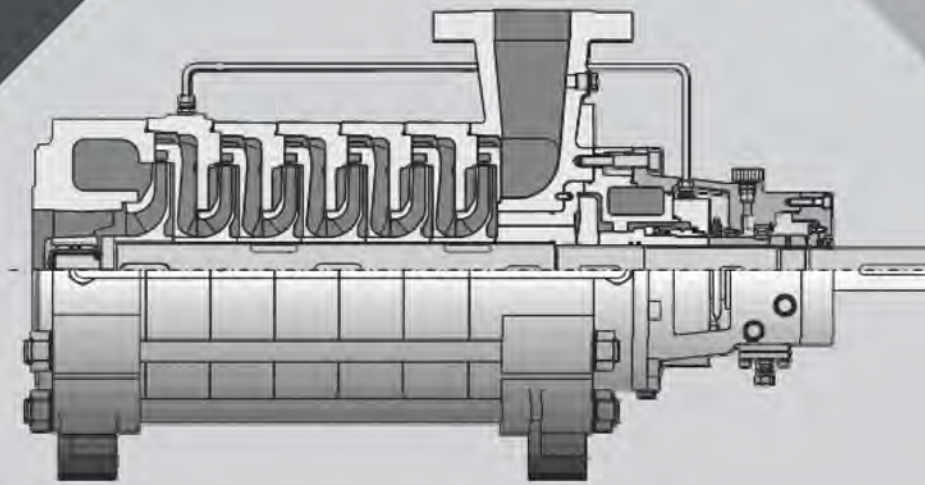




# Installation, Operations, and Maintenance Instructions

3311



**ITT**



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# 1 Introduction and Safety

## 1.1 Important Safety Notice

To: Our Valued Customers:

User safety is a major focus in the design of our products. Following the precautions outlined in this manual will minimize your risk of injury.

ITT Goulds pumps will provide safe, trouble-free service when properly installed, maintained, and operated.

Safe installation, operation, and maintenance of ITT Goulds Pumps equipment are an essential end user responsibility. This Pump Safety Manual identifies specific safety risks that must be considered at all times during product life. Understanding and adhering to these safety warnings is mandatory to ensure personnel, property, and/or the environment will not be harmed. Adherence to these warnings alone, however, is not sufficient — it is anticipated that the end user will also comply with industry and corporate safety standards. Identifying and eliminating unsafe installation, operating and maintenance practices is the responsibility of all individuals involved in the installation, operation, and maintenance of industrial equipment.

Please take the time to review and understand the safe installation, operation, and maintenance guidelines outlined in this Pump Safety Manual and the Instruction, Operation, and Maintenance (IOM) manual. Current manuals are available at <https://www.gouldspumps.com/en-US/Tools-and-Resources/Literature/> or by contacting your nearest Goulds Pumps sales representative.

These manuals must be read and understood before installation and start-up.

For additional information, contact your nearest Goulds Pumps sales representative or visit our Web site at <https://www.gouldspumps.com>

## 1.2 Safety Warnings

Specific to pumping equipment, significant risks bear reinforcement above and beyond normal safety precautions.




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### **WARNING:**

A pump is a pressure vessel with rotating parts that can be hazardous. Any pressure vessel can explode, rupture, or discharge its contents if sufficiently over pressurized causing death, personal injury, property damage, and/or damage to the environment. All necessary measures must be taken to ensure over pressurization does not occur.

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### **WARNING:**

Operation of any pumping system with a blocked suction and discharge must be avoided in all cases. Operation, even for a brief period under these conditions, can cause superheating of enclosed pumpage and result in a violent explosion. All necessary measures must be taken by the end user to ensure this condition is avoided.

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### **WARNING:**

The pump may handle hazardous and/or toxic fluids. Care must be taken to identify the contents of the pump and eliminate the possibility of exposure, particularly if hazardous and/or toxic. Potential hazards include, but are not limited to, high temperature, flammable, acidic, caustic, explosive, and other risks.

---



**WARNING:**

Pumping equipment Instruction, Operation, and Maintenance manuals clearly identify accepted methods for disassembling pumping units. These methods must be adhered to. Specifically, applying heat to impellers and/or impeller retaining devices to aid in their removal is strictly forbidden. Trapped liquid can rapidly expand and result in a violent explosion and injury.

---

ITT Goulds Pumps will not accept responsibility for physical injury, damage, or delays caused by a failure to observe the instructions for installation, operation, and maintenance contained in this Pump Safety Manual or the current IOM available at <http://www.gouldspumps.com/literature>.

## 1.3 Safety

### Definitions

Throughout this manual the words Warning, Caution, Electrical are used to indicate where special operator attention is required.

Observe all Cautions and Warnings highlighted in the Pump Safety Manual and the IOM provided with your equipment.



**WARNING:**

Indicates a hazardous situation which, if not avoided, could result in death or serious injury. Example: Pump shall never be operated without coupling guard installed correctly.

---



**CAUTION:**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. Example: Throttling flow from the suction side may cause cavitation and pump damage.

---

### Electrical Hazard:



**WARNING:**

Indicates the possibility of electrical risks if directions are not followed. Example: Lock out driver power to prevent electric shock, accidental start-up, and physical injury.

---

### Install the shaft guard - if provided



**WARNING:**

- Running a pump without safety devices exposes operators to risk of serious personal injury or death. Never operate a unit unless appropriate safety devices (guards, etc.) are properly installed.
  - Failure to disconnect and lock out driver power may result in serious physical injury or death. Always disconnect and lock out power to the driver before performing any installation or maintenance tasks.
    - Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.
    - Refer to driver/coupling/gear manufacturer's installation and operation manuals (IOM) for specific instructions and recommendations.
-

Exposed rotating shaft between pump seal and bearing frame. Avoid contact and/or install proper guarding. If guarding is not provided with the pump, contact Goulds for price and availability of proper guarding.


## 1.4 General precautions





### WARNING:

A pump is a pressure vessel with rotating parts that can be hazardous. Hazardous fluids may be contained by the pump including high temperature, flammable, acidic, caustic, explosive, and other risks. Operators and maintenance personnel must realize this and follow safety measures. Personal injuries will result if procedures outlined in this manual are not followed. ITT Goulds Pumps will not accept responsibility for physical injury, damage or delays caused by a failure to observe the instructions in this manual and the IOM provided with your equipment.


**Table 1: General Precautions**

WARNING		NEVER APPLY HEAT TO REMOVE IMPELLER. It may explode due to trapped liquid.
WARNING		NEVER use heat to disassemble pump due to risk of explosion from tapped liquid.
WARNING		NEVER operate pump without coupling guard correctly installed.
WARNING		NEVER run pump below recommended minimum flow when dry, or without prime.
WARNING		ALWAYS lock out power to the driver before performing pump maintenance.
WARNING		NEVER operate pump without safety devices installed.
WARNING		NEVER operate pump with discharge valve closed.
WARNING		NEVER operate pump with suction valve closed.
WARNING		DO NOT change service application without approval of an authorized ITT Goulds Pumps representative.
WARNING		<p>Safety Apparel:</p> <ul style="list-style-type: none"> <li>• Insulated work gloves when handling hot bearings or using bearing heater</li> <li>• Heavy work gloves when handling parts with sharp edges, especially impellers</li> <li>• Safety glasses (with side shields) for eye protection</li> <li>• Steel-toed shoes for foot protection when handling parts, heavy tools, etc.</li> <li>• Other personal protective equipment to protect against hazardous/toxic fluids</li> </ul>
WARNING		<p>Receiving:</p> <p>Assembled pumping units and their components are heavy. Failure to properly lift and support equipment can result in serious physical injury and/or equipment damage. Lift equipment only at specifically identified lifting points or as instructed in the current IOM. Current manuals are available at <a href="http://www.gouldspumps.com/literature_ioms.html">www.gouldspumps.com/literature_ioms.html</a> or from your local ITT Goulds Pumps sales representative. Note: Lifting devices (eyebolts, slings, spreaders, etc.) must be rated, selected, and used for the entire load being lifted.</p>
WARNING		<p>Alignment:</p>

## 1.4 General precautions

		Shaft alignment procedures must be followed to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.
WARNING		Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.
CAUTION		Piping: Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.
WARNING		Flanged Connections: Use only fasteners of the proper size and material.
WARNING		Replace all corroded fasteners.
WARNING		Ensure all fasteners are properly tightened and there are no missing fasteners.
WARNING		Startup and Operation: When installing in a potentially explosive environment, please ensure that the motor is properly certified.
WARNING		Operating pump in reverse rotation may result in contact of metal parts, heat generation, and breach of containment.
WARNING		Lock out driver power to prevent accidental start-up and physical injury.
WARNING		The impeller clearance setting procedure must be followed. Improperly setting the clearance or not following any of the proper procedures can result in sparks, unexpected heat generation and equipment damage.
WARNING		If using a cartridge mechanical seal, the centering clips must be installed and set screws loosened prior to setting impeller clearance. Failure to do so could result in sparks, heat generation, and mechanical seal damage.
WARNING		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.
WARNING		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
CAUTION		Never operate the pump without liquid supplied to mechanical seal. Running a mechanical seal dry, even for a few seconds, can cause seal damage and must be avoided. Physical injury can occur if mechanical seal fails.
WARNING		Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.
WARNING		DO NOT operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury.
WARNING		Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
WARNING		Shutdown, Disassembly, and Reassembly: Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes must be worn at all times.



WARNING		The pump may handle hazardous and/or toxic fluids. Observe proper decontamination procedures. Proper personal protective equipment should be worn. Precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.
WARNING		Operator must be aware of pumpage and safety precautions to prevent physical injury.
WARNING		Lock out driver power to prevent accidental startup and physical injury.
CAUTION		Allow all system and pump components to cool before handling them to prevent physical injury.
CAUTION		If pump is a Model NM3171, NM3196, 3198, 3298, V3298, SP3298, 4150, 4550, or 3107, there may be a risk of static electric discharge from plastic parts that are not properly grounded. If pumped fluid is non-conductive, pump should be drained and flushed with a conductive fluid under conditions that will not allow for a spark to be released to the atmosphere.
WARNING		Never apply heat to remove an impeller. The use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and property damage.
CAUTION		Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.
CAUTION		Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.
WARNING		Noise: Sound pressure levels may exceed 80 dbA in operating process plants. Clear visual warnings or other indicators should be available to those entering an area with unsafe noise levels. Personnel should wear appropriate hearing protection when working on or around any equipment, including pumps. Consider limiting personnel's exposure time to noise or, where possible, enclosing equipment to reduce noise. Local law may provide specific guidance regarding exposure of personnel to noise and when noise exposure reduction is required.
WARNING		Temperature: Equipment and piping surfaces may exceed 130°F (54°C) in operating process plants. Clear visual warnings or other indicators should alert personnel to surfaces that may reach a potentially unsafe temperature. Do not touch hot surfaces. Allow pumps operating at a high temperature to cool sufficiently before performing maintenance. If touching a hot surface cannot be avoided, personnel should wear appropriate gloves, clothing, and other protective gear as necessary. Local law may provide specific guidance regarding exposure of personnel to unsafe temperatures.
WARNING		This product contains Carbon Black a chemical known to the State of California to cause cancer. For more information go to <a href="http://www.P65Warnings.ca.gov">www.P65Warnings.ca.gov</a>

## 1.5 Parts



The use of genuine Goulds parts will provide the safest and most reliable operation of your pump. ITT Goulds Pumps ISO certification and quality control procedures ensure the parts are manufactured to the highest quality and safety levels.

Please contact your local Goulds representative for details on genuine Goulds parts.

# 2 Safety Instructions

## 2.1 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 and the responsible personnel or operators prior to installation and commissioning. It must always be available on site.

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

Safety symbol to ISO 3864-B.3.1

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

Safety symbol to ISO 3864-B.3.6

This symbol refers to electrical hazards.



This word gives warning of a hazard to the machine.

Signs affixed to the machine, e.g.

- arrow indicating the direction of rotation
- symbols indicating fluid connections must be visible and kept legible.

## 2.2 Qualification and training of operating personnel

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

The responsibilities of the operating personnel must be exactly defined by the plant operator. If the staff does not have the necessary knowledge, they must be trained and instructed, which may be performed by the machine manufacturer or the supplier on behalf of the plant operator, if required. Moreover, the plant operator is to make sure that the contents of this manual are fully understood by the operating personnel.

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

Non-compliance with the safety instructions may cause a risk to personnel as well as to the environment and the machine. Non-compliance 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;
- leakage of environmentally damaging substances.

## 2.4 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.

## 2.5 Safety instructions relevant to operation

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

## 2.6 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 not operating and has been properly secured from starting. Always lock out power to the driver before performing pump maintenance. The procedure for stopping the machine described in this manual must be followed.

Pumps which handle hazardous fluids must be decontaminated.

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 [7.4 Checks before first start-up on page 28](#), must be observed.

## 2.7 Unauthorized alterations and production of spare parts

Any modification to the machine is permissible only after consultation with Gould's Pumps.

Using genuine spare parts and accessories authorized by the manufacturer is in the interest of safety. Use of other parts may exempt the manufacturer from any liability.

## 2.8 Unauthorized use

Goulds Pumps, inc. will not be liable for any damages or delay caused by failure to comply with the provisions of this instruction manual. The pump is not to be operated at speeds, working pressures, discharge pressures or temperatures higher than, nor used with liquids other than, stated in the original order acknowledgement or the conditions of service for which it was quoted without written permission from Goulds Pumps.

---

## 3 Application

### 3.1 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 data sheet. The pump is covered by warranty under Gould's Pumps' conditions of sale.

### 3.2 Wrong use

---

**NOTICE:**

Operate the pump only for the application stated on the data sheet. 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 pump or motor damage.

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### 3.3 Accessories

The accessories supplied with the pump are indicated on the data sheet. Other accessories may be mounted to the pump or the pump set only after Gould's Pumps' prior consent.

### 3.4 Design and working principle

The 3311 high pressure pump of the Goulds multi-stage line is a horizontal multi-stage ring-section type centrifugal pump.

It meets the technical requirements according to DIN ISO 5199 / EN 25199.

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

The axial thrust is balanced by a hydraulic balancing device consisting of a disc/drum combination. An additional lift-off device is available and intended for special applications. The balancing liquid flows back through an external line to the suction casing.

Suction nozzle: axial or radial.

In the case of radial suction nozzle orientation, the suction casing pump feet assembly allows adaptation to the installation requirements by rotating the casing.

Bearings:

Oil-lubricated anti-friction bearing on the discharge side; suction side sleeve bearing lubricated by the liquid handled or oil-lubricated anti-friction bearing.

Shaft seal:

Packed stuffing box or mechanical seal according to DIN 24960.

Drive:

Depending on its design, the pump is either driven from the discharge side or the suction side, by a customary electric motor or turbine. The direction of rotation is counter-clockwise for discharge side drive, and clockwise for suction side drive, when viewed from drive end.

### 3.5 Applications

- Municipal water supply:  
Pumping stations, treatment plants, booster units.
- Water treatment:

Filtration, reverse osmosis.

- Pumps for industrial purposes:  
General water supply, cold water, boiler feed installations, hot water, pumping of organic and inorganic solutions, high-pressure gas washing; power water generation plants, purifying and cleaning plants, desalinization plants.
- Power supply:  
Small and medium-sized thermal stations, waste incineration installations.

