Johnson Pump®

INSTRUCTION MANUAL

CombiFlex Universal

Vertical centrifugal pump

REVISION: CFU/EN (2502) 4.4

SPXFLOW®

Orginal instructions

Read and understand this manual prior to operating or servicing this product.

EC Declaration of Conformity

(Directive 2006/42/EC, appendix II-A)

Manufacturer

SPX Flow Technology Assen B.V.
Dr. A.F. Philipsweg 51
9403 AD Assen
The Netherlands

hereby declares that all pumps member of product-families, CombiFlex(U)(B), CombiPrime H, CombiMag, CombiMagBloc, CombiPro(L)(M)(V), CombiPrime V, CombiSump, CombiTherm, CombiWell, FRE, FRES, FREF, FREM, KGE(L), KGEF, MCH(W)(S), MCHZ(W)(S), MCV(S) whether delivered without drive, or delivered as an assembly with drive, are in conformity with the provisions of Directive 2006/42/EC (as altered most recently) and where applicable the following directives and standards:

- EC directive 2014/35/EU, "Electric equipment for use within certain voltage limits"
- EC directive 2014/30/EU, “ElectroMagnetic Compatibility”
- standards EN-ISO 12100, EN 809
- standard EN 60204-1 if applicable

The pumps to which this declaration refers may only be put into operation after they have been installed in the way prescribed by the manufacturer, and, as the case may be, after the complete system of which these pumps form part, has been made to fulfil all applicable essential Health & Safety requirements.

EC Declaration of Incorporation

(Directive 2006/42/EC, appendix II-B)

Manufacturer

SPX Flow Technology Assen B.V.
Dr. A.F. Philipsweg 51
9403 AD Assen
The Netherlands

hereby declares that the partly completed pump (Back-Pull-Out unit), member of product-families CombiFlex(U)(B), CombiPrime H, CombiMag, CombiMagBloc, CombiTherm, CombiPro(L)(M)(V), CombiPrime V, FRE, FRES, FREF, FREM, KGE(L), KGEF is in conformity with the provisions of Directive 2006/42/EC as well as with the following standards:

- EN-ISO 12100, EN 809

and that this partly completed pump is meant to be incorporated into the specified pump unit and may only be put into use after the complete machine of which the pump under consideration forms part has been made and declared to comply with all Directives.

These declarations are issued under the sole responsibility of the manufacturer

Assen, October 1st 2024

H. Hoving,

Director Operations.

Instruction manual

SPX FLOW is a global multi-industry manufacturing leader. The company's highly-specialized, engineered products and innovative technologies are helping to meet rising global demand for electricity and processed foods and beverages, particularly in emerging markets.

SPX Flow Technology Assen B.V.
Dr. A. F. Philipsweg 51
9403 AD Assen
The Netherlands

Tel. +31 (0)592 376767
Fax. +31 (0)592 376760

Table of Contents

1 Introduction

1.1 Preface

This manual is intended for technicians and maintenance staff and for those who are in charge of ordering spare parts.

This manual contains important and useful information for the proper operation and maintenance of this pump. It also contains important instructions to prevent potential accidents and damage, and to ensure safe and fault-free operation of this pump.

! **Read this manual carefully before commissioning the pump, familiarize yourself with the operation of the pump and strictly obey the instructions!**

The data published here comply with the most recent information at the time of going to press. However they may be subject to later modifications.

SPXFLOW reserves the right to change the construction and design of the products at any time without being obliged to change earlier deliveries accordingly.

1.2 Safety

This manual contains instructions for working safely with the pump. Operators and maintenance staff must be familiar with these instructions.
Installation, operation and maintenance has to be done by qualified and well prepared personnel.

Below is a list of the symbols used for those instructions and their meaning:

⚠ ***Personal danger for the user. Strict and prompt observance of the corresponding instruction is imperative!***

! **Risk of damage or poor operation of the pump. Follow the corresponding instruction to avoid this risk.**

➢ *Useful instruction or tip for the user.*

Items which require extra attention are shown in **bold print**.

This manual has been compiled by SPXFLOW with the utmost care. Nevertheless SPXFLOW cannot guarantee the completeness of this information and therefore assumes no liability for possible deficiencies in this manual. The buyer/user shall at all times be responsible for testing the information and for taking any additional and/or deviating safety measures. SPXFLOW reserves the right to change safety instructions.

1.3 Guarantee

SPXFLOW shall not be bound to any guarantee other than the guarantee accepted by SPXFLOW. In particular, SPXFLOW will not assume any liability for explicit and/or implicit guarantees such as but not limited to the marketability and/or suitability of the products supplied.

The guarantee will be cancelled immediately and legally if:

- Service and/or maintenance is not undertaken in strict accordance with the instructions.
- The pump is not installed and operated in accordance with the instructions.
- Necessary repairs are not undertaken by our personnel or are undertaken without our prior written permission.
- Modifications are made to the products supplied without our prior written permission.
- The spare parts used are not original SPXFLOW parts.
- Additives or lubricants used are other than those prescribed.
- The products supplied are not used in accordance with their nature and/or purpose.
- The products supplied have been used amateurishly, carelessly, improperly and/or negligently.
- The products supplied become defective due to external circumstances beyond our control.

All parts which are liable to wear are excluded from guarantee. Furthermore, all deliveries are subject to our "General conditions of delivery and payment", which will be forwarded to you free of charge on request.

1.4 Inspection of delivered items

Check the consignment immediately on arrival for damage and conformity with the advice note. In case of damage and/or missing parts, have a report drawn up by the carrier at once.

1.5 Instructions for transport and storage

1.5.1 Weight

A pump or a pump unit is generally too heavy to be moved by hand. Therefore, use the correct transport and lifting equipment. Weight of the pump or pump unit are shown on the label on the cover of this manual.

1.5.2 Use of pallets

Usually a pump or pump unit is shipped on a pallet. Leave it on the pallet as long as possible to avoid damages and to facilitate possible internal transport.

! When using a forklift always set the forks as far apart as possible and lift the package with both forks to prevent it from toppling over! Avoid jolting the pump when moving it!

1.5.3 Hoisting

When hoisting a pump or complete pump units the straps must be fixed in accordance with figure 1.

⚠ ***When lifting a pump or a complete pump unit always use a proper and sound lifting device, approved to bear the total weight of the load!***

⚠ ***Never go underneath a load that is being lifted!***

! **If the electric motor is provided with a lifting eye, this lifting eye is intended only for the purpose of carrying out service activities to the electric motor! The lifting eye is designed to bear the weight of the electric motor only! It is NOT permitted to lift a complete pump unit at the lifting eye of an electric motor!**

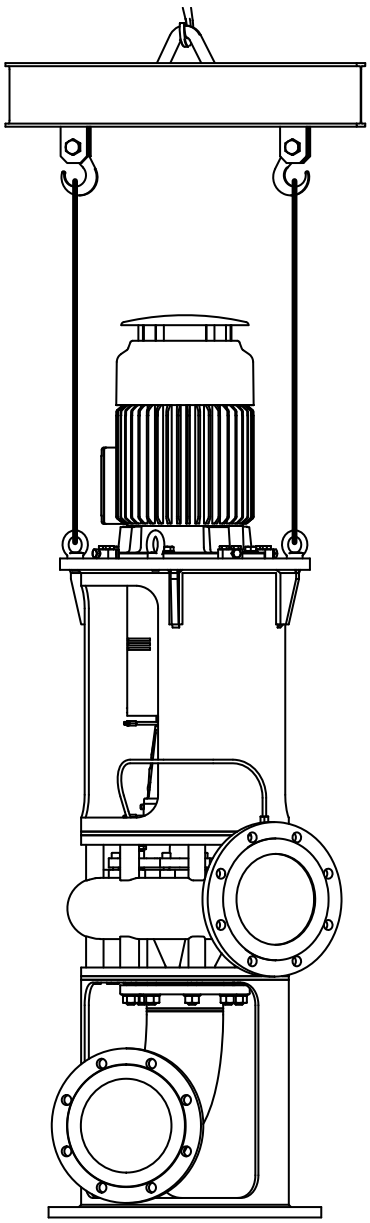

Figure 1: Lifting instructions for pump unit.

1.5.4 Storage

If the pump is not to be used immediately the pump shaft must be turned by hand twice per week.

1.6 Ordering parts

This manual contains a survey of the spare parts recommended by SPXFLOW as well as the instructions for ordering them. A fax-order form is included in this manual.

You should always state all data stamped on the type plate when ordering parts and in any other correspondence regarding the pump.

➢ *This data is also printed on the label on the front of this manual.*

If you have any questions or require further information with regard to specific subjects, then do not hesitate to contact SPXFLOW.

2 General

2.1 Pump description

The CombiFlex Universal is a range of vertical non-self-priming centrifugal pumps. The discharge and suction connection can be mounted in different positions in relation to each other. The bearing section consist of the bearing bracket of the CombiChem pump. The pump is driven by a standard IEC vertical flange motor. The power is transmitted through a flexible coupling. Because of their modular lay-out, constructional components are widely interchangeable, also with other pump types of the Combi system.

