacturer.

3 Push the shaft wearing sleeve (524.21) onto the shaft.

4 Push the case cover (161.21) together with the incorporated parts onto the shaft. Follow the instructions provided by the seal manufacturer. Fix the screws (901.21). Tighten the nuts (920.21).

5 Complete all the lockings, fixings and other seal-related jobs as described in the seal manufacturer's instructions. Continue the assembly according to the following section ”Installation of impeller”.

6 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, cartridge double on the shaft without shaft sleeve (type MS41)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the mechanical seal (433.21) into the case cover (161.21). Follow the instructions provided by the seal manufacturer.

3 Push the case cover (161.21) together with the incorporated parts onto the shaft. Follow the instructions provided by the seal manufacturer. Fix the screws (901.21). Tighten the nuts (920.21).

4 Complete all the lockings, fixings and other seal-related jobs as described in the seal manufacturer's instructions. Continue the assembly according to the following section ”Installation of impeller”.

5 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, cartridge double on the shaft sleeve (type MS42)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screw (901.33).

2 Mount the mechanical seal (433.21) into the case cover (161.21). Follow the instructions provided by the seal manufacturer.

3 Push the shaft wearing sleeve (524.21) onto the shaft.

4 Push the case cover (161.21) together with the incorporated parts onto the shaft. Follow the instructions provided by the seal manufacturer. Fix the screws (901.21). Tighten the nuts (920.21).

5 Complete all the lockings, fixings and other seal-related jobs as described in the seal manufacturer's instructions. Continue the assembly according to the following section ”Installation of impeller”.

6 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, element single (types MS51 and MS52)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the mechanical seal (433.21) parts into the cover plate for seal (471.21) and onto the shaft wearing sleeve (524.21) according to the seal manufacturer's instructions. Make sure that the cylinder pin (562.22) is in the proper position.

3 Place the gasket (400.23) in the cover plate for seal (471.21). Fix the cover plate for seal on the case cover (161.21) with the flange (723.21). Tighten the nuts (920.21).

4 Push the case cover (161.21) together with the incorporated parts onto the shaft. Fix the screws (901.21).

5 Push the shaft wearing sleeve (524.21) together with the incorporated parts onto the shaft against the shoulder. Continue the assembly according to the following section ”Installation of impeller”.

6 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, element double (type MS61)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the mechanical seal (433.22) onto the shaft against the shoulder.

3 Mount the mechanical seal (433.21 and 433.22) parts into the cover plate for seal (471.21) and onto the shaft wearing sleeve (524.21) according to the seal manufacturer's instructions. Make sure that the cylinder pins (562.22 and 562.23) are in the proper position.

4 Place the gasket (400.23) in the cover plate for seal (471.21). Fix the cover plate for seal on the case cover (161.21) with the nuts (920.21).

5 Push the case cover (161.21) together with the incorporated parts onto the shaft. Fix the screws (901.21).

6 Push the shaft wearing sleeve (524.21) together with the incorporated parts onto the shaft against the shoulder. Continue the assembly according to the following section ”Installation of impeller”.

7 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, ready-fitted single (types MS71 and MS72)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Install the gasket (400.21) if included in the delivery

3 Mount the static part of the mechanical seal (433.21) into the case cover (161.21), and the outer rotating part onto the shaft according to the seal manufacturer's instructions. Tighten the nuts (920.21).

4 Push the case cover (161.21) together with the incorporated parts onto the shaft. Fix the screws (901.21).

5 Push the rotating part of the mechanical seal onto the shaft against the shoulder. Continue the assembly according to the following section "Installation of impeller".

6 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, ready-fitted double (type MS81)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Install the gasket (400.21) if included in the delivery.

3 Mount the static part of the mechanical seal (433.21) into the case cover (161.21), and the outer rotating part onto the shaft according to the seal manufacturer's instructions. Tighten the nuts (920.21).

4 Push the case cover (161.21) together with the incorporated parts onto the shaft. Fix the screws (901.21).

5 Push the rotating part of the mechanical seal onto the shaft against the shoulder. Continue the assembly according to the following section "Installation of impeller".

6 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Mechanical seal, US, outside single (type MS91)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the static part of the mechanical seal (433.21) into the case cover (161.21) with the cover plate for seal (471.21). Follow the instructions provided by the seal manufacturer. Tighten the socket head capscrews (914.21).

3 Push the shaft wearing sleeve (524.21) onto the shaft against the shoulder.

4 Push the rotating part of the mechanical seal (433.21) almost to its proper place on the shaft wearing sleeve. Follow the instructions provided by the seal manufacturer.

5 Push the case cover (161.21) together with the incorporated parts onto the shaft. Fix the screws (901.21).

6 Mount the mechanical seal (433.21) into its final place according to the seal manufacturer's instructions. Complete all the lockings, fixings etc. as described in the manufacturer's instructions. Continue the assembly according to the following section "Installation of impeller".

7 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Gland packing (type PG11)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Place the case cover (161.21) on a horizontal surface with the sealing cavity upwards.

3 Place the neck bush (456.21) to the bottom of the sealing cavity.

4 Put the shaft wearing sleeve (524.21) in an upright position to the middle of the sealing cavity.

5 Insert the first two gland packings (461.21), the lantern ring (458.21), the other two gland packings and the two-piece stuffing box gland (452.21). Tighten the nuts (920.21) by hand.

6 Push the casing cover with gland packing parts onto the shaft. Check that the shaft wearing sleeve is placed towards the shaft shoulder.

7 Attach the case cover to the adapter with hexagon head screws (901.21). Continue the assembly according to the following section "Installation of impeller".

8 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.

Liquid ring pump, standard integrated single (type LM11)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Push the case (100.21) into its guideway into the adapter (344.31). Fix the hexagon head screws (901.21).

3 Put the series of compressor rings (487.21) onto the shaft.

4 Push the rotating part of the mechanical seal (433.21) onto the shaft against the shoulder.

5 Push the suction impeller (231.21) onto the shaft. Do not insert the o-ring (412.21) at this stage.

6 Measure the gap between the suction impeller (231.21) and case (100.21), and adjust it according to Table 3 by taking off or adding compressor rings (487.21). While measuring the gap, make sure that both the casing and the suction impeller are tightly in their guideway pressed all the way to the bottom. Measure the gap between the end of the suction impeller hub and the casing because the front face of the vanes is slightly conical.

Table 3, Gap between the suction impeller and casing

Shaft size	Gap (mm)
1	0.2 - 0.3
2	0.2 - 0.3
3	0.2 - 0.3
4	0.25 - 0.35
5	0.3 – 0.4
6	0.3 – 0.4

7 After adjusting the gap, remove the parts again so as to perform the actual assembly.

8 Push the static part of the mechanical seal (433.21) into the case (100.21) by means of the installation sleeve. Follow the instructions provided by the seal manufacturer.

9 Place the seal ring (411.21) onto the hexagon head screw (901.22) and mount the static part of the mechanical seal (433.21) using this screw.