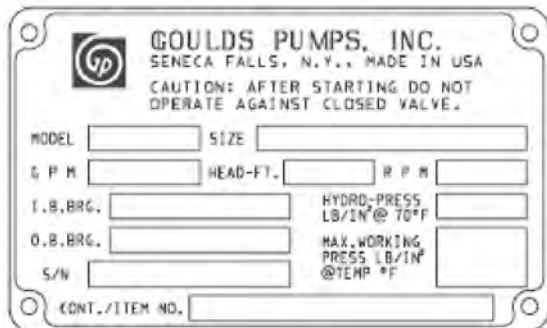
### 3.6 Nameplate Information

Every pump has a Goulds nameplate that provides information about the pump. The tags are located on the pump casing.

When ordering parts, you will need to identify the pump model, size, serial number, and the item number of the required parts. Information can be taken from the pump casing tags. Item numbers can be found later in this manual.

Pump Casing Tag – provides information about the pump’s hydraulic characteristics. Note the format of the pump size: Discharge x Suction – Nominal maximum Impeller Diameter in inches.

(Example: 2x3-7)



# 4 System Layout

## 4.1 Pipework

### 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:  $v_s \approx 1.5$  to  $2.5$  m/s

max. 3 m/s

Discharge line:  $v_D \approx 4$  to  $6$  m/s

Abrupt cross-section transitions or sharp bends should be avoided. Flow disturbances must be kept to a minimum when making necessary branches.

Unfavorable pipework layouts may impair the performance of the pump, especially on the suction side (e.g. bends in several planes in front of the suction nozzle).



### WARNING:

The pipework must be independently supported and positioned such that no excessive forces and moments are exerted on the pump flanges. Excessive loads could result in leakage and be hazardous to personnel.



### CAUTION:

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

Once the flange bolts have been released, the flanges must not yield more than the amount corresponding to the gasket thickness, nor must they be out of parallel nor bear against each other under stress. Check that the flange gaskets do not extend into the interior of the pipe. All pipe components, valves and fittings and the pump nozzles should be thoroughly cleaned before assembly.

Air-relief valves and drain valves must be installed in the suction and discharge lines.

In order to prevent the formation of air pockets,

- a feed line (supply source above the pump) should slope gradually downward towards the pump;
- a suction line (supply source below the pump) should gradually rise to the pump.

Shut-off valves must 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. Flow regulation at constant speed is permissible from the discharge side only.



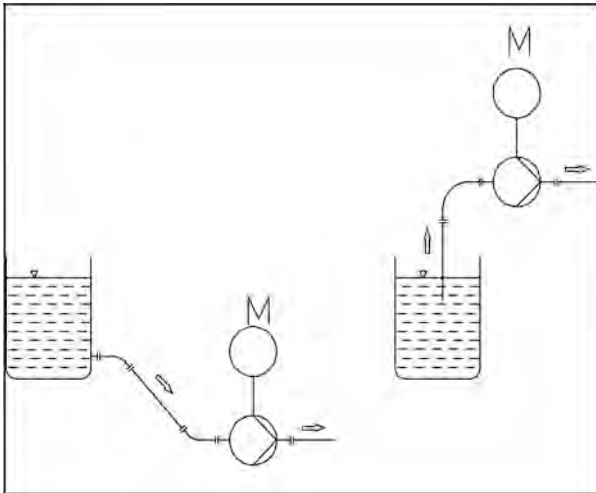
### CAUTION:

- The pipes should have at least the nominal diameter of the pump nozzles. Where this is not possible, it should be ensured that the flow velocity in the suction or feed line does not exceed 2 - 3 m/s.

- Flange seals must not extend into the interior of the pipework.
- Clean the pipework prior to pump installation.
- Support the pipelines so as to prevent distortion of pump components.
- Avoid rough cross-section 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 x suction nozzle diameter upstream from the suction nozzle.
- Shut-off valves in the suction or discharge line must be fully open during operation and must never be used to control the flow.

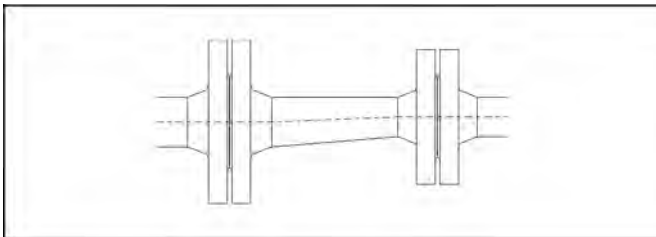
### Suction or feed line

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



**Figure 1: Suction and feed operation**

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



**Figure 2: Eccentric reducer**

If the liquid is contaminated, a filter should be fitted upstream from the pump whose free-space sectional area should be three times the pipe cross-sectional area.



### CAUTION:

- The strainer is for starting purposes only. Solids which are smaller than the mesh size will not be retained by the strainer.
- However, such small particles may collect in the lateral area of the impeller near the clearances, in particular if their concentration is high.



- In order to prevent clogging, it is recommended that the customer provide a sedimentation tank or a larger flushable fine strainer upstream from the pump.

Design:

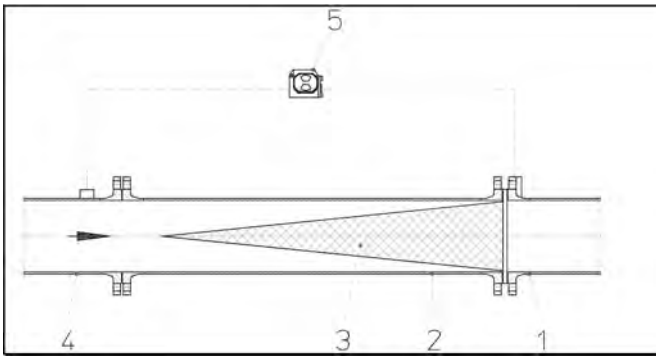
Conical strainer with perforated plate support body with external fine screen, mesh size 0.5 mm, of corrosion-resistant material. The fine screen can be removed after several months of operation, once there are no more deposits.

For new conical strainers supplied by Gould's Pumps the pressure loss can be calculated as follows:

$$H_v = \zeta \cdot \frac{v^2}{2g} \text{ in m}$$

$v$  = medium flow velocity in reference cross-section, in m/s

$\zeta = 4$ , loss coefficient for new conical strainers



1. Pump suction nozzle/flange
2. Pipe section for strainer
3. Conical strainer (installed with its tip against flow direction)
4. Feed line
5. Differential pressure measuring instrument

**Figure 3: Feed line with conical strainer**

Determining the strainer pressure loss

Example:

Feed line = DN 125

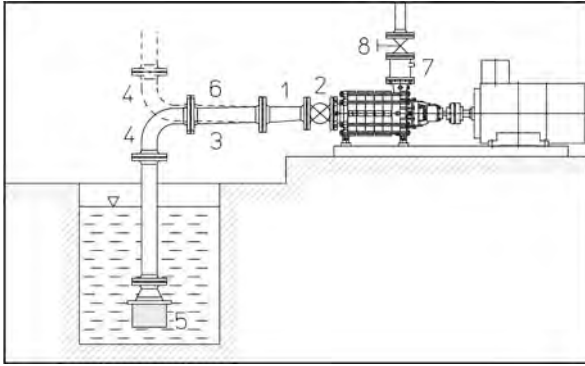
Flow rate 80 m<sup>3</sup>/h

$\zeta = 4$

$v = 1.81$  m/s in the feed line

$$H_v = 4 \cdot \frac{1.81^2}{2 \cdot 9.81} = 4 \cdot \frac{3.276}{19.62} = 0.66 \text{ m}$$

The suction line must be leak-proof and it must be possible to release all air. The suction opening of the suction line should be well below the liquid level, and a foot valve with a strainer should be used. The foot valve must be far enough from the bottom to avoid excessive inlet losses which could impair performance.



1. Eccentric reducer (suction operation) or concentric reducer (feed operation)
2. Shut-off valve
3. Suction line
4. Bend
5. Foot valve
6. Feed line
7. Non-return valve
8. Control valve

**Figure 4: Pump installation**

A shut-off valve should be installed in the feed line; it is to be closed for maintenance work.

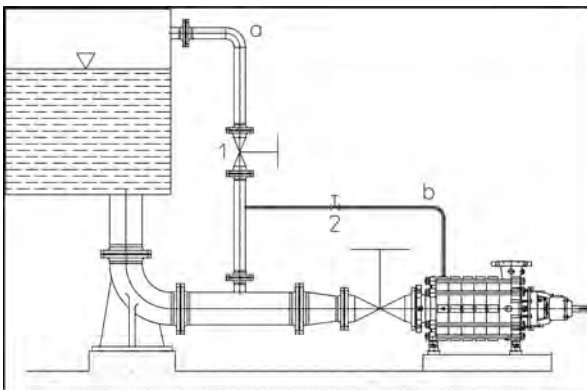
It should be installed such that air pockets cannot form in the spindle cap, i.e. with the spindle in a horizontal position or pointing vertically downward.

### **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 maximum 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 equalizing line.



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

**Figure 5: Vacuum operation**

### Discharge line

For flow control, install a shut-off valve as close to the pump nozzle as possible. It is recommended that a non-return valve be installed between pump nozzle 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.

### 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 rate is automatically returned to the suction side tank.

The minimum flow rate is shown on the curves or the data sheet.

Size	t = 140 °C or lower	t > 140 °C
2x3-7	20 % of $Q_{BEP}$	25 % of $Q_{BEP}$
2.5x4-8	20 % of $Q_{BEP}$	25 % of $Q_{BEP}$
4x5-11	25 % of $Q_{BEP}$	25 % of $Q_{BEP}$

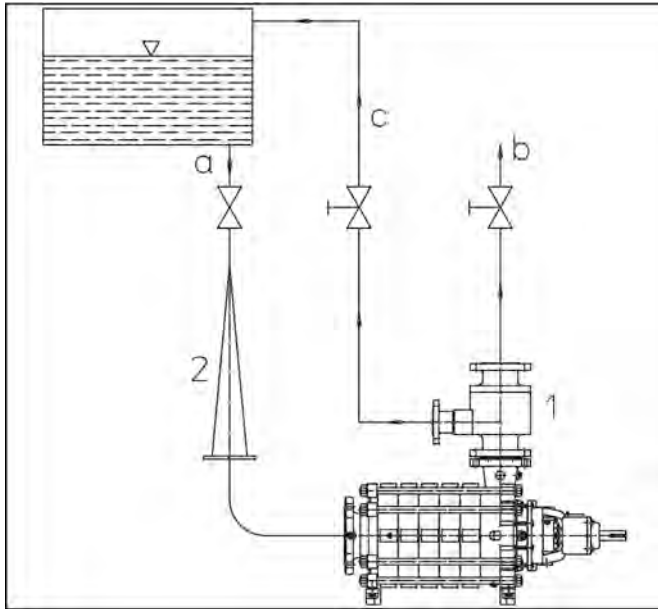
Should exact calculation be required, please contact Gould's Pumps.



### CAUTION:

- Up to the shut-off or non-return 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/suction tank.
- Permissible velocity in the minimum flow line: 7 to 10 m/s.
- 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 nozzle, upstream from the discharge shut-off valve.

- A non-return 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

**Figure 6: Minimum flow control**

**Balancing line**

The balancing line connects the discharge side 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.

**Venting during pump priming**

Before starting the set, 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 pipework. The shut-off valve in the suction or supply line must be fully open.

**Cooling**

Cooling is required if the temperature of the liquid handled exceeds 110 °C, if a packed stuffing box is used, or 140 °C if a mechanical seal is installed. For this purpose 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.

**Drain line, leakage water line**

The pump has connections for leakage water and drain lines.

**Pressure monitoring**

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

**4.2 Electrical connections**

The electrical connection for the driving motor must be in compliance with the relevant rules and requirements.

# 5 Unpacking, Handling, Storage

## 5.1 Safety measures

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**WARNING:**

- 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 set are lifted in horizontal position.
  - Do not attempt to lift the pump or the pump set using eyebolts on pump components.
- 
- 



**CAUTION:**

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

---

## 5.2 Unpacking

Do not unpack the pump until it has been carefully checked for damage that may have occurred in transit. Report any damage on the counterfoil or delivery note.

Claims must be made immediately on the carrier or the transport insurance.

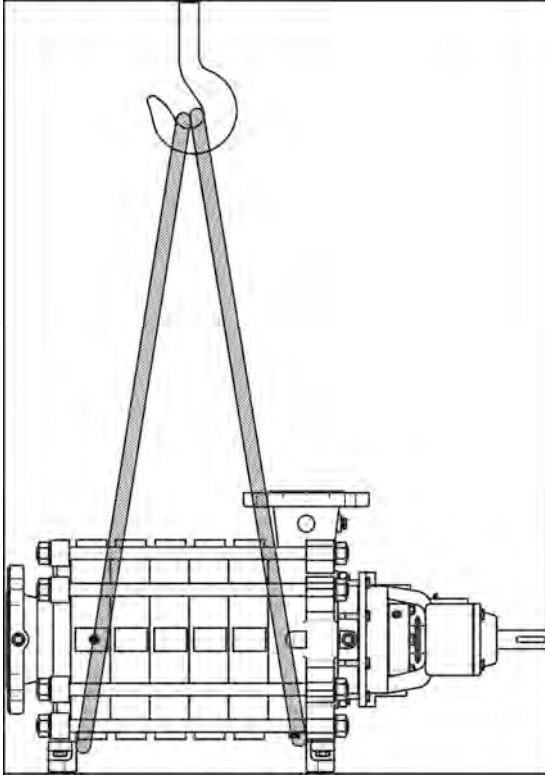
## 5.3 Intermediate storage

If the pump or the pump set is not to be installed immediately it should be stored in a clean, dry and vibration-free room.

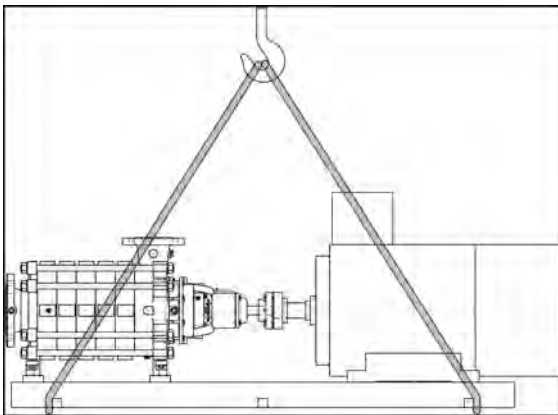
The packing should be checked for damage on a monthly basis.

## 5.4 Handling

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



**Figure 7: Lifting the pump**



**Figure 8: Lifting the pump/motor/baseplate assembly**

## 5.5 Preservation

Usually, only iron pumps are preserved.

### Removal of preservation

To remove the preservative coating, the pump should be filled and drained several times using appropriate agents, e.g. solvent naphtha, diesel oil, or an alkaline detergent. Flush with water, if necessary.

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

**Re-preservation**

If the pump has been supplied preserved and is to be stored, a new preservative coating should be applied after six months.

For suitable preservatives, contact Goulds Pumps.



# 6 Pump Installation

## 6.1 Prerequisites

Prior to the installation of the pump, the storage and handling instructions in [5 Unpacking, Handling, Storage on page 20](#), must have been complied with.

## 6.2 Safety measures



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**WARNING:**

- 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.
- 



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**WARNING:**

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

## 6.3 General

### Fitting tools

Standard tools and lifting equipment are used. These should be available at the customer's end.

### Permissible environment

The ambient temperature range should be from

- 20 °C to + 60 °C.

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

### Space utilization

The space required by the pump or the pump set can be seen from the table of dimensions and the arrangement drawing.

Clear and easy access to the shut-off and regulating valves and the measuring instruments must be ensured.

### Installation position

3311 pumps are installed in horizontal position.