2.2 Type code

Pumps are available in various designs. The main characteristics of the pump are shown in the type code.

Example: **CFU 50-200 G2 M2 L2 K3**

Pump family	
CFU	**C**ombi**F**lex **U**niversal
Pump size	
50-200	diameter discharge connection [mm] - nominal impeller diameter [mm]
Pump casing material	
G	cast iron
NG	nodular cast iron
B	bronze
R	stainless steel
Impeller material	
1	cast iron
2	bronze
3	aluminium bronze
6	stainless steel
Shaft sealing	
M2	mechanical seal, unbalanced, shaft sleeve
M3	mechanical seal, balanced, shaft sleeve
MQ2	mechanical seal, unbalanced, shaft sleeve, unpressurised liquid quench
MQ3	mechanical seal, balanced, shaft sleeve, unpressurised liquid quench
MW2	mechanical seal, unbalanced, shaft sleeve, cooling jacket
MW3	mechanical seal, balanced, shaft sleeve, cooling jacket
C2	cartridge seal, unbalanced
C3	cartridge seal, balanced
CQ3	cartridge seal, balanced, unpressurised liquid quench
CD3	cartridge seal, balanced double seal with buffer pressure system
Bearing	
L2	double row angular contact ball-bearing + cylindrical bearing, grease lubricated or Two single-row angular contact ball-bearings in O-arrangement + cylindrical bearing, grease lubricated
Assembly	
K3	flexible coupling with distance sleeve (spacer) and welded lantern piece consisting of tube and flange elements

2.3 Serial number

Serial number of the pump or pump unit are shown on the name plate off the pump and on the label on the cover of this manual.

Example: **19-001160**

19	year of manufacture
001160	unique number

2.4 Applications

- In general, this pump can be used for thin, clean or slightly polluted liquids. These liquids should not affect the pump materials.
- The maximum allowed system pressure and temperature and the maximum speed depend on the pump type and the pump construction. For relevant data see chapter 10 "Technical data".
- Further details about the application possibilities of your specific pump are mentioned in the order confirmation and/or in the data sheet enclosed with the delivery.
- Do not use the pump for purposes other than those for which it is delivered without prior consultation with your supplier.

⚠ ***Using a pump in a system or under system conditions (liquid, working pressure, temperature, etc.) for which it has not been designed may hazard the user!***

2.5 Construction

2.5.1 Bearing groups

The pump range is divided in a number of bearing groups.

Table 1: Bearing group division.

Bearing groups			
1	**2**	**3**	**4**
32-160	40-250	65-315	125-500
32-200	40A-250	80-315	150-500
40-160	50-250	80-400	150B-400
40-200	50A-250	100-250	200-250
50AC-125	65-160	100-315	200-315
50-160	65-200	100A-315	200-400
50-200	65A-200	100B-315	250-250
	65A-250	100-400	250-315
	80-160	125-250	300-250
	80-200	125-315	300-315
	80-250	125-400	
	80A-250	150-315	
	100C-200	150-400	
	150-200	200-200	
	200-200	250B-315	

The main components are described below:

2.5.2 Pump casing/impeller/suction bend

These are the parts that get into contact with the pumped liquid. For each individual pump type there is only one construction of the pump casing and the impeller. The pump casing and the suction bend are available in cast iron, nodulair cast iron, bronze and in stainless steel, the impeller in cast iron, bronze, aluminium bronze and stainless steel. The square suction bend has been designed in such a way that resistance is low an that all the same a low position of the pump in relation to the floor is possible. The pump types 200-200 and 250B-315 in cast iron and bronze and all stainless steel pumps have a fabricated suction bend.

2.5.3 Shaft sealing

The shaft seal is available in various variants. There are mechanical seal configurations and cartridge seal configurations. The mechanical component seals and the cartridge seals are available in unbalanced and balanced versions. The shaft seal configurations can be provided with cooling jackets and liquid quench, a buffer pressure system is available for cartridge seals. The shaft is not in contact with the liquid handled (dry shaft design).

2.5.4 Bearing

The bearing design for bearing group 1, 2 and 3 pumps is equipped with a double-row angular contact ball-bearing combined with a cylindrical bearing and the bearing group 4 pumps with two single-row angular contact ball-bearings in O-arrangement combined with a cylindrical bearing. The bearings are grease lubricated and foreseen with grease nipples on the bearing covers for re-lubrication.

2.5.5 Lantern piece and coupling

The lantern piece is made of welded pipe and flange elements and supports to electric motor to the pump. Pump and the motor are coupled by a flexible spacer coupling and the coupling is protected by a guard.

After the guard and spacer have been removed, the rotating part of the pump can be easily dismantled as a whole without having to disconnect the electric motor or the piping. This construction is called the Top Pull Out-principle.

2.5.6 Foot support

The pumps are supplied with a foot support made of welded pipe and flange elements for a solid fixation to the foundation.

2.6 Application area

The application area globally looks as follows:,

Table 2: Application area.

	Maximum value
Capacity	1500 m^3/h
Discharge head	125m
System pressure	10 bar
Temperature	200 °C

However, the maximum allowable pressures and temperatures depend strongly on the selected materials and components. Also working conditions may cause differences. For more detailed information see chapter 10 "Technical data".

2.7 Re-use

The pump may only be used for other applications after prior consultation with SPXFLOW or your supplier. Since the lastly pumped medium is not always known, the following instructions should be observed:

1 Flush the pump properly.

2 Make sure the flushing liquid is discharged safely (environment!)

⚠ ***Take adequate precautions and use the appropriate personal protection means like rubber gloves and spectacles!***

2.8 Scrapping

If it has been decided to scrap a pump, the same flushing procedure as described for Re-use should be followed.

3 Installation

3.1 Safety

- Read this manual carefully prior to installation and commissioning. Non-observance of these instructions can result in serious damage to the pump and this will not be covered under the terms of our guarantee. Follow the instructions given step by step.
- Ensure that the pump can not be started if work has to be undertaken to the pump during installation and the rotating parts are insufficiently guarded.
- Depending on the design the pumps are suitable for liquids with a temperature of up to 200°C. When installing the pump unit to work at 65°C and above the user should ensure that appropriate protection measures and warnings are fitted to prevent contact with the hot pump parts.
- If there is danger of static electricity, the entire pump unit must be earthed.
- If the pumped liquid is harmful to men or the environment, take appropriate measures to drain the pump safely. Possible leakage liquid from the shaft seal should also be discharged safely.

3.2 Preservation

In order to prevent corrosion, the inside of the pump is treated with a preserving agent before leaving the factory.

Before commissioning the pump remove any preserving agents and flush the pump thoroughly with hot water.

3.3 Environment

- The foundation must be hard, level and flat.
- The area in which the pump is installed must be sufficiently ventilated. An ambient temperature or air humidity which is too high, or a dusty environment, can have a detrimental effect on the operation of the electric motor.
- There should be sufficient space around the pump unit to operate and if necessary repair it.
- Above the cooling air inlet of the motor there must be a free area of at least ¼ of the electric motor diameter, to ensure unobstructed air supply.

3.4 Mounting

3.4.1 Assembling a pump unit

If the pump and the electric motor still have to assembled, do the following:

1 Remove the guards (0270). Check if there is a key in both shaft ends.

2 Clean the motor and pump shaft. Grease both shaft ends with mounting grease.

3 Mount the flattened coupling part on the pump shaft (2200). Keep the coupling part in line with the pump shaft end and fasten the coupling with the locking screw.

! **For pumps of bearing bracket 4 this coupling half needs to be pre-heated first!**

4 Fix the other coupling half on the motor shaft.

5 Place the electric motor on the flange (0250). Secure the electric motor with bolts (0950), washers (0956) and nuts (0955). Push the coupling half on the motor shaft upward.

➢ *Wherever possible use a hoisting machine and the crane hooks on the electric motor.*

6 Mount the distance sleeve on the lower coupling half.

7 Push the upper coupling half downward. For the correct distance between the coupling halves, see figure 2 with the corresponding table. Then secure the coupling half on the motor shaft.

8 Check whether the coupling can be turned by hand. Check the alignment, see paragraph 3.4.3 "Alignment of the coupling".

9 Mount the guards.

3.4.2 Installation of a pump unit

Pump and motor shafts of complete pump units are adjusted perfectly in line in the works.

1 In case of permanent arrangement place the base plate level on the foundation with the aid of shims.

2 Carefully tighten the nuts on the foundation bolts.

3 Check the alignment of pump and motor shafts and if necessary realign, see paragraph 3.4.3 "Alignment of the coupling".

