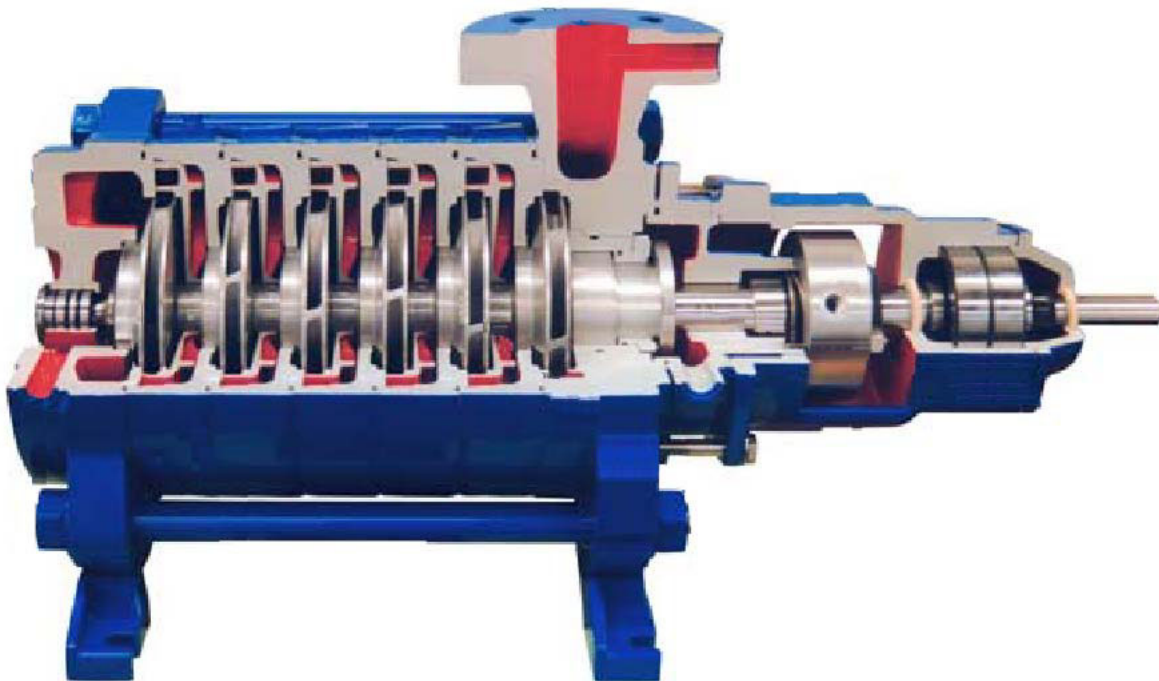




Installation Operation Maintenance Instruction Bulletin

Type MSLA & MSMR Horizontal Multistage Diffuser Pumps



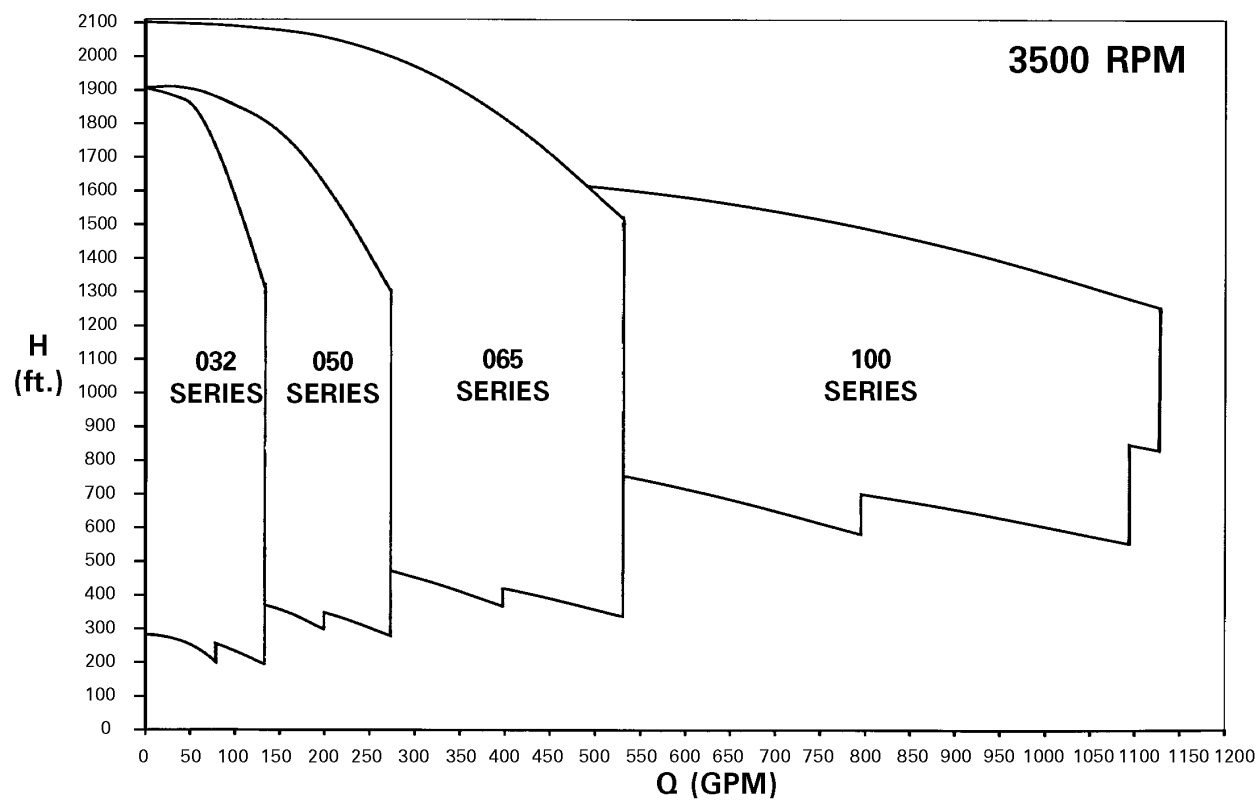
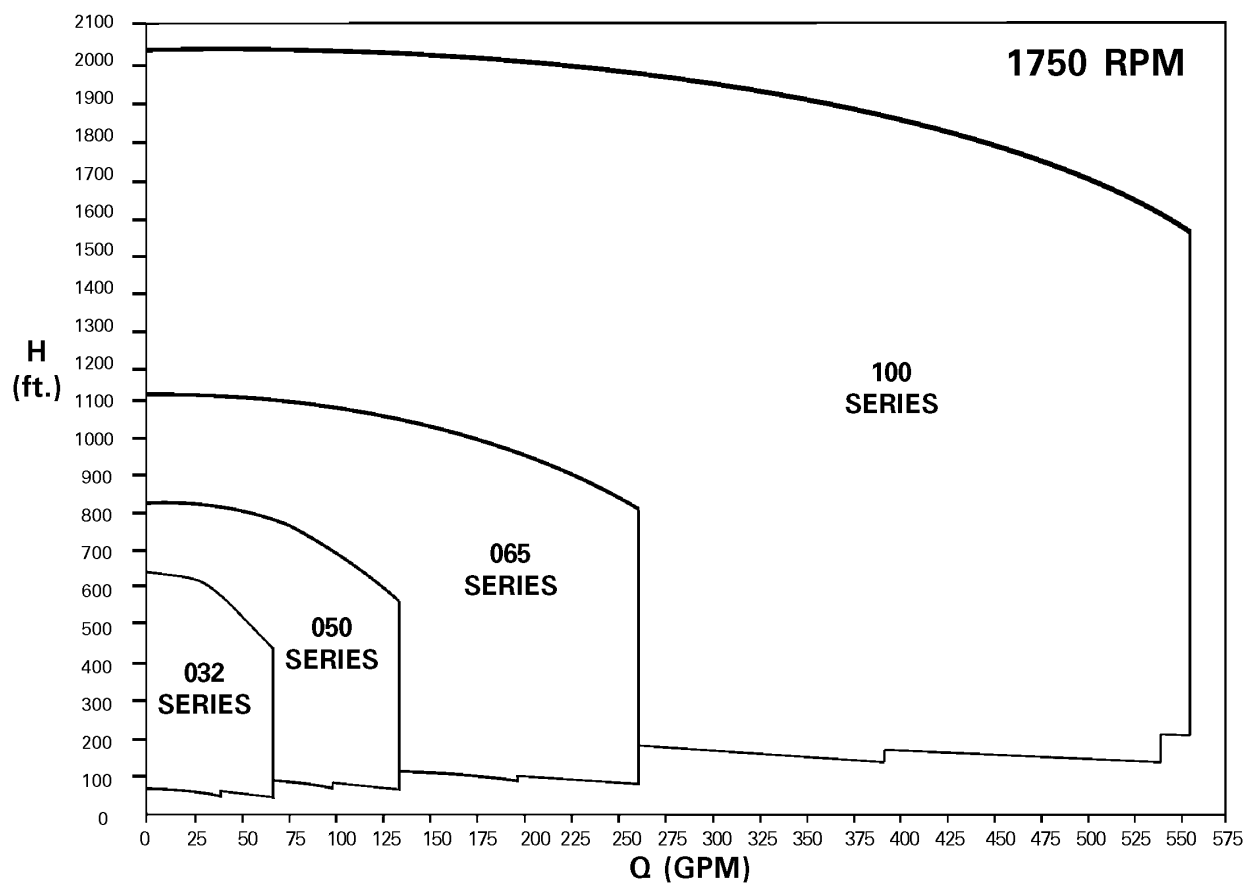
Peerless Pump Company, LLC
2005 Dr. Martin Luther King Jr. Street
Indianapolis, Indiana 46202

Zone Curves -----	Page 2
Safety instructions -----	Section 1
Application -----	Section 2
System layout -----	Section 3
Unpacking, handling, storage -----	Section 4
Pump installation -----	Section 5
Starting and stopping procedures -----	Section 6
Maintenance, disassembly, assembly -----	Section 7
Locating troubles -----	Section 8
Sectional drawings / Parts list -----	Section 9

Please note: Only trained and skilled operating personnel are allowed to install and operate this pump or pump set. Compliance with these operating instructions and all applicable rules and regulations must be ensured.

If you fail to comply with these operating instructions

- people may be put at risk
- the pump or pump assembly may be damaged
- the manufacturer shall not be held liable for damage that may be caused by such non-compliance.



1.1 Safety instructions

This manual gives basic instructions which must be observed during installation, operation and maintenance of the pump.