### Preparatory checks

The foundation of the pump must be level and have a minimum of vibration. The consistency of the concrete should at least correspond to BN15, DIN 1045.

We recommend using a baseplate.

Prior to installation checks should be made with regard to:

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

### **Foundation**

Prior to placing the pump set on the foundation which should be well set, the following preparatory work must be carried out:

- roughen and clean foundation surface
- remove shuttering/cores from the anchor holes
- clean and blow out the anchor holes
- check the positions and dimensions of the anchor holes against the arrangement drawing.

Alternatively:

If the baseplate is fastened by means of heavy load plugs:

- Scribe and drill plug holes
- Clean plug holes and blow them out
- Insert heavy load plugs

### **Installation of the set**

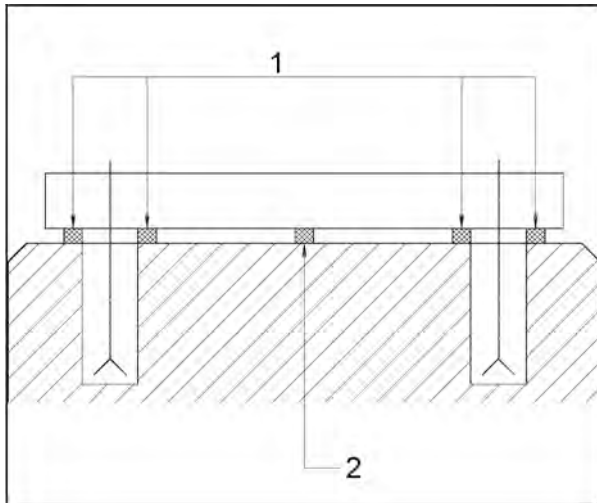
The complete set mounted on the baseplate must be placed on the foundation with its foundation bolts suspended. If heavy load plugs are used, first screw in the threaded rods in the plugs.

## **6.4 Motor**

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

## **6.5 Alignment of the set**

- Place shims under the baseplate on both sides of the foundation bolts.
- Use a spirit level to align the set.
- If the foundation bolts are more than 800 mm 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.
- The foundation bolts should be embedded in concrete using quick-setting grout (this is not required if heavy load plugs are used).
- Tighten the nuts of the foundation bolts in diagonal sequence (after the grout has set).
- Re-check alignment with a spirit level.

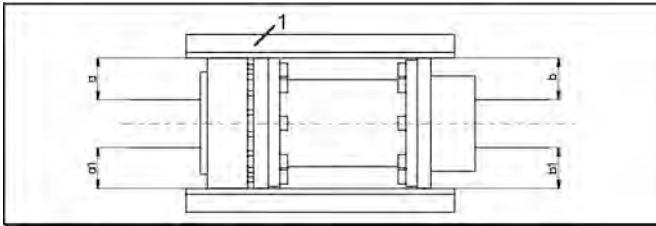


1. Shims
2. Additional shim, if foundation bolt distance  $\geq 800$  mm

**Figure 9: Position of the shims**

After aligning the set the axial clearance between the two coupling halves measured at one point of the coupling must be the same over the complete circumference of the coupling, the permissible tolerance being  $\pm 0.05$  mm.

Carry out the radial alignment of the coupling using a knife-edge straight-edge and a feeler gauge.



Required dimensions:

$a=a1$  and  $b=b1$ , tolerance:  $\pm 0.05$  mm

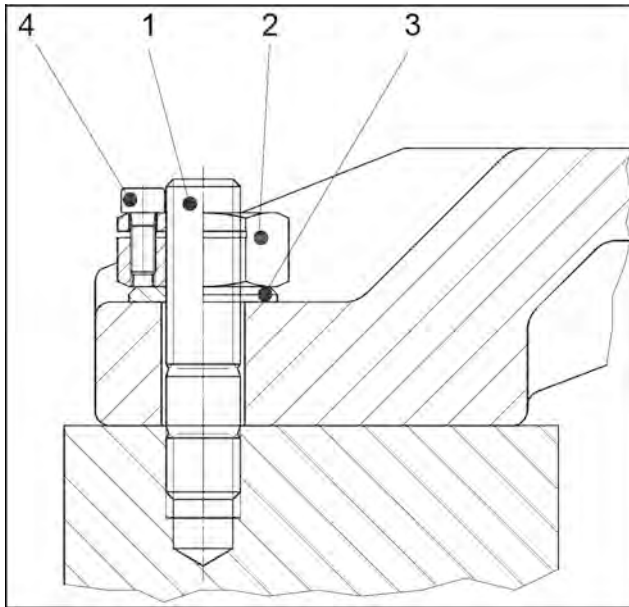
1 knife-edge straight-edge

**Figure 10: Radial alignment**

The pumps are designed for high temperature foot fastening as standard. Therefore, the pump feet must not be fixed to the baseplate in order to avoid distortion caused by high temperatures of the liquid handled and the resulting expansion of the pump casing.

Stud bolts (1) and adjusting nuts (2) are used for the high temperature foot fastening. Install adjusting nut (2) and turn it finger-tight only (do not use a wrench), thus installing the washer (3) free from play; however, the washer (3) should still be movable by light hammer taps. Lock the adjusting nut (2) in its position by tightening the safety screw (4).

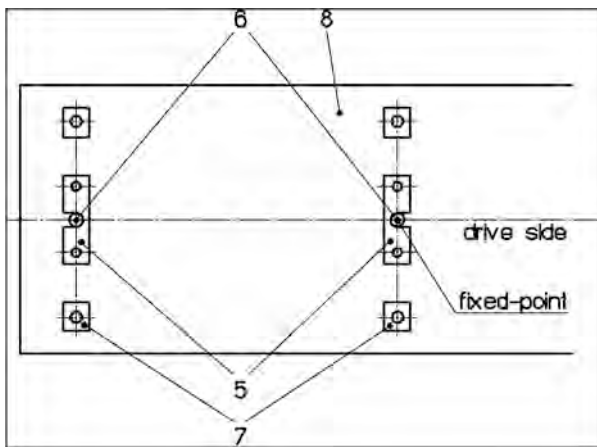
Guide pins (6) on the suction and discharge casing feet prevent lateral movement of the pump. The drive side guide pin is held in place by a guide casing which is bolted to the baseplate (8). The opposite guide pin can move in a guide casing.



1. Stud bolt
2. Adjusting nut
3. Washer
4. Safety screw

**Figure 11: Coupling alignment**

Guide pins (6) on the suction and discharge casing feet prevent lateral movement of the pump. The drive side guide pin is held in place by a guide casing which is bolted to the baseplate (8). The opposite guide pin can move in a guide casing.



5. Guide casing
6. Guide pin
7. Pump foot support
8. Baseplate

**Figure 12: Guide pins**

**CAUTION:**

- Avoid distortions when finally tightening the bolts.
  - The nuts of the foot fastening must be loosened so far that the washers can be moved by light hammer blows.
- 

## 6.6 Grouting the baseplate

Prior to grouting the baseplate, carry out the following preparatory work:

Check the dimensions with regard to height and alignment of flanges.

Re-adjust baseplate, if necessary.

Ram earth-humid concrete under the baseplate or add shrinkage-free grout until the entire space under the baseplate is filled. Grouting should be a continuous process so as to ensure that no air pockets form under the baseplate.

When the grout is set re-tighten the foundation bolts and re-check the alignment of the coupling.

## 6.7 Pump installation in the piping system

**CAUTION:**

- The pipework forces and moments acting on the pump nozzles must not exceed the permissible pump nozzle 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 gaskets.
- Connect the suction or feed line.
- Connect the discharge line.

## 6.8 Hydrostatic test

**WARNING:**

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

## 6.9 Cleaning, flushing and pickling of the pipework

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

# 7 Starting & Stopping Procedures

## 7.1 Prerequisites

The pump or the pump set must have been installed in accordance with the instructions of [6 Pump Installation on page 23](#).

## 7.2 Safety measures



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### WARNING:

- 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.
- 



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### WARNING:

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



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### CAUTION:

- Fill bearing housings with oil.
  - 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 30 seconds, if there is no minimum flow bypass line.
  - Safety measures should be taken at the customer's end 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 or the motor, if necessary.
- 

## 7.3 Electrical connection

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

## 7.4 Checks before first start-up

- Are the pipelines connected and are the flange connections tight?
- Is the pump incl. the pipework 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 switching on the motor.)
- Is the coupling correctly aligned (refer to [6 Pump Installation on page 23](#)).
- Can the washers of the foot-fastening be moved? (Refer to [6.5 Alignment of the set on page 24](#))
- Has the shaft seal been installed?
- Are the supply lines, if any, to the shaft seal open?
- Has the bearing housing been correctly filled with oil? (Refer to [• Oil-lubricated bearings on page 31](#)).

**CAUTION:**

- If the discharge pressure does not rise steadily as the speed increases, stop the motor and re-vent and refill the pump.
- Do not switch the pump on and off more often than ten times per hour (this applies to a max. density of 1000 kg/m<sup>3</sup> of the liquid handled). The motor manufacturer's instructions must be followed.

## 7.5 Starting procedure

- Check everything using the check list of [7.4 Checks before first start-up on page 28](#).
- Switch on 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 fluid quantity of a few cm<sup>3</sup> per hour 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.

## 7.6 Particular information

The following parameters should be monitored during operation:

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

## 7.7 Stopping procedure

- Close the discharge side regulating valve.
- Switch off the motor.
- Once the pump is at rest, close the shut-off valves of the feed line and cooling line (if installed).



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**CAUTION:**

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

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**WARNING:**

- 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 dismantled to be 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.
-



# 8 Maintenance, Disassembly, Assembly

## 8.1 Prerequisites

The pump or the pump set must have been taken out of operation in accordance with the instructions of [7 Starting & Stopping Procedures on page 28](#).

## 8.2 Safety measures




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### WARNING:

- 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.
- 




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### CAUTION:

The workplace for disassembly or assembly must be clean.

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## 8.3 Maintenance and inspection

### Oil-lubricated bearings

If the driver is on the discharge side, the pumps will be equipped with oil-lubricated anti-friction bearings on the drive side and a sleeve bearing lubricated by the liquid handled on the suction side. If the driver is on the suction side, the pump will have an oil-lubricated anti-friction bearing on the suction side. An additional oil-lubricated anti-friction bearing will be mounted on the discharge side of pumps equipped with a lift-off device.

Pumps are shipped from the factory without oil in the bearing housings.

The bearing housings must be filled with oil before initial start-up.




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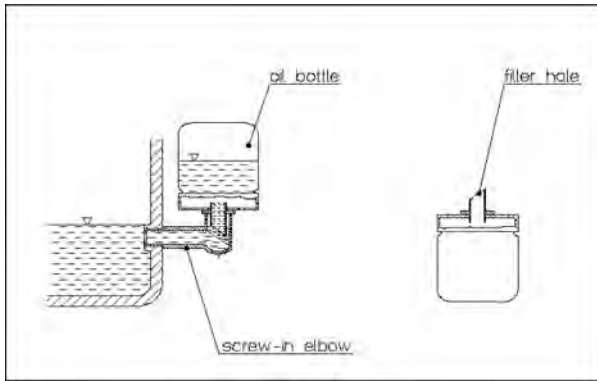
### CAUTION:

Use only very clean and non-ageing oil with good water separating and corrosion protection properties.

Standard design with constant level oiler

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- Pull oil bottle out of the screw-in elbow.
- Fill the bearing housing with oil until the oil becomes visible in the screw-in elbow.
- Fill oil bottle through filler hole.
- Replace oil bottle. As long as there is oil in the bottle the oil level in the bearing housing is sufficient.



If the bearings are new, change first oil after about 200 operating hours. Afterwards, change the oil in accordance with the following table:

light service	normal and severe service
Light contamination, T < 50 °C	light contamination, T > 50 °C
Annually	every six months

Use the following lubricating oils:

	Bearing temperature < 80 °C		Ambient temperature < 0 °C
	n ≤ 1500 rpm	n > 1500 rpm	
Lubricating oil acc. to DIN 51517	CL 68	CL 46	CL 22
Kin. viscosity at 40 °C in mm <sup>2</sup> /s	61.2 to 74.8	41.8 to 50.8	19.8 to 24.2
Neutralization num- ber	≤ 0.15 mg KOH/g		
Ash content, weight-%	≤ 0.02		
Water content, weight-%	≤ 0.1		

Oil consumption (l)

Size	Lift-off device	
	without	with
2x3-7	0.19	0.25
2.5x4-8	0.24	0.30
4x5-11	0.27	0.35

### Mechanical seal

Generally, virtually no maintenance is required on mechanical seals. The mechanical seal should exhibit only light visible leakage. In the case of heavy leakage, the mechanical seal should be checked (refer to [7.6 Particular information on page 29](#)).

### **Packed stuffing box**

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

### **Driving motor**

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

## **8.4 Disassembly**

Operating troubles involving pump disassembly are unlikely in the event of careful monitoring and maintenance of the pump.

However, if trouble occurs, the reason should be found before disassembly, if possible. Repair and overhaul work should be carried out by Goulds Pumps personnel or the pump should be inspected at the manufacturer's factory.

Please note that any disassembly work to be performed during the warranty period requires the approval of Goulds Pumps.

If you disassemble the pump, all components should be treated with utmost care.

All parts must be cleaned carefully, checked for wear and reconditioned or replaced by spare parts, if necessary. It is vital that the shaft is checked for concentricity. Use only genuine spare parts.

## **8.5 Preparation for disassembly**

- Disconnect power to the motor.
- Drain the system between suction side and discharge 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.
- Unbolt the pump from the pipe work.
- Dismantle balancing line.
- Drain the oil from the bearing housings.

## **8.6 Replacement parts**

For re-assembly, replace all O-rings.

The item numbers of replacement parts are given in the components list, refer to [10.13 Parts list on page 63](#).

## **8.7 Disassembly of the pump**

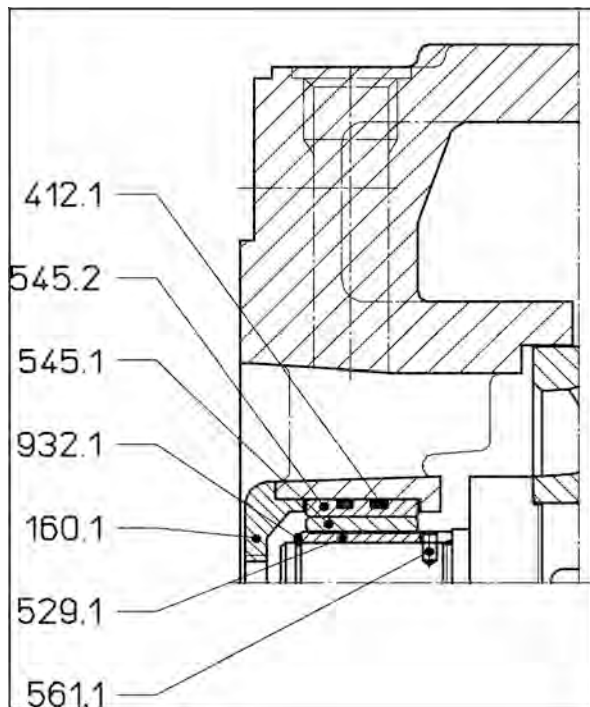
Mark positions and sequence of the parts with a colored pen or a scribe, for later re-assembly.

Measure and record shaft projection to bearing cover (dimension X, [8.24 Bearings on page 46](#)).