3.4.3 Alignment of the coupling

1 Use bolts (0890) to position the electric motor in such a way that the coupling halves are aligned correctly.

2 Place a ruler (A) on the coupling. The ruler should touch both coupling halves over the entire length, see figure 2

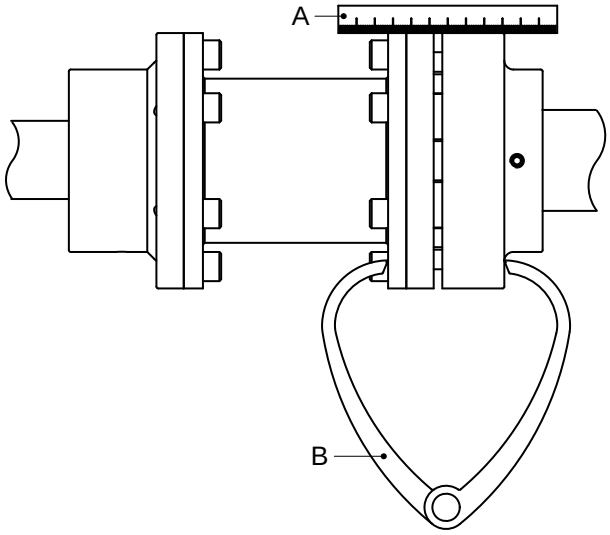

Figure 2: Aligning the coupling by means of a ruler and a pair of outside calipers.

3 Repeat the same check on both sides of the coupling at the height of the shaft. Move the electric motor so that the straight edge touches both coupling halves over the entire length.

4 Check the alignment once again using a pair of external callipers (B) at 2 diametrical opposite points on the sides of the coupling halves, see figure 2.

5 Fit the guard.

3.4.4 Tolerances for aligning the coupling

The maximum allowable tolerances for the alignment of the coupling halves are shown in Table 3. See also figure 3.

Table 3: Alignment tolerances

External diameter of coupling [mm]	V		Va_{max} - Va_{min} [mm]	Vr_{max} [mm]
	min [mm]	max [mm]		
81-95	2	4	0,15	0,15
96-110	2	4	0,18	0,18
111-130	2	4	0,21	0,21
131-140	2	4	0,24	0,24
141-160	2	6	0,27	0,27
161-180	2	6	0,30	0,30
181-200	2	6	0,34	0,34
201-225	2	6	0,38	0,38
225-250	3	8	0,42	0,42
251-280	3	8	0,47	0,47

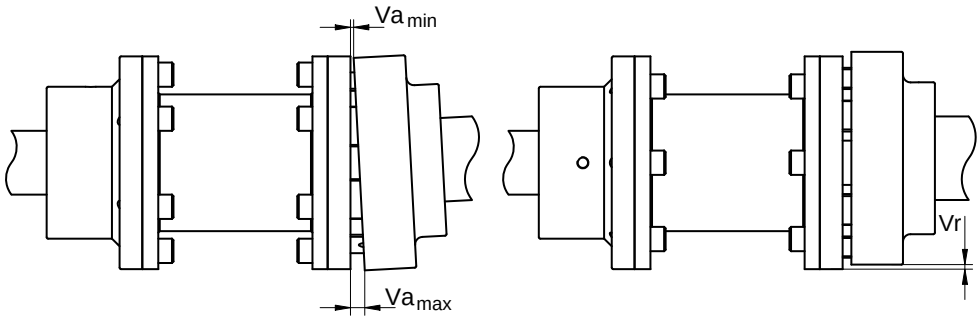

Figure 3: Alignment tolerances spacer coupling.

3.5 Piping

- The piping to the suction and delivery connections must fit exactly and must not be subject to stress during operation.
- The passage of the suction pipe must be amply dimensioned. This pipe should be as short as possible and run towards the pump in such a way that no air pockets can arise. If this is not possible, a venting facility should be provided at the highest point of the pipe.
- If the inside diameter of the suction pipe is larger than the suction connection of the pump, an eccentric reducer should be applied to prevent air pockets and whirls. See figure 4.

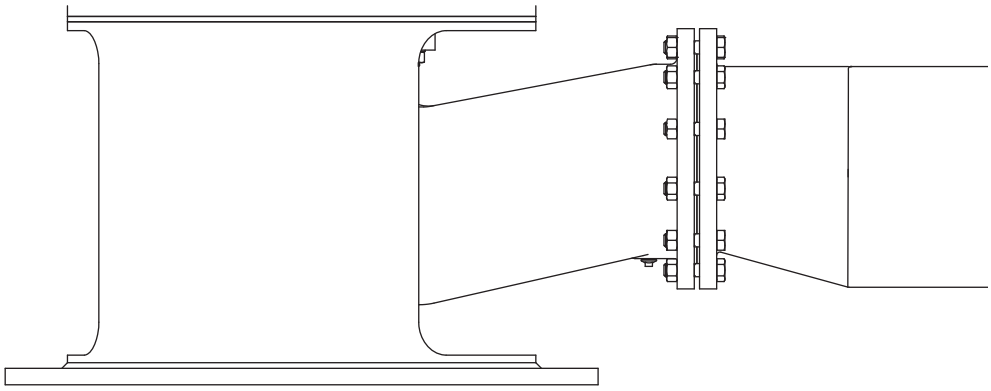

Figure 4: Eccentric reducer to suction flange.

- Sudden changes in the rate of flow can lead to high pressure impulses in the pump and the piping (water shock). Therefore, do not use quick-acting closing devices, valves etc.

3.6 Accessories

- If necessary, fit a foot valve at the bottom of the suction pipe. Combine this foot valve with a suction strainer to prevent impurities from being drawn in.
- When mounting, place temporarily (for the first 24 operating hours) a fine gauze between suction flange and suction pipe so as to prevent internal pump parts from being damaged by foreign matter. If the risk of damage continues to exist, fit a permanent filter.
- Fit any parts that may have been supplied separately.
- In case the pump is provided with an isolation, special attention has to be paid To temperature limits of shaft seal and bearing.

3.7 Connection of the electric motor

⚠ ***The electric motor must be connected to the mains by an approved electrician, according to the locally prevailing regulations of the electricity company.***

- Refer to the instruction manual belonging to the electric motor.
- If possible, fit a working switch as close as possible to the pump.

4 Commissioning

4.1 Inspection of the pump

Check whether the pump shaft turns freely. Do this by turning the shaft end at the coupling a few times by hand.

4.2 Inspection of the motor

Check whether the fuses have been mounted.

4.3 Filling the quench liquid tank MQ2 - MQ3 - CQ3

In case the pump is equipped with shaft seal configurations MQ2, MQ3, CQ3:

1 Unscrew the filler cap (1680) and top up the quench liquid tank with a sufficient amount of the appropriate quench liquid.

2 Check the level on the liquid level indicator (1620).

3 Refit the filler cap (1680).

4.4 Preparing the pump unit for commissioning

Proceed as follows, both when the unit is put into operation for the first time and after the pump has been overhauled.

4.4.1 Auxiliary connections

- Cartridge seal configuration **CD3** must be connected to a pressurised buffer liquid supply. **Set the buffer liquid pressure to 1,5 -2 bar higher than the pressure at the impeller hub, see paragraph 10.7 "Pressure near the impeller hub for shaft sealing group CD3**".
- Shaft seal configuration with cooling jacket **MW2, MW3** must be connected to an external cooling liquid system.

4.4.2 Filling the pump

1 Fully open the stop valve in the suction pipe. Close the delivery stop valve.

2 Fill the pump and the suction pipe with the liquid to be pumped.

3 Turn the pump shaft a few times by hand and add more liquid, if necessary.

4.5 Checking the sense of rotation

⚠ ***Beware of possible non-screened rotating parts, when checking the sense of rotation!***

1 The sense of rotation of the pump is indicated by an arrow. Check whether the sense of rotation of the motor corresponds with that of the pump.

2 Let the motor run for only a short time and check the sense of rotation.

3 If the sense of rotation is **not** correct, alter the sense of rotation. See the instructions in the user manual belonging to the electric motor.

4 Fit the guard.

4.6 Start-up

1 Open the stop valves in the supply and return lines for flushing or cooling liquid, if the pump is connected to a flushing or cooling system. Ensure these systems are switched on and set at the proper values.

2 Start the pump.

3 As soon as the pump is under pressure, slowly open the delivery stop valve until the working pressure is attained.

⚠ ***Make sure that when a pump is running, rotating parts are always properly screened off by the guard!***

4.7 Pump in operation

When the pump is in operation, pay attention to the following:

- The pump should never run dry.
- Never use a stop valve in the suction line to control pump output. The stop valve should always be fully opened during operation.
- Check whether the absolute inlet pressure is sufficient, to prevent vaporization in the pump.
- Check whether the pressure difference between suction and delivery side corresponds with the specifications of the pump's duty point.
- The mechanical seal may never show visible leakage.

4.8 Noise

The noise production of a pump depends to a great extent on the operating conditions. The values stated in paragraph 10.9 "Noise data" are based on normal operation of the pump, driven by an electric motor. In case the pump is driven by a combustion engine, or in case it is used outside the normal operation area, as well as in case of cavitation, the noise level may exceed 85 dB(A). In that case precautions should be taken, like building a noise-barrier around the unit or wearing hearing protection.

5 Maintenance

5.1 Daily maintenance

Regularly check the outlet pressure.

⚠ ***No water should get into the terminal box of the electric motor when the pump room is sprayed clean!***
Never spray water on hot pump parts! The sudden cooling down may cause them to burst and hot water may flow out!