10 Push the case (100.21) into its guideway into the adapter (344.31). Fix the hexagon head screws (901.21).

11 Push the compressor rings (487.21) onto the shaft against the shoulder.

12 Push the rotating part of the mechanical seal (433.21) onto the shaft.

13 Grease the o-ring (412.22) slightly and place it into its proper groove in the suction impeller (231.21). Push the suction impeller onto the shaft.

14 Push the cylinder pin (562.21) into its hole in the case (100.21).

15 Place the o-ring (412.23) into its groove in the case.

16 Install the case cover (161.21) into its guideway into the adapter (344.31). Tighten the hexagon head screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

Liquid ring pump, standard integrated double (type LM21)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Push the case (100.21) into its guideway into the adapter (344.31). Fix the hexagon head screws (901.21).

3 Put the series of compressor rings (487.21) onto the shaft.

4 Push the rotating part of the mechanical seal (433.21) onto the shaft against the shoulder.

5 Push the suction impeller (231.21) onto the shaft. Do not insert the o-ring (412.21) at this stage.

6 Measure the gap between the suction impeller (231.31) and case (100.21), and adjust it according to Table 3 by taking off or adding compressor rings (487.21). While measuring the gap, make sure that both the casing and the suction impeller are tightly in their guideway pressed all the way to the bottom. Measure the gap between the end of the suction impeller hub and the casing because the front face of the vanes is slightly conical.

7 After adjusting the gap, remove the parts again so as to perform the actual assembly.

8 Push the static part of the mechanical seal (433.21) into the case cover (161.21) by means of the installation sleeve. Follow the instructions provided by the seal manufacturer.

9 Mount the rotating part on the atmospheric side of the mechanical seal (433.21) onto the shaft against the shoulder.

10 Place the seal ring (411.21) onto the hexagon head screw (901.22) and mount the static part of the mechanical seal (433.21) using this screw.

11 Push the case (100.21) into its guideway into the adapter (344.31). Fix the hexagon head screws (901.21).

12 Push the compressor rings (487.21) onto the shaft against the shoulder.

13 Push the rotating part of the mechanical seal (433.21) onto the shaft.

14 Grease the o-ring (412.22) slightly and place it into its proper groove in the suction impeller (231.21). Push the suction impeller onto the shaft.

15 Push the cylinder pin (562.21) into its hole in the case (100.21).

16 Place the o-ring (412.23) into its groove in the case.

17 Install the case cover (161.21) into its guideway into the adapter (344.31). Tighten the hexagon head screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

Liquid ring pump, element single (type SM11)

1 Fix the adapter (344.31) into the bearing housing (330.31) with hexagonal screws (901.33).

2 Push the case (100.21) into its guideway into the adapter (344.31).

3 First, push the shaft wearing sleeve (524.21) and then the series of compressor rings (487.21) onto the shaft.

4 Push the suction impeller (231.21) onto the shaft. Do not install the o-rings (412.21), the parts of the mechanical seal (433.21) nor the cover plate for seal (471.21) yet.

5 Measure the gap between the suction impeller (231.21) and case (100.21), and adjust it according to Table 3 by taking off or adding compressor rings (487.21). While measuring the gap, make sure that both the case and the suction impeller are tightly in their guideway pressed all the way to the bottom.

Measure the gap between the end of the suction impeller hub and the case. The gap is bigger at the vanes of the suction impeller, since the front face of the vanes is slightly conical.

Once the gap between the suction impeller and case is correct, the gap between the suction impeller and the case cover (161.21) will also become automatically correct.

6 After adjusting the gap, remove the suction impeller, shaft wearing sleeve and case again so as to perform the actual assembly.

7 Fasten the cylinder pins (562.22 and 562.21) into the cover plate for seal (471.21) and case (100.21).

8 Install the static part of the mechanical seal (433.21) into the cover plate for seal (471.21). Make sure that the position of the static part in relation to the cylinder pin is correct. Place the o-ring (412.24) into the groove in the cover plate for seal. Install the cover plate for seal into the case (100.21) with socket head capscrews (914.21).

9 Install the case (100.21) with its parts into its guideway into the adapter (344.31).

10 Install the rotating part of the mechanical seal (433.21) into place into the shaft wearing sleeve (524.21) and push the shaft wearing sleeve onto the shaft.

11 Install the needed the compressor rings (487.21) onto the shaft.

12 Place the o-ring (412.21) into its groove and then push the suction impeller (231.21) onto the shaft.

13 Install the o-ring (412.23) into its groove in the case (100.21).

14 Install the case cover (161.21) into its guideway into the adapter (344.31). Make sure that the cylinder pin (562.21) goes into its hole in the case cover. Fix the screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

Liquid ring pump, ready-fitted double (type SM21)

1 Fix the adapter (344.31) into the bearing housing (330.31) with hexagonal screws (901.33).

2 Push the case (100.21) into its guideway into the adapter (344.31).

3 Push the inner rotating part of the mechanical seal (433.21) on the shaft against the shoulder. Remove the o-ring from the periphery of the part.

4 Put the series of compressor rings (487.21) onto the shaft against the front face of the part of the mechanical seal.

5 Push the suction impeller (231.21) onto the shaft. Do not insert the o-ring (412.21) at this stage.

6 Measure the gap between the suction impeller (231.21) and case (100.21), and adjust it according to Table 3 by taking off or adding compressor rings (487.21). While measuring the gap, make sure that both the case and the suction impeller are tightly in their guideway pressed all the way to the bottom. Measure the gap between the end of the suction impeller hub and the case because the front face of the vanes is slightly conical.

7 After adjusting the gap, remove the parts again so as to perform the actual assembly.

8 Push the outer rotating part of the mechanical seal onto the shaft against the shoulder.

9 Install the static part of the mechanical seal into the case (100.21). Fasten the socket head capscrews (914.21).

10 Push the case (100.21) into its guideway into the adapter (344.31).

11 Push the inner rotating part of the mechanical seal (433.21) onto the shaft. Put the o-ring (which was removed in item 3) back into its groove to the periphery of the part.

12 Push the compressor rings (487.21) onto the shaft against the front face of the part of the mechanical seal.

13 Place the o-ring (412.21) into its groove inside the suction impeller and then push the suction impeller (231.21) onto the shaft.

14 Push the cylinder pin (562.21) into its hole in the case (100.21).

15 Place the o-ring (412.23) into its groove in the case (100.21).

16 Install the case cover (161.21) into its guideway into the adapter (344.21). Tighten the hexagon head screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

Air separating pump, element single (type RM11)

1 Press the stationary seat of the mechanical seal (433.21) with its o-ring into the adapter (344.31) without damaging the sliding surface of the seal.

2 Fix the stuffing box housing (451.21) to the bearing housing (330.31) with the nuts (920.22) of the studs (902.22). Do not damage the sliding surface of the seal.

3 Fix the rotating part of the mechanical seal (433.21) on the expeller (235.21), making sure it fits tightly against the shoulder and lock it with the locking screws of the seal. The sliding surfaces must not be damaged.

4 Push the expeller with seal onto the shaft.

5 Fit the o-ring (412.23) on the cover (160.21).

6 Fit the gaskets (400.23) in their places between the cover (160.21) and the case cover (161.21) and between the cover (160) and the stuffing box housing (451.21).