## 8.8 Discharge side drive

### 8.9 Dismantling of the bearings

a) Sleeve bearing, lubricated by the liquid handled (non-drive side)



**Figure 13: Axial suction nozzle**

- Remove bearing cover 160.1
- Remove circlip 932.1
- Pull out bearing bush 545.1/545.2 with O-rings 412.1
- Remove bearing sleeve 529.1



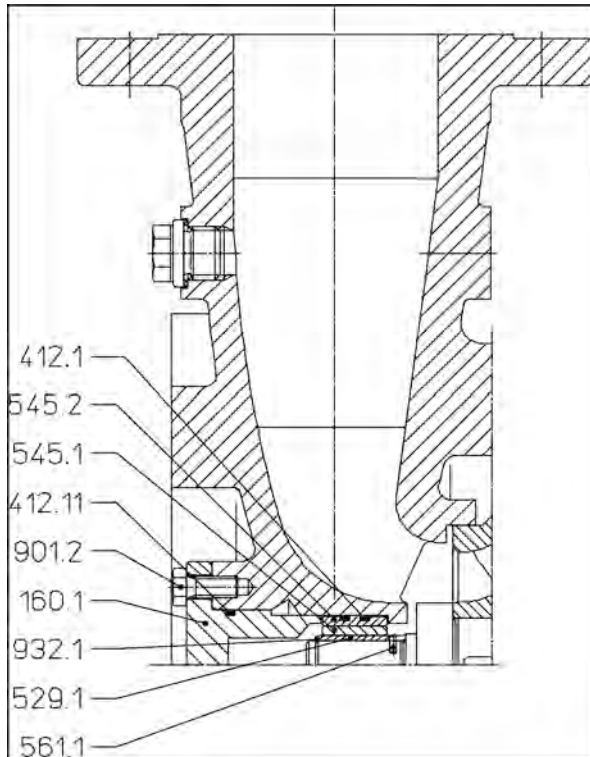
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**CAUTION:**

Anti-rotation grooved pin 561.1 must remain in the shaft.

Radial suction nozzle

- 
- Release hexagon head bolts 901.2



**Figure 14: Radial suction nozzle**

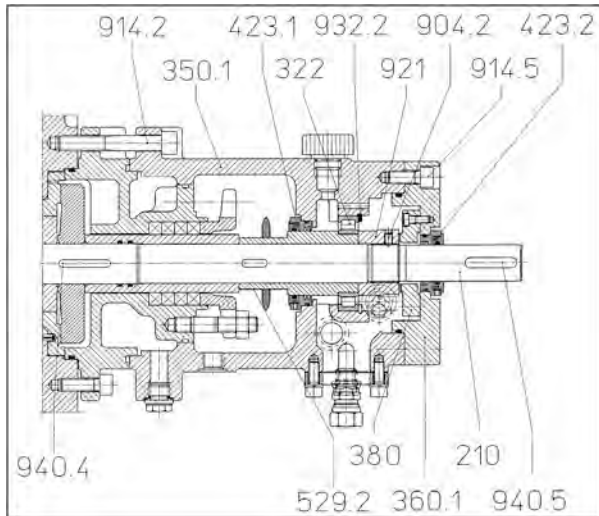
- Remove bearing cover 160.1 with O-ring 412.11
- Remove circlip 932.1
- Pull out bearing bush 545.1/545.2 with O-rings 412.1
- Remove bearing sleeve 529.1



**CAUTION:**

Anti-rotation grooved pin 561.1 must remain in the shaft.

- b) Anti-friction bearing,
- oil-lubricated – drive side
  - without lift-off device



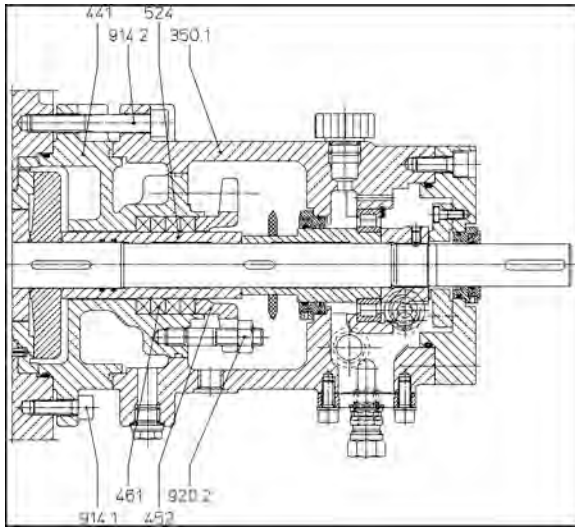
- If installed - remove cooling and/or circulation line
- Remove key 940.5
- Release bolts 914.5
- Remove bearing cover 360.1 with labyrinth ring 423.2 and limiting ring 380
- Release grub screw 904.2
- Remove circlip 932.2
- Support shaft 210 and key 940.5, and release shaft nut 921
- Release bolts 914.2
- Withdraw bearing housing 350.1, labyrinth ring 423.1, bearing 322 and bearing sleeve 529.2
- Remove key 940.4

c) Anti-friction bearing,

- oil-lubricated - drive side
- with lift-off device -
- If installed - remove cooling and/or circulation line
- Remove key 940.5
- Remove suction side bearing cover 160.1 as described under a) for axial or radial suction nozzle
- Fix shaft 210 axially on the suction side
- Release bolts 914.5
- Remove bearing cover 360.1 with labyrinth ring 423.2 and limiting ring 380
- Compress spring 950 by moving bearing carrier 382
- Remove circlip 932.3
- Remove bearing 321
- Release bolts 914.4
- Remove bearing housing 350.2 with bearing carrier 382 and spring 950
- Release grub screw 904.1
- Release bearing sleeve 529.3
- Remove circlip 932.2
- Pull spacer sleeve 525 from shaft 210
- Release bolts 914.2
- Withdraw bearing housing 350.1, labyrinth ring 423.1, bearing 322, bearing sleeve 529.2
- Remove key 940.4

## 8.10 Dismantling of shaft seal

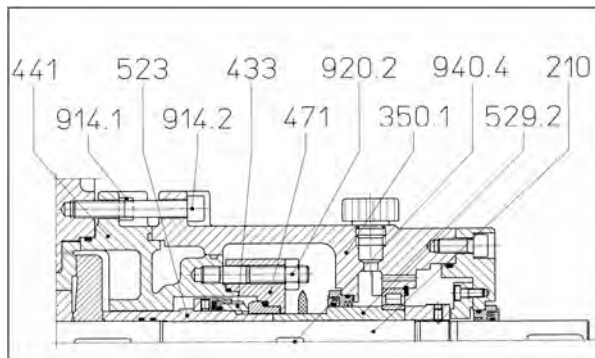
### a) Stuffing box packing



Dismantle bearings in accordance with 7.4.3.1.1 b) or c)

- Release nuts 920.2
- Slide back the stuffing box gland 452
- Remove packing rings 461
- Remove balancing line
- Release bolts 914.1
- Dismantle sealing casing 441
- Withdraw shaft wearing sleeve 524

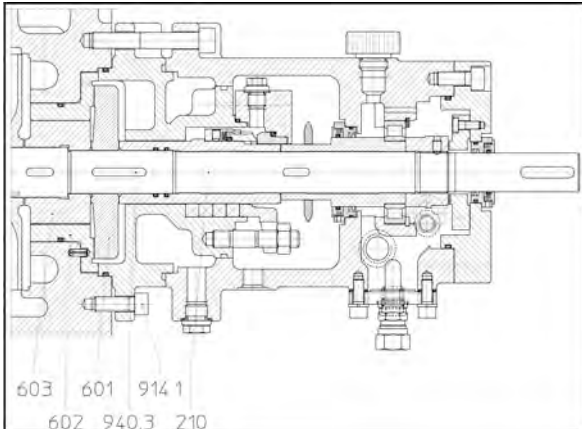
### b) Mechanical seal



Dismantle bearings in accordance with 7.4.3.1.1 b) or c)

- Release nuts 920.2
- Remove seal cover 471
- Remove balancing line
- Release bolts 914.1
- Withdraw sealing casing 441, mechanical seal 433 and shaft sleeve 523

## 8.11 Dismantling of balancing device

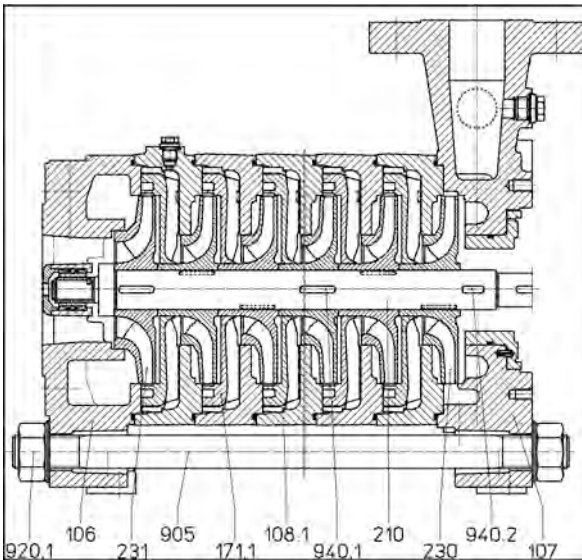


Dismantle bearings in accordance with 7.4.3.1.1 b) or c)

Dismantle shaft seal in accordance with 7.4.3.1.2 a) or b)

- Pull balance disc 601 from shaft 210
- Remove key 940.3
- Dismantle balance disc seat 602
- Pull balance drum 603 from shaft 210

## 8.12 Dismantling of hydraulic unit



Dismantle bearings in accordance with 7.4.3.1.1 b) or c)

Dismantle shaft seal in accordance with 7.4.3.1.2 a) or b)

Dismantle balancing device in accordance with 7.4.3.1.3

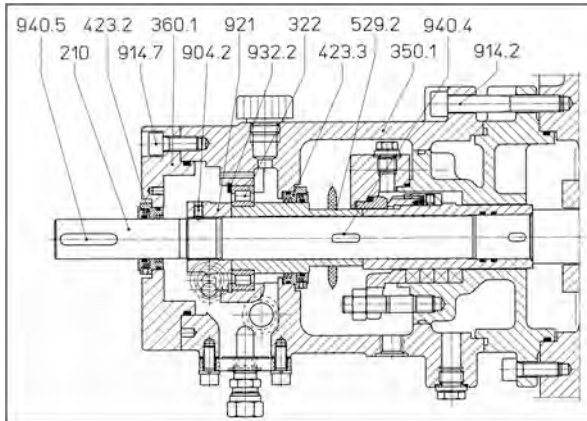
- Remove key 940.2
- Release nuts 920.1
- Remove tie bolts 905
- Support stage casing 108.1



- Dismantle delivery casing 107
- Remove, from stage to stage, impeller 230, key 940.1, stage casing 108.1 with diffuser 171.1, in that order

## 8.13 Suction side drive

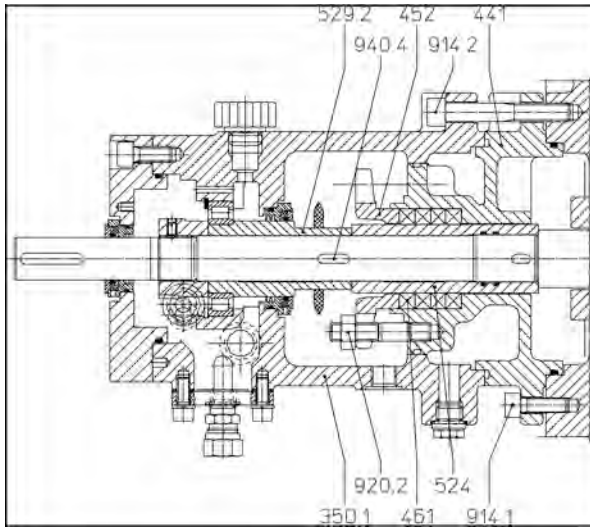
### 8.14 Dismantling the oil-lubricated anti-friction bearing - drive side



- If installed - remove cooling and/or circulation line
- Remove key 940.5
- Release bolts 914.7
- Dismantle bearing cover 360.1 with labyrinth ring 423.2
- Release grub screw 904.2
- Remove circlip 932.2
- Support shaft 210 and key 940.5, and release shaft nut 921
- Release bolts 914.2
- Withdraw bearing housing 350.1, labyrinth ring 423.3, bearing 322 and bearing sleeve 529.2
- Remove key 940.4

### 8.15 Dismantling the shaft seal - drive side

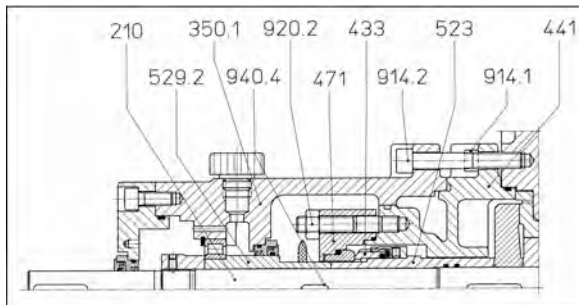
- a) Stuffing box packing



Dismantle bearings in accordance with 7.4.3.2.1

- Release nuts 920.2
- Slide back the stuffing box gland 452
- Remove packing rings 461
- Release bolts 914.1
- Remove sealing casing 441
- Withdraw shaft wearing sleeve 524

b) Mechanical seal

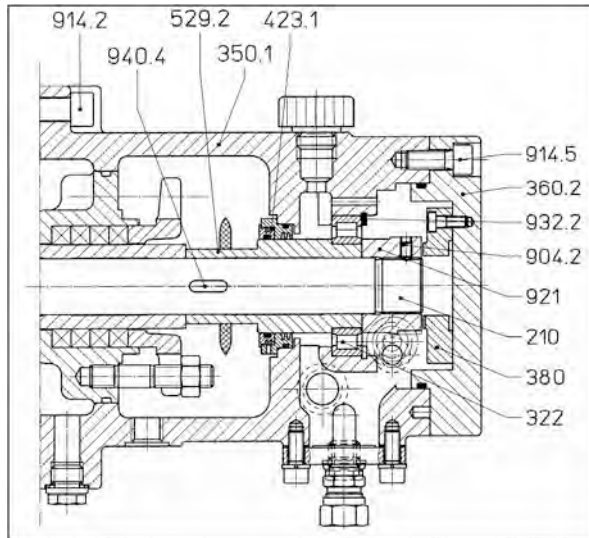


Dismantle bearings in accordance with 7.4.3.2.1

- Release nuts 920.2
- Dismantle seal cover 471
- Release bolts 914.1
- Withdraw sealing casing 441, mechanical seal 433 and shaft sleeve 523