! **Flawed maintenance will result in shorter lifespan, possible break down and in any event loss of warranty.**

5.2 Shaft sealing

5.2.1 Mechanical seal

A mechanical seal generally requires no maintenance, however, **it should never be allowed to run dry**. If there are no problems, do not dismantle the mechanical seal. As the seal faces have run in on one another dismantling usually implicates replacement of the mechanical seal. If a mechanical seal shows any leakage it has to be replaced.

5.2.2 Quenched shaft seals MQ2 - MQ3

Regularly check the liquid level of the quench liquid tank.

5.2.3 Double mechanical seal CD3

Regularly check the pressure of the flushing liquid. This pressure must be **1,5 - 2 bar higher than the pressure at the impeller hub**. See paragraph 10.7 "Pressure near the impeller hub for shaft sealing group CD3" for this value.

5.3 Lubrication of the bearings

The bearings requires re-greasing **after every 1000 hours of operation.** The bearings are filled with grease during assembly. In case the pump is overhauled, the bearing house and the bearings have to be cleaned and provided with new grease. For recommended greases see paragraph 10.1 "Grease".

5.4 Environmental influences

- Regularly clean the filter in the suction pipe or the suction strainer at the bottom of the suction pipe, as the inlet pressure may become too low if the filter or the suction strainer is fouled.
- If there is a risk that the pumped liquid expands during solidification or freezing, the pump has to be drained and, if necessary, flushed after it has been put out of service.
- If the pump is out of service for a long time, it has to be preserved and stored on a vibration-free foundation.
- Check motor for accumulation of dust or dirt, which might influence motor temperature.

5.5 Noise

If a pump starts making noise, this may point to certain problems with the pump unit. A crackling noise can indicate cavitation or excessive motor noise can indicate deterioration of the bearings.

5.6 Motor

Check motor specifications for start-stop frequency.

5.7 Faults

⚠ ***The pump, of which you want to determine the fault, may be hot or under pressure. Take the appropriate precautions first and protect yourself with the proper safety devices (safety goggles, gloves, protective clothing)!***

To determine the source of the malfunctioning of the pump, proceed as follows:

1 Switch off the power supply to the pump unit. Lock the working switch with a padlock or remove the fuse. In case of a combustion engine: switch off the engine and close the fuel supply to the engine.

2 Close the stop valves.

3 Determine the nature of the fault.

4 Try to determine the cause of the fault with chapter 6 "Problem solving" and take the appropriate measures or contact your installer.

6 Problem solving

Faults in a pump installation can have various causes. The fault may not be in the pump, it may also be caused by the pipe system or the operating conditions. Firstly, always check that installation has been executed in accordance with the instructions in this manual and that the operating conditions still correspond with the specifications for which the pump was purchased.

In general, breakdowns in a pump installation are attributable to the following causes:

- Faults with the pump.
- Breakdowns or faults in the pipe system.
- Faults due to incorrect installation or commissioning.
- Faults due to incorrect choice of pump.

A number of the most frequently occurring failures as well as their possible causes are shown in the table below.

Table 4: Most frequently occurring failures.

Most common faults	**Possible causes, see Table 5.**
Pump delivers no liquid	1 2 3 4 8 9 10 11 13 14 17 19 20 21 29
Pump has insufficient volume flow	1 2 3 4 8 9 10 11 13 14 15 17 19 20 21 28 29
Pump has insufficient head	2 4 13 14 17 19 28 29
Pump stops after start up	1 2 3 4 8 9 10 11
Pump has higher power consumption than normal	12 15 16 17 18 22 23 24 25 26 27 32 38 39
Pump has lower power consumption than normal	13 14 15 16 17 18 20 21 28 29
Mechanical seal has to be replaced to often	23 25 26 30 32 33 36
Pump vibrates or is noisy	1 9 10 11 15 18 19 20 22 23 24 25 26 27 29 37 38 39 40
Bearings wear too much or become hot	23 24 25 26 27 37 38 39 40 42
Pump running rough hot or seizes	23 24 25 26 27 37 38 39 40 42

Table 5: Possible causes of pump failures.

	Possible causes
1	Pump or suction pipe is not sufficiently filled or de-aerated
2	Gas or air coming from the liquid
3	Air lock in the suction pipe
4	Air leak in the suction pipe
8	The manometric suction head is too high
9	Suction pipe or suction strainer is blocked
10	Insufficient immersion of foot valve or suction pipe during operation of the pump
11	NPSH available too low
12	Speed too high
13	Speed too low
14	Wrong sense of rotation
15	Pump does not operate at the right duty point
16	Liquid density differs from the calculated liquid density
17	Liquid viscosity differs from the calculated liquid viscosity
18	Pump operates when the liquid flow is too low
19	Wrong pump selection
20	Obstruction in impeller or pump casing
21	Obstruction in the piping
22	Wrong installation of the pump unit
23	Pump and motor not well aligned
24	Rotating part running out of true
25	Imbalance in rotating parts (for instance: impeller or coupling)
26	Pump shaft is running out of true
27	Bearings faulty or worn out
28	Wear ring faulty or worn out
29	Damaged impeller
30	Seal faces of the mechanical seal are worn out or damaged
32	Bad mounting of the mechanical seal
33	Mechanical seal not suitable for the pumped liquid or operation circumstances
36	Flushing liquid to the mechanical seal is polluted
37	Axial retaining of impeller or pump shaft is defective
38	The bearings have been mounted wrongly
39	Too much or too little bearing lubrication
40	Wrong or polluted lubricant
42	Too high axial force because of worn dorsal blades or excessive inlet pressure

7 Disassembly and assembly

7.1 Precautionary measures

⚠ ***Take adequate measures to avoid that the motor is started while you are working on the pump. This is especially important for electric motors with remote control:***

- Switch the operating switch near the pump (if available) to "OFF".
- Switch off the pump switch on the switchboard.
- If necessary remove the fuses.
- Hang a danger board near the switchboard cabinet.

7.2 Special tools

Assembly and disassembly work requires no special tools. However, such tools can make certain jobs easier, for instance replacing the shaft seal. If such is the case it will be indicated in the text.

7.3 Position numbers

The position numbers used in the descriptions below refer to the figures shown in the description. These numbers are also used in the general cross section drawings and the corresponding parts lists in chapter 9 "Parts".

7.4 Draining

! **Make sure no liquid gets into the environment!**

Before starting any disassembly the pump should be drained.

1 If necessary, close the valves in the suction and delivery pipe and in the flushing or cooling supply lines to the shaft seal.

2 Remove the drain plug (0330). If possible, also drain the suction bend (0400) through drain plug (0350) to a certain extent.

3 If harmful liquids are pumped wear protective gloves, shoes, glasses, etc., and thoroughly flush the pump.

4 Refit the drain plug.

7.5 Disassembly and assembly Top Pull Out unit

➢ *The Top Pull Out unit and the electric motor of large pumps are too heavy to be lifted by hand. Use appropriate hoisting equipment.*

The pumps are designed with a Top Pull Out system. For that reason they are provided with a "spacer"-coupling. The intermediate piece of this coupling can be removed. After that the pump cover with the entire rotating part can be removed. This way the pump can be dismantled to a major extent without having to loosen the suction and delivery piping. The motor can remain in its position.

7.5.1 Disassembly Top Pull Out unit

1 Remove the guard (0270).

2 Remove the seal guards (0276).

3 Disconnect possible flushing and/or cooling lines.

4 Remove the spacer (0210) from the spacer coupling.

5 Mark the position of the pump cover (0110) in relation to the pump casing (0100).

6 Remove the Allen screws (0800) and lift the Top Pull Out unit out of the pump through the opening in the lantern piece (0250).

7.5.2 Assembly Top Pull Out unit

1 Mount a new gasket (0300) for the pump casing and lower the Top Pull Out unit in the right position into the pump casing. Take care not to damage the gasket (0300).

2 Tighten the Allen screws (0800) crosswise.

3 Reconnect the flushing and/or cooling lines.

4 Fit the seal guards (0276).

5 Mount the spacer of the spacer coupling (0210).

6 Check the alignment of pump and motor shaft, see paragraph 3.4.3 "Alignment of the coupling". If necessary they have to be realigned.

7 Mount the guard (0270).

7.6 Replacement the impeller and the wear ring

The play between the impeller and the wear ring is 0,3 mm to the diameter at delivery. In case the play has increased to 0,5-0,7 mm due to wear, the impeller and the wear ring should be replaced.