It is therefore imperative that this manual be read by the installer, operators and all responsible personnel prior to assembly and commissioning. It must always be kept available at the installation site.

Within this manual, safety instructions are marked with safety symbols.

This general hazard symbol below highlights information which non-compliance with, could cause a risk to personal safety.



Safety symbol

This symbol refers to electrical safety.



Safety symbol

CAUTION

This word gives warning of a hazard affecting the equipment.

Signs affixed to the equipment, e.g.

- nameplate
- arrow indicating the direction of rotation
- symbols indicating fluid connections
- coupling alignment/realignment

must be observed and kept legible.

1.2 Qualification and training of operating personnel

The personnel responsible for operation, maintenance, inspection and assembly must be adequately trained and qualified.

1.3 Hazards in the event of non-compliance with the safety instructions

Non-compliance with the safety instructions may cause a risk to the personnel as well as to the environment and equipment and may result in a loss of any right to claim damages.

For example, non-compliance may involve the following hazards:

- failure of important functions of the equipment;
- failure of specified maintenance and repair procedures;
- electrical, mechanical and chemical hazards affecting personal safety;
- release of environmentally damaging substances.

1.4 Safety at work

When operating the pump, the safety instructions contained in this manual, the relevant national accident prevention regulations and any other service and safety instructions issued by the plant operator must be observed.

1.5 Safety instructions relevant to operation

- If hot or cold machine components involve hazards, the customer must ensure these components are guarded against accidental contact.
- Contact guards for moving parts (e.g. coupling) must not be removed from the equipment while in operation.
- Any leakage of hazardous (e.g. explosive, toxic, hot) fluids (e.g. from the shaft seal) must be controlled to prevent any risk to personal safety or the environment. Statutory regulations must be complied with.
- Hazards resulting from electricity must be prevented, and local regulations must be complied with.

1.6 Safety instructions relating to maintenance, inspection and assembly work

It shall be the plant operator's responsibility to ensure that all maintenance, inspection and assembly work is performed by authorized and qualified personnel who have adequately familiarized themselves with the subject matter by studying this manual in detail.

Any work on the machine shall only be performed when it is at a standstill. The procedure for stopping the machine described in this manual must be followed.

Pumps which handle hazardous fluids must be decontaminated, before any work is performed.

On completion of work all safety and protective equipment must be re-installed and made operative again.

Prior to restarting the machine, the instructions listed under sub-section 6.4 "Checks before initial start-up" must be observed.

1.7 Unauthorized alterations and production of spare parts

Any modification to the machine is permissible only after consultation with Sterling SIHL.

Using genuine spare parts and accessories authorized by the manufacturer is in the interest of safety. Use of other parts will exempt the manufacturer from any liability, and/or void the warranty.

1.8 Unauthorized use

The reliability of the pump delivered will only be guaranteed if it is used in the manner intended, in accordance with Section 2.1 of this manual.

Operation below or above the limit values specified on the data sheet is not permitted.

1.5 Safety instructions relevant to operation

- If hot or cold machine components involve hazards, the customer must ensure these components are guarded against accidental contact.
- Contact guards for moving parts (e.g. coupling) must not be removed from the equipment while in operation.
- Any leakage of hazardous (e.g. explosive, toxic, hot) fluids (e.g. from the shaft seal) must be controlled to prevent any risk to personal safety or the environment. Statutory regulations must be complied with.
- Hazards resulting from electricity must be prevented, and local regulations must be complied with.

1.6 Safety instructions relating to maintenance, inspection and assembly work

It shall be the plant operator's responsibility to ensure that all maintenance, inspection and assembly work is performed by authorized and qualified personnel who have adequately familiarized themselves with the subject matter by studying this manual in detail.

Any work on the machine shall only be performed when it is at a standstill. The procedure for stopping the machine described in this manual must be followed.

Pumps which handle hazardous fluids must be decontaminated, before any work is performed.

On completion of work all safety and protective equipment must be re-installed and made operative again.

Prior to restarting the machine, the instructions listed under sub-section 6.4 "Checks before initial start-up" must be observed.

1.7 Unauthorized alterations and production of spare parts

Any modification to the machine is permissible only after consultation with Sterling SIHL.

Using genuine spare parts and accessories authorized by the manufacturer is in the interest of safety. Use of other parts will exempt the manufacturer from any liability, and/or void the warranty.

1.8 Unauthorized use

The reliability of the pump delivered will only be guaranteed if it is used in the manner intended, in accordance with Section 2.1 of this manual.

Operation below or above the limit values specified on the data sheet is not permitted.

2.1 Limitation of use

Operation of the pump must be limited to the application and operating conditions stated by the purchaser and confirmed on the manufacturer's proposal. The pump is covered by warranty under Sterling SIHI's conditions of sale.

2.2 Wrong use



- Operate the pump only for the application stated on the proposal. Operation outside these limits of product application will increase the risk to personal safety and the environment.

CAUTION

- Do not exceed the density stated on the data sheet as this could cause a motor overload condition.
- Do not operate the pump outside its characteristic curve so as to avoid cavitation and motor damage.

2.3 Accessories

The accessories provided with the pump are indicated on the proposal (see Appendix). No other accessories should be mounted to the pump or the assembly set without Sterling SIHI's prior consent.

2.4 Design and working principle

The Multi are high pressure pumps of the SIHI^{multi} line. The multi-stage is a ring-section type centrifugal pumps with closed impellers.

They meet the technical requirements to DIN ISO 5199 / EN 25199.

The pump casings are held together by external tie bolts and sealed by O-rings.

The axial thrust is balanced by a hydraulic balancing device. The balancing liquid flows back through an external line from the shaft sealing casing to the suction casing.

The suction flange may be either: axial or radial (vertical, left or right). The discharge flange may be any of the radial positions (vertical, left or right). As viewed from the driven side.

The pump feet are bolted to the suction and discharge sections.

Bearings:

The suction side sleeve bearing is lubricated by the liquid handled, grease-lubricated anti-friction bearings are used on the discharge side.

Shaft seal:

A mechanical seal or a packed stuffing box are available.

The pump is driven from the discharge side. The direction of rotation is counter-clockwise, when viewed from driven end.

2.5 Pump model number identification

The pump model number on the nameplate identifies all essential construction features.

Sample model number :

MSMR 05008 9BA 001 0R P01

MSM	Pump series
R	Engineering version
050	Size of discharge nozzle
08	Number of stages
9	placeholder no significance
B	Hydraulics version
A	Bearing version
001	Shaft seal style
0R	Material of construction
P	Stage casing seal
01	Flange position and design

2.6 Nameplate

In the event of questions, please provide the following information as noted on the nameplate:

- Model number
- Serial number
- Also provide purchase order number

3.1 Piping System Layout

3.1.1 General

In short discharge lines, the nominal diameter should be such that the piping resistance is only a small proportion of the discharge head. For long pipelines, the most cost-effective solution should be determined on a case-by-case basis.

Flow velocity guidelines:

Suction line: $v_s \gg 4.9$ to 8.2 ft/s
max. 9.8 ft/s

Discharge line: $v_d \gg 13.1$ to 19.7 ft/s

Abrupt cross-sectional changes or sharp bends should be avoided to minimize flow disturbances and turbulence when making piping layouts.

Flow disturbances and turbulence caused by the pipework layouts may impair the performance of the pump, especially on the suction side.



- The piping must be independently supported and positioned such that less than the max. permissible forces and moments are exerted on the pump flanges.
- Excessive loads could cause leakages and be hazardous to personnel.

CAUTION

If hot water is handled, excessive pipe loads and moments can cause a misalignment of the coupling between pump and driver, thus reducing operating safety of the unit.

With the flange bolts removed, the flanges must not be more than the amount corresponding to the gasket thickness apart, nor must they be out of parallel or bear against each other under pressure. Check that the flange gaskets do not extend into the interior of the pipe. All pipe components, valves and fittings and the pump flanges should be thoroughly cleaned before assembly.

Air-relief valves and drain valves should be installed

in the suction and discharge lines.

In order to prevent the formation of air pockets,

- a suction line should rise to the pump and
- a feed line should slope gradually downward towards the pump.

Shut-off valves should be installed in the suction and discharge lines and in all pipelines connecting the pump with the liquid system.

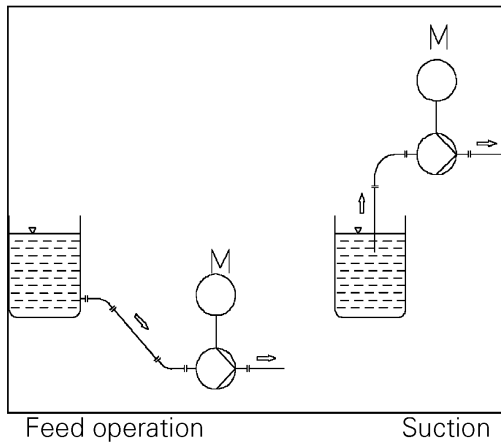
The valves enable the pump to be depressurized and dismantled without having to drain the system.

CAUTION

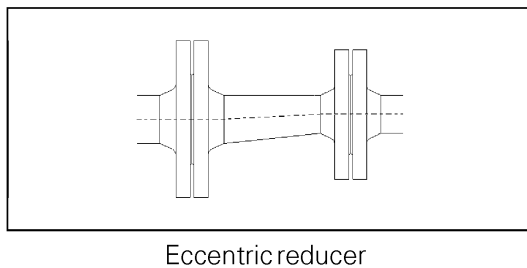
- The pipes should have at least the nominal diameter of the pump flanges. Where this is not possible, it should be ensured that the flow velocity in the suction or feed line does not exceed: 9.8 ft/s.
- Flange seals must not extend into the interior of the pipework.
- Clean the piping prior to pump installation.
- Support the pipelines so as to prevent distortion of pump components.
- Avoid abrupt cross-sectional transitions and sharp bends.
- Eccentric reducers must be used in the event of different nominal diameters.
- In the event of unfavorable suction conditions, steady flow should be ensured over a length of $15 \times$ suction flange diameter upstream of the suction flange.
- Shut-off valves in the suction or discharge line must be fully open during operation and must **never** be used to control the flow.

