Operating and Maintenance Instructions

Volute – Casing Centrifugal Pumps for handling Hot Water to 207°C ALLTHERM

Series NHT and CHT

VM – No.: 460.0015 GB
Edition: 12.96
Ident – No.: 550 238

Retain for future use!

Order no.:	**Pump ident no.:**
Machine no.:	**Pump type:**

Operating data of pump as per order data sheet
Dimensions as per technical specification VM 500/...

Contents

These Operating and Maintenance Instructions contain information from the pump manufacturer. They may need to be supplemented by instructions of the operator company for its personnel. These instructions do not take account of specific information relating to operation and maintenance of the process plant into which the pump is integrated. Such information can only be given by the persons responsible for construction and planning of the plant (plant manufacturer).
Such specific instructions relating to operation and maintenance of the process plant into which the pump is integrated have priority over the instructions of the pump manufacturer.

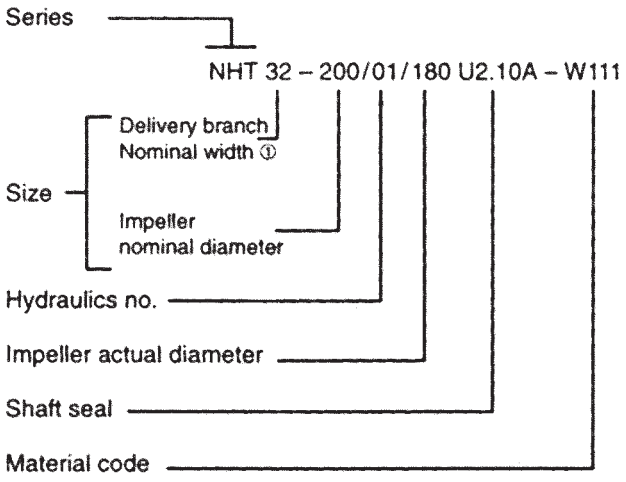
Refer to the operating instructions of the plant manufacturer!

1 General

1.1 Abbreviation

The abbreviation of the centrifugal pump is set up according to the following schema, and is engraved on the type plate.

Example:



① For the two–stage sizes the number of stages precedes the nominal delivery branch width, separated by a slash, e.g. 2/32–200/...

1.2 Application and range of utilization

The volute–casing centrifugal pumps **ALLTHERM** series NHT and CHT are single and two–stage pumps of the process type of construction for handling hot water.

The fluids must contain no abrasive components and must not chemically attack the pump materials.

The application of uniform components in several pump series and sizes allows for economical stocking of spares and procurement of replacement parts.

1.3 Performance data

The exact performance data applicable to the pump can be taken from the order data sheet and/or acceptance test report, and are engraved on the name plate.

1.4 Warranty

Our warranty for shortcomings in the supply is laid down in our delivery conditions. No liability will be undertaken for damages caused by non–compliance with the operating instructions and service conditions.

If at any later date the operating conditions change (e.g. different fluid conveyed, speed, viscosity, temperature or supply conditions), it must be checked by us from case to case and confirmed, if necessary, that the pump is suited for those purposes. Where no special agreements were made, pumps supplied by us may, during the warranty period, only be opened or varied by us or our authorized contract service workshops; otherwise our liability for any defects will cease.

1.5 Testing

Prior to leaving our factory, all pumps are subjected to a leak and pressure test. A performance test is carried out if agreed. Only properly operating pumps, achieving the performance assured by us, leave the factory.

Thus, compliance with the following operating instructions ensures fault–free operation and full delivery.

1.6 Availability

As a matter of principle, we recommend stocking replacement pumps and withdrawable units (hydraulic action system) where the supplied pumps are a decisive factor in maintaining a production or delivery process. In this way downtimes can be avoided, or reduced to a minimum.

1.7 Temperature and pressure limits

The following diagram shows the application limits as a function of temperature, internal pump pressure and casing material.

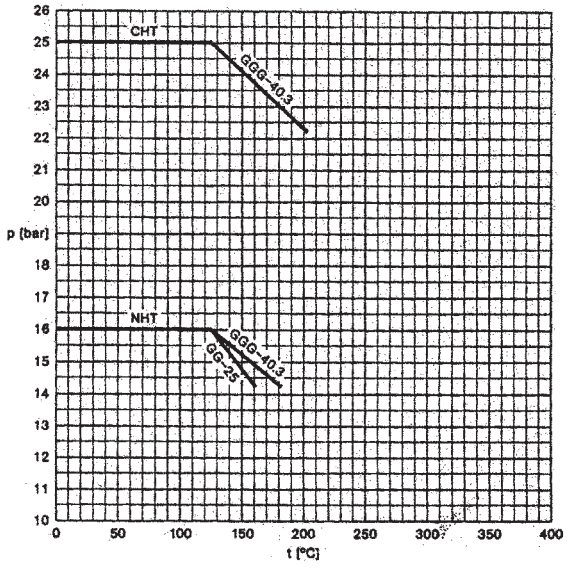


Fig. 1: Internal pump pressure as a function of the temperature of the liquid to be pumped.

The sum of inlet pressure and maximum delivery pressure must not be greater than the permissible internal pump pressure!

2 Safety

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

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

2.1 Marking of instructions in the operating instructions

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

Warning symbol
as per DIN 4844–W9

Warning of danger from electric voltage is given as follows:

Warning symbol
as per DIN 4844–W8.

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

ATTENTION

Instructions affixed directly to the machine such as

- Directional markers
- Signs for fluid connections

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

2.2 Personnel qualification and training

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

2.3 Dangers in the event of non–compliance with safety instructions

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

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

2.4 Responsible working practices

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

2.5 Safety instructions for the user/operator

- Hot or cold parts representing a danger must be protected against accidental contact on site.
- Protection against accidental contact for moving parts (such as the coupling) must not be removed while the machine is in operation.
- When operating pump aggregates in a dust–laden environment (e.g. milling, chipboard manufacture, bakeries), the surfaces of the pumps and motors must be cleaned at regular intervals, depending on local conditions, in order to maintain the cooling effect and eliminate the possibility of spontaneous combustion. This particularly applies to aggregates in hot–oil plants. Refer also to explosion protection regulations (ZH 1/10).
- Leakage (e.g. from the shaft seal) of hazardous substances being handled, such as explosive, toxic or hot materials, must be discharged such that no danger to persons or the environment is created. Legal regulations must be observed.
- Dangers from electrical energy must be eliminated. For details in this regard, refer to VDE and local power company regulations.

2.6 Safety instructions for maintenance, inspection and mounting work

The operator company shall ensure that all maintenance, inspection and mounting work is performed by authorized and qualified specialist personnel who have thoroughly studied the operating instructions.

Work on the machine is only to be carried out when the machine is at a standstill. The means of shutdown of the machine described in the operating instructions must always be followed.

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

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

2.7 Unauthorized conversion and production of replacement parts

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

2.8 Impermissible modes of operation

The operating safety of the machine supplied is only ensured when it is used in accordance with *Section 1* of the operating instructions. The limit values given on the data sheet must under no circumstances be exceeded.

3 Transportation and Intermediate Storage

3.1 Packaging

Attention must be paid to the markings on the packaging.
The suction and pressure sides and all auxiliary connections must always be closed with dummy plugs during transportation and storage. The plugs must be removed when the pump aggregate is installed.

3.2 Transportation

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

⚠ **The crane device and cables must be adequately dimensioned. The cables must not be attached only to the attachment eyes of the motor.**

Complete aggregates, with a base plate–mounted horizontal foot pump and mounted, coupled motor, must be transported to the place of installation as shown in the illustration.