7 Fix the combination of cover and case cover to the adapter with hexagon head screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

Gas separator, standard integrated single (types GM11 and GM12)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Push the static part of the mechanical seal (433.21) into the case cover (161.21) by means of the installation sleeve. Follow the instructions provided by the seal manufacturer.

3 Place the seal ring (411.21) onto the hexagon head screw (901.22). Mount the static part of the mechanical seal (433.21) to the stuffing box housing (451.21) using the screw.

4 Push the stuffing box housing with its parts into its place in the adapter (344.31).

5 Push the rotating part of the mechanical seal (433.21) onto the shaft against the shoulder.

6 Grease the o-ring (412.22) slightly and place it into its proper groove in the expeller (604.21). Place the o-ring (412.21) in the middle of the expeller and push the expeller onto the shaft.

7 Install the gasket (400.22) or o-ring (412.23) into its place in the stuffing box housing (451.21).

8 Push the case cover (161.21) into its place in the adapter (344.31) and fasten the hexagon head screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

Gas separator, standard integrated double (types GM21 and GM22)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Mount the rotating part on the atmospheric side of the mechanical seal (433.21) against the shaft sleeve.

3 Push the static part of the mechanical seal (433.21) into the case cover (161.21) by means of the installation sleeve. Follow the instructions provided by the seal manufacturer.

4 Place the seal ring (411.21) onto the hexagon head screw (901.22). Mount the static part of the mechanical seal (433.21) to the stuffing box housing (451.21) using the screw.

5 Push the stuffing box housing with its parts into its place in the adapter (344.31).

6 Push the rotating part of the mechanical seal (433.21) onto the shaft against the shoulder.

7 Grease the o-ring (412.22) slightly and place it into its proper groove in the expeller (604.21). Place the o-ring (412.21) in the middle of the expeller and push the expeller onto the shaft.

8 Install the gasket (400.22) or o-ring (412.23) into its place in the stuffing box housing (451.21).

9 Push the case cover (161.21) into its place in the adapter (344.31) and fasten the hexagon head screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

Gas separator, static seal (types GS11 and GS12)

1 Fix the adapter (344.31) to the bearing housing (330.31) with the hexagon head screws (901.33).

2 Grease the o-ring (412.25) slightly and place it into the groove of the static seal (435.21). Push the static seal (435.21) to the thrust ring (475.21).

3 Grease the o-ring (412.24) slightly and place it into its proper groove in the thrust ring (475.21). Place the thrust ring (475.21) on the stuffing box housing (451.21) and fix it with the studs (902.21) and nuts (920.21). Do not tighten the nuts.

4 Push the shaft wearing sleeve (524.21) onto the shaft against the shoulder.

5 Push the stuffing box housing with its parts into its place in the adapter (344.31).

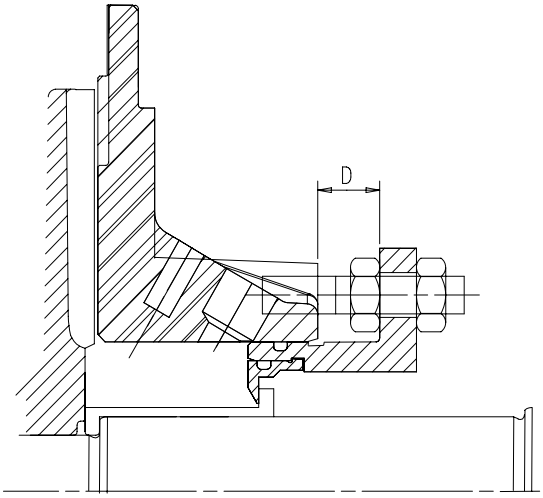
6 Grease the o-ring (412.22) slightly and place it into its proper groove in the expeller (604.21). Place the o-ring (412.21) in the middle of the expeller and push the expeller onto the shaft.

7 Mount the gasket (400.22) or o-ring (412.23) into its place in the stuffing box housing (451.21).

8 Push the case cover (161.21) into its place in the adapter (344.31) and fasten the hexagon head screws (901.21). Continue the assembly according to the following section ”Installation of impeller”.

9 When the exchange unit is fully assembled, pull the thrust ring (475.21) and the static seal (435.21) against the shaft wearing sleeve (524.21). The assembly groove (3 mm x 0.5 mm) at the thrust ring comes out 0.5 mm from stuffing box housing end. Tighten the nuts (920.21) by hand so that the thrust ring is precisely aligned with the shaft. Tighten the locking nuts. The distance between the face of the casing cover and the thrust ring is according to Fig. 6.

10 Loosen the hexagon head screws (901.21) and mount the guards (683.21 and 683.22). Tighten the screws.



Shaft size	D (mm)
1	17
2	17
3	20
4	20
5	24
6	24

Fig. 6

5 Bearing unit

5.1 Disassembly

N O T E
Always renew the bearings once they have been removed from the shaft.

Bearing unit (grease and oil splash)

1 Fasten the bearing unit firmly to a vice at the bearing housing (330.31).

2 Detach the coupling (840.51) using an extractor.

3 Unscrew the hexagon head screws (901.31) and washers (554.31) of the bearing cover (360.31). Remove the guard end (685.51).

4 Draw the bearing cover out by using the hexagon head screws (901.31). As a result, the deflector (507.31) will also come off.

5 Strike the pump side end of the shaft (210.31) with a soft hammer, where upon the shaft with its bearings will come off the bearing housing. Simultaneously the other deflector (507.31) also comes off. Note that the lugs in the oil ring (644.31) should fit into the grooves in the bearing housing (330.31).

6 Fasten the shaft with its bearings to a vice and detach the bearing nut (923.31) and lockwasher (931.31).

7 Detach the antifriction bearings (320.31 and, 320.32) and oil ring (644.31) from the shaft with an extractor or by means of a hammer and a punch.

Bearing unit (oil bath)

1 Fasten the bearing unit firmly to a vice at the bearing housing (330.31).

2 Detach the coupling (840.51) using an extractor.

3 Unscrew the hexagon head screws (901.31) of the bearing cover (360.31). Remove the guard end (685.51).

4 Draw the bearing cover out by using the hexagon head screws (901.31). As a result, the deflector (507.31) will also come off.

5 Strike the pump side end of the shaft (210.31) with a soft hammer, where upon the shaft with its bearings will come off the bearing housing. Simultaneously the other deflector (507.32) also comes off.

6 Fasten the shaft with its bearings to a vice and detach the bearing nut (923.31) and lockwasher (931.31).

7 Detach the antifriction bearings (320.31 and, 320.32) from the shaft with an extractor or by means of a hammer and a punch.

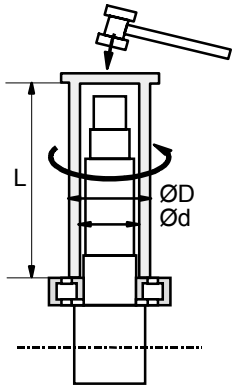
5.2 Reassembly

N O T E
It is absolutely necessary to place the bearings correctly according to the O-system (so called Back-To-Back-Design).