3.1.2 Suction or feed line

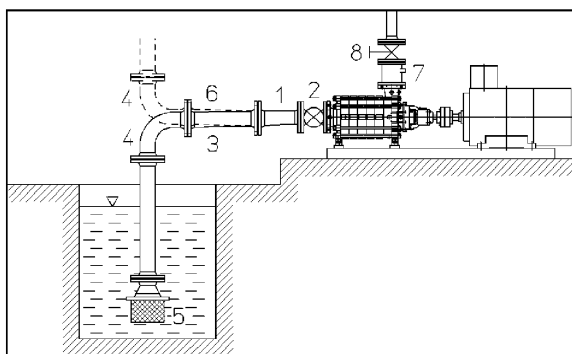
A suction line should rise to the pump and a feed line should slope gradually downward towards the pump.



Reducers mounted must be eccentric to eliminate the possibility of air pockets being formed.



During startup or if the liquid is contaminated, a filter should be fitted upstream of the pump whose filter area should be at least, three times the pipe cross-sectional area. A conical strainer with a perforated plate support body should be used. The external fine screen, mesh size of 0.5mm, should be made of corrosion-resistant material. The fine screen can be removed after several months of operation, once there are no more contaminants.



- 1 eccentric reducer (suction operation) or concentric reducer (feed operation)
- 2 shut-off valve
- 3 suction line

- 4 elbow
- 5 foot valve with strainer
- 6 feed line
- 7 non-return valve
- 8 shut-off valve

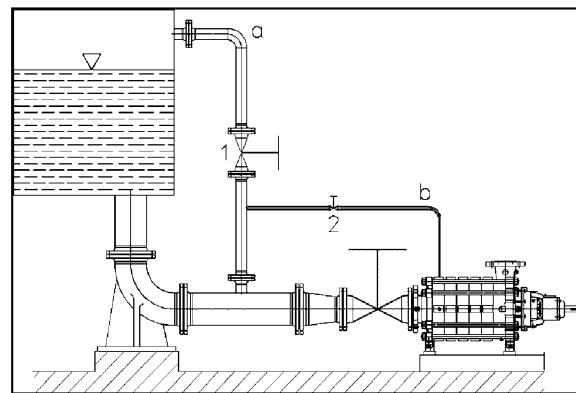
Pump installation

A shut-off valve should be installed in the feed line, it is to be closed for maintenance work. It should be installed such that air pockets cannot form in the spindle cap, i.e. with the spindle in a horizontal position or pointing vertically downward.

3.1.3 Vacuum equalizing pipe

If the pump draws from a system or tank under vacuum, an equalizing pipe must be installed connecting the vent connection at the suction casing or the highest point of the suction line to a point above the max. liquid level in the suction tank.

- The line should be fitted with a shut-off valve which should only be closed for maintenance work on the pump.
- To assist in starting the pump, we also recommend that a pipeline, which can be shut off, be installed between the first stage and the equalising line.



- a Equalising line
- b Additional line
- 1 Shut-off valve
- 2 Shut-off valve (vacuum-tight)

Vacuum operation

3.1.4 Discharge line

Install a shut-off valve as close to the pump flange as possible. It is recommended that a check valve be installed between the pump flange and shut-off valve, thus protecting the pump against reverse rotation and also the pump and the foot valve against water hammer that may occur in the event of sudden shut-down.

3.1.5 Minimum flow line

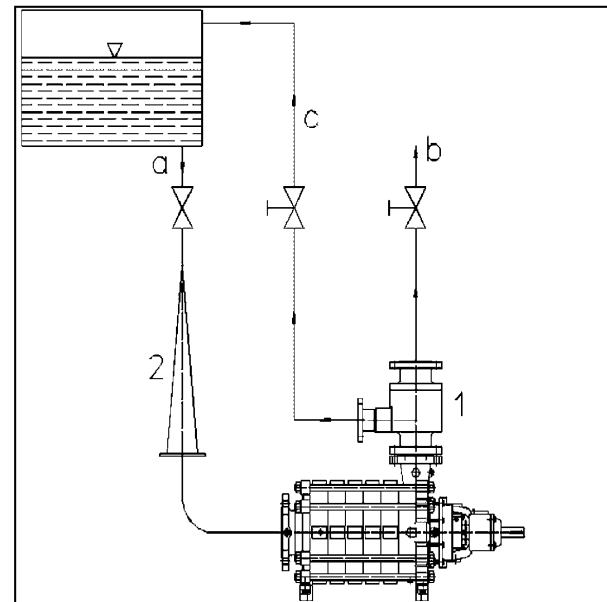
The minimum flow line (or bypass line) should be used if operation with the discharge side shut-off valve closed is possible. The minimum flow valve ensures that a sufficient flow rate is automatically returned to the suction side tank.

Size	t = 284°F or lower	t > 284°F
032	15 % of B.E.P.	20 % of B.E.P.
050	20 % of B.E.P.	25 % of B.E.P.
065	20 % of B.E.P.	25 % of B.E.P.
100	25 % of B.E.P.	25 % of B.E.P.

Should an exact calculation be required, please contact Sterling SIHI.

CAUTION

- Up to the shut-off or check valve, the line should be designed to suit the nominal pressure of the discharge line, afterwards in accordance with the design pressure of the feedwater tank.
- Velocity in the minimum flow line to be determined from discharge line flow rate.
- If an automatic device (bypass non-return valve) is used, ensure that even in the case of trouble, liquid can be returned through the minimum flow line.
- Frequent checks are recommended. Early replacement of the minimum flow valve (which is exposed to heavy wear) will prevent energy losses.
- The minimum flow valve should be installed near the pump discharge branch, upstream of the discharge shut-off valve.
- A check valve should be installed in the minimum flow nozzle or the minimum flow line.
- For repair or overhaul work on the pump or the bypass non-return valve, a shut-off valve must be installed in the minimum flow line (c).



- a Feed line
- b Discharge line
- c Bypass line
- 1 Bypass non-return valve
- 2 Conical strainer

Minimum flow control

3.1.6 Balancing line

The balancing line connects the shaft sealing casing with the suction casing. There is no throttling or shut-off device in this line, which serves to hydraulically balance the pump.

The balancing line can also be returned by the customer to the feed tank or the feed line.

3.1.7 Venting during pump priming

Before starting the pump, the pump and the suction line must be completely vented and filled with the liquid handled. To bleed the air, several holes with plugs have been provided. Similar holes may be used in the piping. The shut-off valve in the suction or feed line must be fully open.

3.1.8 Sealing liquid

Sealing liquid is required for the shaft seal in order to prevent the infiltration of air.

- The customer should install the sealing liquid line from the discharge line (downstream of the non-return valve) to the shaft seal casing.
- If two identical pump sets are installed, the sealing liquid can be taken from the common discharge line, above the non-return valve.
- The gauge pressure against atmosphere should amount to 14.5 to 7.25 psi..

3.1.9 Cooling

If cooling is required for a packed stuffing box or a mechanical seal, the pump is equipped with a shaft sealing casing which can be cooled. The connecting points for the cooling lines are on the shaft sealing casing. The customer should provide either an open circuit, i.e. a cooling water return line to the drain system, or a closed circuit including a return to the cooling circuit to be provided.

3.1.10 Drain line, leakage water line

The pump has connections for leakage water and drain lines.

3.1.11 Pressure monitoring

In order to monitor the pressures upstream and downstream of the pump, the installation of measuring points in the piping is recommended.

3.2 Electrical connections

The electrical connection for the drive motor must comply with the relevant local rules and requirements.

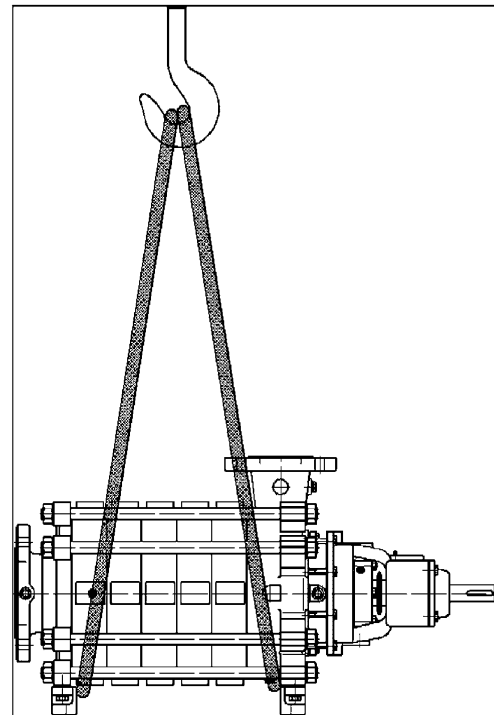
4.1 Safety measures



- Do not lift heavy equipment overhead of personnel.
- A safe distance must be kept when lifting and moving the equipment.
- Use only approved and suitable lifting equipment.
- The length of the lifting equipment should be such that the pump or the assembly are lifted in horizontal position.
- Do not attempt to lift the pump or the pump assembly using eyebolts on pump components.

CAUTION

- Do not remove protection covers from the pump branches, as they prevent contamination of the pump.



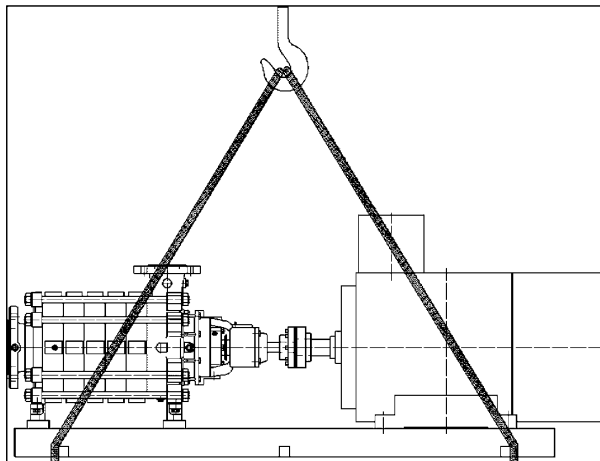
Lifting the pump

4.2 Unpacking

Do not unpack the pump until it has been carefully checked for damage that may have occurred in transit. Report any damage to the carrier.

4.3 Handling

The pump or the pump set must be lifted as shown below and above right:



Lifting the pump set

4.4 Preservation

All pumps with iron casings will be preserved.

4.5 Preservation and Storage

All pumps with cast iron wetted components will have been filled with a preservative and drained. These pumps should be placed into service as soon as possible. The pump should be stored in a dry and vibration free room. When stored or installed, without being in service, the pump should be filled with a rust preservative, and the shafts rotated weekly. If freezing might occur ensure that an antifreeze is used. If the preservative freezes, cracking of the pump parts may occur, which is not covered under and will void the warranty.