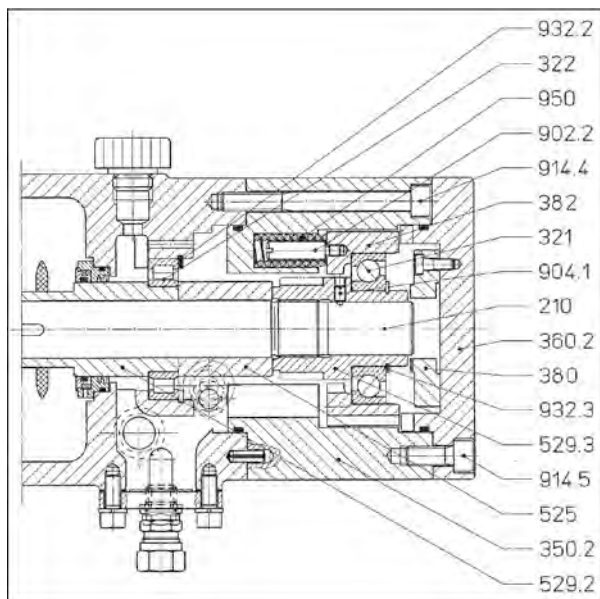
## 8.16 Dismantling of oil-lubricated anti-friction bearing- non-drive side

a) Without lift-off device



- If installed - remove cooling and/or circulation line
- Release bolts 914.5
- Remove bearing cover 360.2 with limiting ring 380
- Release grub screw 904.2
- Remove circlip 932.2
- Support shaft 210 on the drive side with key 940.5, and release shaft nut 921
- Release bolts 914.2
- Withdraw bearing housing 350.1, labyrinth ring 423.1, bearing 322 and bearing sleeve 529.2
- Remove key 940.4

b) With lift-off device

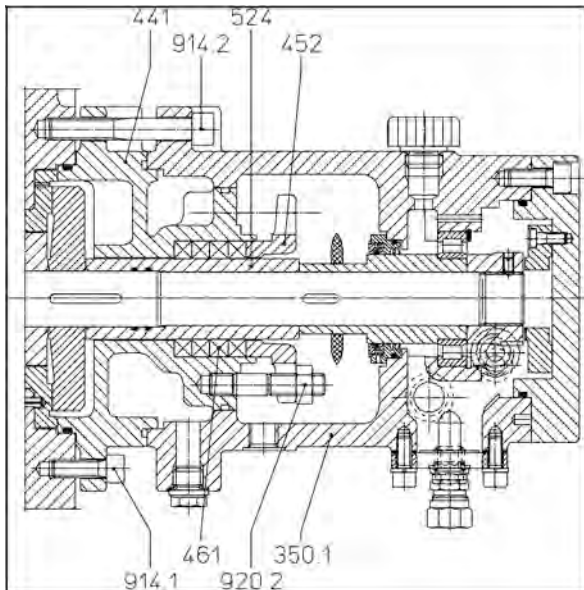


- If installed - remove cooling and/or circulation line
- Fix shaft 210 axially on the drive side
- Release bolts 914.5
- Remove bearing cover 360.2 with limiting ring 380

- Compress spring 950 by moving bearing carrier 382
- Remove circlip 932.3
- Remove bearing 321
- Release bolts 914.4
- Remove bearing housing 350.2 with bearing carrier 382 and spring 950
- Release grub screw 904.1
- Release bearing sleeve 529.3
- Remove circlip 932.2
- Pull spacer sleeve 525 from shaft 210
- Release bolts 914.2
- Withdraw bearing housing 350.1, labyrinth ring 423.1, bearing 322 and bearing sleeve 529.2
- Remove key 940.4

## 8.17 Dismantling of shaft seal - non-drive side

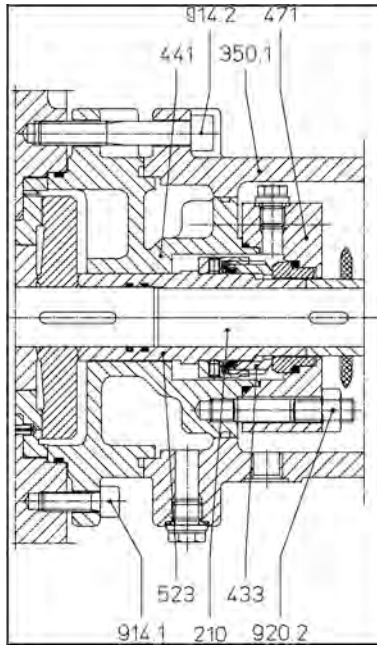
### a) Stuffing box packing



Dismantle bearings in accordance with 7.4.3.2.3 a) or b)

- Release nuts 920.2
- Slide back the stuffing box gland 452
- Remove packing rings 461
- Remove balancing line
- Release bolts 914.1
- Dismantle sealing casing 441
- Withdraw shaft wearing sleeve 524

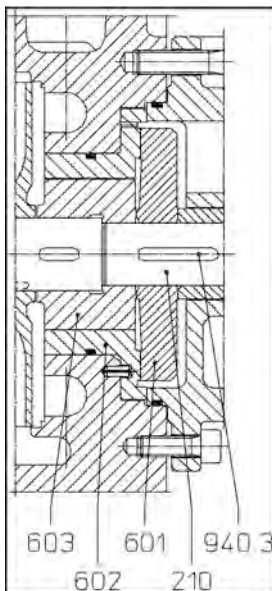
### b) Mechanical seal



Dismantle bearings in accordance with 7.4.3.2.3 a) or b)

- Release nuts 920.2
- Remove seal cover 471
- Remove balancing line
- Release bolts 914.1
- Withdraw sealing casing 441, mechanical seal 433 and shaft sleeve 523

## 8.18 Dismantling of the balancing device



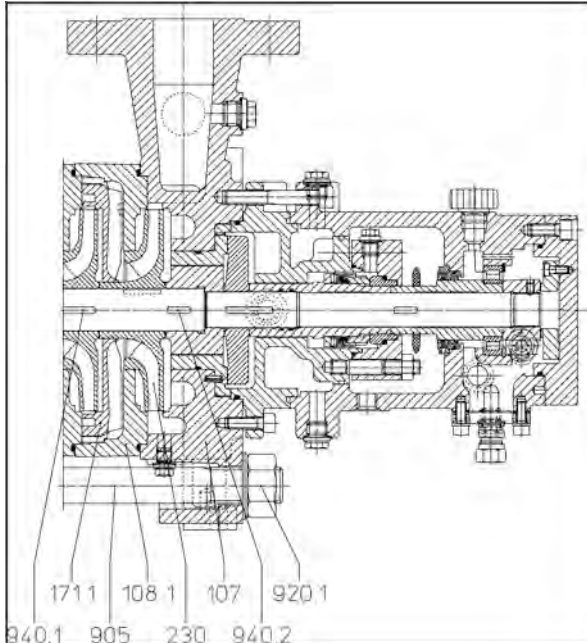
Dismantle bearings in accordance with 7.4.3.2.3 a) or b)

Dismantle shaft seal in accordance with 7.4.3.2.4 a) or b)

- Pull balance disc 601 from shaft 210
- Remove key 940.3

- Dismantle balance disc seat 602
- Pull balance drum 603 from shaft 210

## 8.19 Dismantling of hydraulic unit



Dismantle bearings in accordance with 7.4.3.2.3 a) or b)

Dismantle shaft seal in accordance with 7.4.3.2.4 a) or b)

Dismantle balancing device in accordance with 7.4.3.2.5

- Remove key 940.2
- Release nuts 920.1
- Remove tie bolts 905
- Support stage casing 108.1
- Remove delivery casing 107
- Remove, from stage to stage, impeller 230, key 940.1, stage casing 180.1 with diffuser 171.1, in that order

## 8.20 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 clearance area and casing or cover clearance area of a new pump is between 0.3 and 0.6 mm, depending on size and material. In the case of excessive wear in the clearance area, wear rings must be installed.

Shaft

Carry out a concentricity check.

## 8.21 Assembly



### CAUTION:

The assembly work must be based on good engineering practice.

- Use no force.
- Heavy parts must be supported during assembly.
- Before assembly, apply a layer of an appropriate erection substance on the fitting points. Observe instructions with regard to cleanliness and safety.
- The properties of new pump components must not be changed without our head office's consent.
- All parts must be clean and free from chips or dust.
- The unit may be re-assembled in the reverse manner to disassembling.
- Observe the tightening torques specified.
- Quick-sticking glues are not permitted.

Tightening torques

Size 2x3-7				
No. of stages	≤ 12	13 - 15	16 - 18	
Tightening torque	710 Nm	850 Nm	900 Nm	

Size 2.5x4-8				
No. of stages	≤ 8	9 - 13	14 - 18	
Tightening torque	610 Nm	920 Nm	980 Nm	

Size 4x5-11				
No. of stages	≤ 4	5 - 8	9 - 12	13 - 15
Tightening torque	790 Nm	1420 Nm	1570 Nm	1790 Nm

## 8.22 Pump assembly

- Installation starts on the suction side.
- The pump should be assembled in a vertical position, if possible.
- Install the parts in their original position.
- 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 (nominal tightening torque at last stage).

## 8.23 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 wearing 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 tightened at a slant.

**CAUTION:**

- The pump rotating assembly must be free to rotate by hand.
- The stuffing box leakage must not be adjusted until start-up (Refer to [7 Starting & Stopping Procedures on page 28](#)).

Dimensions in mm	Pump size		
	2x3-7	2.5x4-8	4x5-11
Packing cross-section	10	10 12.5	
Number of rings	4	5	
Shaft diameter	45	75 95	

## Mechanical seals

**CAUTION:**

- Utmost care should be taken when mounting the rotary and stationary seal rings so as to avoid contamination and/or distortion on the sealing 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 axial installation dimension against the installation drawing.

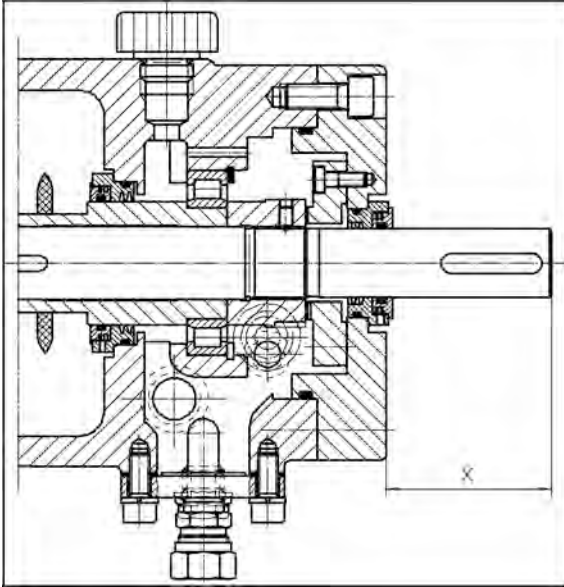
Install the mechanical seal in the reverse manner to disassembling.

## 8.24 Bearings

## Discharge side drive

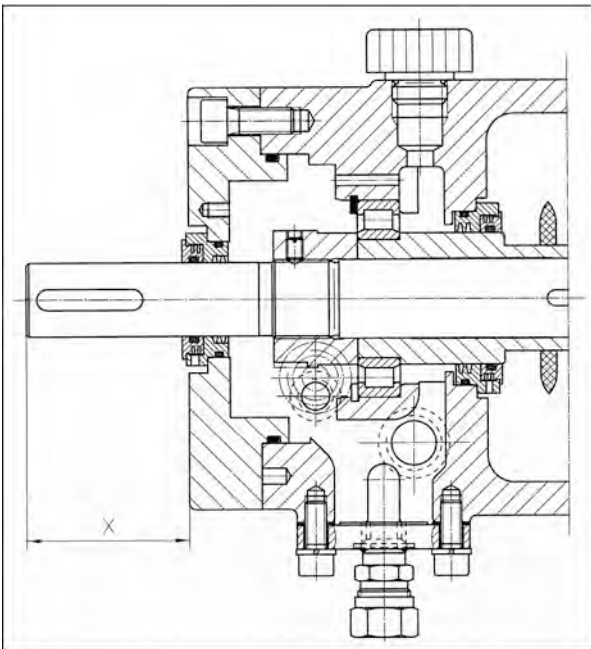
- Install sleeve bearing in the reverse manner to disassembling.
- Install anti-friction bearing with or without lift-off device in the reverse manner to disassembling.



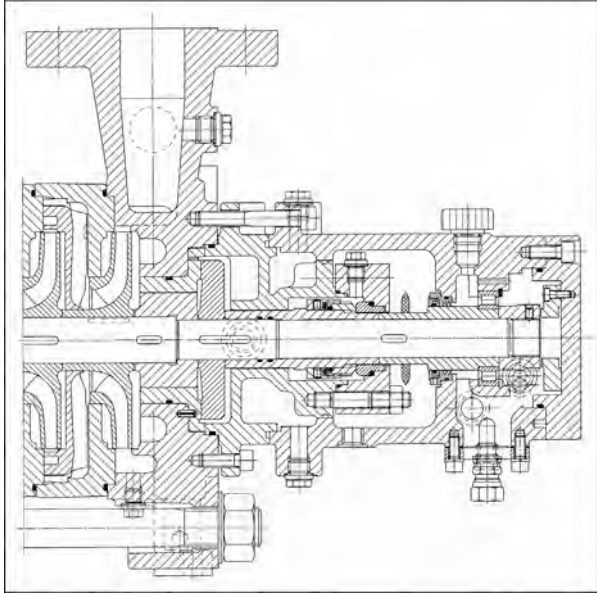
**CAUTION:**

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

## Suction side drive



Install suction side anti-friction bearing in the reverse manner to disassembling.



Install discharge side anti-friction bearing, without or with lift-off device in the reverse manner to disassembling.



---

**CAUTION:**

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

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# 9 Locating Troubles

## 9.1 Troubles and possible causes

Trouble	Cause	Remedial action
Insufficient liquid delivered	Wrong direction of rotation.	Re-connect the motor.
	Discharge pressure too high.	Check the system for contaminants, re-adjust 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, or install 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 not tight enough.	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 clearances.	Install wear rings, diaphragm bushes.
	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.	

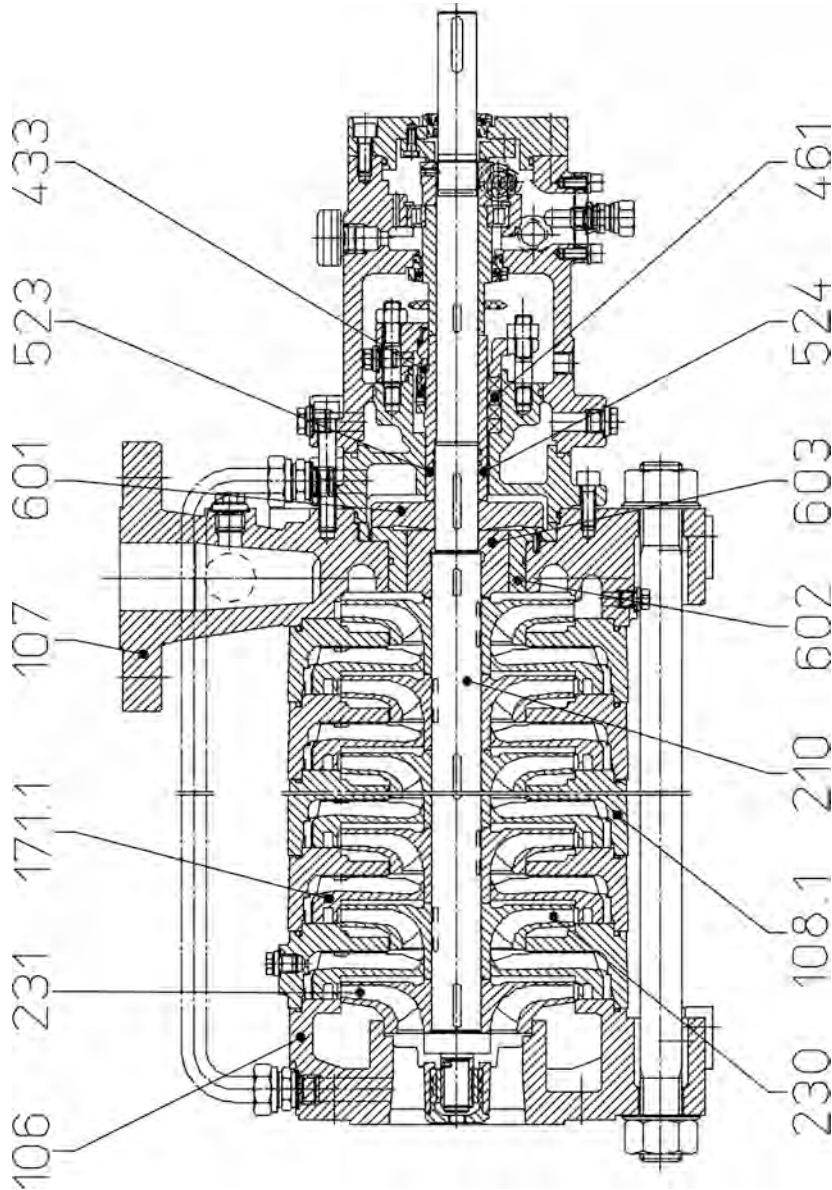
9.1 Troubles and possible causes

Unsteady running of pump, excessive noise	Flow rate too low / too high.	Ensure minimum flow / throttle discharge side shut-off 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.
	Base of the pump not level. Pump distorted.	Check pump installation and adjustment.
	Foreign substances in the pump.	Open the pump and clean it.
Motor circuit breaker switches off	Requirements as to pumping conditions not met.	Check the pumping conditions against the data sheet.
	Base of the pump not level. Pump distorted.	Check the installation and alignment of the pump.
	Foreign substances in the pump.	Open the pump and clean it.