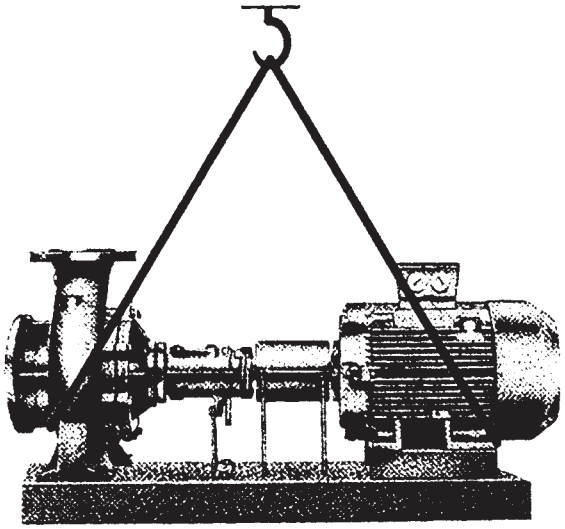


Fig. 2: Transportation of a horizontally mounted pump aggregate

3.3 Preservation and storage of the centrifugal pumps

3.3.1 Preservation

If required, the pumps delivered by us are already provided with the requested preservation protection according to the storage time specified by the customer. Also in the case of prolonged shutdown, the pumps must be protected against corrosion. In those cases, an outside and inside preservation is to be provided. The durability of the protection against corrosion, which is limited in time, depends on the composition of the preservative to be applied and the storage conditions. Therefore, such preservatives should only be used which have a minimum durability of 12 months. The below–listed preservative can be applied for outside and inside preservation.

3.3.1.1 Outside preservation

Points of preservation	Preservative
All bright and unvarnished parts such as: shaft ends, couplings, flange facings, valve and manometer connections	TECTYL 506 or mixture of TECTYL 506 and TECTYL 511–M ①

The outside preservative should be applied by painting or spraying with a spray gun.

3.3.1.2 Inside preservation

Points of preservation	Preservative
All bright and unvarnished parts such as: shaft ends, couplings, flange facings, valve and manometer connections	TECTYL 506 or mixture of TECTYL 506 and TECTYL 511–M ①

① Manufacturer: VALVOLINE OEL GmbH & Co.
Überseering 9
22297 Hamburg

Note: The preservative listed above is to be regarded as a recommendation. Preservatives having the same preserving properties offered by other mineral oil producers can also be used.

The preservative is to be applied by filling the pump. For these purposes, the suction side of the pump must first be closed with a dummy flange. During filling, the pressure flange must be on a higher level than the suction flange. During the filling process, the shaft must be slowly cranked against the direction of rotation. Filling must be continued until the preservative reaches the sealing strip of the delivery flange, bubble–free. Then the outlet side is to be closed with a dummy flange.

3.3.1.3 Monitoring of preservation

In the event of prolonged storage, the preservation of the pump must be checked by the customer at regular intervals.
Every six months the pump level must be checked; if necessary, preservative must be topped up to the sealing strip on the pressure flange.
At the same time, the packing must be checked for destruction, and repaired if necessary.
Note: Liability for damages caused by improper preservation cannot be assumed by us.

3.3.1.4 Durability of the preservative

According to the preservative manufacturer, the durability of »TECTYL 506« is 4 to 5 years in case of indoor storage and 12 to 24 months in case of outdoor storage, and that of »TECTYL 511–M« approx. 18 months in case of indoor storage.

When mixing »TECTYL 506« and »TECTYL 511–M« in the same proportion, a durability of 2 1/2 to 4 years in case of indoor storage, and a maximum of 12 months in case of outdoor storage under roof can be expected. With additional packing, the service life is increased.

The active ingredients contained in this preservative provide sufficient protection against corrosion even at high air humidity (sea, tropical climate). Therefore, a temperature limitation (+ and –) does not exist.

3.3.1.5 Depreservation

Prior to setting the pump in motion, the preservative applied must be removed.

The preservative applied for inside preservation must be drained off and disposed of in an environmentally compatible manner.

The pump must be dismounted and thoroughly cleaned. This particularly applies to pumps used in the food industry or in drinking water supply. A suitable foodstuff–compatible solvent, compatible with the delivery medium, may be applied. Appropriate solvents are for example: spirit, Ritzol 155, or heavily alkaline soap suds. Steam jet cleaning devices with appropriate admixtures can also be used (allow solvent to act beforehand).

ATTENTION Prior to start–up after prolonged storage, all elastomers (O–rings, shaft seals) must be checked for their elasticity of shape. Embrittled elastomers must be exchanged. Elastomers of ethylene–propylene rubber (EPDM) must always be replaced. The pump must be filled with fluid to prevent seizing of the components.

Note: If pipelines, tanks or other parts in the plant are wetted with the paraffin–containing preservative, the entire plant must be depreserved. All preservative residues must be eliminated; malfunctions of the pump may occur if they are not.

3.3.2 Storage

During storage of the pump, the suction and outlet branches and all other supply and discharge branches must always be closed with dummy flanges or dummy plugs.

Storage should be in a dry, dust–free room. During storage, the pump should be cranked at least once a month. During this process, parts such as the shaft and bearings should change their position.

ATTENTION Only proper storage and packing ensures the durability of the preservative applied.

4 Description

4.1 Structural design

Horizontal, single and two–stage, single–entry volute–casing centrifugal pump with axial inlet of the process type of construction.

4.1.1 Volute casing

Volute casing with cast–on feet and casing cover with cooling ribs.

4.1.2 Branch positions/flanges

Suction branch: axially
Delivery branch: radially upwards

Flanges:
Series NHT: to DIN 2501 PN 16
Series CHT: to DIN 2501 PN 25

4.1.3 Auxiliary connections

For required auxiliary connections refer to the binding installation diagram of the pump aggregate.

4.1.4 Impeller

Enclosed radial wheel without back vanes. Axial thrust compensation by relief bore holes.
Two–stage design: two enclosed radial wheels without back vanes. Axial thrust compensation by opposing impeller arrangement.
Residual thrust absorbed by groove ball bearing in the bearing housing.

4.1.5 Shaft

The pump is equipped with a particularly rigid shaft, providing trouble–free operation in all load phases. As a result of the bending rigidity and the short distance between bearing and shaft seal, true running is achieved creating optimum conditions for the shaft seal. The deflection measured at the point of the shaft seal is below 0.05 mm. This value applying to the entire characteristic area already contains the radial movement of the shaft resulting from the bearing play.

4.1.6 Bearing and lubrication

Pump side: one medium–lubricated sliding bearing.
Drive side: one grease–lubricated groove ball bearing C3 to DIN 625.

4.1.7 Shaft seal

Uncooled, maintenance–free mechanical seal of the balanced type. A cooling and throttling line for lowering the temperature of the liquid pumped is arranged between impeller and mechanical seal.
Through the leakage connection LO, emerging liquid leakage quantities, if any, can be safely drained and completely collected.

The following materials are provided for the mechanical seal:

Abbre–viation	Material type		Material code DIN 24 960
U2.10A	Rotating seal ring	Hard carbon	A
	Stationary seal ring	Silicium carbide	Q1
	O–ring	EPDM	E
	Spring	CrNiMo steel	G
	Other structural parts	CrNiMo steel	G

4.2 Construction of the pump aggregate

4.2.1 Drive

The pumps can be directly coupled with electric motors, or any other prime movers.
In most cases, surface–cooled three–phase squirrel cage induction motors are used as driving motors, type IM B3, class of protection IP 54 to IEC standard, class B insulation, outputs and speeds to DIN 42 673.

The exact motor data are to be found on the order data sheet.

4.2.2 Shaft coupling and contact protection

Flexible shaft coupling to DIN 740 without or with spacer.
Protection against accidental protection **to DIN 24 295** is provided where a pump, base plate and shaft coupling are supplied as the product package.

According to accident prevention regulations, the pump must only be operated with a protection against accidental contact as per DIN 24 295.

If no contact protection is provided, it must be attached by the operator.

4.2.3 Base plate

Of cast iron or steel. Execution is dependent on size. See separate installation diagrams.

5 Installation/Mounting

5.1 Installation

The pump and coupled drive motor are generally mounted horizontally on a common base plate.