4.6 Removal of preservation

To remove the factory installed preservative coating, the pump should be flushed several times using clean water.

The pump must be installed and put into operation immediately afterwards.

5.1 Requirements

Prior to the installation of the pump, the storage and handling instructions in Section 4 must have been complied with.

5.2 Safety measures



- The pipework must be properly installed. Fluid leakage during operation may cause health hazards or environmental damage.
- The shut-off valves in the suction or feed line and in the discharge line must be closed.
- All internal rules and guidelines must be complied with.
- Hot components must have contact guards.



- Disconnect power to the equipment so as to eliminate electrical shock hazards!

5.3 General

5.3.1 Fitting tools

Standard tools and lifting equipment are used..

5.3.2 Permissible environment

The ambient temperature range should be from - 4 °F to + 140 °F.

The atmospheric humidity should be low in order to avoid corrosion.

5.3.4 Installation position

Multi pumps are installed in the horizontal position.

5.3.5 Preparatory checks

The foundation of the pump must be level and be subjected to minimum of vibration.

Prior to installation, checks should be made with regard to:

- possible damage to the pump or the pump assembly that may have occurred in transit
- ease of running (check that the shaft is free to rotate by hand).

5.3.6 Foundation

The pump assembly should be mounted on a foundation capable of supporting it. The foundation should be horizontally level and have a commercially flat surface.

5.4 Motor

Prior to assembly the direction of rotation of the motor must be checked (arrow on pump bearing).

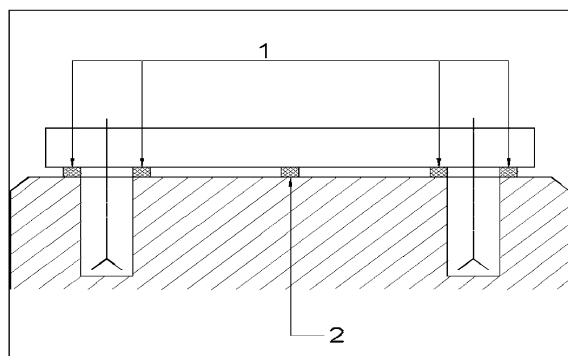
5.5 Installation and Alignment of the Pump Assembly

- Place shims under the baseplate on both sides of the foundation bolts (see Fig.).
- Use a level to align the assembly.
- If the foundation bolts are more than 32 inches apart, place additional shims between the foundation bolts to prevent the baseplate from sagging. Care should be taken to minimize distortion of the baseplate during installation.
- Tighten the nuts of the foundation bolts in diagonal sequence
- Re-check alignment with a level.



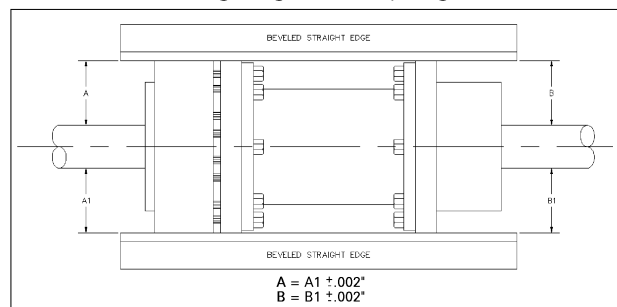
Position of the shims

After levelling the assembly the alignment of the pump and motor must be checked for alignment. Remove the coupling guard and align the assembly using the procedures recommended by the coupling manufacturer.



- 1 shims
- 2 additional shims if the foundation bolts are more than 32" apart

Aligning the coupling

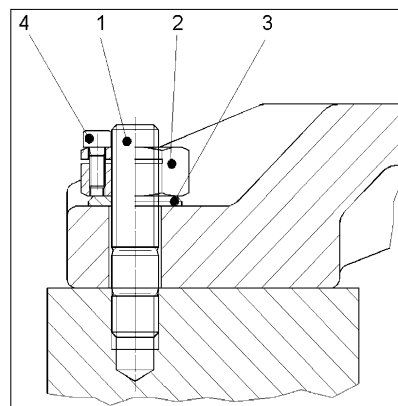


a=a1 and b=b1, tolerance: 0.05 mm (.002")

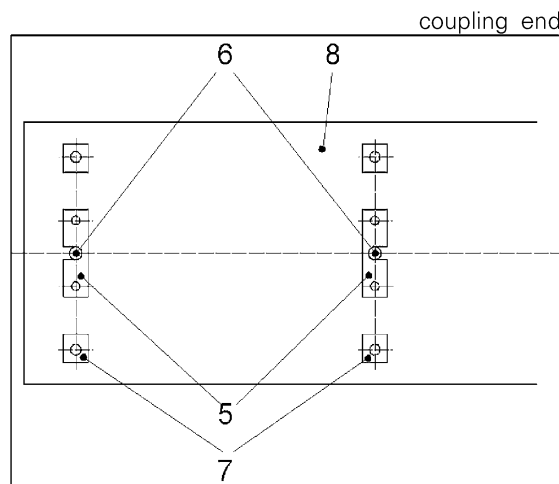
The pumps may be equipped with a high temperature foot fastening. The feet are not screwed firmly to the baseplate/baseframe to avoid distortions due to the expansion of the pump casing at higher temperatures.

For the high temperature foot fastening, studs (1) and adjusting nuts with slot (2) are used. The adjusting nut with slot (2) should be tightened by hand (without a wrench) with zero clearance between washer (3), nut (2) and pump foot in such a way that the washer (3) could be moved by light taps with a hammer.

Lock the adjusting nut in its position by tightening the safety bolt (4).



- 1) Stud 2) Adjusting nut with slot 3) Washer 4) Safety bolt
- To avoid a displacement of the pump transverse to the longitudinal axis, the feet of the suction and delivery casings are equipped with guide pins (6). These guide pins (6) are able to slide in guide blocks (5) which are fixed firmly to baseplate/ baseframe (8).



- 5 Guide block
- 6 Guide pin
- 7 Pump foot contact pad
- 8 Baseplate

CAUTION

- Avoid distortions when finally tightening the bolts.

5.7 Pump installation in the piping system

CAUTION

- The pipework forces and moments acting on the pump flange must not exceed the permissible flange loads.
- The pump must not be used to clean the pipework with chemicals.

- Remove the protection covers from the pump flanges and the auxiliary pipeline connections.
- Insert the flange seals.
- Connect the suction or feed line.
- Connect the discharge line.

5.8 Hydrostatic test



- If the piping system is to undergo a hydrostatic pressure test, the pump must be excluded from such testing.

5.9 Cleaning, flushing and pickling of the pipework

When the pipework is cleaned, flushed or pickled, the pump should be excluded.

6.1 Requirements

The pump or the pump assembly must be installed in accordance with the instructions of Section 5.

6.2 Safety measures



- If there is no shaft seal, interrupt all further work and install a shaft seal. Priming the pump with the liquid handled in the absence of a shaft seal may present a human-health or environmental hazard.
- Ensure that people and the environment are not put at risk through explosive, toxic, hot, crystalline, or acid liquids handled.



- Be sure that all electrical connections comply with the local rules and regulations and that this work is done by authorised personnel only.

CAUTION

- The pump must be completely primed and vented.
- Check the direction of rotation only with the pump primed.
- If the liquid handled is hot, the pump should be filled slowly so as to avoid distortions or heat shocks.
- The flow rate should be changed at constant speed only on the discharge side. During operation the regulating valve in the suction or feed line should always be fully open.
- Do not run the pump with the regulating valve closed for more than two minutes, if there is no minimum flow bypass line.
- Safety measures should be taken to ensure (for example by means of a relief valve) that the permissible pump casing pressure is not exceeded during operation.
- Repeat the alignment of the coupling at operating temperature. Re-align the pump and motor, if necessary.

6.3 Electrical connection

Connect the electrical supply to the motor in accordance with the connection diagram in the terminal box.

6.4 Checks before first start-up

- Is the piping connected and are the flange connections tight?
- Is the pump and the piping correctly primed?
- Is the shut-off valve in the discharge line closed?
- Is the shut-off valve in the suction or feed line fully open?
- Is the motor ready?
- Is the direction of rotation of the motor correct? (Check by momentarily jogging on the motor.)
- Has the coupling alignment been verified?
- Has the shaft seal been installed?
- Are the supply lines, if any, to the shaft seal open?
- In the case of oil lubrication: Has the bearing housing been correctly filled with oil?

CAUTION

- If the discharge pressure does not rise steadily as the speed increases, stop the motor, vent and refill the pump.
- Do not switch the pump on and off more often than ten times per hour (this applies to liquids with a max. Specific Gravity of one(1)). The motor manufacturer's instructions should be followed.

6.5 Starting procedure

- Check everything using the check list of sub-section 6.4.
- Energize the motor.
- Check the pressure gauges at the pressure measuring points.
- Open the discharge side regulating valve to adjust the duty point of the pump.

CAUTION

- A small fluid quantity will typically leave the mechanical seal in the form of vapor, mist or droplets. If there should be a considerable increase in the leakage rate after the start-up phase, stop the pump and check the mechanical seal.
- If a stuffing box is installed, the leakage rate after start-up should be higher than during operation. After about 1 hour, tighten the gland nuts gradually until there is a slight drop leakage.



- Please note that there will always be some residual liquid even if the pump is emptied in vertical position.
- Ensure that the pump does not contain any hazardous substances when it is returned to the manufacturer's factory.
- Ensure that during prolonged inactivity the pump is operated for about five minutes every 1 to 3 months. Follow the instructions under 6.5.

6.6 Particular information

The following parameters should be monitored during operation:

- power consumption of the motor
- smoothness of pump operation (no vibration)
- bearing temperature
- leakage

6.7 Stopping procedure

- Close the discharge regulating valve.
- Denergize the motor.
- When the pump is at rest, close the shut-off valves of the feed and cooling lines.

CAUTION

- If there is danger of freezing, the pump should be drained.

7.1 Requirements

The pump must have been taken out of operation in accordance with the instructions of Section 6.

7.2 Safety measures



- Flush the pump thoroughly before disassembly to purge away the residual liquid left after draining the pump.
- Ensure that people and the environment are not put at risk through explosive, toxic, hot, crystalline, or acid liquids handled.

CAUTION

- The workplace for disassembly or assembly must be clean.

If the pump is operating in a harsh (e.g. dusty or hot) environment the regreasing intervals should be considerably shorter.