# 10 Sectional Drawing / Parts List

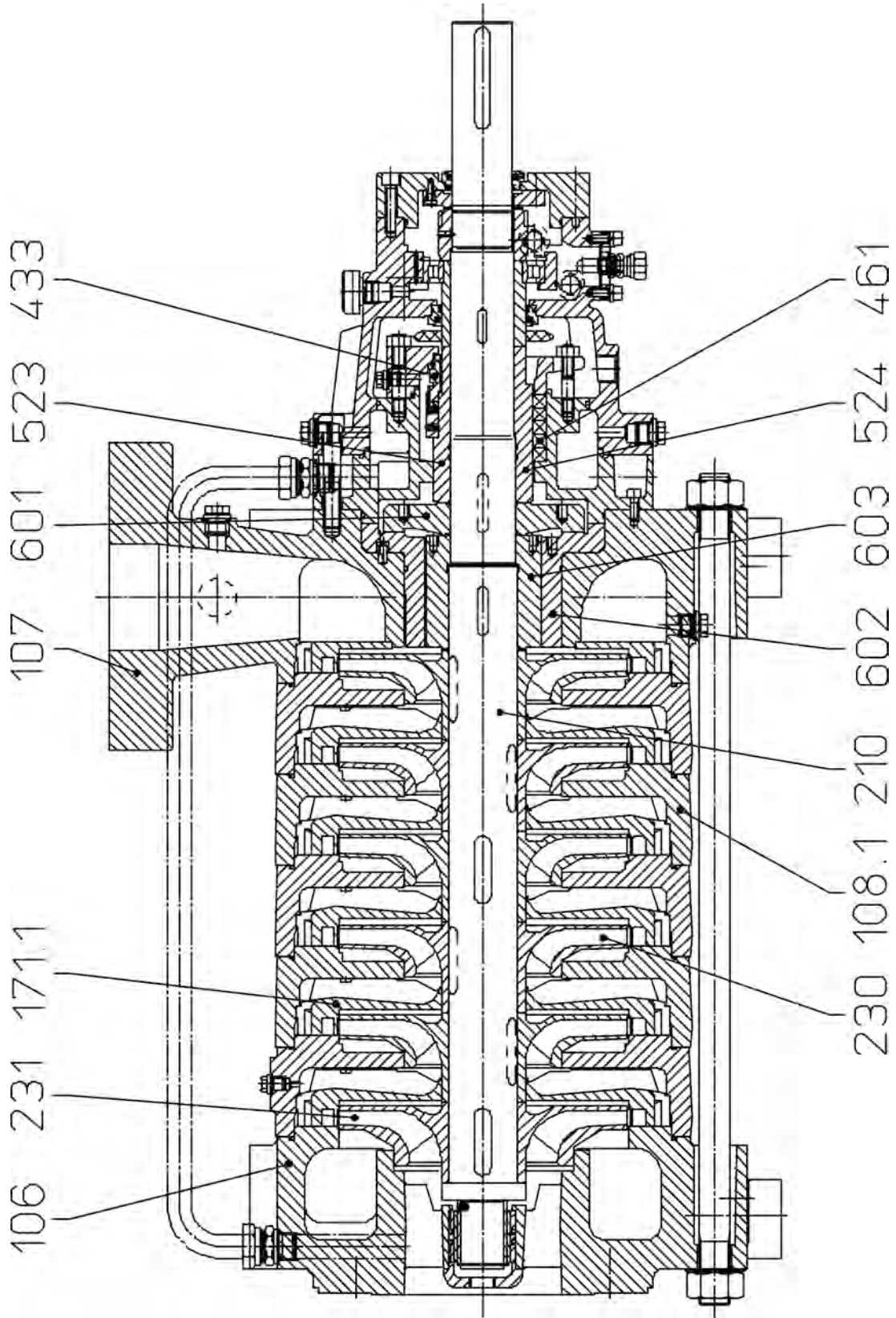
## 10.1 Sectional Drawing – Size: 2x3-7

Discharge side drive - with axial inlet, without lift-off device



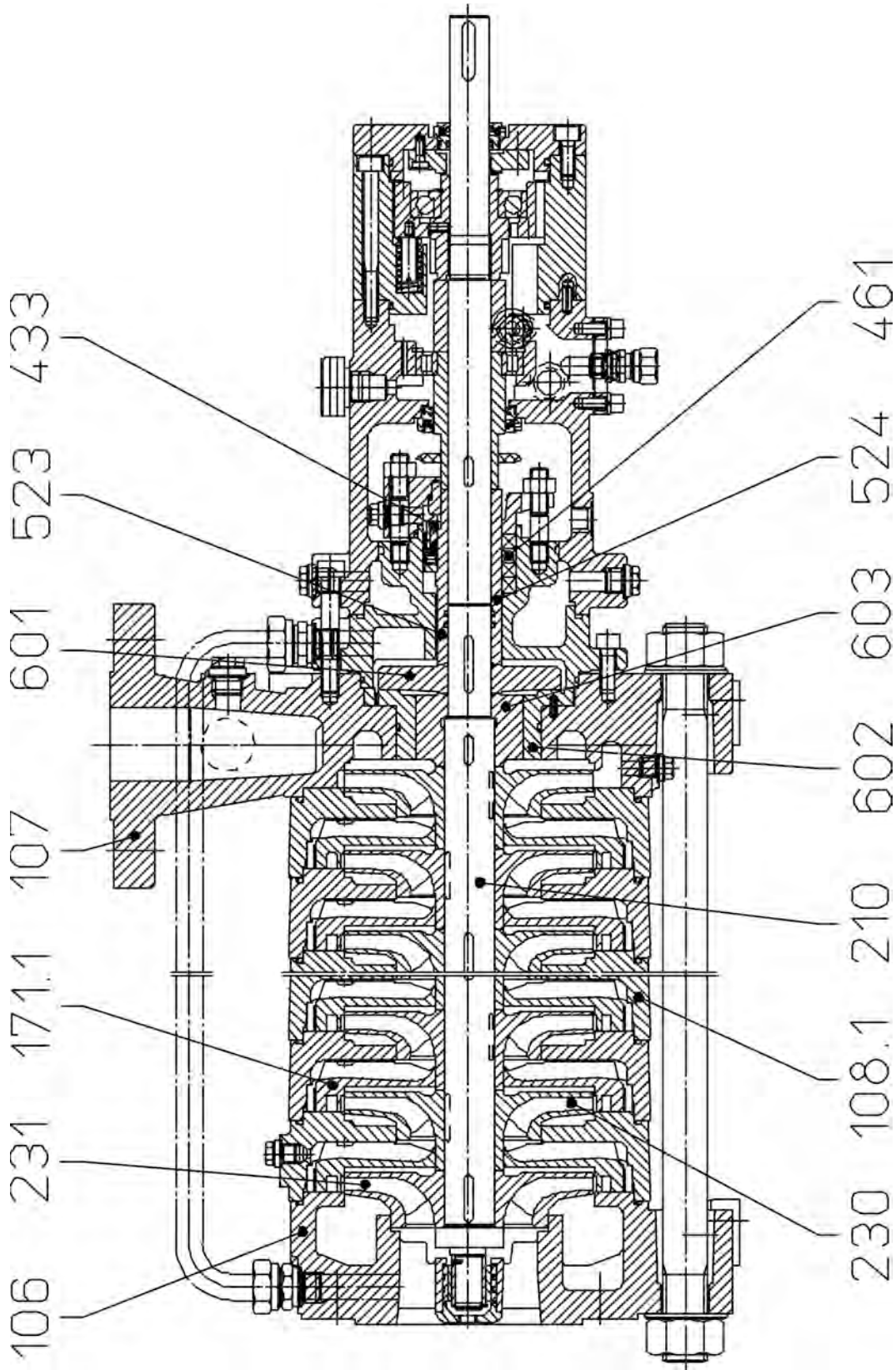
## 10.2 Sectional Drawing – Size: 2.5x4-8 & 4x5-11

Discharge side drive - with axial inlet, without lift-off device



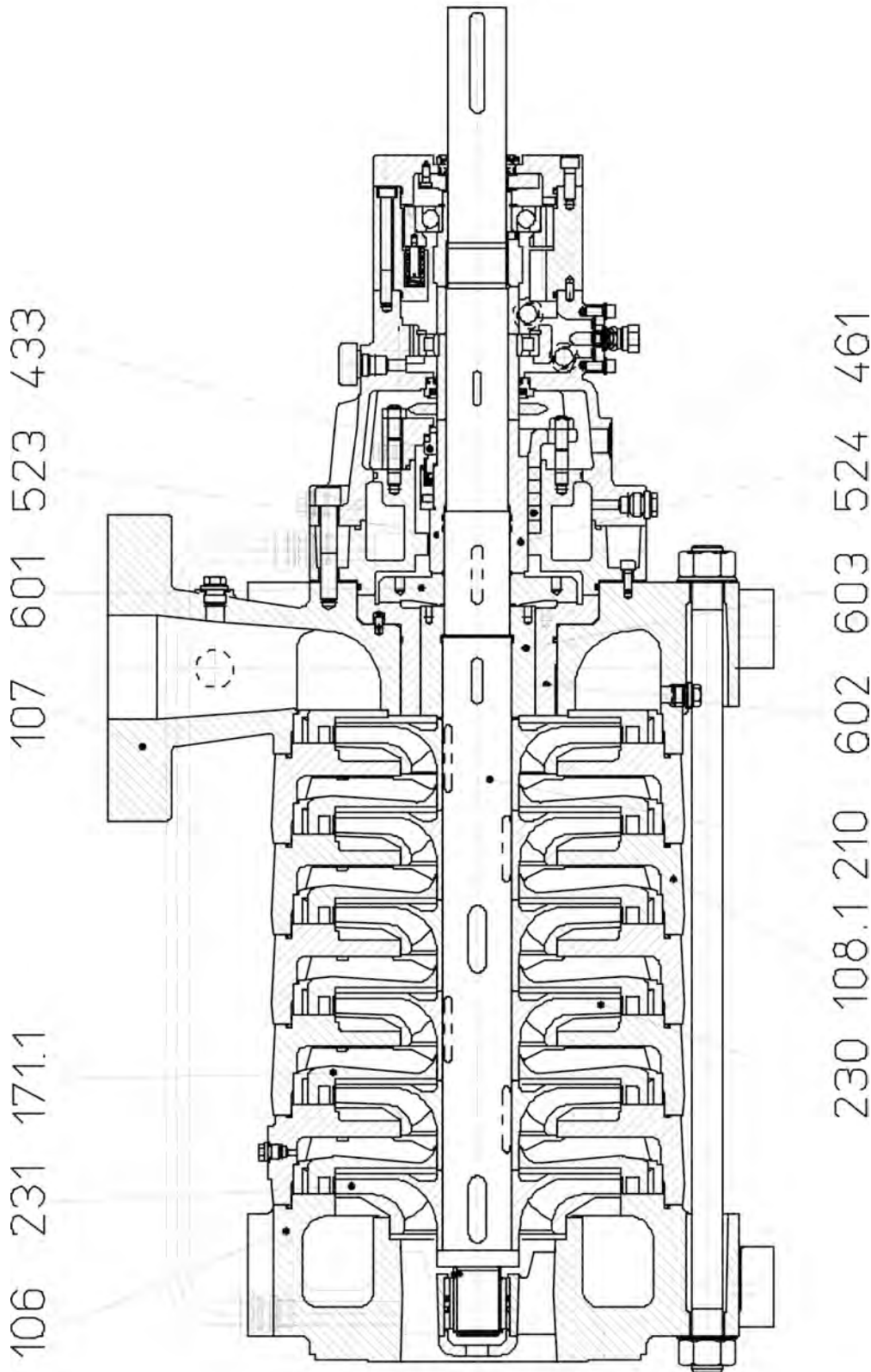
### 10.3 Sectional Drawing – Size: 2x3-7

Discharge side drive - with axial inlet, with lift-off device



## 10.4 Sectional Drawing – Size: 2.5x4-8 & 4x5-11

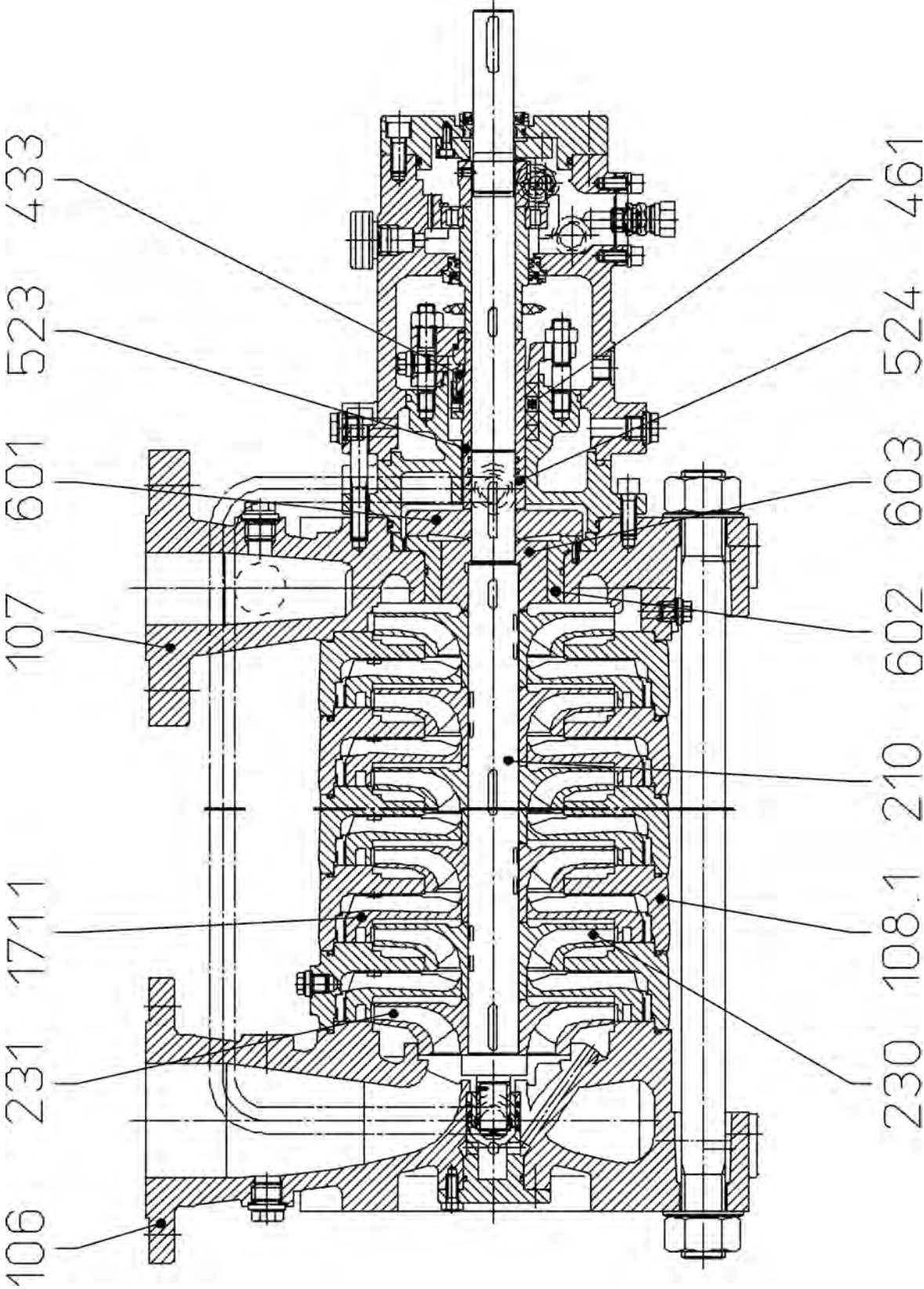
Discharge side drive - with axial inlet, with lift-off device