5.1.1 Place of installation

The aggregate should as far as possible be installed at the lowest point of the plant; that is, where the geodetic supply head is highest.

The temperature transfered by the delivery fluid onto the casing cover and the bearing bracket is significantly reduced by the special design of the overall insert unit. The installation location must be chosen such that no heat build–up can occur in the area of the bearing bracket.

ATTENTION Only the spiral casing may be insulated with heat–insulating material. All other pump components must not be insulated, in order to ensure optimum heat discharge.

⚠ To prevent injury from burns, appropriate protective devices must be installed (protection against accidental contact).

5.1.2 Ambient temperature at the place of installation

Pump aggregates in enclosed rooms must be installed such that no heat build–up occurs. If ambient temperatures above +40°C are to be expected, suitable ventilation must be provided to discharge the radiated heat and supply adequate fresh air to the room. Consult the factory if necessary.

5.2 Mode of fastening

The mode of fastening is dependent on the design type and size of the pump and the coupled motor, as well as local installation conditions.

Horizontal pumps with feet and the driving motor are fixed on a common base plate.

Precise details on form and dimensions are given in the installation diagram.

5.3 Foundation

5.3.1 Design

The foundation may be concrete or a load–bearing foundation frame, of steel for example.

The condition for all foundation designs is:

The foundation must be designed so that it can take the weight of the pump aggregate across its entire area.

5.3.2 Characteristics of a steel foundation frame

A steel foundation frame must be designed so that the base plate makes contact across its entire area, and can be bolted or welded on.

ATTENTION the base plate is only supported at four points the pump aggregate will hang down in the middle. This will affect the alignment of the coupling and may also lead to severe noise being generated.

5.3.3 Characteristics of a concrete foundation

When placing the concrete foundation it must be ensured that space is left between the top edge of the finished foundation block and the bottom edge of the base plate for alignment according to the pre–set system dimensions of the plant, and for packing with mortar casting compound.

The set concrete foundation must be horizontal, flat and clean. Smears on the foundation must be removed.

The cut–out anchoring holes for the foundation bolts must be cleaned and blown out with air. Prior to installation of the pump aggregate the surface of the concrete foundation must be roughened and cleaned to ensure good adhesion between the foundation block and the mortar casting compound.

5.3.4 Alignment of the pump aggregate on the concrete foundation

Before the pump aggregate is mounted on the set concrete foundation, the foundation bolts must be inserted in the fixing holes on the base plate.

The pump aggregate can then be aligned to its pre–set height and system dimensions. This is done using steel shims, arranged directly underneath each foundation bolt.

The steel shims must sit flush. The total height of the steel shims is determined by the pre–set system dimensions of the plant.

If, in the base plate design version, the fixing holes are more than 750 mm apart, we recommend fitting additional steel shims in the middle of the base plate.

Possible deviations from a flat–machined surface on the pump can be detected using a machine spirit level.

Note: The permissible deviation is max. 1 mm per 1 m length.

The measurement with the machine spirit level is taken in longitudinal and transverse direction of the pump.

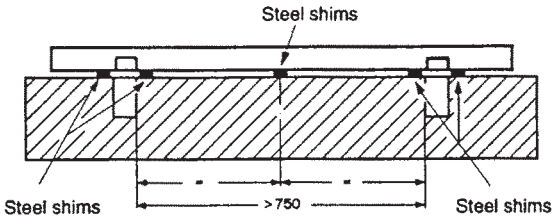


Fig. 3: Alignment with steel shims for horizontal mounting

5.3.5 Fixing the pump aggregate on the concrete foundation

When the aggregate has been aligned on the concrete foundation the base plate must be cast–on across its entire length and the anchoring holes with the inserted foundation bolts filled in with a non–shrinking mortar casting compound.

When the mortar casting compound on the base plate and in the anchoring holes has set, the foundation bolts should be tightened evenly, alternating side to side.

Note: When casting–on and packing with the mortar casting compound, it must be ensured that the base plate makes contact with the foundation over its entire area. Tap to check that there are no cavities.

5.4 Checking the coupling alignment

A complete pump aggregate delivered has been carefully assembled at the factory. After proper installation, and prior to start–up of the pump aggregate, the alignment of the coupling between the drive motor and the pump must be checked. The check is best made with a straight–edge and a feeler gauge in two planes, each offset by 90°, on the circumference of the coupling.

If a height, lateral or angle offset is detected between the two coupling halves, the drive motor should be re–aligned to the pump such that the coupling halves are flush with each other (level out with flat packing shims as necessary). The gap between the two coupling halves must be the same all round the circumference of the coupling. The specified gap is shown in the installation diagram. The spacing between the straight–edge laid over both coupling halves and the respective shaft must be the same all round the circumference.

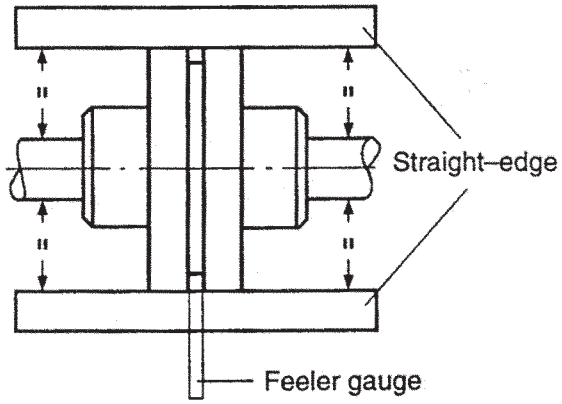


Fig. 4: Alignment of the coupling with straight–edge and feeler gauge

In place of the straight–edge and feeler gauge, the radial and axial alignment of the coupling can be checked with dial gauges. This gauging method is used for couplings with spacers (removable couplings).

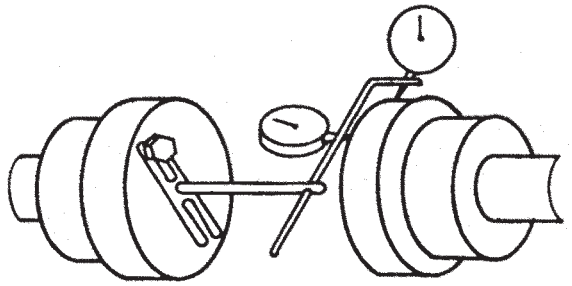


Fig. 5: Alignment of the coupling with dial gauges

Note: The permissible axial and radial deviation, measured on the front face of the coupling and the coupling circumference respectively, may be max. 0.1 mm, but as far as possible should be kept below 0.05 mm.

When the foundation bolts have been aligned and tightened the pump/drive motor unit must be able to be spun by hand without pressure points.

ATTENTION Out–of–flush errors on the coupling may lead to heavier wear of the coupling, the anti–friction bearing and the shaft seal.

5.5 Assembly of pump and drive motor

If the aggregate is only assembled at the place of use, the coupling is assembled as follows:

1. Coat the pump and motor shaft ends with a fine film of molybdenum disulfide (e.g. Molykote) and insert keys.

2. Push on the coupling halves on the pump and motor side with the aid of a pusher device until the shaft end is flush to the coupling hub.
   If no puller is available, heating the coupling halves to approx. 100°C (without rubber buffer) facilitates pushing.
   ATTENTION The possibility of axial shock stress on the pump and drive motor components during assembly of the coupling must be eliminated. When fitting the coupling halves, brace the pump shaft on the impeller side and the motor shaft on the fan side. Dismount the fan hood if necessary.

3. For axial securing, tighten a setscrew with inside hexagon socket on both coupling hubs using a double offset hexagon socket screwdriver (without extension tube) to DIN 911.

4. When assembling the pump and motor, make sure the specified gap between the coupling halves is maintained (see our dimension sheets).

5. In the case of horizontally mounted pump aggregates fixed on a base plate or directly on the foundation, the coupling must be aligned as described in Section 5.4.

6. Mount the contact protection.
   According to accident prevention regulations, the pump must only be operated with a protection against accidental contact.