Only high quality, anticorrosive lithium based grease containing no resins or acids should be used.

After 17500 operating hours or 2 years the rolling contact bearings should be replaced.

7.3.2 Mechanical seal

Generally, no maintenance is required on mechanical seals. The mechanical seal may exhibit only light visible leakage. In the case of heavy leakage, the mechanical seal should be checked (see also Section 6.6).

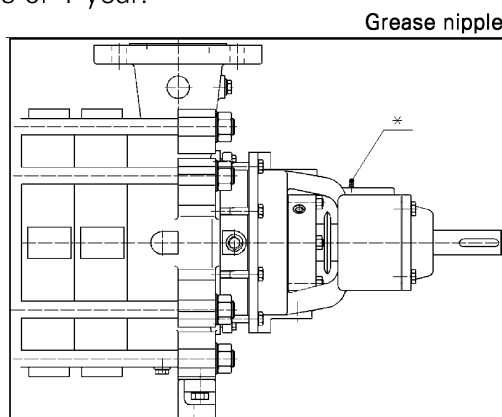
7.3.3 Packed stuffing box

With a packed stuffing box, there is always leakage in the form of drops. In the case of heavy leakage, the packing and the shaft wearing sleeve should be checked for scoring).

7.3 Maintenance and inspection

7.3.1 Bearings

The pumps is equipped with a grease-lubricated roller bearing on the drive side and a sleeve bearing lubricated by the liquid handled inside the pump on the suction side, if the driver is on the discharge side. With a suction side driver, the suction side bearing is also a roller bearing. Roller bearings should be re-greased after 8000 operating hours or 1 year.



Re-greasing

7.3.4 Drive motor

Maintenance of the drive motor should be in compliance with the manufacturer's instructions.

7.4 Disassembly

Note: Be sure to follow all safety procedures while performing the procedures described in this section.

7.4.1 Preparation for disassembly

- Disconnect power to the motor.
- Drain the system between suction side and delivery side shut-off valves.
- Disconnect and dismantle existing sensors and monitoring devices, if necessary.
- Dismantle coupling.
- Drain the liquid from the pump.
- Dismantle shaft seal supply lines, if any.
- Disconnect the pump from the pipework.
- Dismantle balancing line.

7.4.2 Spare parts

For re-assembly, replace all O-rings.

For item numbers of spare parts, please refer to the component list, Section 9.

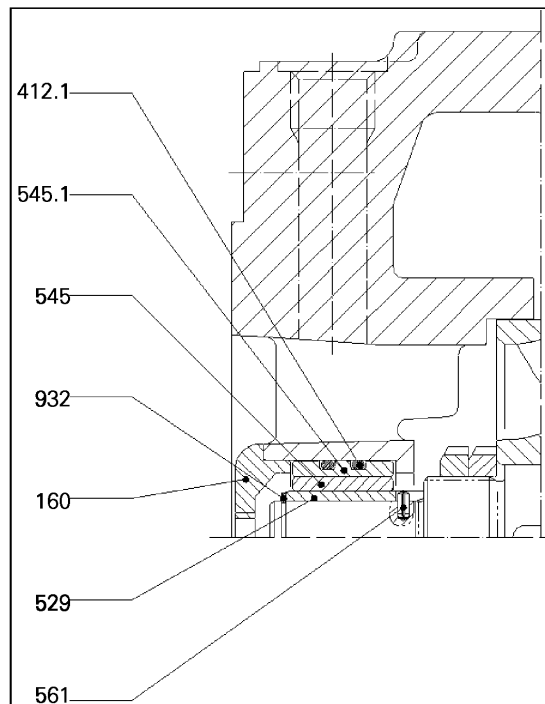
7.4.3 Disassembly of the pump

- Mark positions and sequence of the parts with a colored pen or a scribe, for later re-assembly.
- Measure and record shaft projection to bearing cover (dimension X, Sections 7.4.3.1 and 7.6.2.2).

7.4.3.1 Disassembly of the bearings

Discharge side drive

Sleeve bearings, lubricated by the liquid handled (non0drive side)

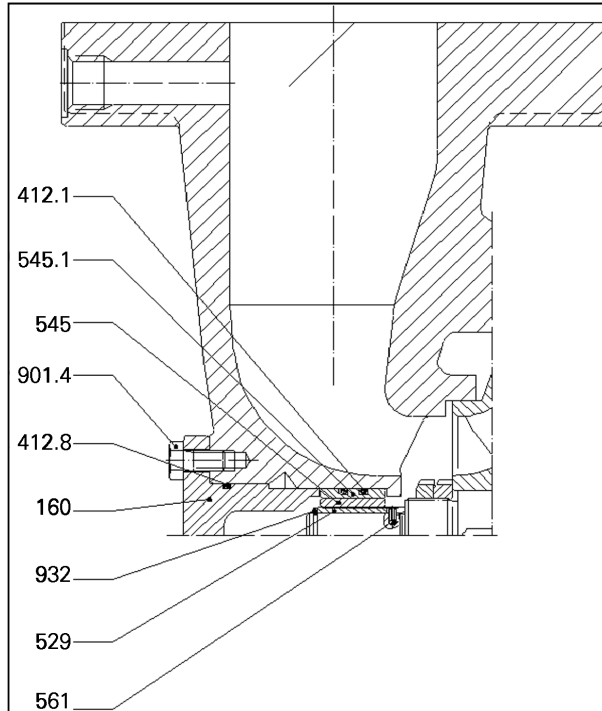


Axial Suction Nozzle

- Remove bearing cover 160, using forcing screw.
- Remove circlip 932.
- Withdraw bearing bush 545 / 545.1, with O-rings 412.1.
- Withdraw bearing sleeve 529.

CAUTION

- The anti-rotation locking grooved pin 561 should remain in the shaft.

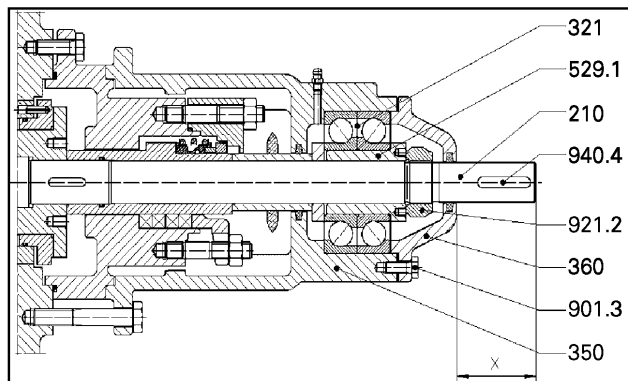


Radial Suction Nozzle

- Remove hexagon head bolts 901.4.
- Remove bearing cover 160, and O-ring 412.8, using forcing screws.
- Remove circlip 932.
- Withdraw bearing bush 545/545.1 with O-rings 412.1.
- Remove bearing sleeve 529.

CAUTION

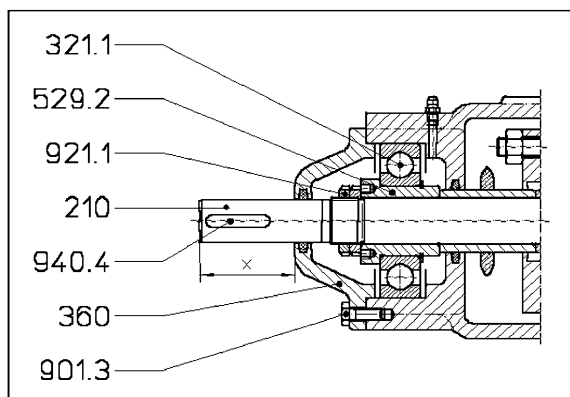
- The anti-rotation locking grooved pin 561 should remain in the shaft.



Roller bearing (drive side)
grease lubricated

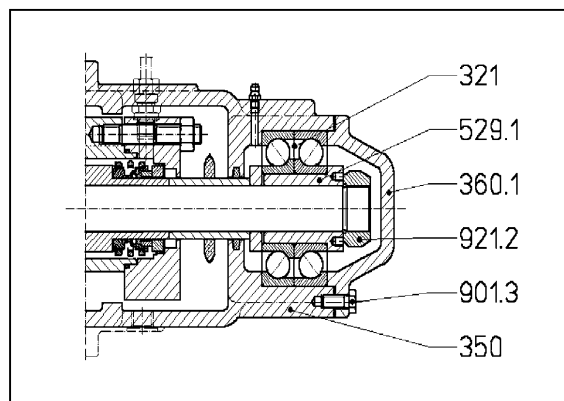
- Remove key 940.4
- Remove bolts 901.3.
- Dismantle bearing cover 360.
- Secure shaft 210 and key 940.4, and release shaft nut 921.2.
- Withdraw bearing sleeve 529.1, with bearing 321.

Suction side drive



Roller bearing (suction side drive)
grease lubricated

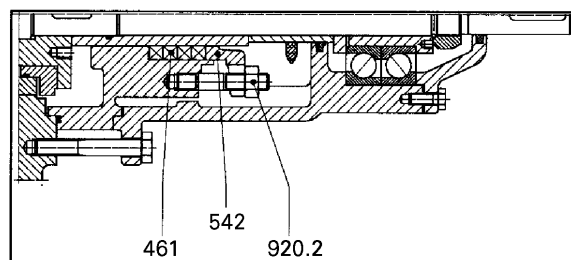
- Remove key 940.4
- Remove bolts 901.3.
- Dismantle bearing cover 360.
- Secure shaft 210 and key 940.4, and release shaft nuts 921.1.
- Withdraw bearing sleeve 529.2, with bearing 321.1



Roller bearing (suction side drive)
grease lubricated

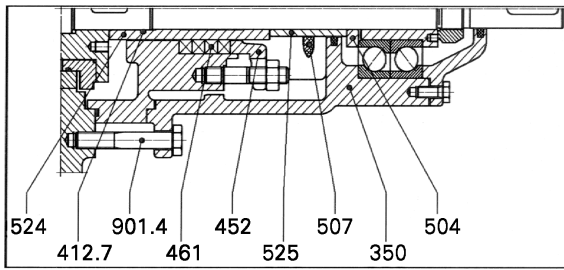
- Remove bolts 901.3.
- Dismantle bearing cover 360.1.
- Secure shaft or coupling on the drive side and release shaft nut 921.2.
- Withdraw bearing sleeve 529.1 with bearing 321.