Bearing unit (grease and oil splash)

1 Check the shaft (210.31) in a span. Their maximum radial difference is 0.05 mm.

2 Fasten the shaft to a vice with the impeller end of the shaft upwards. Use soft sheets between the vice clamp jaws to avoid shaft damage. Use a punch to push the oil ring (644.31) onto the shaft. Heat the cylinder roller bearing (320.31) (deep groove ball bearing on shaft size 7) to ca +100°C and push it onto the shaft. Remember to place the spacer ring of the bearing on the shaft shoulder side. Fig. 7.



Shaft size (mm)	1	2	3	4	5	6	7
Ød	37	47	57	67	87	105	125
ØD	50	60	71	80	100	115	135
L_{min}	185	205	220	280	320	360	400

Fig. 7

3 Let the bearing cool down. Then tap it tightly by the inner ring against the shoulder using a pipe punch. Rotate the pipe punch between the blows.

4 Turn the shaft so that the coupling side is upwards, fasten it to a vice.

5 Heat the two angular contact ball bearings (320.32) to approx. +100°C and push them onto the shaft. Let the bearings cool down.

6 Place the lockwasher (931.31) on the shaft.

7 Tighten the angular contact ball bearings by means of the bearing nut (923.31) tightly against the shaft shoulder, use a suitable hooked wrench.

8 Bend the lockwasher tooth into the bearing nut slots.

9 Tighten the bearing housing (330.31) vertically to the vice with the coupling side upwards.

10 Grease the o-ring (412.32) of the labyrinth ring (423.31) lightly and stretch it into its groove. Tap the labyrinth ring (423.31) into the bearing housing (330.31) with a soft hammer. Make sure that the water holes in the labyrinth ring will end up underneath.

11 Grease the o-ring (412.32) of the labyrinth ring (423.32) lightly and stretch it into its groove. Tap the labyrinth ring (423.32) into the bearing cover (360.31) with a soft hammer. Make sure that the water holes in the labyrinth ring will end up underneath.

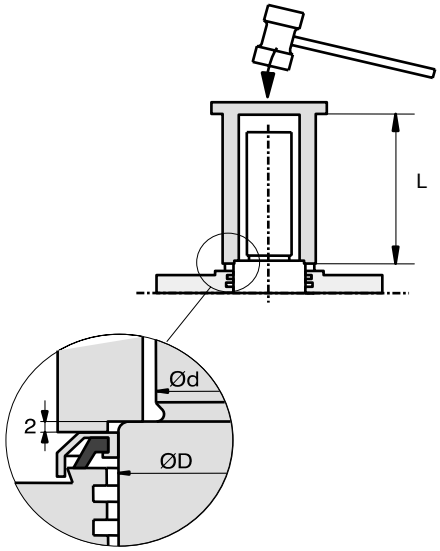
12 Heat the bearing housing first slightly (max. +80°C) to ease the installation of the shaft unit.

13 Lower the shaft carefully into the bearing housing. Note that the lugs in the oil ring (644.31) should fit into the grooves in the bearing housing (330.31).

14 Grease the o-ring (412.31) of the bearing cover lightly and stretch it into its groove.

15 Set the bearing cover into its place. Place the guard end (685.61) on the bearing cover, mount the washers (554.31) and fix it with the hexagon head screws (901.31) into the bearing housing.

16 Place the deflectors (507.31) with care onto the shaft by using e.g. a special pipe punch shown in Fig. 8. Grease the rubber lip before installation.



Shaft size (mm)	Coupling side			Impeller side		
	Ød	ØD	Lmin	Ød	ØD	Lmin
1	24	35	160	30	35	160
2	32	45	180	40	45	180
3	42	55	195	50	55	195
4	48	65	250	60	65	250
5	75	85	290	80	85	290
6	90	100	320	90	100	320
7	110	120	180	110	120	360

Fig. 8

Bearing unit (oil bath)

1 Check the shaft (210.31) with its shaft wearing sleeve (524.21) in a span. Their maximum radial difference is 0.05 mm.

2 Fasten the shaft to a vice with the impeller end of the shaft upwards. Use soft sheets between the vice clamp jaws to avoid shaft damage. Heat the cylinder roller bearing (320.31) to ca +100°C and push it onto the shaft. Remember to place the spacer ring of the bearing on the shaft shoulder side. Fig. 7.

3 Let the bearing cool down. Then tap it tightly by the inner ring against the shoulder using a pipe punch. Rotate the pipe punch between the blows.

4 Turn the shaft so that the coupling side is upwards, fasten it to a vice.

5 Heat the two angular contact ball bearings (320.32) to approx. +100°C and push them onto the shaft. Let the bearings cool down.

6 Place the lockwasher (931.31) on the shaft.

7 Tighten the angular contact ball bearings by means of the bearing nut (923.31) tightly against the shaft shoulder, use a suitable hooked wrench.

8 Bend the lockwasher tooth into the bearing nut slots.

9 Tighten the bearing housing (330.31) vertically to the vice with the coupling side upwards.

10 Tap the labyrinth ring (423.31) into the bearing housing (330.31) with a soft hammer. Make sure that the water holes in the labyrinth ring will end up underneath.

11 Tap the labyrinth ring (423.32) into the bearing cover (360.31) with a soft hammer. Make sure that the water holes in the labyrinth ring will end up underneath.

12 Heat the bearing housing first slightly (max. +80°C) to ease the installation of the shaft unit.

13 Lower the shaft carefully into the bearing housing. Make sure not to damage the labyrinth ring in the bearing housing.

14 Grease the o-ring (412.31) of the bearing cover lightly and stretch it into its groove.

15 Set the bearing cover cautiously into its place. Make sure that the water holes in the labyrinth ring will end up underneath. Place the coupling guard end (685.51) on the bearing cover. Secure these to the bearing housing with the hexagon head screws (901.31).

16 Tighten the hexagon head screws (901.31) of the bearing cover.

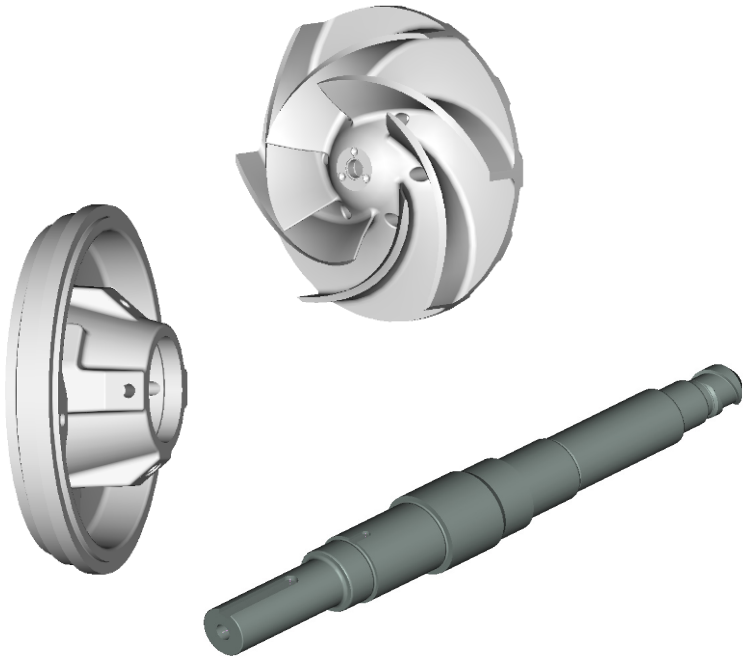
17 Place the deflectors (507.31 and 507.32) with care onto the shaft by using e.g. a special pipe punch shown in Fig. 8. Grease the rubber lip before installation.