5.6 Space required for maintenance and repair

ATTENTION The pump must be accessible from all sides in order to be able to carry out necessary visual inspections.

Adequate space must be provided for maintenance and repair work, in particular for removal of the drive motor and of the cartridge unit. It must also be ensured that all pipelines can be attached and removed without hindrance.

5.7 Laying the pipelines

5.7.1 Nominal widths

The nominal diameters of the pipelines need not necessarily correspond to those of the inlet and outlet branch, however, they must not be smaller. Different nominal diameters of suction branches and suction pipelines are to be compensated for by eccentric transition pieces. Formation of air bags is to be avoided.

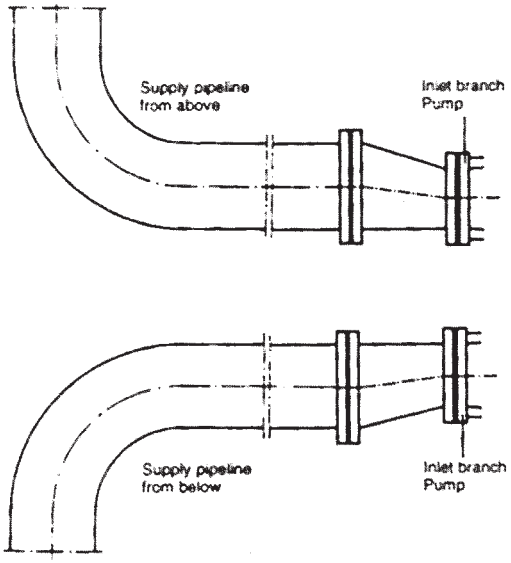


Fig. 6: Laying of pipelines

For short pipelines, the nominal width should be enough to keep the flow resistance as low as possible. For long pipelines the economical nominal width should be determined from case to case.

5.7.2 Change of cross–sections and directions
Sudden changes of cross–sections and directions, as well as hairpin bends, are to be avoided.

5.7.3 Supports and flange connections
The pipelines must be connected to the pump with the power disconnected. They must be supported close to the pump and must allow easy screwing–on to avoid twisting. When the connections are loosened the pipeline must neither be slanted nor springing, nor must it be under pressure.
Any thermal stresses occurring on the pipelines must be kept away from the pump by suitable means, e.g. installing compensators.

5.7.4 Cleaning pipelines prior to attachment
Prior to assembly, all pipeline parts and valves must be thoroughly cleaned; especially in the case of welded pipelines, burrs and welding beads must be removed. Flange packings must not protrude inwards.

5.7.5 Supply pipeline
In order to avoid the formation of air bags, the supply pipeline must be laid with a slight inclination to the pump.

5.7.5.1 Stop valve (supply operation)
Close to the pump, a stop valve must be installed in the supply pipeline which, during operation, must be completely opened and must not be used for regulating purposes.

5.7.6 Pressure pipeline

5.7.6.1 Stop valve in the pressure pipeline
A stop valve should be installed in the pressure pipeline close to the pump, to regulate the delivery.

5.7.6.2 Check valve in the pressure pipeline
It is recommended to install a check valve between the pressure connection and the stop valve in order to prevent damaging fluid splashes onto the pump when the plant comes to a sudden standstill.

5.7.6.3 Bleeding
A bleed facility should be provided at the highest point of the pressure pipeline.

5.7.7 Auxiliary connections
The positions of the auxiliary connections on the pump are shown in the sectional drawing and the installation diagram.

The following connections are always provided:

FF/V	Filling/Venting
FD1, FD2	Fluid drain
LO	Leakage outlet

5.8 Safety and control devices

5.8.1 Manometers
Suitable pressure gauges are to be installed in the suction and pressure pipelines.

5.8.2 Thermometers
Thermometers must be provided to monitor the temperature of the delivery fluid.

5.8.3 Safety devices in the inlet, delivery and auxiliary pipelines
Safety devices in the form of stop valves must be installed in the pipelines, if not already provided, to allow the pipelines to be shut off and disconnected during maintenance and repair work.

5.9 Electrical connections

The power supply cables of the coupled drive motor must be connected by a trained electrician, according to the motor manufacturer's circuit diagram. The applicable VDE regulations and local power company rules must be observed.
Danger from electrical energy must be eliminated.

6 Start–up/Shutdown

When starting up and shutting down the pump, accident prevention regulations must be observed in addition to general safety regulations.

6.1 Preparations for (initial) start–up

6.1.1 Filling and bleeding the pump in the plant

Prior to starting up, the pump must be bled in the plant. For this, the plant and the pump must be filled with delivery fluid (see plant manufacturer's operating instructions).
During filling with delivery fluid, we recommend slowly rotating the pump shaft by hand to allow air pockets to escape into the piping system.
If the pump fails to build up pressure when started up (see manometer), bleeding must be repeated.

ATTENTION **The pump must not run dry, not even for checking the direction of rotation.**

6.1.2 Filling and bleeding the sealing chamber

Due to the sealing effect of the throttling line, the sealing chamber must be separately filled with liquid to be pumped.
For bleeding and filling, remove the screw plug of connection FF/V and fill in clean water of the same quality as the liquid pumped. If no further air escapes the connection FF/V must be closed again.

During bleeding of the pump and the plant, hazardous or environmentally harmful fluid and gas emerging must be safely collected and discharged.

6.1.3 Control of drive motor direction of rotation

The direction of rotation of the motor must match the direction of rotation arrow on the pump. The motor can be briefly switched on to check the direction of rotation. A wrong direction of rotation impairs delivery and may damage the pump.
If it is wrong, the direction of rotation of the three–phase motor can be reversed by swapping any two phases.

6.2 Start–up

6.2.1 Starting

To avoid overloading the drive motor, the pump should be run up only against a closed pressure stop valve during starting.
The stop valve in the inlet pipeline must be fully open.

6.2.2 Checking the coupling alignment

Prior to starting and after the first run–up of the pump to operating temperature, the coupling alignment is to be checked. Readjust, if necessary (please refer to Section 5.4 above). The pump shaft must be capable of being cranked by hand and without any pressure points.

6.2.3 Drive

Switch on the motor.
Pay attention to product–specific characteristics. Refer to the operating instructions of the drive motor manufacturer.

6.2.4 Setting the delivery values of the pump and heating–up of the plant

First, heat the plant to 100 – 130°C with the pump running. For these purposes, the stop valve on the supply side must be completely opened. The stop valve provided on the outlet side must be opened to such a degree that first, a minimum delivery flow (please refer to Section 6.2.5 below) is achieved and maintained to heat the plant with the pump.
After the operating temperature has been reached, open the outlet–side stop valve until the required delivery values are reached. The delivery flow may be increased to such an extent as is safely possible for the motor which must not be overloaded.

ATTENTION The plant manufacturers' instructions concerning heating–up of the plant have priority over the above general recommendations.

6.2.5 Maintaining the minimum delivery rate

To prevent cavitation damage as a result of additional heating of the fluid, the pump should not be run against the closed stop valve in the pressure pipeline except in the starting phase.

ATTENTION The following equation is applied to determine the minimum delivery rate:
Output [KW] at rate Q = zero (see characteristic) for the design impeller diameter [mm] x faktor 0.5 = minimum delivery rate [m^3/h].

6.2.6 Temperature

Sudden temperature shocks are to be avoided.

6.2.7 Higher density of the delivery fluid

If the density of the delivery fluid is higher than foreseen by the design of the pump, the motor may be overloaded.

6.2.8 Higher delivery rate

If delivery is run at a higher rate than foreseen by the design of the pump, it is essential to ensure that the existing suction head is still adequate, because otherwise cavitation and resulting damage may occur.
Condition: $NPSH_{avail.} > NPSH_{req.}$
The delivery rate should, as far as possible, not exceed the value at η_{opt}.

6.2.9 Spare pump

A spare pump belonging to the plant must always be kept ready for operation. For these purposes, the stop valve on the supply side must be completely open. The stop valve on the outlet side must be opened to such a degree that the pump, filled and bleeded, has operating temperature.
Note: The pump must be secured against backflow, by means of a delivery–side check valve for example.