7.6.1 Disassembly of the impeller

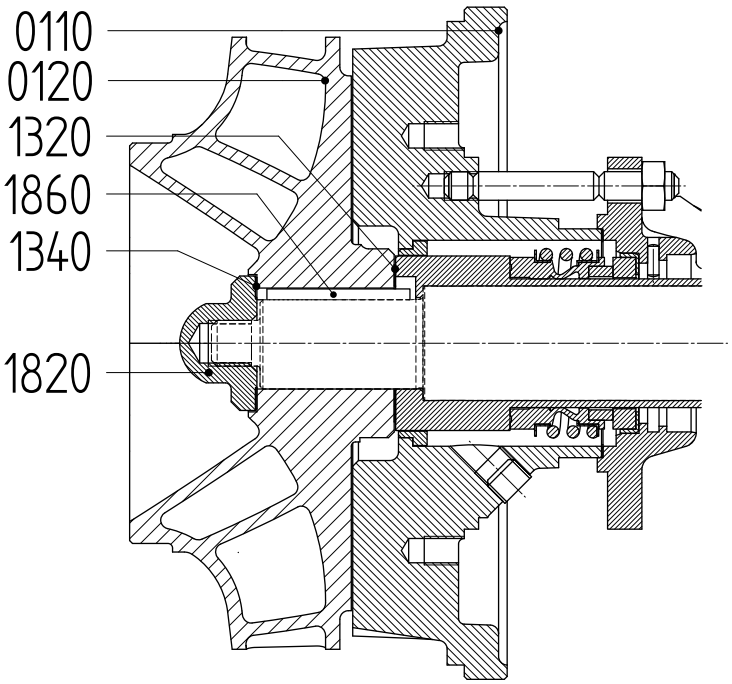

Figure 5: Disassembly of the impeller.

The item numbers used are referring to figure 5.

1 Remove the Top Pull Out unit, see paragraph 7.5 "Disassembly and assembly Top Pull Out unit".

2 Remove the cap nut (1820) and the gasket (1340). Sometimes the nut has to be heated to break the Loctite-contact.

3 Pumps of bearing bracket 4: Heat the impeller with a torch.

4 Remove the impeller (0120) with a pulley puller, or wrest the impeller by inserting for instance 2 big screwdrivers between the impeller and the stuffing box cover (0110).

5 Remove the gasket (1320).

6 Remove the impeller key(s) (1860).

7.6.2 Mounting the impeller

1 Place the impeller key (1860) in the key way of the pump shaft. Some types have 2 keys.

2 Fit the gasket (1320).

3 Push the impeller onto the pump shaft.

4 Degrease the thread on the pump shaft and the thread in the cap nut.

5 Fit the gasket (1340).

6 Put a drop of Loctite 243 on the thread and fit the cap nut. For tightening moment of the cap nut see paragraph 10.2.2 "Tightening moments for cap nut".

7.6.3 Disassembling the wear ring

After removing the Top Pull Out unit the wear ring can be removed. In most cases the ring has been fixed so tightly that it cannot be removed undamaged.

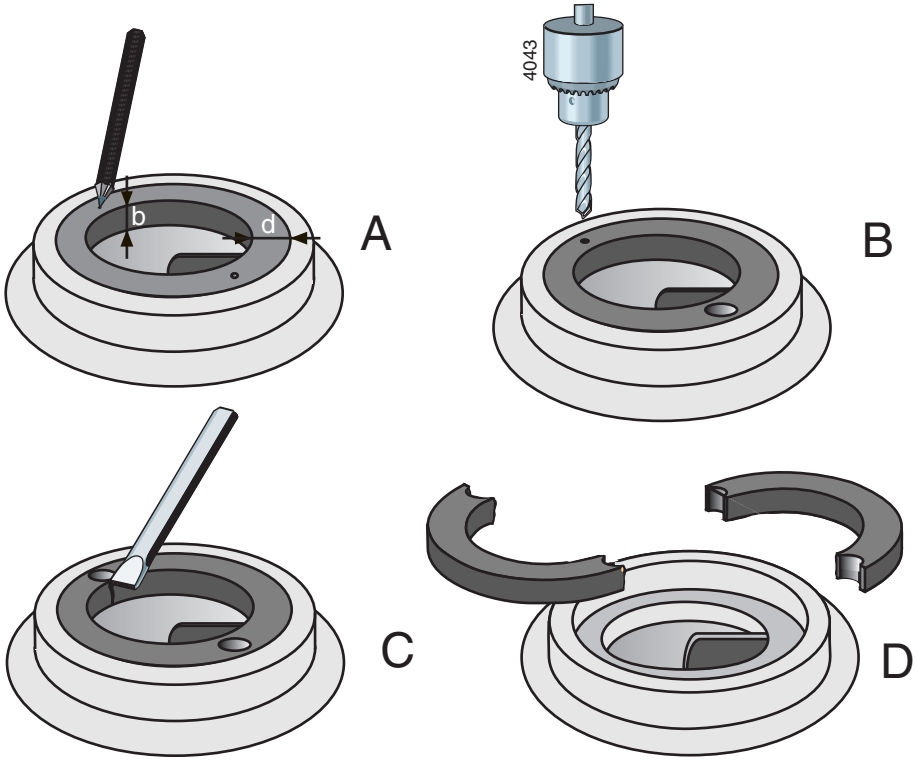

Figure 6: Removal of wear ring.

1 Measure the thickness (d) and the width (b) of the ring, see figure 6 A.

2 Make a centre hole in the middle of the edge of the ring at two opposite points, see figure 6 B.

3 Use a drill with a diameter just a little bit smaller than the thickness (d) of the ring and drill two holes in the ring, see figure 6 C. Don't drill deeper than the width (b) of the ring. Take care not to damage the fitting edge of the pump casing.

4 Use a chisel to cut the remaining part of the ring thickness. Now you can remove the ring in two parts from the pump casing, see figure 6 D.

5 Clean the pump casing and carefully remove all bore dust and metal splinters.

7.6.4 Assembling the wear ring

1 Clean and degrease the fitting edge of the pump casing where the wear ring is to be mounted.

2 Degrease the outer edge of the wear ring and put a few drops of Loctite 641 on it.

3 Fit the wear ring in the pump casing. **Take care it is not pushed out of alignment!**

7.7 Mechanical seals M2, M3, MQ2, MQ3, MW2, MW3

7.7.1 Instructions for mounting a mechanical seal

➢ *First read the following instructions regarding the mounting of a mechanical seal. Follow these instructions closely when mounting a mechanical seal.*

- **Leave the assembly of a mechanical seal with PTFE (Teflon) covered O-rings to a specialist.** These rings are easily damaged during assembly.
- A mechanical seal is a fragile precision instrument. Leave the seal in its original packing until you are ready to fit it!
- Clean all receiving parts properly. Make sure your hands and working environment are clean!
- **Never touch the sliding surfaces with ones fingers!**
- Take care not to damage the seal during assembly. Never put the rings down on their sliding surfaces!

7.7.2 Disassembling a mechanical seal M2-M3

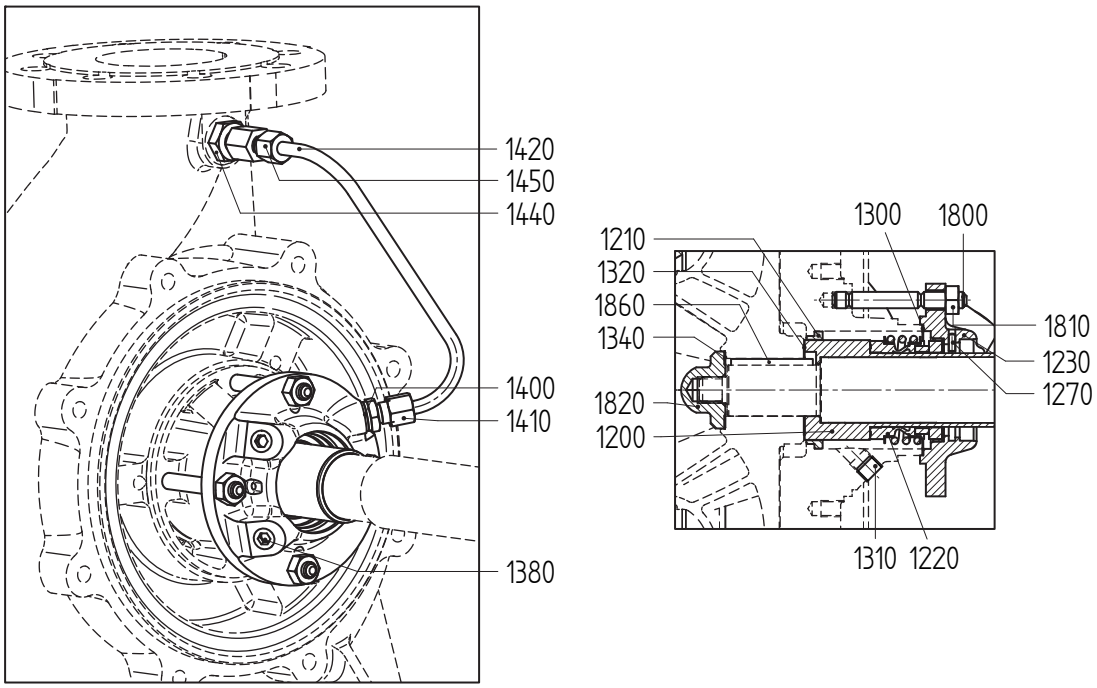

Figure 7: Mechanical seal M2-M3.

The item numbers used are referring to figure 7.

1 Remove the impeller, see paragraph 7.6.1 "Disassembly of the impeller"

2 Remove the nuts (1810) and push the mechanical seal cover (1230) backward.

3 Mark the position of the stuffing box cover (0110) in relation to the bearing bracket (2100). Knock the stuffing box cover loose and remove it.