SULZER

SPP id: 110901 / en / **N31575** / 1

AHLSTAR

PROCESS PUMPS



Spare parts recommendation

1 Recommended spare parts

1 Recommended spare parts

To avoid long and expensive outages, we recommend that the following spare parts be kept in store preferably as spare part units, spare part kits and maintenance kits rather than as individual parts. The number of spare parts is evaluated for two year's use in normal operating conditions, Table 1 - Table 4.

1.1 Wet end

Table 1, Spare parts recommendation (APP, EPP, NPP, WPP)

WEEN.1	Wet end	Number of identical parts and units in various pumps							
		1	2	3	4	5	6 7	8 9	≥10
		Number of recommended spare parts							
	Spare part kit	1	1	1	1	2	2	3	30 %
	Service kit	2	4	6	8	8	9	12	150 %
102.11	Volute case							1	10 %
135.11	Sideplate	1	1	1	1	2	2	3	30 %
230.11	Impeller	1	1	1	1	2	2	3	30 %
502.11	Casing wear ring	1	2	2	2	3	3	4	50 %
412	O-rings	2	4	6	8	8	9	10	100 %
Refer to the parts lists of the pumps when estimating the number of needed spare parts.									

Table 2, Spare parts recommendation (A, Process pump)

WEEN.1	Wet end	Number of identical parts and units in various pumps							
		1	2	3	4	5	6 7	8 9	≥10
		Number of recommended spare parts							
	Spare part kit	1	1	1	1	2	2	3	30 %
	Service kit	2	4	6	8	8	9	12	150 %
102.11	Volute case							1	10 %
135.11	Sideplate	1	1	1	1	2	2	3	30 %
230.11	Impeller	1	1	1	1	2	2	3	30 %
412	O-rings	2	4	6	8	8	9	10	100 %
Refer to the parts lists of the pumps when estimating the number of needed spare parts.									

1.2 Sealing unit

Table 3, Spare parts recommendation

SEUN.2	Sealing unit	Number of identical parts and units in various pumps							
		1	2	3	4	5	6 7	8 9	≥10
		Number of recommended spare parts							
	Spare part kit	1	2	3	4	5	6	7	90 %
	Service kit	2	4	6	8	8	9	12	150 %
100.21	Case							1	10 %
161.21	Case cover							1	10 %
231.21	Suction impeller	1	1	1	1	2	2	3	30 %
400	Gaskets	2	4	6	8	8	9	12	150 %
412	O-rings	2	4	6	8	8	9	10	100 %
433.21	Mechanical seal	1	2	3	4	5	6	7	90 %
435.21	Static seal	1	2	3	4	5	6	7	90 %

SEUN.2	Sealing unit	Number of identical parts and units in various pumps							
		1	2	3	4	5	6 7	8 9	≥10
		Number of recommended spare parts							
451.21	Stuffing box housing							1	10 %
452.21	Stuffing box gland							1	10 %
456.21	Neck bush							1	10 %
458.21	Lantern ring							1	10 %
461.21	Gland packing				24			32	400 %
475.21	Thrust ring	1	2	3	4	5	6	7	90 %
487.21	Compressor ring							1	10 %
524.21	Shaft wearing sleeve	1	2	2	2	3	3	4	50 %
542.21	Throttle bushing							1	10 %
604.21	Expeller	1	1	1	1	2	2	3	30 %
Refer to the parts lists of the pumps when estimating the number of needed spare parts.									

1.3 Bearing unit

Table 4, Spare parts recommendation

BEUN.3	Bearing unit	Number of identical parts and units in various pumps							
		1	2	3	4	5	6 7	8 9	≥10
		Number of recommended spare parts							
	Spare part kit	1	1	1	2	2	3	4	50 %
	Service kit	2	4	6	8	8	9	10	100 %
183.31	Support foot							1	10 %
210.31	Shaft	1	1	1	2	2	2	3	30 %
320.31	Antifriction bearing	1	1	1	2	2	3	4	50 %
320.32	Antifriction bearing		2		4		6	8	50 %
330.31	Bearing housing							1	10 %
344.31	Adapter							1	10 %
412	O-rings	2	4	6	8	8	9	10	100 %
423	Labyrinth ring							1	10 %
507.31	Deflector		4		8		8	10	100 %
923.31	Bearing nut	1	1	1	2	2	2	3	30 %
931.31	Lockwasher	1	1	1	2	2	2	3	30 %
940.31	Key	1	1	1	2	2	2	3	30 %
Refer to the parts lists of the pumps when estimating the number of needed spare parts.									

John Crane Safematic Oy
P.O. Box 10
FIN-40951 MUURAME
FINLAND

Tel +358 14 600611
Fax +358 14 600 600

No. 20000272EN
Date 01.03.2001
Revision No. 03
Date 10.08.2004

SE2 SEALS
SE2-APR-SEALS (SmartFlow Use) **AHLSTAR PUMP**

APPLICATION

Pumps for abrasive and effluent liquids, e.g. pumps in washing, evaporation and causticizing plants of pulp mills, additive pumps in paper mills.

T_{max} = 210 °C (410 °F)
p_{max} = 25 bar (360 psi)
p_{max} = 15 bar (210 psi) (sealwater)
n_{max} = 3000 $^{1}/_{min}$

SEAL MATERIALS AND SPECIAL CHARACTERISTICS

The materials of the seal are listed on the attached assembly drawings. The seal type and the identification code of the seal is etched on the seal.

INSTALLATION OF THE SEAL

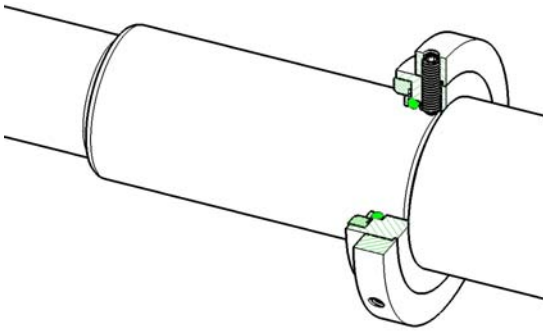
Points to be observed in installation

Care and cleanliness have to be observed during installation. The parts must not be force fitted as they are designed to require hand fitting only. Contact of sliding faces should be avoided. If this cannot be avoided, the faces should be cleaned with a cleaning solvent and a soft cloth prior to pressing the sliding faces together.

The surface joints of the components and the auxiliary sealing (O-rings) have to be lubricated before assembling. Sharp edges must be removed from all shoulders over which the seal parts have to be pushed.