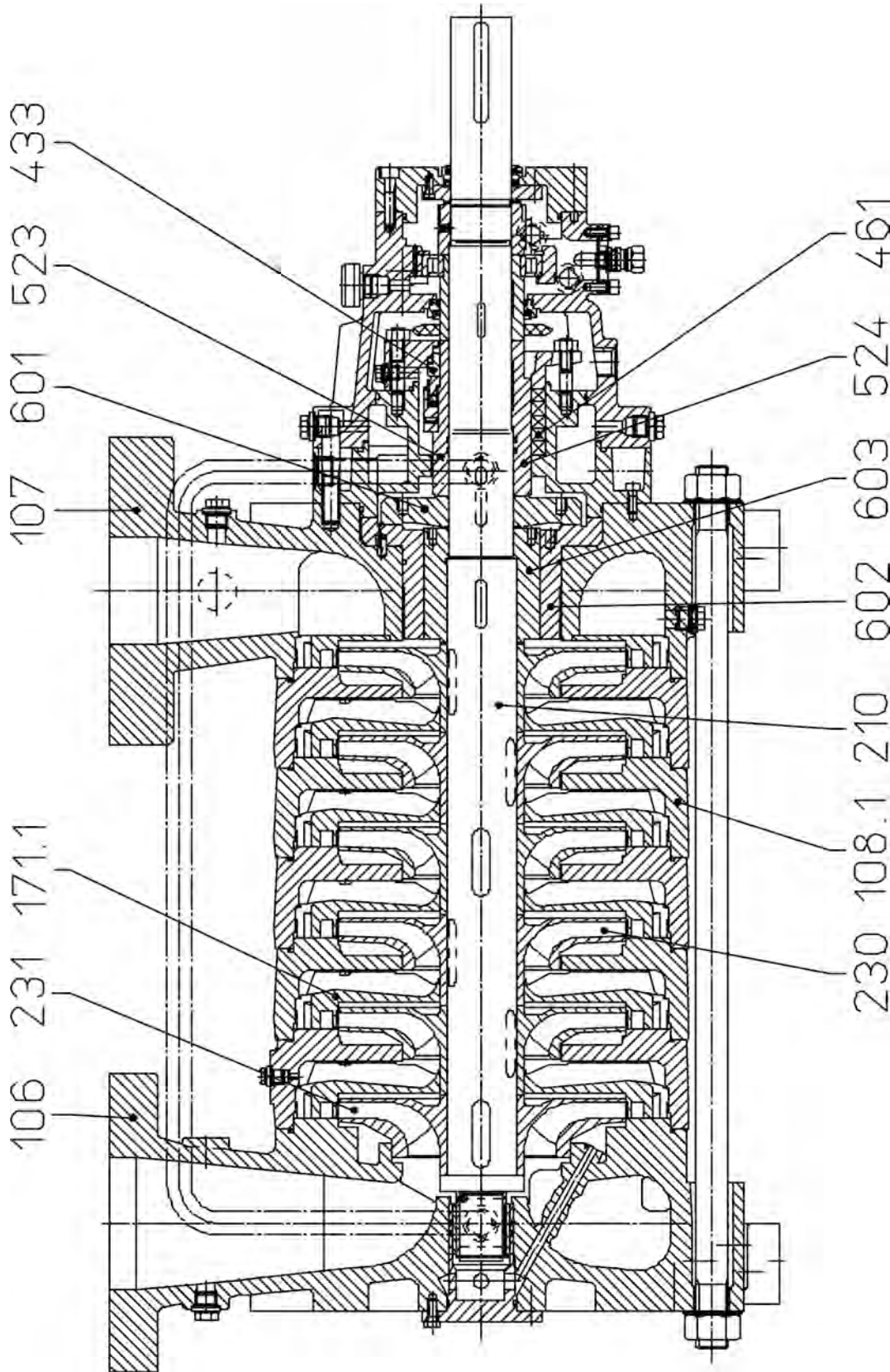
# 10.5 Sectional Drawing – Size: 2x3-7

Discharge side drive - with radial inlet, without lift-off device



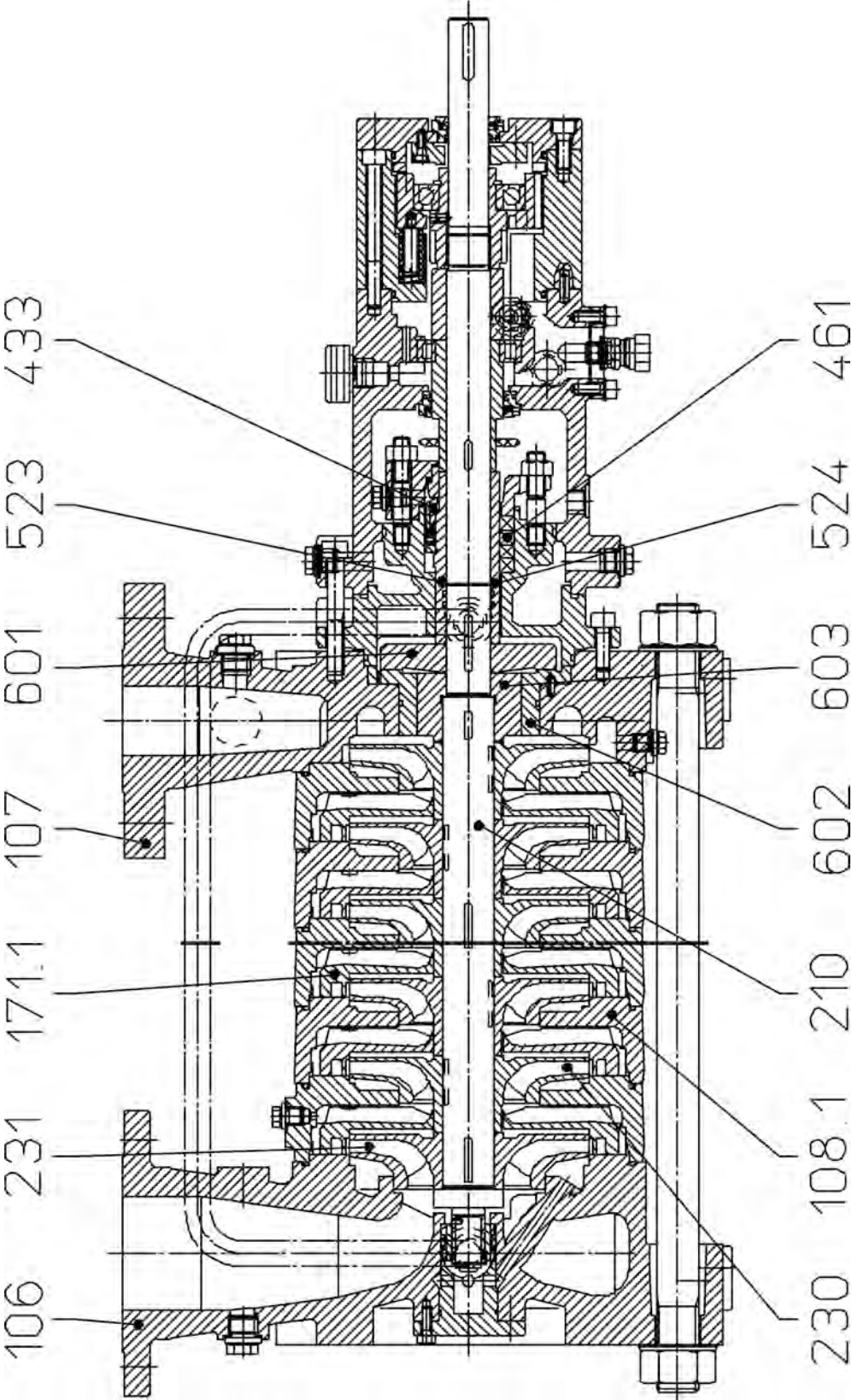
## 10.6 Sectional Drawing – Size: 2.5x4-8 & 4x5-11

Discharge side drive - with radial inlet, without lift-off device



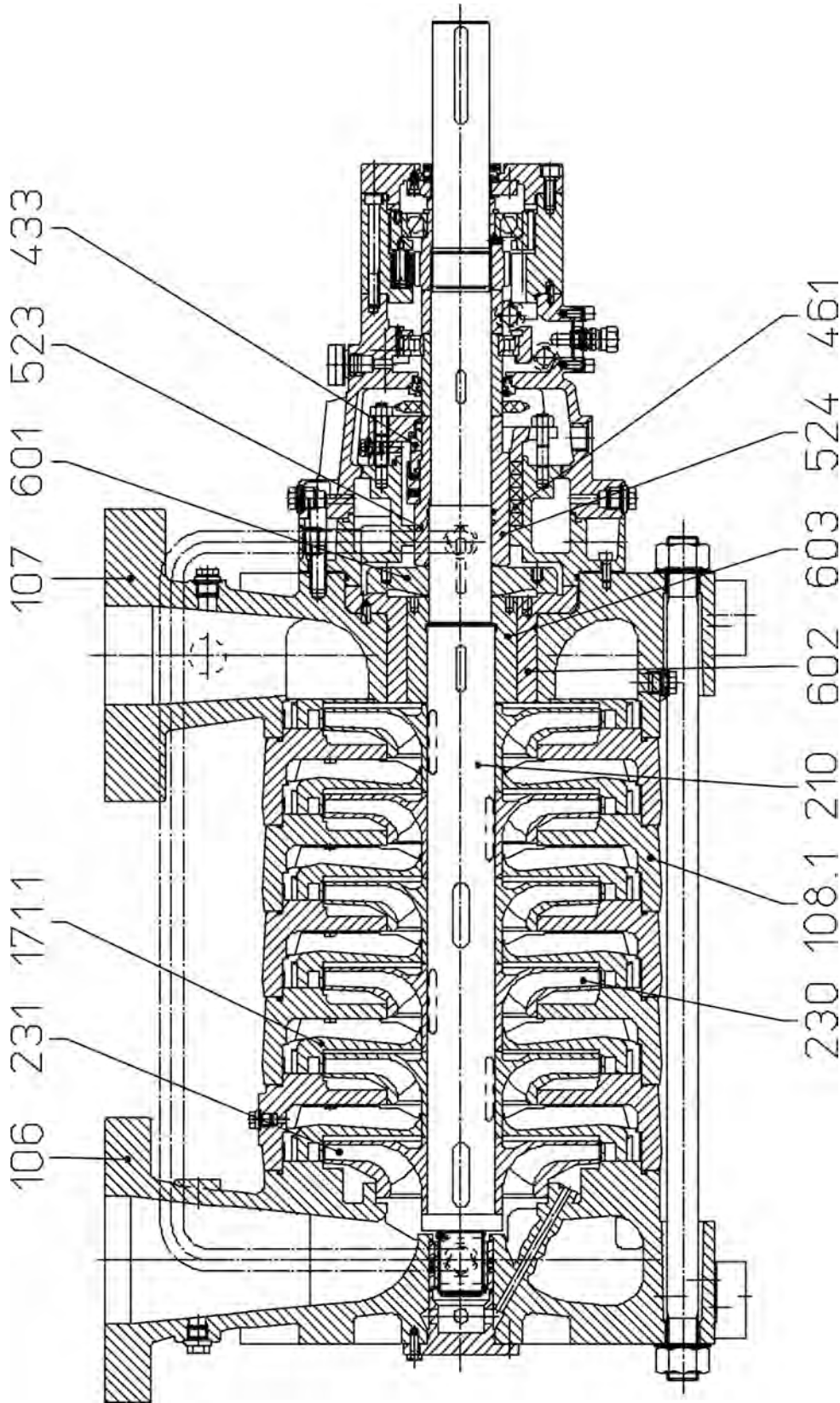
# 10.7 Sectional Drawing – Size: 2x3-7

Discharge side drive - with radial inlet, with lift-off device



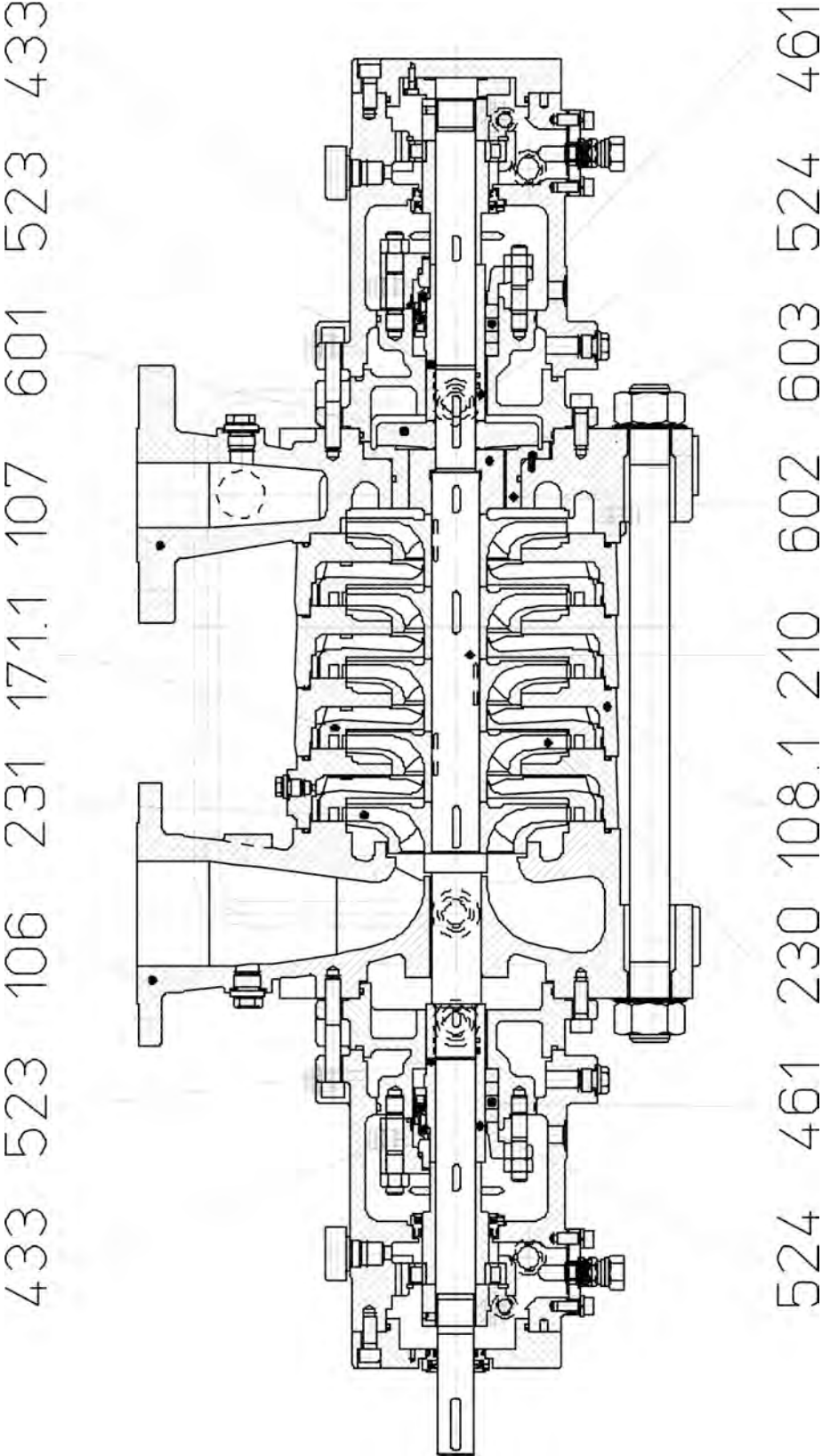
## 10.8 Sectional Drawing – Size: 2.5x4-8 & 4x5-11