7.4.3.2 Disassembly of the shaft seal



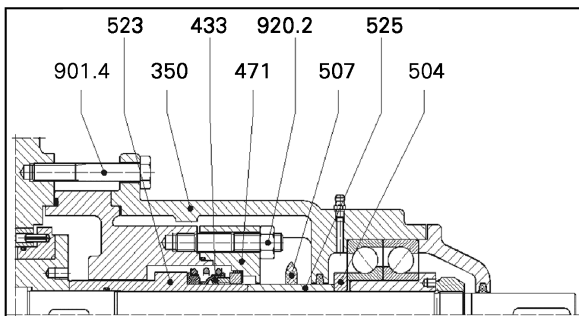
Stuffing box packing

- Remove nuts 920.2.
- Push back the stuffing box gland 542.
- Remove packing rings 461, using a packing extractor.



Stuffing box packing

- Dismantle roller bearing in accordance with Section 7.4.3.1.
- Remove spacer ring 504 (not applicable for the drive side in the case of suction side drive).
- Remove bolts 901.4.
- Remove bearing housing 350.
- Remove spacer sleeve 525 with thrower 507.
- Remove stuffing box gland 452.
- Remove shaft protection sleeve 524 with O-ring 412.7.



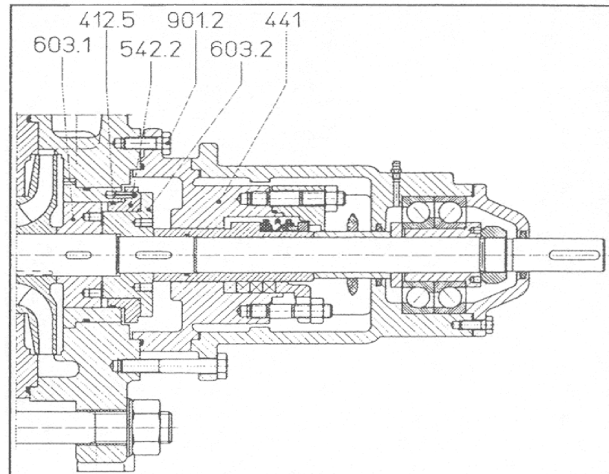
Mechanical seal

- Dismantle roller bearing in accordance with Section 7.4.3.1.
- Remove spacer ring 504 (not applicable for the drive side in the case of suction side drive).
- Remove bolts 901.4.
- Remove bearing housing, 350.
- Remove spacer sleeve 525 with thrower 507.
- Remove nuts 920.2.
- Remove seal cover 471 with stationary seal ring.
- Remove shaft sleeve 523 with mechanical seal 433.

Dismantling a double back-to-back mechanical seal:

- Determine working mode on the basis of the installation drawing.
- Observe documentation.

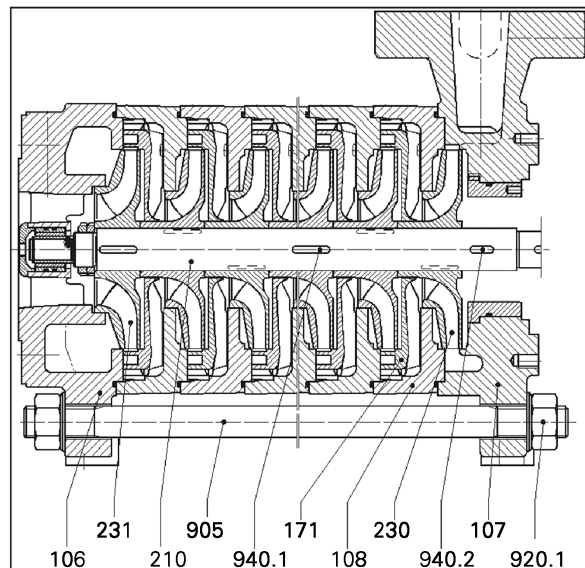
7.4.3.3 Dismantling the balance drum



Balance drum

- Dismantle roller bearing, shaft seal, as per Sections 7.4.3.1 and 7.4.3.2.
- Remove bolts 901.2.
- Remove housing for shaft seal 441.
- Withdraw part 603.2.
- Withdraw part 542.2 with O-ring 412.5.
- Remove balance drum 603.1.

7.4.3.4 Dismantling hydraulics unit



- Dismantle bearing, shaft seal and balance drum, in accordance with 7.4.3.1, 7.4.3.2, and 7.4.3.3.
- Remove key 940.2.
- Remove nuts 920.1.
- Remove tie bolts 905.
- Support stage casings, dismantle delivery casing 107.
- Remove, stage by stage, impeller 230, key 940.1, stage casing 108, with diffuser 171.

7.5 Work after disassembly

- Clean all parts
- Clean the clearances and sealing surfaces.

The following pump components, if existing, must be checked:

- **Mechanical seal:**
If the running faces are damaged or worn, replace the mechanical seal.
- **Clearances:**
The diameter difference between impeller hub and casing or cover clearance area should be 0.3 mm to 0.5 mm. In the case of excessive wear in this clearance area, wear rings must be installed.

7.6 Assembly

CAUTION

- The assembly work must be based on good engineering practice.
- Use no force.
- Heavy parts should be supported during assembly.
- Before assembly, apply a layer of anti seize compound on the low clearance rotating parts. Observe instructions with regard to cleanliness and safety.
- All parts must be clean and free from chips or dust.
- The unit may be re-assembled by reversing the disassembly procedures.
- Observe the tightening torques specified.
- Quick-sticking glues or adhesives are not permitted.

7.6.1 Tightening torques

Thread	M8	M10	M12	M16
Torque [Nm]	12	23	40	98
Torque (Ft/Lbs)	9	17	30	73

Thread	M24x1.5	M27x1.5	M30x1.5
Torque [Nm]	230	380	550
Torque (Ft/Lbs)	170	281	406

7.6.2 Pump assembly

- Assembly starts on the suction side.
- The pump should be assembled in vertical position, if possible.
- Install the parts in their original position, as previously marked.
- Observe the sectional drawing with list of components.
- Lightly tighten the nuts of the tie bolts.
- Place pump on its feet, in horizontal position, on a flat work surface.
- Tighten nuts of the tie bolts in several stages in diagonal sequence (recommended tightening torque at last stage).

7.6.2.1 Shaft seal

Packed stuffing box

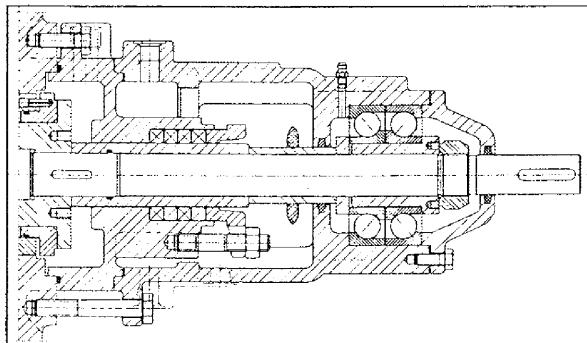
CAUTION

- The packing rings must not be inserted until after the pump, including the bearings, has been completely installed.
- Only pre-compressed packing rings are permissible.
- Thoroughly clean the packing area and the stuffing box gland.
- The first packing ring should now be laterally bent open and pushed on the shaft protection sleeve.
- Slide the packing ring into the packing chamber using the stuffing box gland.
- Install the other packing rings in the same manner, however with the gaps 180° apart.
- Turn the gland nuts finger-tight.
- Check that the gland is not cross threaded.

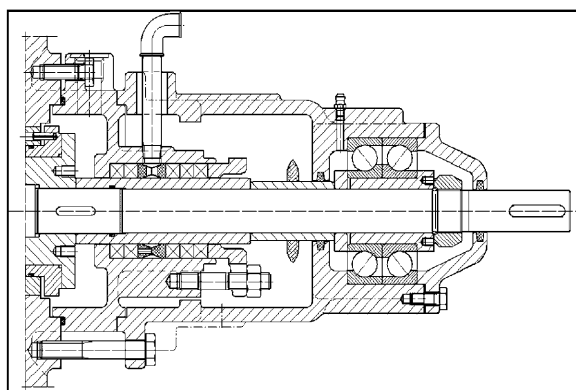
CAUTION

- The pump rotating assembly must be free to rotate by hand.
- The stuffing box leakage must not be adjusted until after start-up (see Section 6).

Dimensions	Pump size			
	032	050	065	100
Packing cross-section	10		10	
Number of rings, normal	4		4	
Number of rings, with external sealing	5		5	
Shaft diameter(mm)	4.5		70	
Shaft diameter(in.)	1.5		2.25	



Uncooled stuffing box packing



Stuffing box packing with external sealing

Mechanical seals

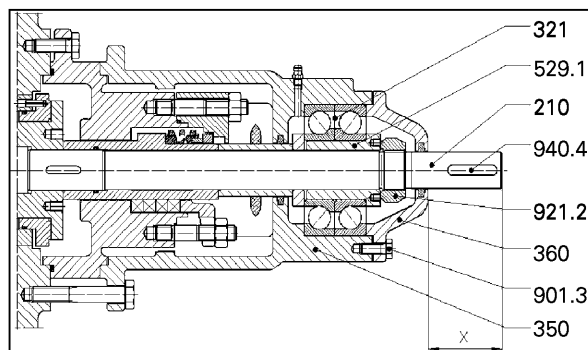
- Install the mechanical seal in the reverse manner to disassembly.

CAUTION

- Utmost care should be taken when mounting the rotary and stationary seal rings so as to avoid contamination and/or distortion on the sliding surfaces.
- EPDM seals must not be exposed to oil or grease.
- In order to achieve the compression pressure required for the operational reliability of the mechanical seal, check the installation dimension against the installation drawing.

7.6.2.2 BearingsDelivery side driveSleeve bearing

- Install sleeve bearing in the reverse manner to disassembly.

Rolling contact bearing (thrust bearings)

- Slide angular contact ball bearing 321 in X-arrangement (see fig.) on bearing sleeve 529.1 and install them together.
- Tighten shaft nut 921.2.
- Install bearing cover 360.
- Tighten bolts 901.3.
- Check clearance between bearing housing 350 and bearing cover 360 (0.2 to 1.0 mm).