4 Pull the shaft sleeve (1200) off the pump shaft. Loosen the set screw (n.a. for bellows seal) and remove the rotating part of the mechanical seal from the shaft sleeve.

5 Pull the mechanical seal cover (1230) off the pump shaft. Push the counter-ring of the mechanical seal through the shaft passage inward out of the cover

7.7.3 Assembling a mechanical seal M2-M3

1. Ensure the shaft sleeve (1200), the throttling bush (1210) and the splash ring (2220) are undamaged. The splash ring should also clasp the pump shaft properly. If necessary, replace these parts. In that case, secure the throttling bush (1210) with Loctite 641.
2. Put the mechanical seal cover flat down and press the counter-ring of the seal straight into it. The notch in the counter ring must correspond to the locking pin (1270), else the counter ring will break! If necessary, use a plastic pressure piece. **Never hammer it inside!** The maximum axial turn of the counter-ring is 0,1 mm.
3. Place the bearing bracket with the shaft upright and place a new gasket (1300).
4. Push the mechanical seal cover onto the pump shaft.
5. Push the rotating part of the seal onto the shaft sleeve. Put some glycerine or silicon spray on the O-ring or the bellows to facilitate the assembly. Fix the mechanical seal with the set screw (n.a. for bellows seal).
6. Push the shaft sleeve (1200) onto the pump shaft.
7. Fit the stuffing box cover in the right position in the fitting edge of the bearing bracket. **Check whether the stuffing box cover is at right angles to the pump shaft.**
8. Fit the mechanical seal cover (1230) to the stuffing box cover. Check the position in view of the connection points. Tighten the nuts (1810) crosswise. The cover should not be placed oblique.
9. Fit the impeller and other parts, see paragraph 7.6.2 "Mounting the impeller".

7.7.4 Disassembling a mechanical seal MQ2-MQ3

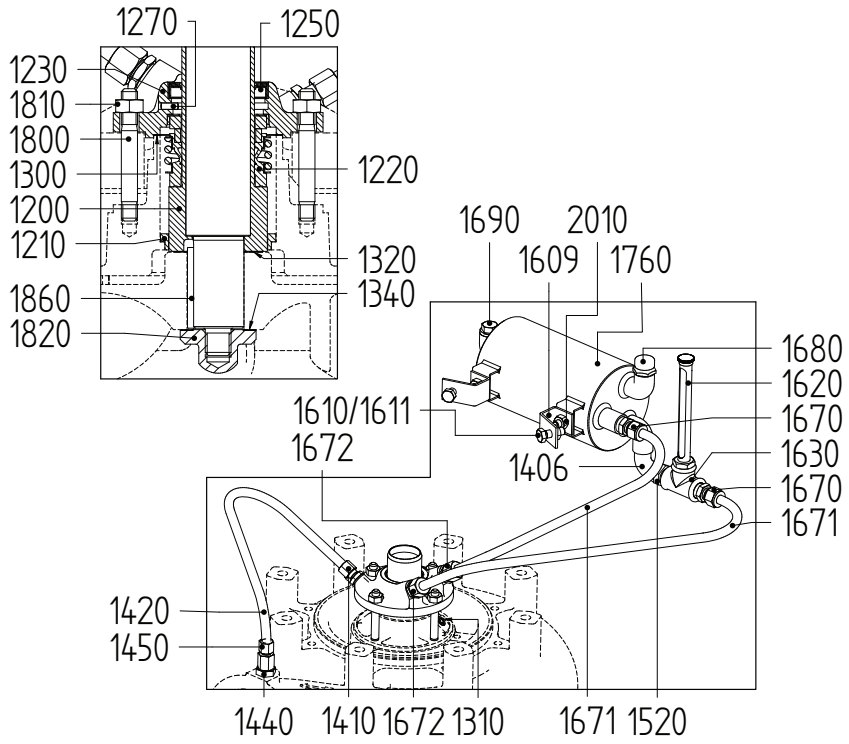

Figure 8: Mechanical seal MQ...

The item numbers used are referring to figure 8.

1 Remove the impeller, see paragraph 7.6.1 "Disassembly of the impeller"

2 Remove the nuts (1810) and push the mechanical seal cover (1230) backward.

3 Mark the position of the stuffing box cover (0110) in relation to the bearing bracket (2100). Knock the stuffing box cover loose and remove it.

4 Pull the shaft sleeve (1200) off the pump shaft. Loosen the set screw (n.a. for bellows seal) and remove the rotating part of the mechanical seal from the shaft sleeve.

5 Pull the mechanical seal cover (1230) off the pump shaft. Push the counter-ring of the mechanical seal through the shaft passage inward out of the cover. Push the lip seal (1250) outward out of the cover.

7.7.5 Assembling a mechanical seal MQ2-MQ3

1 Ensure the shaft sleeve (1200), the throttling bush (1210) and the splash ring (2220) are undamaged. The splash ring should also clasp the pump shaft properly. If necessary, replace these parts. In that case, secure the throttling bush (1210) with Loctite 641.

2 Put the mechanical seal cover flat down and press the counter-ring of the seal straight into it. The notch in the counter ring must correspond to the locking pin (1270), else the counter ring will break! If necessary, use a plastic pressure piece. **Never hammer it inside!** The maximum axial turn of the counter-ring is 0,1 mm.

3 Turn the mechanical seal cover and press the lip seal (1250) into its seat. Apply some glycerine or silicon spray on the lip seal to facilitate the assembly. If necessary, use a plastic pressure piece.

4 Place the bearing bracket with the shaft upright and place a new gasket (1300).

5 Push the mechanical seal cover onto the pump shaft.

6 Push the rotating part of the mechanical seal onto the shaft sleeve. Put some glycerine or silicon spray on the O-ring or the bellows to facilitate the assembly. Fix the mechanical seal with the set screw (n.a. for bellows seal).

7 Push the shaft sleeve (1200) onto the pump shaft.

8 Fit the stuffing box cover in the right position in the fitting edge of the bearing bracket. **Check whether the stuffing box cover is at right angles to the pump shaft.**

9 Fit the mechanical seal cover (1230) to the stuffing box cover. Check the position in view of the connection points. Tighten the nuts (1810) crosswise. The cover should not be placed oblique.

10 Fit the impeller and other parts, see paragraph 7.6.2 "Mounting the impeller".

7.7.6 Disassembling a mechanical seal MW2-MW3

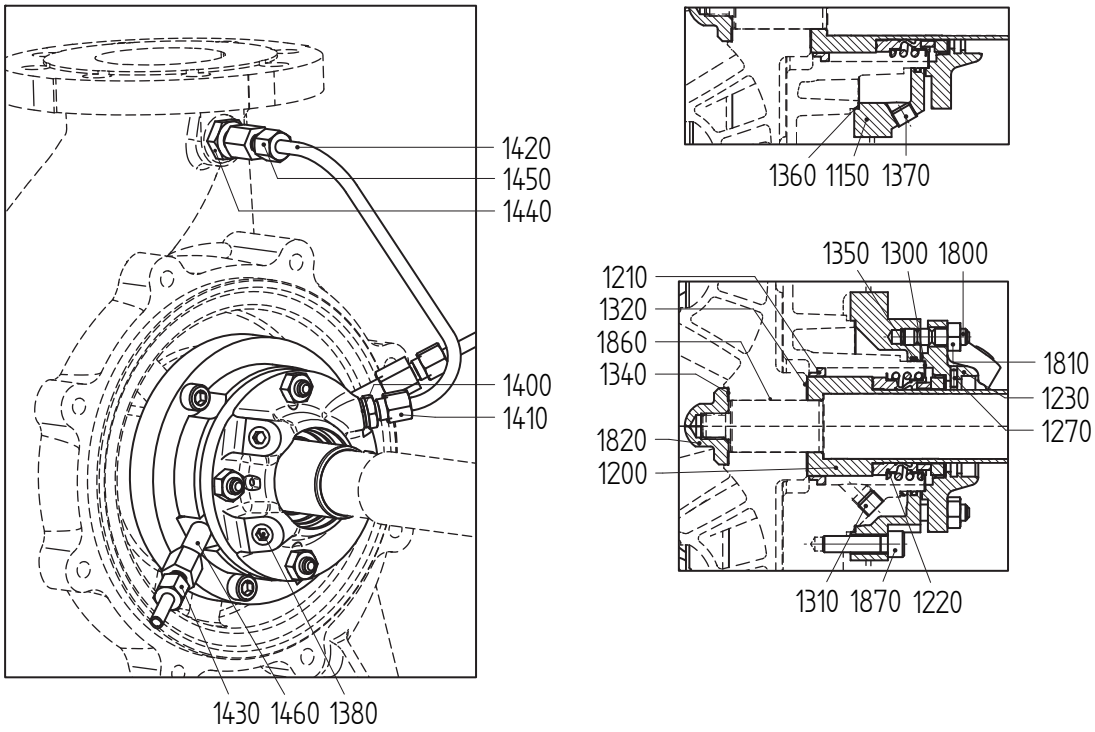

Figure 9: Mechanical seal MW...