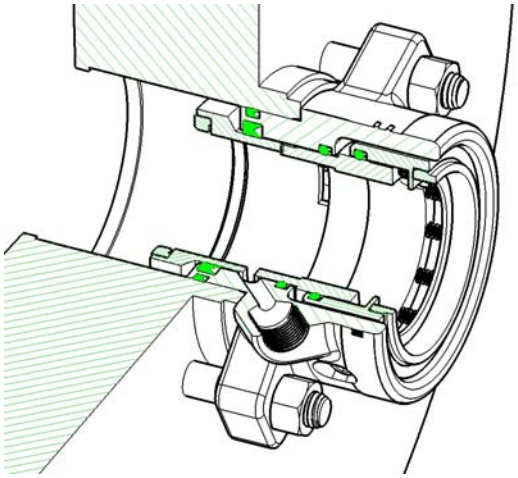
Prior to installation, check the seal for any damage which may have occured during transportation. Follow the installation instructions of the equipment very carefully.

Installation



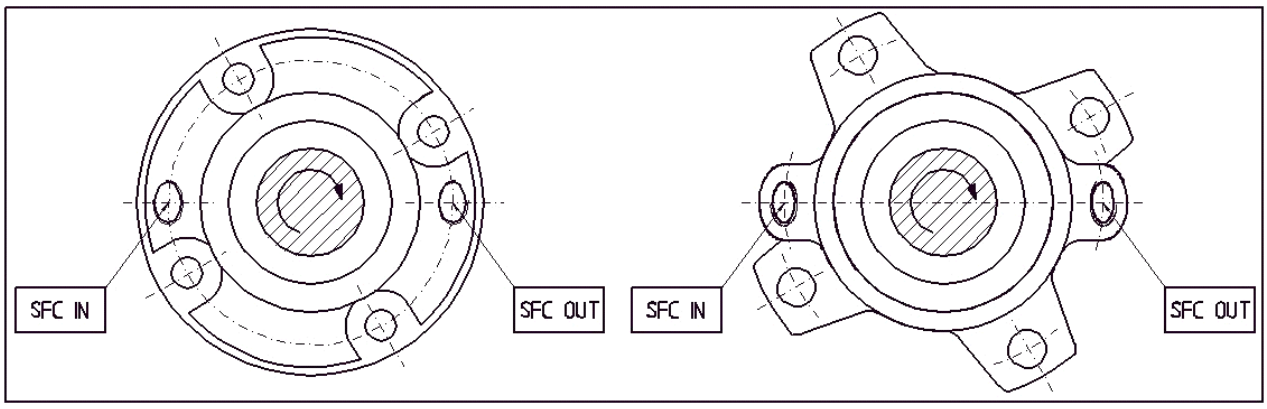
27201.jpg

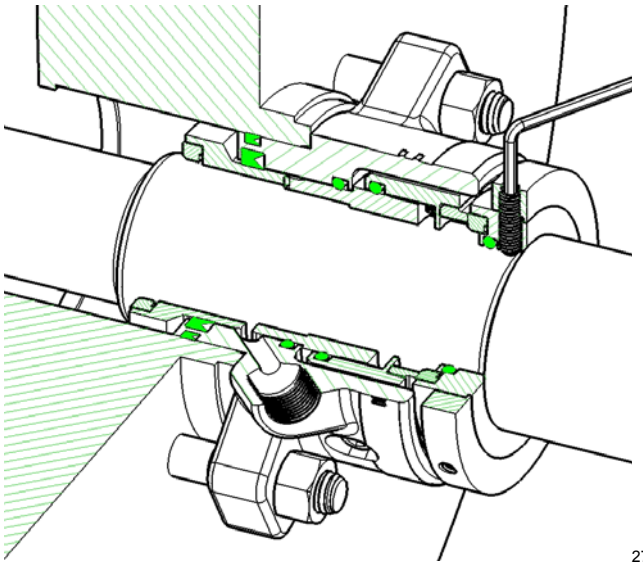
- Slide the outboard rotary seat ring onto the shaft up against the shaft shoulder.



27202.jpg

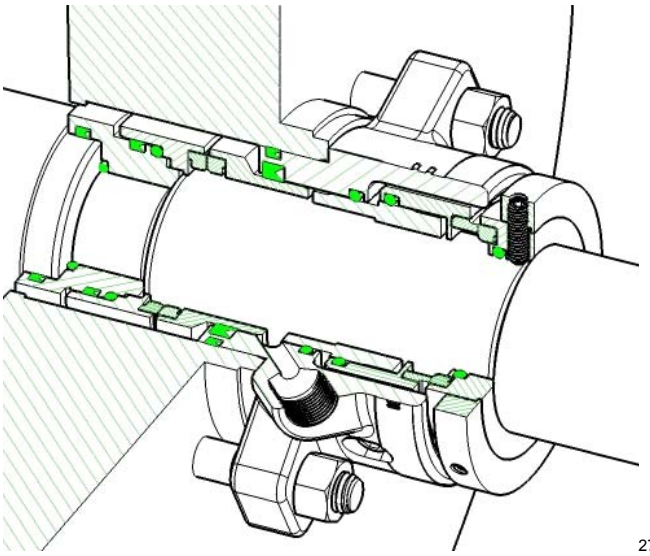
- Install the cooling sleeve as shown in the assembly drawing in EPP and EPT models.
- Slide the seal stationary assembly into the stuffing box as shown.
- Bolt the seal gland onto the stuffing box.
- Make sure that the pipe connections are accessible.
- If the water connections of the seal are marked with ”SFC IN” and ”SFC OUT”, the seal is designed to be used with SmartFlow and it includes the necessary fitting parts.
- A seal marked with SFC has to be mounted in a way the water connections are situated in relation to the direction of rotation of the pump as shown in the picture below.





27203.jpg

- Fasten the stuffing box housing into the lantern.
- Uniformly tighten the set screws in the utboard sealing ring against the shaft. (3 pcs).



27204.jpg

- Install the thrust ring and the O-ring.
- Make sure, that all the sharp edges has been removed (proper fillet and chamfer) over which the seal will be pushed.
- Tighten the thrust ring with the impeller.
- Install the seal water connections.

Disassembly

1. Remove the seal water hoses.
2. Remove the impeller.
3. Pull out the thrust ring package from the shaft.
4. Loosen the set screws.
5. Detach the lantern from the stuffing box housing.
6. Loosen the bolts of the gland and pull out the seal.
7. Remove the outboard rotary seat ring from the shaft.

OPERATION, USE AND SERVICE OF THE SEAL

Operation The SE2 seal is a double-acting mechanical seal. It requires seal water for operation. The sliding faces get their lubrication from seal water.

Use Note! Do not run the seal without seal water. Regulate the seal water flow to 0,5-3 l/min. Outcoming seal water temperature should not exceed 60 °C (140 °F). If the seal requires more cooling, increase the flow. Regulate the seal water pressure 2 bars (30 psi) higher than the product pressure to be sealed.

Requirements for seal water quality:

- Solid particles max. 10 mg/l, may not contain clay or alike fine-grained stuff.
- Solid particle size max. 50 µm
- Silicate content max. 10 mg/l
- Permanganate number max. 30
- Iron content max. 1 mg/l
- Total hardness < 10 °dH

For seal water control we recommend the use of John Crane Safematic Safeunit™ control unit.