ATTENTION In plants in which impermissible temperature of the heat–transfer medium may arise due to failure of the operating pump, a standby pump of sufficient output must be provided.
Two independent energy sources must be provided for the operating and standby pumps.

6.3 Shutdown and Restart

6.3.1 Stopping operation

- **Pump run–on**
  Prior to the motor being switching off, the pump must have sufficient run–on when the heating source is switched off. The delivery fluid temperature must be reduced to the extent that heat build–up inside the pump is avoided.

- **Pressure pipeline**
  f a check valve is installed in the pressure pipeline, the stop valve can remain open. If no check valve is fitted, the stop valve must be closed.

- **Drive**
  Switch off the motor. Make sure the pump runs down smoothly and evenly.

- **Inlet line**
  Close stop valve in inlet line.

- **Stop valves**
  Delivery–side stop valves must not be closed before the pump comes to a standstill. If check valves are fitted, the stop valves can stay open. For extended periods at standstill, and in the event of overpressure on the suction side (inlet), the suction–side stop valve must be closed.

6.3.2 Restart

Before restarting, check that the pump shaft is at a standstill. If the stop valve in the delivery pipeline is leaky, the pump shaft may rotate in reverse direction due to the backflow of the delivery fluid.

ATTENTION The pump must not be switched on when the pump shaft is rotating in reverse direction, as this may damage the pump shaft.

6.3.3 Measures in case of prolonged interruption

If a prolonged interruption is intended, and there is a risk of frost, the pump must be drained and preserved (see Section 3.3).

7 Maintenance/Repair

7.1 Maintenance

- The instructions in Section *2, Safety*, must be observed in maintenance and repair work.
- Regular monitoring and maintenance of the pump and drive motor increases their service life.

The following instructions are generally applicable.

7.1.1 General monitoring

1. The pump must not run dry.
2. The minimum delivery rate must always be maintained (see Section 6.2..).
3. The drive motor must not be overloaded.
4. The mechanical seal must not have any uncontrolled leakage.
5. The sealing chamber must always be filled with liquid to be pumped. If the plant and/or pump was drained, the sealing chamber must be topped up with liquid to be pumped and bleeded again (please refer to Section 6.1.2 above).
6. Pressure and temperature monitors and flow meters must be observed.

7.1.2 Maintenance of components

7.1.2.1 Bearing and lubrication

The pump side medium–lubricated sliding bearing is maintenance–free.

The drive–side groove ball bearing is lubricated by special grease. The nominal service life of the groove ball bearing achieves at least the required operating hours required in the Technical Requirements DIN ISO 5199.
At the factory, the groove ball bearing was provided with a sufficient grease filling. For the relubrication periods for the grease–lubricated rolling bearing, please refer to the following listing.

Speed [min^{-1}]	Lubrication period in operating hours
1450	13.500
1750	12.200
2900	8.600
3500	7.700

Notes:

1. At a maximum ambient temperature of 35°C and a maximum operating temperature of the hot water of 207°C, the temperature at the coupling–side rolling bearing is 70°C. Higher ambient temperatures and missing ventilation may cause higher temperatures.
2. In case of temperatures **over** 70°C, the lubrication period for 15°C each temperature rise **must** be reduced to one half!
3. Unfavourable operating and ambient conditions such as dust, high air humidity, aggressive atmosphere etc. may require even shorter lubrication periods.

At least after 2 years, the groove ball bearing must be dismounted and cleaned with Diesel fuel. After cleaning, check whether the bearing surface is bright and undamaged. If this is not the case, the groove ball bearing must be replaced (please refer to Section 7.2 below – Dismounting and Mounting Instructions).
If the groove ball bearing is still ok, it may be mounted again.

The grease filling for the coupling–side rolling bearing is to be effected as described hereinafter.

1. Fill hollow spaces between the rolling bodies up to approx. 40% with grease. Depending upon the bearing size, this corresponds to the following grease quantities.

Bearing bracket size	Grease quantity
360	6 grams
470	12 grams

2. Scrape off excessive grease (most suitably with your fingers, do not use any metallic object).

Rolling bearing greases:
For the lubrication of the drive–side groove ball bearing, the below–listed rolling bearing grease or an equivalent special grease with molybdenum disulfite portion and the following characteristics must be used.

Quality:
The rolling bearing grease must be free from resin and acid and anti–corrosive.

Characteristics:

Worked penetration	265–295 mm/10
Dropping point	260 °C
Range of temperature application:	–10 bis 150 °C

Manufacturer	Brand
Total ①	BEL–RAY MOLYLUBE 126 E.P. GREASE 2

① Sole distributor in the Federal Republic of Germany: Deutsche Total GmbH

7.1.2.2 Shaft seal

Single–acting, maintenance free mechanical seal of the balanced type. A cooling and throttling line for lowering the temperature of the liquid pumped is arranged between impeller and mechanical seal.

Even in case of failure of the mechanical seal, the additional safety elements prevent seepage from emerging in a hazardous quantity and manner.
Heat transfer seepages which may perhaps emerge from a damaged shaft seal can be drained through seepage drain LO. Minimal dripping of non–volatile media resulting from the functioning of the components is to be expected.

At the site, it must be assured by the operator that the seepages drained through seepage drain LO are safely and completely collected in a closed tank.

Due to the special design of the cartridge–unit pump, the temperature is reduced to such an extent that proper functioning of the bearing and shaft seal is assured. In the event of heavy leakage due to wear, the mechanical seal should be replaced.

ATTENTION As dry running of the mechanical seal must be avoided, the pump may be started in a filled and vented condition only.

For dismounting and mounting of the shaft seal, see Dismounting and Mounting Instructions, Section 7.2.

7.1.2.3 Coupling

Following initial start–up, after first heating of the pump to operating temperature and at regular intervals, the alignment of the coupling and the condition of the flexible elements in the coupling is to be checked (please refer to Section 5.4 above).
Note: Worn flexible elements are to be replaced.

7.1.2.4 Drive

Refer to the operating instructions of the motor manufacturer.

7.2 Repair (Dismounting and Mounting Instructions)

General

Trained Service fitters are available on request to carry out mounting and repair work.

Where repairs are carried out by the operator's own personnel or by specialist fitters, it must be ensured that the pump is fully drained and cleaned.
This particularly applies to pumps which are sent for repair to our factory or one of our service workshops.
We must refuse acceptance of repair work on pumps filled with fluid, for the protection of our staff and for environmental reasons. Otherwise we must invoice the customer/operator for the costs of environmentally compatible disposal.
Where repairs are to be carried out on pumps which have been operated with hazardous substances ① and/or environmentally harmful media, the customer/operator must inform its own personnel on site, or our personnel where repairs are returned to our factory or a service workshop, without being specifically requested to do so.
In such cases a verification of delivery material, for example in the form of a DIN safety data sheet, must be submitted to us together with the request for a Service fitter.

Alternatively, you can request a certificate of safety (form no. 448/191) from our Service department, filling it out truthfully, correctly and in full. Send the completed form to the center commissioned with carrying out the repair, or hand it to our Service fitter.

① **Hazardous substances are:**

- Toxic substances
- Health–endangering substances
- Corrosive substances
- Irritants
- Explosive substances
- Fire–inducing substances
- Highly flammable, easily flammable and normally flammable substances
- Carcinogenic substances
- Substances impairing fertility
- Genetically distorting substances
- Substances in other ways hazardous to humans

For all work on site, the operator's own personnel and/or our fitters must be advised of the possible dangers involved in the repair work.

The most important dismounting and mounting operations are described in these instructions. The mounting steps described in the individual sections must be consistently observed.