The item numbers used are referring to figure 9.

1 Remove the impeller, see paragraph 7.6.1 "Disassembly of the impeller"

2 Remove the Allen screws (1870) and push the cooling jacket (1150) with the mechanical seal cover backward.

3 Mark the position of the stuffing box cover (0110) in relation to the bearing bracket (2100). Knock the stuffing box cover loose and remove it.

4 Pull the shaft sleeve (1200) off the pump shaft. Loosen the set screw (n.a. for bellows seal) and remove the rotating part of the mechanical seal from the shaft sleeve.

5 Pull the cooling jacket (1150) with the mechanical seal cover off the pump shaft. Remove the O-ring (1350) to inspect its condition. Replace it if necessary.

6 Unscrew the nuts (1810) and remove the mechanical seal cover (1230) from the cooling jacket.

7 Push the counter-ring of the mechanical seal through the shaft passage inward out of the cover.

7.7.7 Assembling a mechanical seal MW2-MW3

1 Ensure the shaft sleeve (1200), the throttling bush (1210) and the splash ring (2220) are undamaged. The splash ring should also clasp the pump shaft properly. If necessary, replace these parts. In that case, secure the throttling bush (1210) with Loctite 641.

2 Place the O-ring (1350) into the groove of the cooling jacket. Apply some glycerine or silicon spray on the O-ring to facilitate the assembly.

3 Put the mechanical seal cover (1230) flat down and press the counter-ring of the seal straight into it. The notch in the counter ring must correspond to the locking pin (1270), else the counter ring will break! If necessary, use a plastic pressure piece. **Never hammer it inside!** The maximum axial turn of the counter-ring is 0,1 mm.

4 Fit the mechanical seal cover (1230) to the cooling jacket (1150) and fix it with nuts (1810).

5 Place the bearing bracket with the shaft upright and place a new gasket (1300).

6 Push the cooling jacket with the mechanical seal cover onto the pump shaft.

7 Push the rotating part of the seal onto the shaft sleeve. Put some glycerine or silicon spray on the O-ring or the bellows to facilitate the assembly. Fix the mechanical seal with the set screw (n.a. for bellows seal).

8 Push the shaft sleeve (1200) onto the pump shaft.

9 Fit the stuffing box cover in the right position in the fitting edge of the bearing bracket. **Check whether the stuffing box cover is at right angles to the pump shaft.**

10 Fit the cooling jacket (1150) to the stuffing box cover and fix it with Allen screws (1870). Check the position in view of the connection points. Tighten the Allen screws crosswise. The cover should not be placed oblique.

11 Fit the impeller and other parts, see paragraph 7.6.2 "Mounting the impeller".

7.8 Cartridge seals C2, C3, CQ3, CD3

7.8.1 Instructions for mounting a cartridge seal

➢ *First read the following instructions regarding mounting a cartridge seal. Follow these instructions closely when mounting a cartridge seal.*

- This mechanical seal comes as a 'full cartridge seal'. This means that this mechanical seal must be mounted as one single piece and that it shall NOT be taken apart!
- A cartridge seal is a fragile precision instrument. Leave the cartridge seal in its original packing until you are ready to mount it!
- Clean all receiving parts properly. Make sure your hands and working environment are clean!

7.8.2 Disassembling a cartridge seal

1 Fit the loosely supplied centering tabs on the cover of the seal cartridge into the groove in the seal collar in order to immobilise the cartridge seal.
2 Disassemble the impeller, see paragraph 7.6.1 "Disassembly of the impeller".
3 Remove the Allen screws and pull the seal cartridge backwards towards the bearing bracket (2100).
4 Remove the Allen screws (0850) and knock the pump cover loose from the bearing bracket.
5 Pull the entire seal cartridge from the pump shaft.

7.8.3 Mounting a cartridge seal

1 Put the bearing bracket in upright position (impeller side up).
2 Push the seal cartridge onto the pump shaft.
3 Mount the pump cover (0110) in the correct position in the fitting edge of the bearing bracket (2100). **Check whether the pump cover is at right angles to the pump shaft**. Fasten the pump cover with Allen screws (0850).
4 Mount the seal cartridge to the pump cover (0110). Check the position in view of the connection points.
5 Fit the impeller and other parts, see paragraph 7.6.2 "Mounting the impeller".
6 Remove the centering tabs of the seal cartridge, store them carefully. The shaft must now be able to rotate freely.

7.9 Bearing

7.9.1 Instructions for assembly and disassembly of bearings

➢ *First read the following instructions regarding assembly and disassembly. Follow these instructions closely when assembling and disassembling bearings.*

Disassembly:

- Use **a proper puller** to remove the bearings from the pump shaft.
- If no proper puller is available, carefully knock at the inner raceway of the bearing. Use an ordinary hammer and a mild steel drift for this.
  Never knock at the bearing with a hammer!

Assembly:

- Make sure your working place is clean.
- Leave the bearings in their original packing as long as possible.
- Make sure the pump shaft and the bearing seats do have a smooth surface, free of burrs.
- Slightly oil the pump shaft and the other relevant parts before assembly.
- **Preheat the bearings to 110°C** before mounting them on the pump shaft.
- If preheating is not possible: knock the bearing onto the pump shaft. **Never knock at the bearing directly!** Use a mounting bush positioned against the inner raceway of the bearing and a normal hammer (a soft hammer might loose some splinters which could damage the bearing).
- **Always apply a new locking washer (2570) when assembling bearings!**

7.9.2 Disassembling bearing)

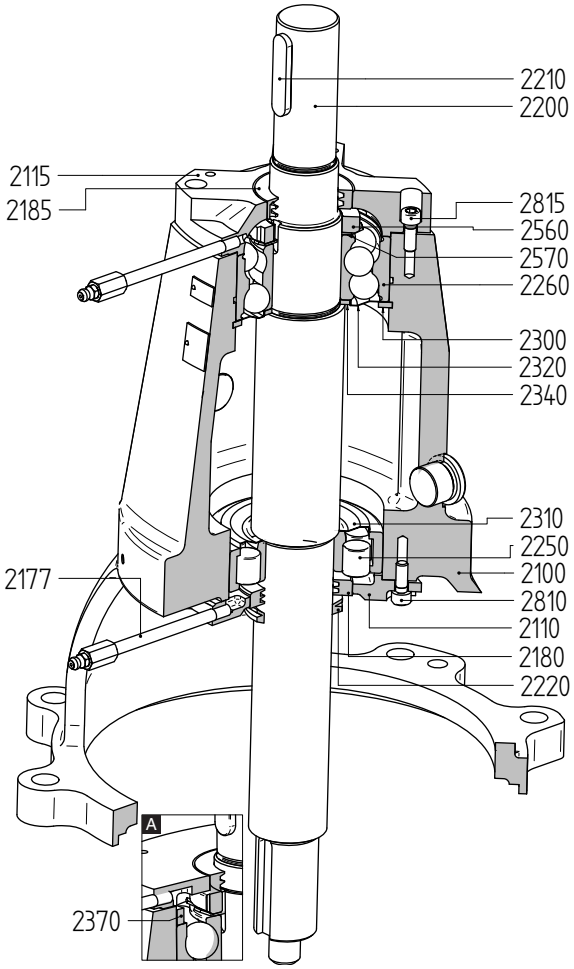

Figure 10: Bearing (A = bearing group 3).

The item numbers used are referring to figure 10.

1 Dismantle the impeller and the shaft seal.
2 Remove the splash ring (2220).
3 Remove the coupling with a coupling puller and remove the coupling key (2210).
4 Remove pipe (2177) from bearing cover (2110).
5 Unscrew the Allen screws (2810 and 2815) and remove the bearing covers (2110 and 2115) and (only for bearing group 3) the spacer sleeve (2370).
6 Check to ensure that the oil seals (2180 and 2185) are undamaged. Replace them if necessary.
7 Knock at the pump shaft (2200) at the impeller side to loosen the bearings from the bearing bracket. Use a plastic hammer to avoid damage to the thread.
8 Remove the inner circlip (2300) as soon as the first bearing (2260) is out of the bearing bracket. Subsequently remove the pump shaft with the bearings from the bearing bracket.
9 Knock the lip of the locking washer (2570) out of the lock nut (2560) and loosen the lock nut.
10 Remove the bearings from the pump shaft.

11 Remove the adjusting ring (2340) (n.a. for bearing group 4), the Nilos rings (2320 and 2310) and the inner circlip (2300).

7.9.3 Assembling bearing L2

1 Clean the interior of the bearing bracket properly.

2 Fit the adjusting ring (2340) (n.a. for bearing group 4) and the Nilos ring (2310) on the pump shaft.

3 Fit the inner circlip (2300) and the Nilos ring (2320) around the pump shaft.

! **Make sure the Nilos rings are positioned properly!**

4 Preheat the double row angular contact ball bearing (bearing group 4: the 2 single row angular contact ball bearings) and the inner ring of the cylindrical roller bearing (2250) and fit them on the pump shaft. Watch the mounting sequence: **fit the angular contact ball bearing(s) at drive side!**
The single row angular contact ball bearings must be fitted in "O"-setup!