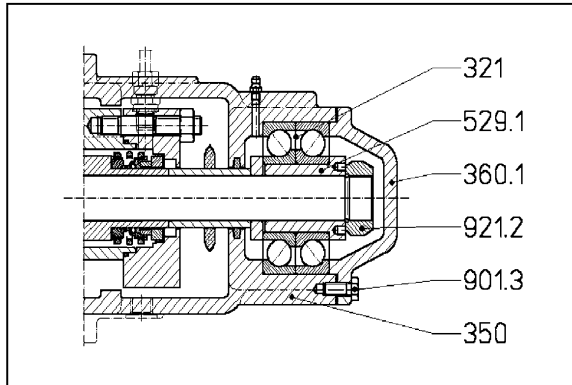
CAUTION

Check axial position of the rotor. Dimension X must be the same as before disassembly.

Suction side drive

Roller bearing (drive side radial bearing)

- Insert bearing sleeve 529.2 with bearing 321.1.
- Tighten shaft nuts 921.1.
- Tighten bolts 901.3 to fasten bearing cover 360.



Roller bearing (thrust bearing)

- Slide angular contact ball bearing 321 in X-arrangement (see fig.) on bearing sleeve 529.1 and install them together.
- Tighten shaft nut 921.2.
- Install bearing cover 360.1.
- Tighten bolts 901.3.
- Check clearance between bearing housing 350 and bearing cover 360 (0.2 to 1.0 mm).

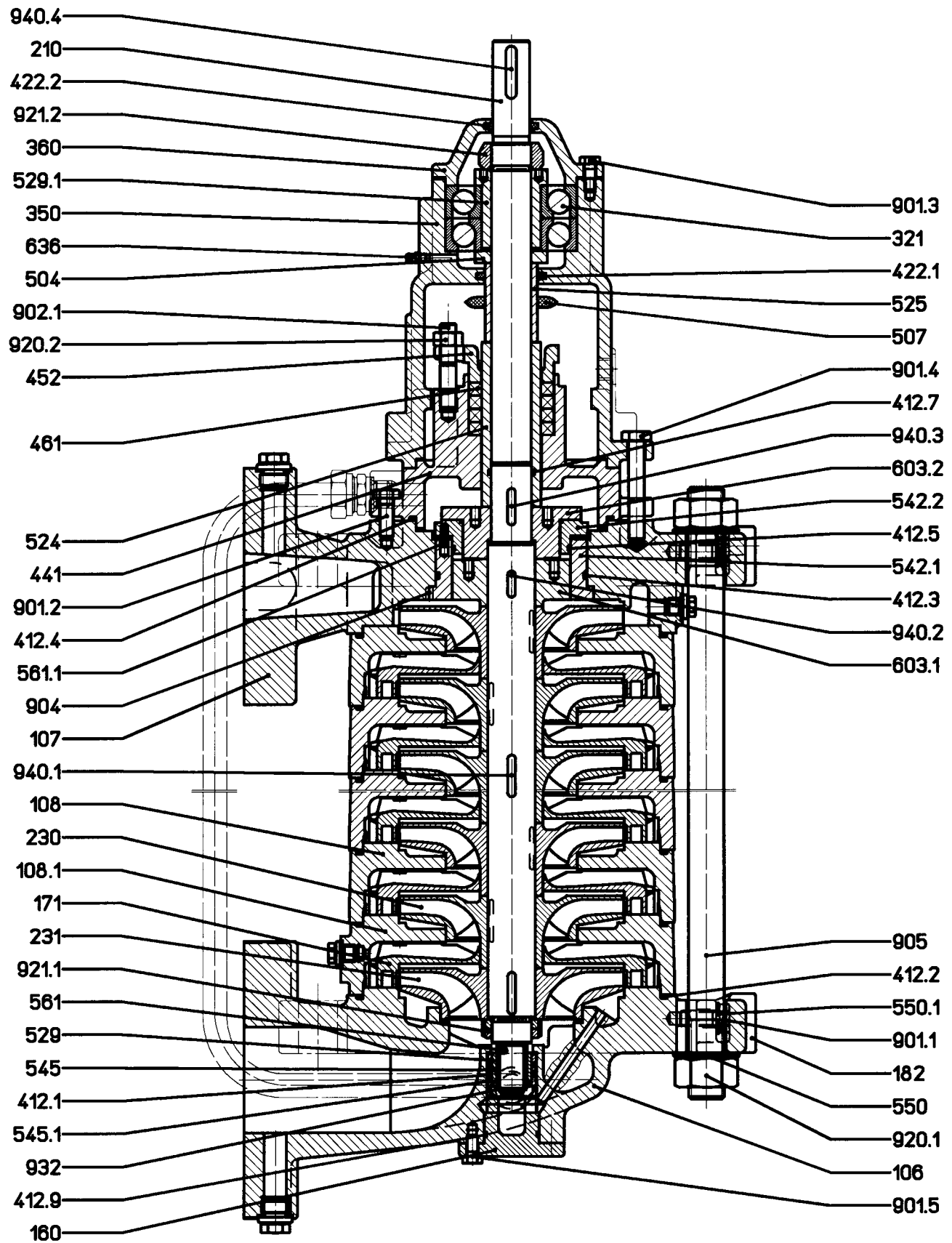
CAUTION

- Check axial position of the rotor. Dimension X must be the same as before disassembly.

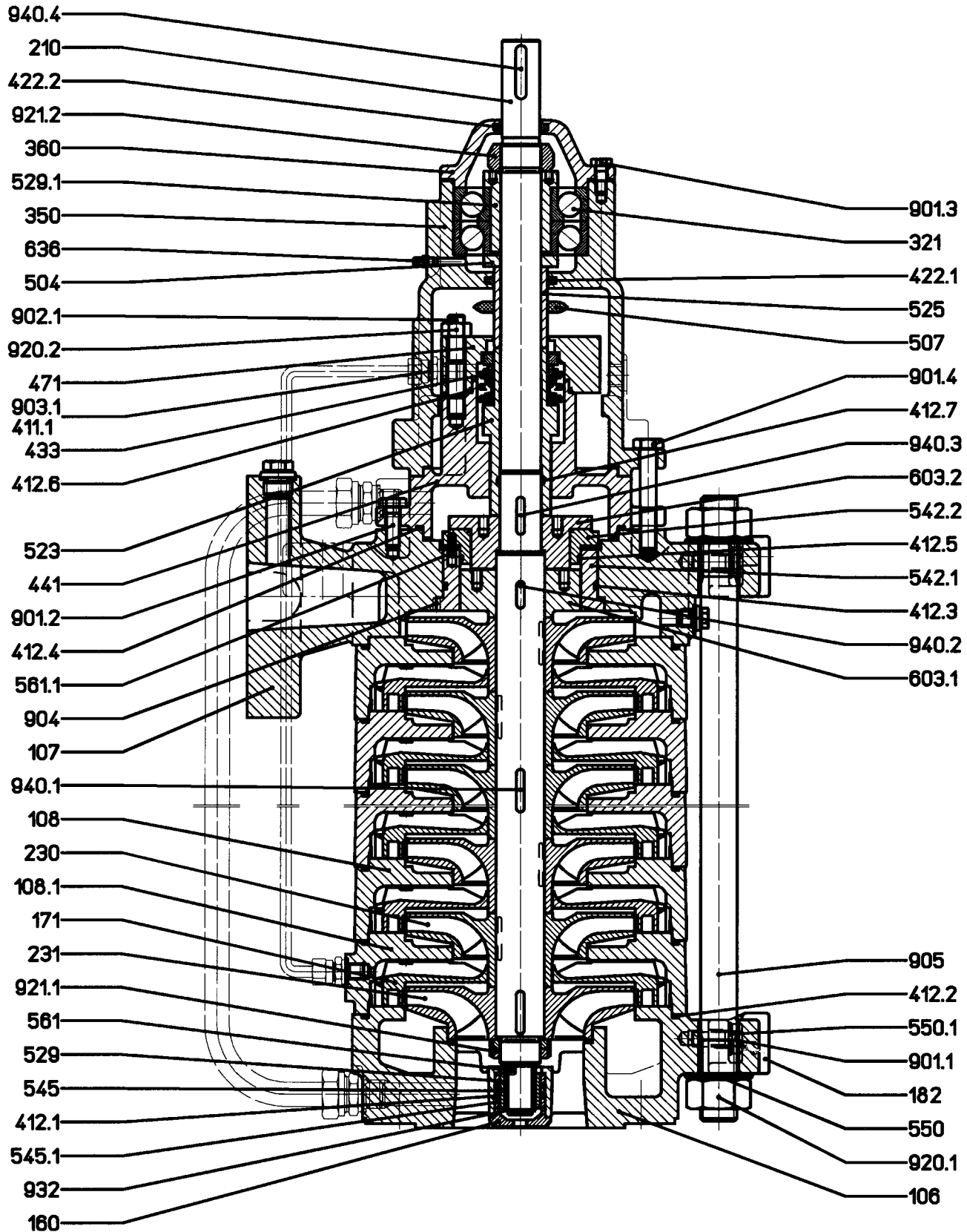
8.1 Troubleshooting

Trouble	Cause	Remedial action
Insufficient liquid delivered	Wrong direction of rotation.	Re-connect the motor.
	System-pressure too high.	Check the system for contaminants, re-access the duty point.
	Suction lift too high or insufficient NPSHa.	Check liquid levels, open suction side shut-off valves, clean suction side filter / dirt trap.
	Pump / pipeline insufficiently filled with liquid.	Vent and re-fill the pump / pipeline.
	Sealing clearances too great due to wear.	Replace worn pump components, wear rings.
	Leakage in casing or suction pipework.	Replace casing seal, check flange connections.
	Impellers or diffusers clogged.	Disassemble the pump, clean the impellers or diffusers.
Insufficient suction performance of pump	Suction lift too high or insufficient NPSHa.	Check liquid levels, open suction side shut-off valves, clean suction side filter / dirt trap.
	Leakage in casing, shaft seal, foot valve or suction pipework.	Replace casing seal, check shaft seal, check flange connections.
	Loose or clogged parts in the pump.	Open the pump and clean it.
Pump leakage	Casing bolts loose.	Check tightening torque of the tie bolts.
	Defective mechanical seal.	Check the sealing surfaces and secondary seals of the mechanical seal, replace damaged components.
	Damaged seals.	Replace seals.
Temperature increase in the pump	Discharge side valve closed.	Open discharge side valve.
	Suction lift too high or insufficient NPSHa	Check liquid levels, open suction side shut-off valves, clean suction side filter / dirt trap.
	Pump / pipeline insufficiently filled with liquid.	Vent and re-fill the pump / pipeline.
Increase in bearing temperature	Internal components worn	Renew worn parts.
	Excessive pump clearances.	Install wear rings as required
	Increase in axial thrust.	Check clearances, throttling gap and balancing line.
	Insufficient, too much, contaminated or unsuitable lubricant.	Add, reduce or replace lubricant.
	Bearings worn.	Replace bearings.
	Shaft sealing area insufficiently cooled.	Check cooling lines, remove any deposits in the cooling liquid container.
	Coupling misaligned or coupling components worn.	Align or replace.
	Pump distorted, or sympathetic vibrations in the pipework.	Check pump and pipework fastening. Install vibration-absorbing pipework support and/or flexible connections.
	Flow rate too low / too high.	Ensure minimum flow / throttle discharge side shut-off valve.
	Internal/external rings of the thrust bearings loose.	Axially clamp internal / external rings.
Unsteady running of pump, excessive noise	Suction lift too high or insufficient NPSHa.	Check liquid levels, open suction side shut-off valves, clean suction side filter / dirt trap.
	Pump / pipeline insufficiently filled with liquid.	Vent and re-fill the pump / pipeline.
	Base of the pump not level. Pump distorted.	Check pump installation and adjustment.
	Foreign substances in the pump.	Open the pump and clean it out.
Motor circuit breaker switches off	Requirements as to pumping conditions not met.	Check the pumping conditions on the basis of the data sheet.
	Base of the pump not level. Pump distorted.	Check the installation of the pump.
	Foreign substances in the pump.	Open the pump and clean it.