Safematic Safeseal is designed and manufactured to operate safely if used properly. These operation and installation instructions are general requirements for the use of a mechanical seal. General safety and mill regulations should also be followed. The user must also take into account the possible dangerous situations which can be caused by eventual seal damage.

Use with SmartFlow

SE2-APR seals include a seal water circulation ring designed to be used with SmartFlow. When using the seal together with SmartFlow, the operating limits defined in SmartFlow's installation and operation instructions no. 20000338 are in force. A seal without a circulation ring should not be used with SmartFlow.

Service When service or repair is required please contact the manufacturer or his representative.

ENCL. Assembly drawing

We certify that AHLSTAR pump has been manufactured, tested and inspected according to the following international standards (if no other specified requirements exist):

- EN ISO 5199:2002 Technical specifications for centrifugal pumps -- Class II
- EN 2858:2010 (ISO 2858:1975) End-suction centrifugal pumps (rating 16 bar) -- Designation, nominal duty point and dimensions (standard's range up to size 44-200)
- EN ISO 9001:2001 Quality management systems -- Requirements

1 Inspection before assembly

Components to be assembled have been examined.

Installation dimensions have been examined.

Information on the nameplate has been examined.

2 Materials

Materials have been manufactured according to the standard specified in order specification and part list.

3 Balancing of rotating components

All rotating components are balanced according to ISO 1940 G6.3 standard, and the low pulse impeller according to ISO 1940 G2.5.

4 Hydrostatic test

All pressure containing parts (eg. casing, casing cover etc.) including their fasteners have been hydrostatically tested with clean water at ambient temperature (15 °C minimum for carbon steel). The hydrostatic test has been considered satisfactory when the test pressure is maintained for at least 10 min. without visible leakage. The hydrostatic pressure is 1.5 times the design pressure.

5 Performance test

Performance test has been done according to the EN ISO 9906 grade 2.

During performance tests the pump vibration, bearing temperature and visually the shaft seal have been checked.

6 Final inspection

A final inspection has been done so, that the scope of supply is correct and complete according to the purchase order, including component identification, painting and preservation and technical documentation.

7 Preparation for dispatch

All internal parts made of material which are not resistant to corrosive attack by the environment have been drained and treated with a water displacing rust-preventative prior to shipment.

Exterior surfaces, except for machined surfaces, have been given at least one coat of the manufacturer's standard paint which shall be selected taking into account environmental considerations. The under-side of baseplates have been prepared for grouting.

Exterior machined surfaces of cast iron and carbon steel parts have been coated with a suitable rust preventative.

Bearings and bearing housings have been protected by preservative oil which is compatible with the lubricant. A label warning (oil lubricated bearing housings must be filled with oil to the proper level prior to starting) have securely attached to the pump.

Information on preservation agents and their removal have been securely attached to the pump.

All openings to the pressure chamber have weather-resistant closures substantial enough to withstand accidental damage.

Each unit have been prepared and small piping and auxiliaries secured, to prevent damage during shipment and storage.

The pump and all components supplied loose with it have been clearly and durably marked with the prescribed identification number.

Kotka 1.3.2012

Ilkka Sinisalo
Head Operations BA SPP

Based on the continuous tests we certify that the analysis values as well as the mechanical-technological data of material are within the standard EN 10204-2.2 and the following limits. The material options are mentioned in the product specification and in the part list.

Material alternatives

Part no.	Description	Code	Material
WEEN.1	**WET END**		
102.11	Volute case	53	A48 CL 35 B
		46	A216 WCB
		41	A890 3A
		4E	A747 CB7Cu-2
		4L	A890 1B
		4T	A890 5A
		4U	654 SMO
		EJ	SULZER 2304
135.11	Sideplate	5B	A532 IIIA
		46	A216 WCB
		41	A890 3A
		4E	A747 CB7Cu-2
		4L	A890 1B
		4T	A890 5A
		4U	654 SMO
175.11	Flow straightener	41	A890 3A
		4E	A747 CB7Cu-2
		4L	A890 1B
		4T	A890 5A
		4U	654 SMO
230.11	Impeller	5B	A532 IIIA
		41	A890 3A
		4E	A747 CB7Cu-2
		4L	A890 1B
		4T	A890 5A
		4U	654 SMO
502.11 502.12	Casing wear ring	41	A890 3A
		4E	A747 CB7Cu-2
		4L	A890 1B
		4T	A890 5A
		4U	654 SMO
SEUN.2	**SEALING UNIT**		
100.21	Case	41	A890 3A
		46	A216 WCB
		4E	A747 CB7Cu-2
		4L	A890 1B
		4T	A890 5A
		4U	654 SMO
161.21 451.21	Case cover Stuffing box housing	53	A48 CL 35 B
		41	A890 3A
		46	A216 WCB
		4E	A747 CB7Cu-2
		4L	A890 1B
		4T	A890 5A
		4U	654 SMO
231.21 235.21 604.21	Suction impeller Expeller Expeller	41	A890 3A
		4E	A747 CB7Cu-2
		4L	A890 1B
		4T	A890 5A
		4U	654 SMO
475.21	Thrust ring	41	A890 3A
		4U	654 SMO

Part no.	Description	Code	Material
BEUN.3	**BEARING UNIT**		
183.31	Support foot	52	A48 CL 30 B
330.31	Bearing housing	52 53	A48 CL 30 B A48 CL 35 B
344.31	Adapter	5H	A395 60-40-18
360.31	Bearing cover	52	A48 CL 30 B

Material specifications

SPP id	MCN	Marking	Typical chemical analysis %	Tensile strength MPa (ksi)	Yield strength MPa (ksi)	Elongation %	Hardness HB
3L		254 SMO	Carbon max 0.02 Manganese max 1.0 Silicon max 0.8 Phosphorus max 0.03 Sulphur max 0.01 Chromium 19.5-20.5 Nickel 17.5-18.5 Molybdenum 6.0-6.5 Copper 0.5-1.0 Nitrogen 0.18-0.22				
41	J0265	A890 3A	Carbon max 0.06 Manganese max 1.00 Silicon max 1.00 Phosphorus max 0.04 Sulphur max 0.04 Chromium 24.0-27.0 Nickel 4.0-6.0 Molybdenum 1.75-2.5 Nitrogen 0.15-0.25	655 (95)	450 (65)	25	(230)
46	J0297	A216 WCB	Carbon max 0.30 Manganese max 1.00 Silicon max 0.60 Phosphorus max 0.04 Sulphur max 0.045 Copper max. 0.30 Nickel max. 0.50 Chromium max. 0.50 Molybdenum max 0.20 Vanadium max. 0.03 (Cu+Ni+Cr+Mo+V) max 1.00	485-655 (70 – 95)	250 (36)	22	(160)
4E	J0264	A747 CB7Cu-2	Carbon max 0.07 Manganese max 0.70 Silicon max 1.00 Phosphorus max 0.035 Copper 2.50-3.20 Chromium 14.0-15.5 Nickel 4.5-5.5 Molybdenum max 0.50 Niobium 0.15-0.35 %	1205 (174)	1035 (150)	5	(400)
4L	J0266	A890 1B	Carbon max 0.04 Manganese max 1.0 Silicon max 1.00 Phosphorus max 0.04 Sulphus max 0.04 Chromium 24.5-26.5 Nickel 4.75-6.0 Molybdenum 1.75-2.25 Copper 2.75-3.25	690 (100)	485 (70)	16	(250)