Discharge side drive - with radial inlet, with lift-off device



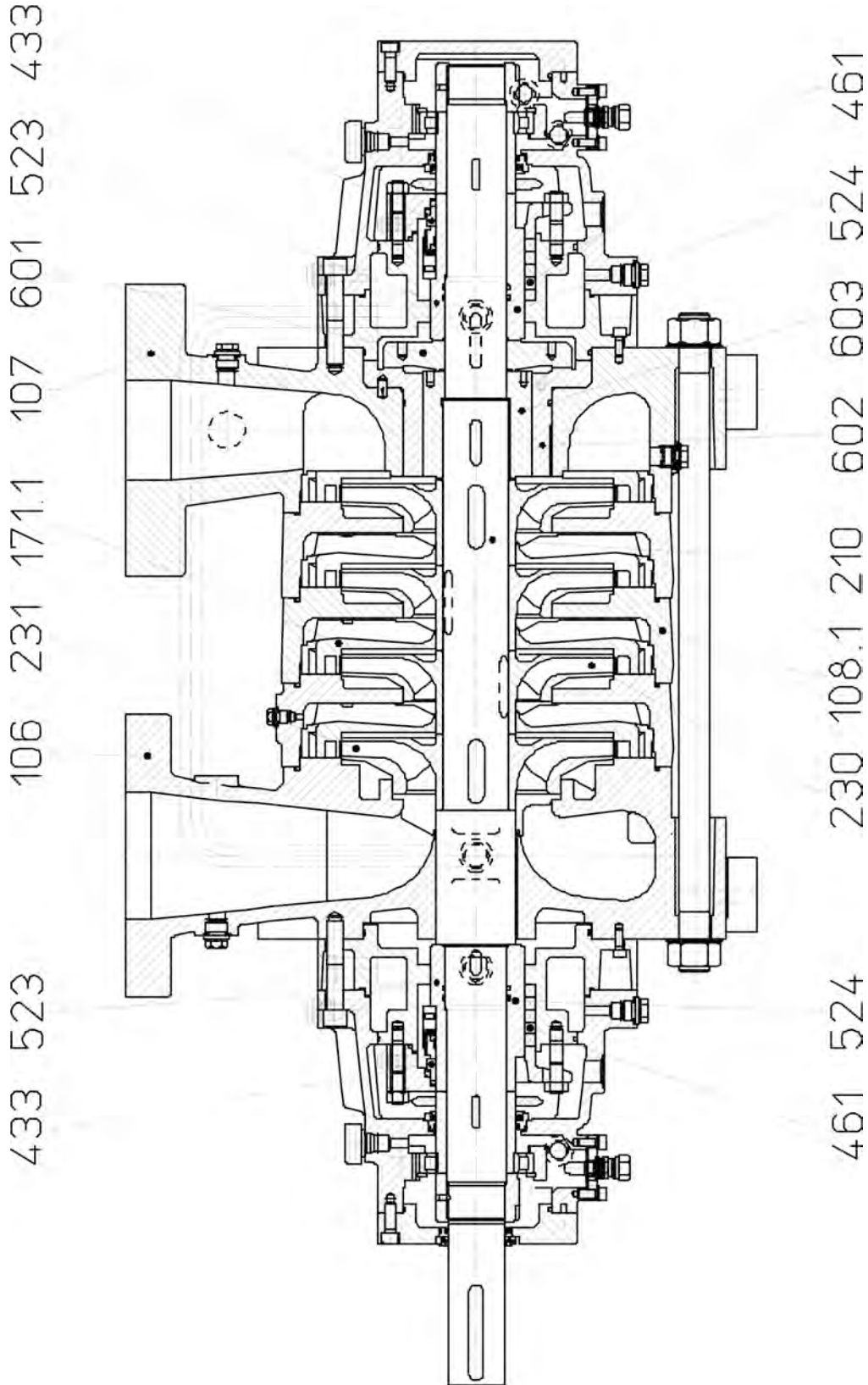
# 10.9 Sectional Drawing – Size: 2x3-7

Suction side drive - without lift-off device



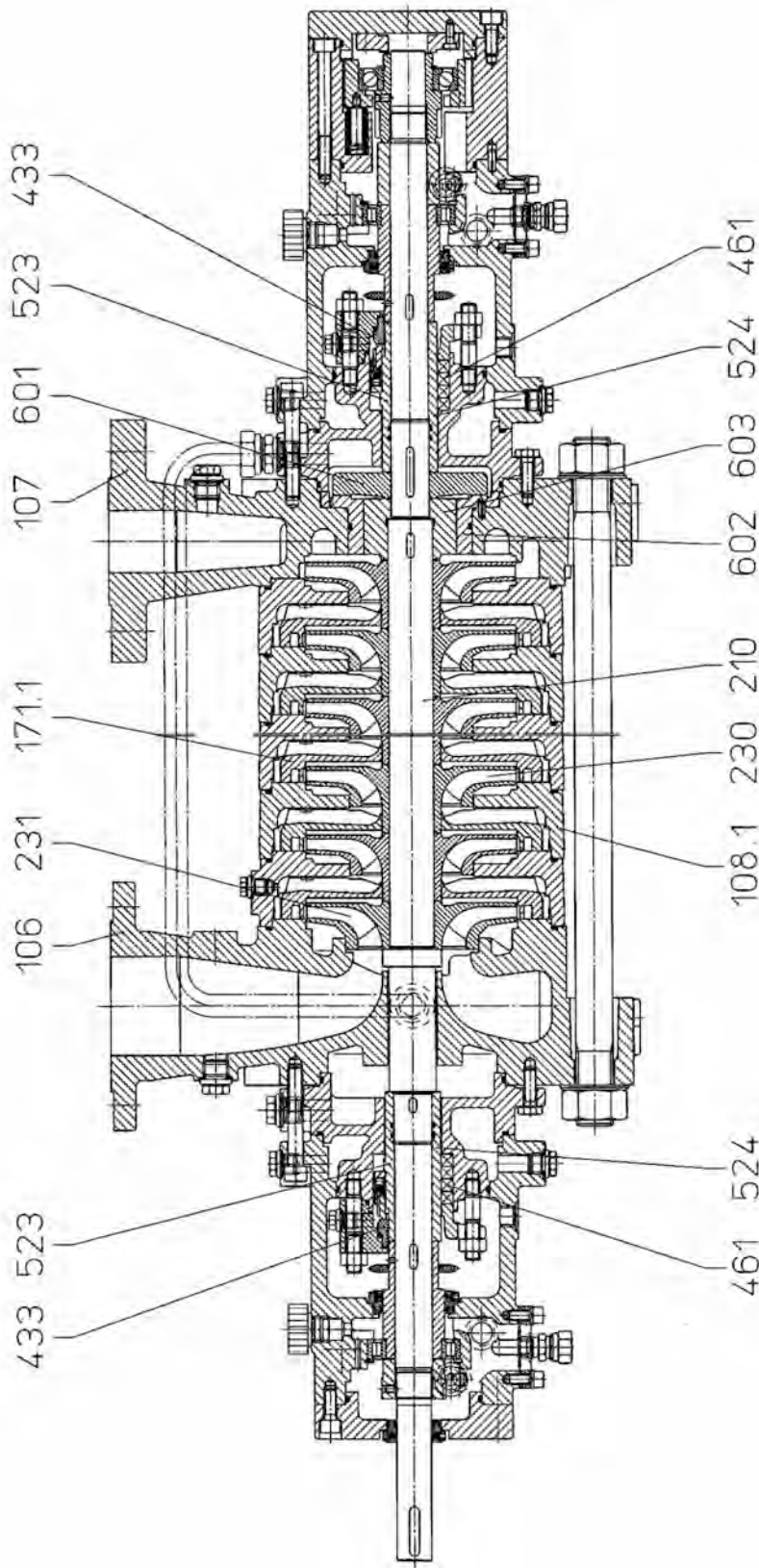
## 10.10 Sectional Drawing – Size: 2.5x4-8 & 4x5-11

Suction side drive - without lift-off device



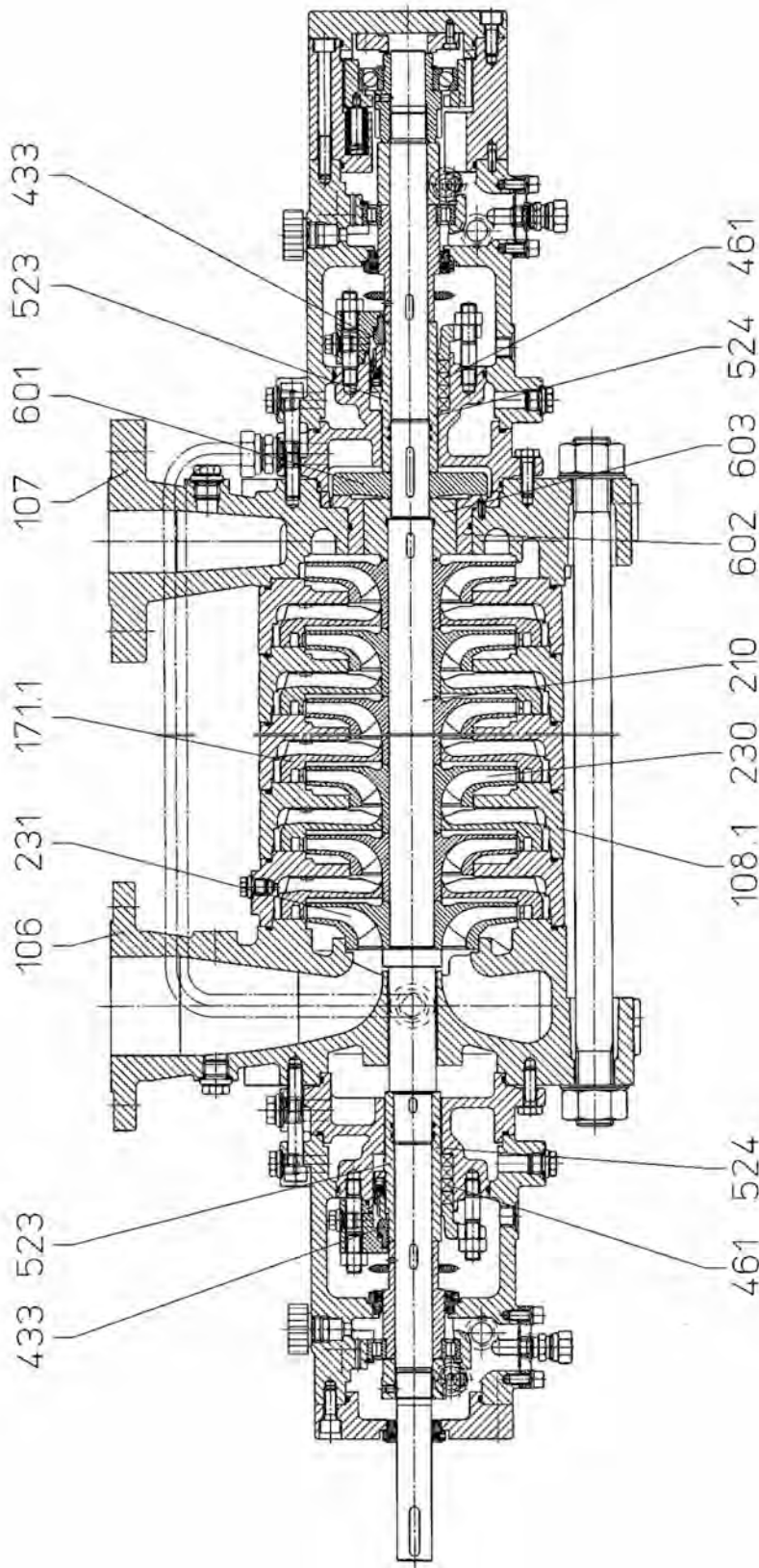
# 10.11 Sectional Drawing – Size: 2x3-7

Suction side drive - with lift-off device



## 10.12 Sectional Drawing – Size: 2.5x4-8 & 4x5-11

Suction side drive - with lift-off device





## 10.13 Parts list

Gould's Item #	Part number DIN	Denomination
100S	106	Suction casing
100D	107	Delivery casing
100G	108/108.1	Stage casing
100T	108.2	Stage casing with extraction
109C	160.1	Bearing cover
119C	160.2	Oil room cover
150	171.1	Diffuser
150L	171.2	Diffuser last stage
239	182	Foot
122	210	Shaft
101	230	Impeller
301	231	Suction impeller
409	322	Bearing
228C / 134	350.1/.2	Bearing housing
109	360.1/.2	Bearing cover
458	380	Limiting ring
443B	382	Bearing carrier
360E	400	Gasket
351W	411.1/.2/.3	Joint ring
412 / 496	412.1/.2/.../.11	O-Ring
332 / 333	423.1/.2	Labyrinth ring
383	433	Mechanical seal
184	441	Sealing casing
107 / 250	452	Stuffing box gland
106	461	Packing ring
383	471	Seal cover
123	507	Thrower
126 / 258	523	Shaft sleeve
126	524	Shaft wearing sleeve
157	525	Spacer sleeve
157B / 521	529.1/.2/.3	Bearing sleeve
197A / 408	545.1/.2	Bearing bush
437	550.1/.2	Disc
445	561.1	Grooved pin
469 / 819	561.2/.3/.4	Grooved pin
297	601	Balance disc
298	602	Balance disc seat
300	603	Balance drum
251	642	Oil level sight glass
113A	672	Venting device
370	901.1/.2	Hexagon head bolt
353 / 375	902.1/.2	Stud
492Q / 358X	903.1/.2	Screwed plug
228C	904.1/.2	Grub screw

## 10.13 Parts list

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356S	905	Tie bolt
113	913	Vent plug
341 / 370 / 371 / 372	914.1/.2.../.6	Hexagon socket head cap screw
355 / 357F	920.1/.2	Nut
124	921	Shaft nut
843	930	Safety device
361	932.1/.2/.3	Circlip
178 / 400 / 401	940.1/.2/.3/.4/.5	Key
708	950	Compress spring

### HOW TO ORDER

When ordering parts call  
1-800-446-8537  
or your local Goulds Representative  
Emergency parts service is available

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