7.2.1 Dismounting the centrifugal pump

Before dismounting, the following work must be carried out:

- The power supply cable must be disconnected from the motor by an authorized electrician. Electrical danger must be eliminated! The motor must be secured against being switched on.
- Close all stop devices in the supply and pressure pipeline.
- Allow the pump housing to cool to ambient temperature.
- Drain the fluid in flowable condition from the pump. For these purposes, screw out plugs for draining.
  Note: Use a collecting tank.
- The pump must be depressurized and drained.

- Hazardous substances and/or environmentally harmful media must be drained off and collected such that no danger to life and limb is created. Environmentally compatible disposal must be ensured.
- Remove auxiliary pipelines, if fitted.
- Dismount manometer lines, manometers and holding devices.
- Dismount protection against accidental contact and supporting foot.

7.2.1.1 Dismounting the cartridge–unit pump

The cartridge–unit pump consists of all pump components except for the volute casing. For the dismounting of the cartridge–unit pump, the motor must first be dismounted when using a shaft coupling without spacer. During subsequent assembly see to it that the motor is exactly aligned.
When using a coupling with spacer, the cartridge–unit pump can be dismounted towards the motor side, whereas the volute casing and motor may remain on the base plate and the pipelines at the volute casing.

- If a shaft coupling with spacer is available, dismount spacer. In case of shaft coupling without spacer, dismount motor from the foundation.
- Loosen hexagon screws (901.01) and turn out.
- Pull cartridge–unit pump consisting of impeller, shaft, casing cover etc. with the bearing bracket (330.01) out of the centering of the volute casing.
- Remove gasket (400.01) and clean sealing surfaces.

7.2.1.2 Dismounting the impeller with single–stage centrifugal pump

ATTENTION Dismount impeller horizontally to ensure the sliding bearing does not fall out and become damaged.

- Remove impeller nut (922.01) with spring ring (936.01) from the shaft (210.01).
- Withdraw impeller (230.01) from the shaft (210.01).
- Remove key (940.01) from the shaft (210.01).

7.2.1.3 Dismounting the impellers with two–stage centrifugal pump

ATTENTION Dismount impellers horizontally to ensure the sliding bearing does not fall out and become damaged.

- Loosen hexagon sockets with cup points (904.05) in the threaded ring (514.01), and screw out.
- By means of a pin–type face spanner, turn threaded ring (514.01) from the impeller first stage (230.02).
- Remove impeller second stage (230.03) from the impeller first stage (230.02).
- Pull stage casing (108.01) with installed diffuser (171.01) out of the centering of the casing cover (161.02) and over the impeller first stage (230.02).
- Remove impeller nut (922.01) with spring ring (936.01) from the shaft (210.01).
- Withdraw impeller first stage (230.02) from the shaft (210.01).
- Remove key (940.01) from the shaft (210.01).

7.2.1.4 Dismounting the sliding bearing, shaft seal and groove ball bearing

- Loosen hexagon socket with cup point at the pump–side coupling half, and withdraw coupling half from the shaft end. Use pull–off device!
- Remove key (940.02) from the shaft (210.01).
- Unscrew screw plug (903.11) to drain sealing chamber and drain off residual medium into a receiver.
- Loosen and unscrew socket–head cap screws (914.03).
- Withdraw bearing bracket with groove ball bearing, shaft and mechanical seal concentrically out of casing cover (161...) towards drive side.
  Note: This causes the casing cover to push the sliding bearing off the shaft.
  Note: Special care should be taken to ensure that the shaft is removed concentrically and not canted, to avoid damaging the sliding bearing.
- Remove O–ring (412.04) from bearing bracket (330.01) and clean sealing faces.
- Withdraw sliding bearing (310.01) from bush.
- Loosen and unscrew socket–head cap screws (914.08).
- Remove bearing cover (360.02) over shaft (210.01).
- Remove circlip (932.04) and distance washer (551.05) from shaft (210.01).
- Press shaft (210.01) out of groove ball bearing (321.02) towards pump side.
  Note: Special care should be taken to ensure that the shaft is removed concentrically and not canted, to avoid damaging the mechanical seal.
- Remove distance washer (551.04) over shaft (210.01).
- Remove rotating part of mechanical seal concentrically over shaft (210.01).
- Remove mechanical seal counter–ring (433.01) with O–ring from bearing bracket (330.01) towards pump side.
  Note: Special care should be taken to ensure that the mechanical seal counter–ring is removed concentrically and not canted, to avoid damaging the counter–ring.
- Remove groove ball bearing (321.02) from bearing bracket (330.01).
- Clean shaft (210.01), primarily in area of shaft sealing, bearing seats and coupling seats.
- Clean bearing bracket (330.01) in area of mechanical seal counter–ring and bearing seats.

- Turn impeller nut (922.01) onto the shaft (210.01), and tighten. Pay attention to the tightening torque.
  Note: For tightening the hexagon nut, hold the shaft with an appropriate tool over the coupling half.

- Mount stage casing (108.01) with installed diffuser (171.01) over the impeller first stage (230.02) in the centering of the casing cover (161.02).
  Note: See to it that one of the back vanes at the diffuser is between the stopping cams cast in the stage casing.

- Push impeller second stage (230.03) onto impeller first stage (230.02).
  Note: The engaging dogs of the impeller second stage must catch the engaging dogs of the impeller first stage.

- By means of the pin–type face spanner, turn threaded ring (514.01) onto the impeller first stage (230.02).
  Note: Prior to turning onto the impeller, coat thread of the threaded ring with molybdenum disulfite (e.g. Molykote).

- Screw hexagon sockets with cup points (904.05) as torsion protection into the threaded ring (541.01).

7.2.2.4 Mounting the cartridge–unit pump

- Fit key (940.02) into shaft (210.01).

- Heat coupling half (without rubber buffer) to approx. 100°C.

- Coat shaft end with a fine film of molybdenum disulfide (e.g. Molykote).

- Push heated coupling half onto shaft end and tighten setscrew.

- Insert new gasket (400.01) in the volute casing (102.01).
  Note: To facilitate mounting, we recommend to coat the gasket with an appropriate adhesive.

- Push cartridge–unit pump consisting of impeller, shaft, casing cover etc. with the bearing bracket (330.01) into the centering of the volute casing (102.01). In doing so, the gasket (400.01) must not be displaced.

- By means of the hexagon screws (901.01), fix the complete cartridge–unit pump to the volute casing (102.01).

Following the mounting the centrifugal pump, the following operations are to be performed.

- Align coupling (please refer to Section 5.4 above).

- Attach manometer pipelines, manometer and holding devices to the pump.

- Attach protection against accidental contact and supporting foot.

- Fill pump with liquid to be pumped.

- The power supply cable must be connected to the motor by an authorized electrician. Electrical danger must be eliminated! Pay attention to direction of rotation.

Start up pump as per instructions in Section 6.

7.3 Replacement parts

We recommend stocking parts for two years' continuous operating conditions as per the application guidelines in the VDMA data sheet 24 296 (see Section 7.3.2).

However, for operational safety reasons, we recommend you always stock a complete installation or standby pump.
The advantage is that in the event of a fault or damage the standby unit can replace the non–functioning unit quickly and without great effort.

7.3.1 Ordering spare/replacement parts

When ordering spare and replacement parts, besides the **part number, denomination** and **quantity**, the following should also be quoted:

Pump abbreviation,
Pump number,
Year of construction.

This information is engraved on the rating plate of the pump.

7.3.2 Replacement parts for two–year continuous operation as per VDMA 24 296

Part No.	Part denomination	Number of pumps (including standby pumps)						
		2	3	4	5	6 und 7	8 und 9	10 und mehr
		Set/Replacement parts quantity						
171.01	Diffuser (Pump sizes : 2/25–200, 2/32–200, 2/40–250, 2/50–250)	1	1	2	2	2	3	30%
210... ①	Shaft with distance washer 551.04 distance washer 551.05 impeller nut 922.01 circlip 932.04 spring ring 936.01 key 940.01 key 940.02	1	1	2	2	2	3	30%
230.01	Impeller (all single–stage pump sizes)	1	1	1	2	2	3	30%
230.02 230.03	Impeller first stage and Impeller second stage with threaded ring 514.01 (Pump sizes: 2/25–200, 2/32–200, 2/40–250, 2/50–250)	1	1	1	2	2	3	30%
321.02	Groove ball bearing	1	1	2	2	3	4	50%
– ①	Cartridge–unit pump, consisting of: Bearing bracket, casing cover, shaft, groove ball bearing etc.	–	–	–	–	–	1	2
400.01 412.04	Gasket O–ring	4 4	6 6	8 8	8 8	9 9	12 12	150% 150%
433.01	Mechanical seal, complete	2	3	4	5	6	7	90%

① Can be purchased as assembly group/sale group.