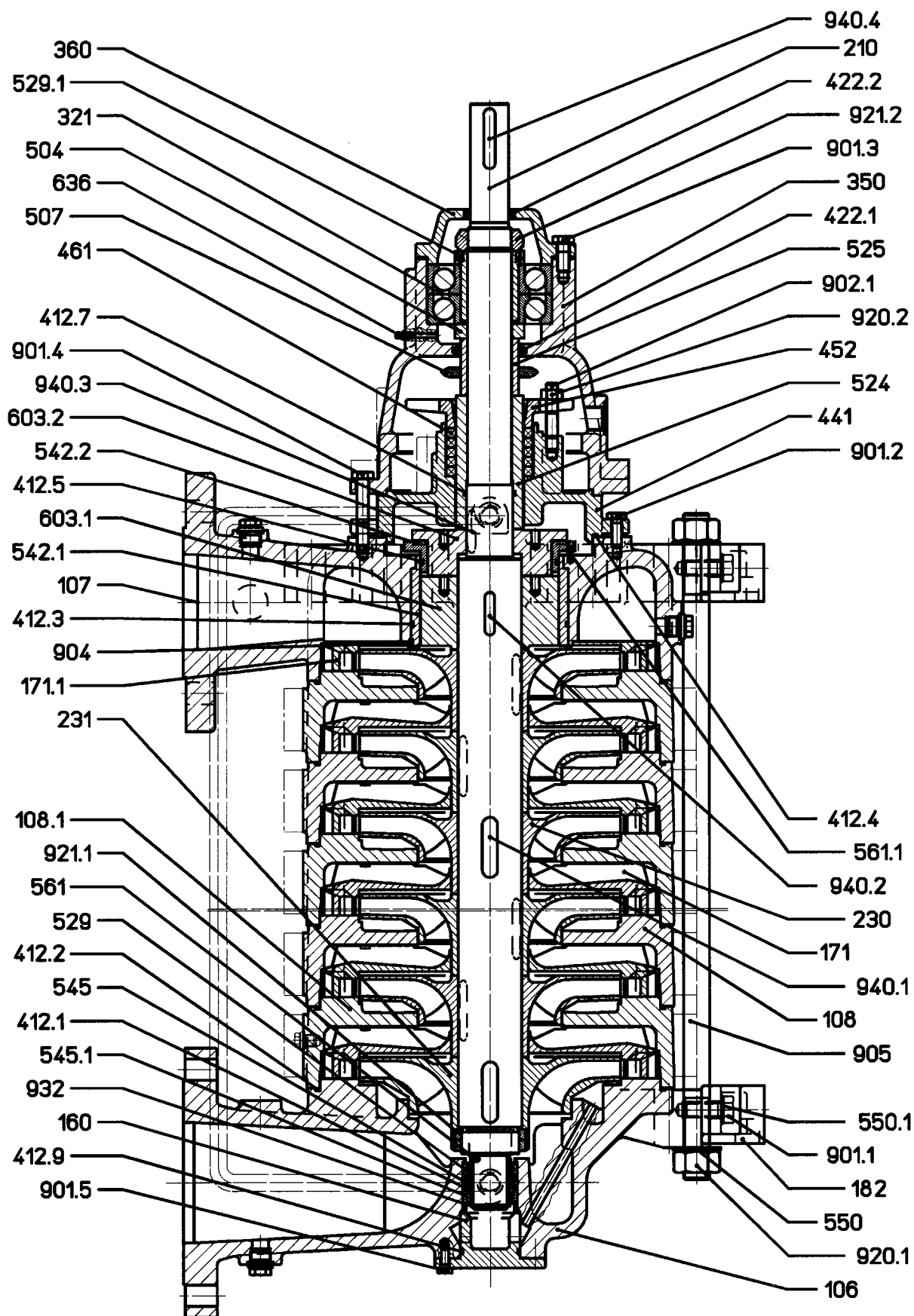
9.1 Sectional drawings - MSM 032 and 050 - radial



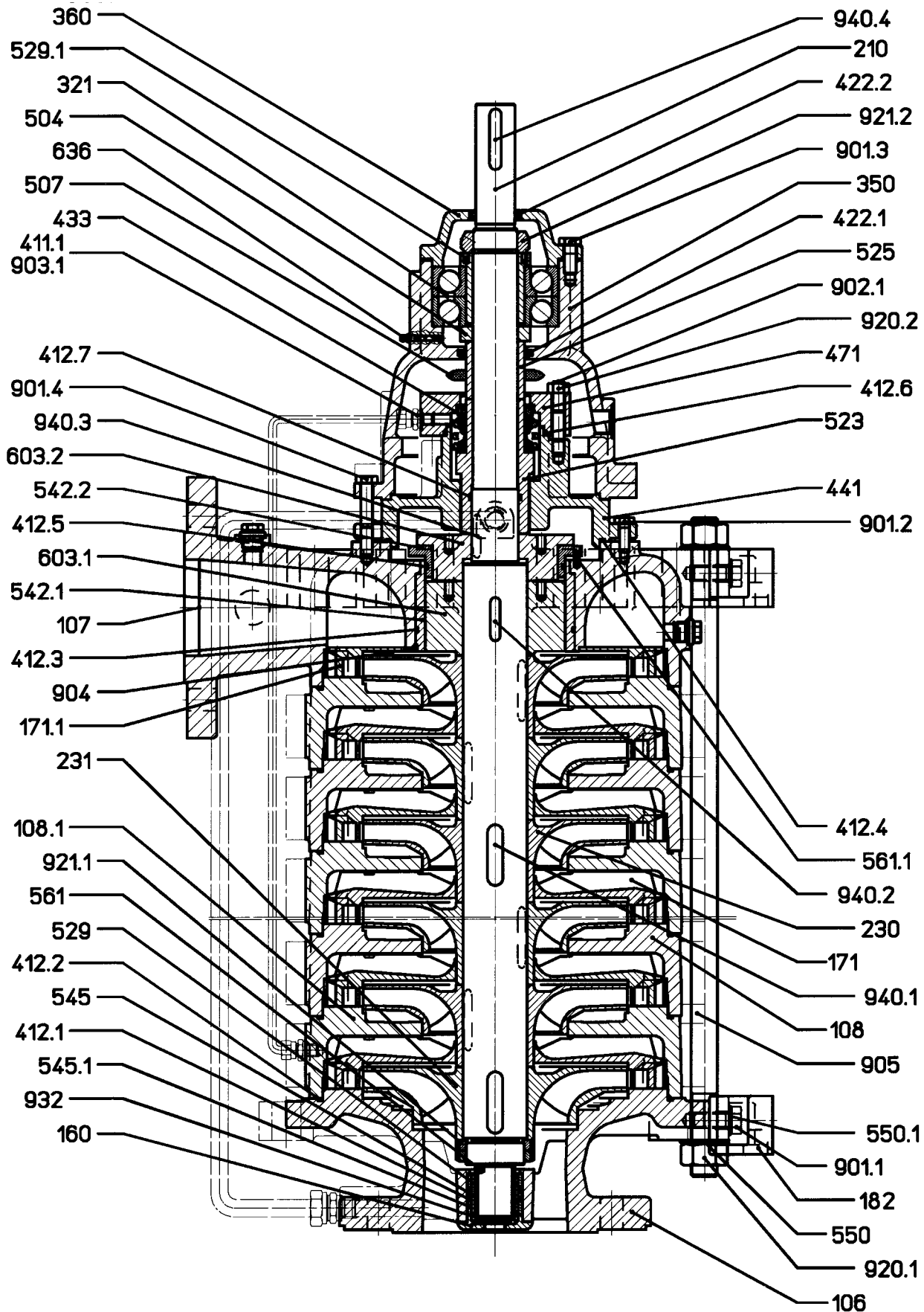
Sectional drawings - MSM 032 and 050 - axial



Sectional drawings - MSM 065 and 100 - radial



Sectional drawings - MSM 065 and 100 - axial



9.2 Parts list

Part number DIN	Denomination
106	Suction casing
107	Discharge casing
108/1	Stage casing
160	Cover
171	Diffuser
171.1	Diffuser, last stage
182	Foot
210	Shaft
230	Impeller
231	Suction impeller
321	Radial ball bearing
350	Bearing housing
360	Bearing cover
411.1	Joint ring
412.1/2/.../9	O-Ring
422.1/2	Felt ring
433	Mechanical seal
441	Housing for shaft seal
452	Gland
458	Lantern ring
461	Gland packing
471	Seal cover
504	Spacer ring
507	Thrower / Slinger
523	Shaft sleeve
524	Shaft wearing sleeve
525	Spacer sleeve
529/1	Bearing sleeve
542.1/2	Throttling bush
545/1	Bearing bush
550/1	Disc
561/1	Grooved pin
603.1/2	Balance drum
636	Grease nipple
901.1/2/.../5	Hexagon head bolt
902.1	Stud
903.1	Screwed plug
904	Grub screw
905	Tie bolt
920.1/2	Nut
921.1/2	Shaft nut
932	Circlip
940.1/2/3/4	Key