SPP id	MCN	Marking	Typical chemical analysis %	Tensile strength MPa (ksi)	Yield strength MPa (ksi)	Elongation %	Hardness HB
4T (*	J0267	A890 5A	Carbon max 0.03 Manganese max 1.5 Silicon max 1.00 Phosphorus max 0.04 Sulphus max 0.04 Chromium 24.0-26.0 Nickel 6.0-8.0 Molybdenum 4.0-5.0 Nitrogen 0.10-0.30	680 (99)	515 (75)	18	(250)
4U	J0271	654 SMO	Carbon max 0.025 Chromium 23.0-25.0 Nickel 21.0-23.0 Molybdenum 7.1-7.5 Copper 0.3-0.7 Nitrogen 0.45-0.55	600 (87)	350 (51)	40	(220)
52	F0066	A48 CL 30 B	Carbon 3.2-3.7 Silicon1.7-2.4 Manganese 0.4-0.9	200 (29)			(170-220)
53	F0067	A48 CL 35 B	Carbon 3.2-3.7 Silicon1.7-2.4 Manganese 0.4-0.9	250 (36)			(170–220)
5B	F0068	A532 IIIA	Carbon 2.0-3.3 Manganese max 2.0 Silicon max 1.5 Phosphorus max 0.10 Copper max 1.2 Sulphus max 0.06 Chromium 23.0-30.0 Nickel max 2.5 Molybdenum max 3.0				(min. 600)
5H	F0047	A395 60-40-18	Carbon min 3.0 Silicon max 2.5 Phosphorus max 0.08	415 (60)	275 (40)	18	143-187
EJ		SULZER 2304	Carbon max 0.06 Chromium 22.0-24.0 Nickel 3.5-5.5 Molybdenum 0.1-0.6 Copper 0.1-0.6 Nitrogen 0.05-0.20	550 (80)	360 (52)	25	(200)

*) At Sulzer Karhula foundry, the PRE target value of the material ASTM A890 5A (4T) is 41. The minimum accepted value of 4T is 40.

Kotka 1.3.2012

Ilkka Sinisalo
Head Operations BA SPP

We certify that AHLSTAR pump has been finished according to the option mentioned in the product specification.

1 Product outside surface treatment

Atmospheric-corrosivity category C4, ISO 12944-2, temperatures <150 °C, zinc-rich primer

1.1 Wet end outside surface treatment

- Relates to part numbers 102.11 (volute case) and 175.11 (flow straightener)

1.1.1 Painting, standard method

- Painting of wet end is made according to EN-ISO 12944-5 standard
- Preparation of steel substrates grade Sa 2 ½ according to standard ISO 8501-1

Painting of cast iron and carbon steel components:

- Atmospheric corrosivity category C4 according to standard 12944-2 "Classification of environment"
- Paint system A4.14/M EPZn[R] EP200/3
  - 1 x priming coat (EPZn[R]) 40 µm
  - 1 x intermediate coat (EP) 80 µm
  - 1 x top coat (EP) 80 µm
  - Nominal dry film thickness 200 µm
- Machined surfaces paint system EP80/1
  - 1 x top coat (EP) 80 µm
  - Nominal dry film thickness 80 µm

Painting of stainless steel components:

- Paint system EP80/1
  - 1 x top coat (EP) 80 µm
  - Nominal dry film thickness 80 µm

1.1.2 Sandblast

Outside surfaces of volute casing made of stainless steel is sandblasted.

1.2 Sealing unit outside surface treatment

- Relates to part numbers 100.21 (case), 161.21 (case cover) and 451.21 (stuffing box housing)

1.2.1 Painting, Standard method

- Painting of sealing unit is made according to EN-ISO 12944-5 standard
- Preparation of steel substrates grade Sa 2 ½ according to standard ISO 8501-1

Painting of cast iron and carbon steel components:

- Atmospheric corrosivity category C4 according to standard 12944-2 "Classification of environments"
- Paint system A4.14/M EPZn[R] EP200/3
  1 x priming coat (EPZn[R]) 40 µm
  1 x intermediate coat (EP) 80 µm
  1 x top coat (EP) 80 µm
  Nominal dry film thickness 200 µm

Painting of stainless steel components:

- Paint system EP80/1
  1 x top coat (EP) 80 µm
  Nominal dry film thickness 80 µm

1.2.2 Sandblast

Outside surfaces of sealing unit component made of stainless steel is sandblasted.

1.3 Bearing unit outside surface treatment

- Relates to part numbers 183.31 (support foot), 330.31 (bearing housing), 344.31 (adapter) and 360.31 (bearing cover)

1.3.1 Painting, standard method

- Painting of bearing unit is made according to EN-ISO 12944-5 standard
- Preparation of steel substrates grade Sa 2 ½ according to standard ISO 8501-1

Painting of cast iron components:

- Atmospheric corrosivity category C4 according to standard 12944-2 "Classification of environments"
- Paint system A4.14/M EPZn[R] EP200/3
  1 x priming coat (EPZn[R]) 40 µm
  1 x intermediate coat (EP) 80 µm
  1 x top coat (EP) 80 µm
  Nominal dry film thickness 200 µm
- Machined surfaces paint system EP80/1
  1 x top coat (EP) 80 µm
  Nominal dry film thickness 80 µm
- Bearing housing unmachined innersurfaces paint system EP80/1
  1 x top coat (EP) 80 µm
  Nominal dry film thickness 80 µm

1.4 Coupling guard surface treatment

- Relates to part numbers 685.51 (guard end), 686.51 (guard jacket) and 686.52 (guard jacket)

1.4.1 Painting, standard method

- Paint system powder paint EP100/1

1 x top coat (EP) 100 µm

Nominal dry film thickness 100 µm

- Paint system Liquid paint EP120/2

  2 x top coat (EP) 60 µm

  Nominal dry film thickness 120 µm

1.4.2 Non-treated

Stainless steel/Brass guards are without painting.

1.5 Baseplate surface treatment

Relates to part number 890.61 (baseplate)

1.5.1 Hot galvanizing

Steel baseplates are hot dip galvanized according to standard EN-ISO 1461.

1.5.2 Painting, standard method

- Painting of baseplate is made according to EN-ISO 12944-5 standard
- Preparation of steel substrates grade P2 according to standard EN-ISO 8501-3

Painting of steel components:

- Atmospheric corrosivity category C4 according to standard EN-ISO 12944-2 "Classification of environments"
- Paint system A4.14/M EPZn[R] EP200/3

  1 x priming coat (EPZn[R]) 40 µm

  1 x intermediate coat (EP) 80 µm

  1 x top coat (EP) 80 µm

  Nominal dry film thickness 200 µm
- Machined surfaces paint system EP80/1

  1 x top coat (EP) 80 µm

  Nominal dry film thickness 80 µm

1.5.3 Non-treated

Stainless steel baseplates are without painting.

Kotka 1.3.2012

Ilkka Sinisalo
Head Operations BA SPP