8 Operating Faults, Causes and Remedial Action

8.1 Faults with reference number for cause and remedial action

The table below is intended as a guide to identifying faults and their possible causes.

If faults occur which are not listed here, or which cannot be traced back to the listed causes, we recommend consulting the factory, or one of our branch offices or sales offices.

The pump must be depressurized and drained when faults are being rectified.

Centrifugal pump faults	Reference numbers for cause and remedial action
Delivery rate too low	1, 2, 3, 4, 5, 6, 7, 8, 9, 21, 22
Delivery head too low	2, 3, 4, 5, 6, 7, 8, 9, 21, 22
Power consumption of pump too high	9, 11, 12, 16, 17, 21, 22, 25
Delivery pressure too high	9, 12
Bearing temperature increased	16, 17, 18, 20, 25
Pump housing leaky	23
Heavy leakage of shaft seal	13, 16, 17
Pump not operating smoothly	2, 3, 4, 5, 6, 8, 11, 16, 17, 24, 25, 26
Pump gets hot	2, 5, 26

8.2 Causes and remedial action

Ref. no.:	Cause	Remedial action
1	Counterpressure higher than design pressure of pump.	1. Open stop valve in pressure pipeline until operating point is reached. 2. Install impeller with larger diameter. 3. Increase rotation speed (turbine, combustion engine) ①
2	Pump or pipelines not properly bled or filled.	Bleed and top up pump or pipelines.
3	Inlet pipeline or impeller blocked.	Clean pipelines and impeller.
4	Air pockets forming in pipeline.	Perhaps install a vent valve, or lay pipeline differently.
5	$NPSH_{plant}$ (inlet) too low.	1. Check fluid level in inlet tank. 2. Open stop valve in inlet pipeline fully. 3. Lay inlet pipeline differently if friction losses are too high. 4. Check filter in inlet pipeline, if fitted.
6	Wrong direction of rotation of pump.	Reverse polarity of any two phases on motor.
7	Rotation speed too low.	Increase rotation speed (turbine, combustion engine). ①
8	Excessive wear on inner pump parts.	Replace worn parts.
9	Density or viscosity of delivery medium does not comply with pump design data.	Consult the factory in the event of faults due to non-compliance with design data. ①
10	–	–
11	Delivery head lower than nominal delivery head of pump.	1. Regulate operating point with stop valve in pressure pipeline. 2. Turn off impeller in event of continuous overload.
12	Rotation speed too high.	Reduce rotation speed (turbine, combustion engine). ①
13	Shaft seal damaged.	Check shaft seal parts for wear and replace if necessary.
14	–	–
15	Packing material unsuitable for the delivery medium. Gland is askew, or too loosely tightened.	1. Wrong packing material used. Repack pump with suitable material. 2. Tighten gland evenly.
16	Pump aggregate wrongly aligned.	Re-align pump as described.
17	Pump twisted.	Check pipelines for twists in connections.

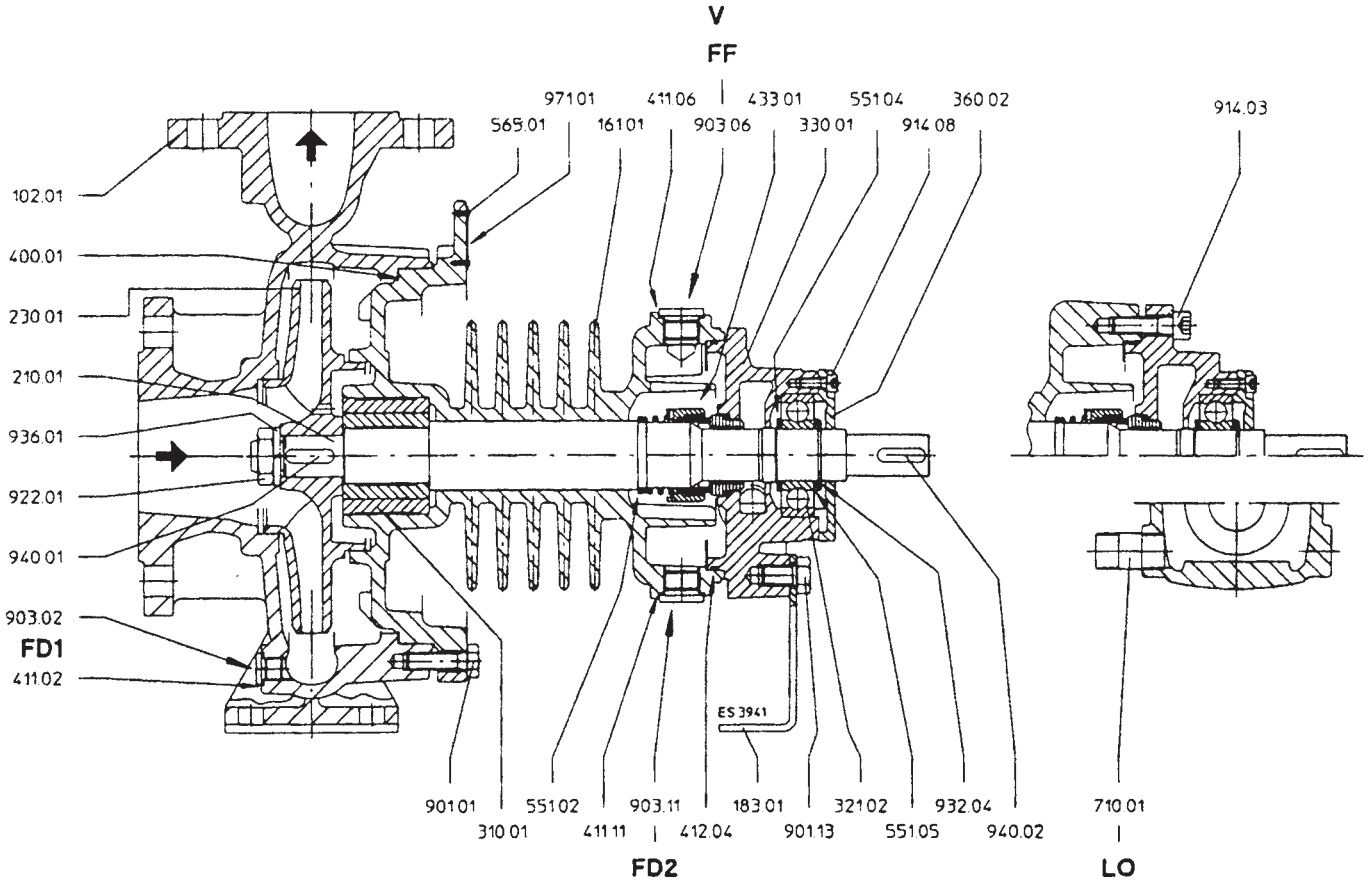
18	Excessive axial thrust.	Clean relief bore holes in impeller.
19	–	–
20	Specified coupling half gap not complied with.	Set coupling half gap as per installation diagram.
21	Motor voltage incorrect.	Use motor with correct voltage.
22	Motor runs only to two phases.	1. Check cable connection. 2. Replace fuses.
23	Screws not tight.	1. Tighten screws. 2. Replace gaskets.
24	Impeller out–of–true.	1. Clean impeller. 2. Re–balance impeller.
25	Groove ball bearing defective.	Replace groove ball bearing.
26	Delivery rate below minimum.	Increase delivery rate to minimum.

① Consult factory

9 Associated Documentation

9.1 Sectional drawing for single–stage sizes

Sizes at bearing–bracket sizes 360 and 470

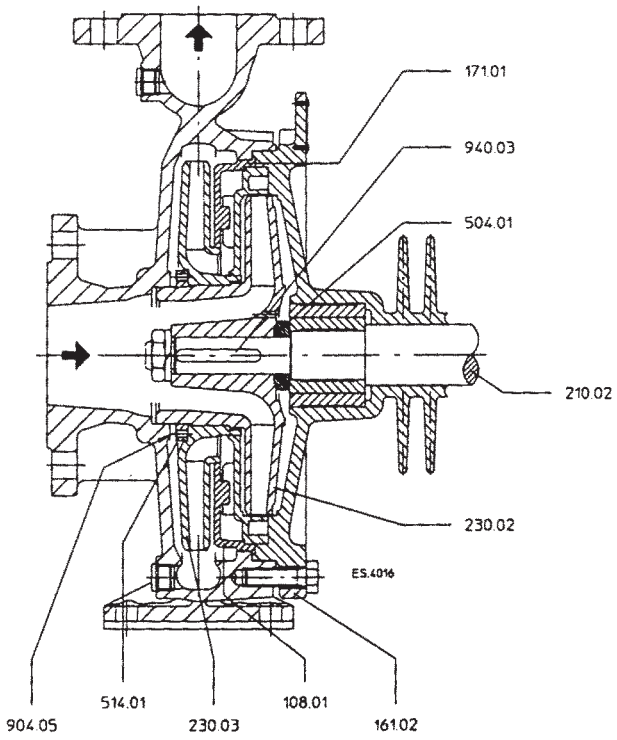


Shaft seal: Uncooled, balanced mechanical seal
with pre–mounted throttling and cooling line

Abbreviation: **U2.10A**

9.2 Sectional drawing for two–stage sizes

Sizes at bearing–bracket size 360



Shaft seal: Uncooled, balanced mechanical seal
with pre–mounted throttling and cooling line

Abbreviation: **U2.10A**

Description	Ident No.
Volute casing	102.01
Stage casing	108.01
Casing cover	161.01
Casing cover	161.02
Diffuser	171.01
Supporting foot	183.01
Shaft	210.01
Shaft	210.02
Impeller	230.01
Impeller first stage	230.02
Impeller second stage	230.03
Sliding bearing	310.01
Groove ball bearing	321.02
Bearing bracket	330.01
Bearing cover	360.02
Gasket	400.01
Joint ring	411.02
Joint ring	411.06
Joint ring	411.11
O–ring	412.04
Mechanical seal	433.01
Spacer ring	504.01

Description	Ident No.
Threaded ring	514.01
Distance washer	551.02
Distance washer	551.04
Distance washer	551.05
Rivet	565.01
Pipe	710.01
Hexagon screw	901.01
Hexagon screw	901.13
Screw plug	903.02
Screw plug	903.06
Screw plug	903.11
Hexagon socket with cup point	904.05
Socket–head cap screw	914.03
Socket–head cap screw	914.08
Impeller nut	922.01
Circlip	932.04
Spring ring	936.01
Key	940.01
Key	940.02
Key	940.03
Name plate	971.01

Connections	
FD1, FD2	Fluid drain
FF/V	Filling/Bleeding
LO	Leakage outlet

7.2.2 Mounting the centrifugal pump

ATTENTION Before remounting check all parts for wear and, as necessary, replace with **original replacement parts.**

Clean all parts before mounting. Always fit new gaskets.

7.2.2.1 Mounting the groove ball bearing, shaft seal and sliding bearing

The table below shows the allocation of the pump sizes to the bearing bracket size and the groove ball bearings to be installed.

Pump size	Bearing bracket size	Groove ball bearing Abbreviation
25–160 25–200 2/25–200 32–160 32–200 2/32–200 40–160 40–200 40–250 2/40–250 50–160 50–200 50–250 2/50–250 65–160 65–200 80–160 100–160	360	6306 J C3 DIN 625 Part No. 321.02 Lubrication by: Grease filling
65–250 65–315 80–200 80–250 80–315 100–200 100–250 100–315 125–200 125–250 150–200	470	6308 J C4 DIN 625 Part No. 321.02 Lubrication by: Grease filling

- If required, carefully clean groove ball bearing (321.02) with Diesel fuel. The bearing surfaces being bright and undamaged, the groove ball bearing may be re–used. If this is not the case, the bearing must be replaced.
- The groove ball bearing (321.02) to be installed in the bearing bracket (330.01) on the drive side must be provided with a special grease filling **(please refer to Section 7.1.2.1. above).**
- Insert distance washer (551.04) loosely in bearing bracket (330.01).
- Push grease–filled groove ball bearing (321.02) into cleaned bearing seat of bearing bracket (330.01).
- As an aid to mounting, attach bearing cover (360.02) to bearing bracket (330.01) with socket–head cap screws (914.08).
- Place bearing bracket (330.01) with built–in groove ball bearing vertically in a mounting device with bearing cover (360.02) facing downwards.
- Insert mechanical seal counter–ring with new O–ring in cleaned seat of bearing bracket (330.01).
- Mount rotating part of mechanical seal with new O–ring concentrically onto shaft (210.01).
  Note: Mechanical seals are high–grade precision parts. Careful handling and extreme cleanliness during installation are essential to ensure proper functioning.
- Press shaft (210.01) concentrically from pump side into cleaned bearing bracket (330.01) until distance washer (551.04) contacts with groove ball bearing and shaft collar.
  ATTENTION Knocks on the shaft must be avoided at all costs, as they will damage the mechanical seal.
- Loosen socket–head cap screws (914.08) and remove bearing cover (360.02) from bearing bracket (330.01).
- Place distance washer (551.05) over shaft (210.01) in front of groove ball bearing (321.02).
- Fit circlip (932.04) in shaft groove provided.
- Attach bearing cover (360.02) to bearing bracket (330.01) with socket–head cap screws (914.08).
- Insert new O–ring (412.04) in bearing bracket (330.01).
- Push bearing cover (161...) over shaft (210.01) and attach to bearing bracket (330.01) with socket–head cap screws (914.03).
- Push sliding bearing onto shaft (210.01) as far as shaft collar.
  Note: Sliding bearings are high–grade precision parts. Careful handling and extreme cleanliness during installation are essential to ensure proper functioning.
- Mount key (940.01) in the shaft (210.01).
- Push impeller (230.01) over the key (940.01) onto the shaft (210.01).
- Place spring ring (936.01) and/or spring washer (934.01) over the shaft (210.01) in front of the impeller (230.01).
- Turn impeller nut (922.01) onto the shaft (210.01), and tighten. Pay attention to the tightening torque.
  Note: For tightening the hexagon nut, hold the shaft with an appropriate tool over the coupling half.

7.2.2.3 Mounting the impellers in a two–stage centrifugal pump

- Mount key (940.01) in the shaft (210.01).
- Push impeller first stage (230.02) over the key (940.01) onto the shaft (210.01).
- Place spring ring (936.01) over the shaft (210.01) in front of the impeller first stage (230.02).

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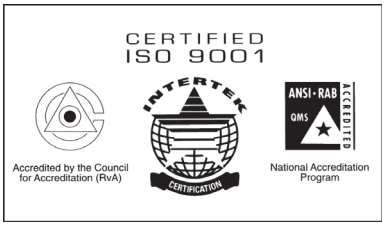
ALLWEILER

HOUTTUIN

IMO PUMP

WARREN



Quality Management System

VM 460.0015 GB 12.96 – Ident No. 550 238

Imo Pump
1710 Airport Road
PO Box 5020
Monroe, NC USA
28111.5020

tel 704.289.6511
fax 704-289-9273
email Imo.Pump@ColfaxCorp.com
web www.Imo-Pump.com