5 Make sure they are positioned straight on the pump shaft and press them firmly against the shaft collar and against the adjusting ring (2340). The Nilos ring (2310) is now fixed between the pump shaft and the inner ring of the cylindrical roller bearing. **Let the bearings cool down!**

6 Fit the locking washer (2570) and screw the lock nut (2560) on the pump shaft. Tighten the lock nut and lock it by knocking a lip of the locking washer into the opening of the lock nut.

7 Fit the pump shaft with bearings, starting from the motor side, in the bearing bracket.

8 Make sure the Nilos ring (2320) is placed before the inner circlip and fit the inner circlip (2300) **in the second groove.**

9 Carefully knock the pump shaft into the bearing bracket until the outer ring of the bearing (2260) touches the inner circlip (2300). After each knock rotate the pump shaft one turn to prevent bearing damage. The Nilos ring (2320) is now fixed between the bearing and the inner circlip.

10 Fit the outer ring of the cylindrical roller bearing. This ring should go into the bearing bracket **straight.**

11 Fit the spacer sleeve (2370) (only for bearing group 3).

12 Fit the bearing covers (2110 and 2115) and fix them with Allen screws (2810 and 2815).

13 Fit the pipe (2177) into bearing cover (2110).

14 Fit the splash ring (2220).

15 Fit the shaft seal and the impeller.

8 Dimensions

8.1 Pump dimensions - bearing groups 0, 1, 2, 3 (G, NG, B)

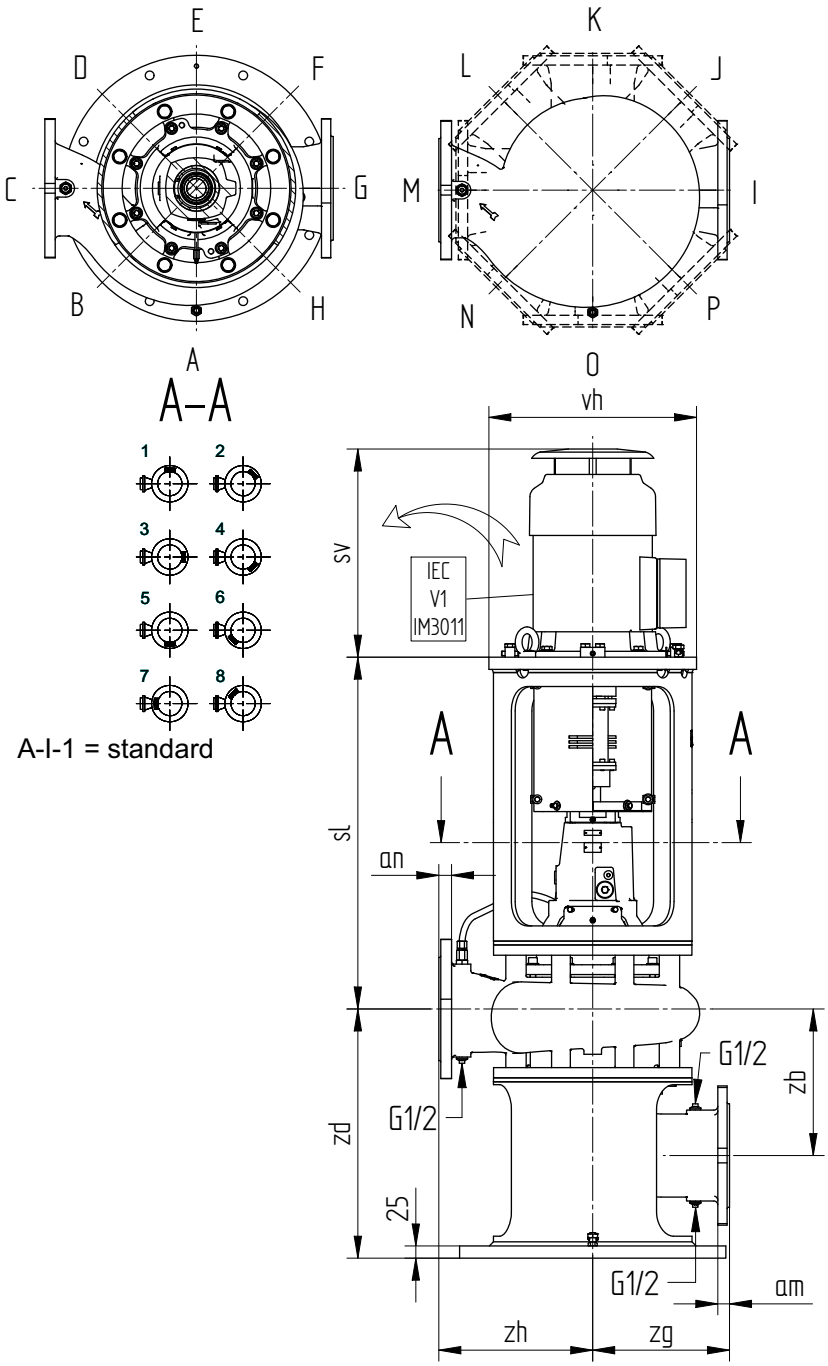

Figure 11: Pump dimensions.

Standard:

- disassembly opening lantern: pos A
- suction bend: pos I
- junction box electric motor: pos 1

8.1.1 Dimensions delivery flange

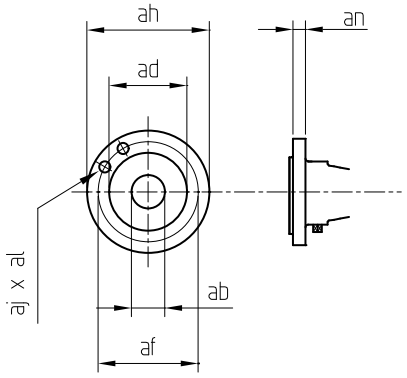

Figure 12: Dimensions delivery flange.

ISO 7005 PN16					
ab	**ad**	**af**	**ah**	**aj x al**	**an**
32	78	100	140	4 x 18	18
40	88	110	150	4 x 18	18
50	102	125	165	4 x 18	20
65	122	145	185	4 x 18	20
80	138	160	200	8 x 18	22
100	158	180	220	8 x 18	22
125	188	210	250	8 x 18	24
150	212	240	285	8 x 23	24

ISO 7005 PN10					
ab	**ad**	**af**	**ah**	**aj x al**	**an**
200	268	295	340	8 x 23	26
250	320	350	395	12 x 23	28

8.1.2 Dimensions suction flange

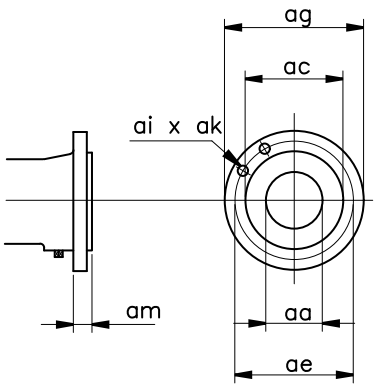

Figure 13: Dimensions suction flange.

ISO 7005 PN16					
aa	**ac**	**ae**	**ag**	**ai x ak**	**am**
65	122	145	185	4 x 18	24
80	138	160	200	8 x 18	25
100	158	180	220	8 x 18	27
125	188	210	250	8 x 18	28
150	212	240	285	8 x 22	29
200	268	295	340	8 x 22	31

ISO 7005 PN10					
aa	**ac**	**ae**	**ag**	**ai x ak**	**am**
200	268	295	340	8 x 22	24
250	320	350	395	12 x 22	26

8.1.3 Dimensions foot support

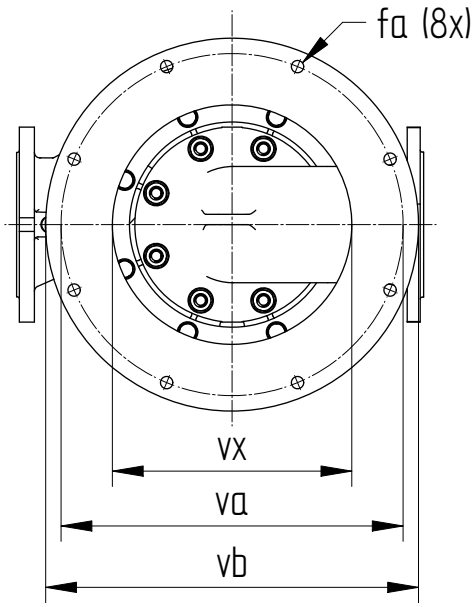

Figure 14: Dimensions foot support.

fa	va	vb	vx	pump type
18	460	500	300	32-160, 40-160, 50-160, 65-160, 80-160
18	500	545	350	32-200, 40-200, 50-200, 65-200, 80-200, 100C-200, 150-200
18	555	600	400	40-250, 50-250, 65A-250, 80-250, 80A-250, 100-250, 125-250, 200-200
18	600	650	450	65-315, 80-315, 100-315, 125-315, 150-315, 250B-315
22	750	800	550	80-400, 100-400, 125-400, 150-400

8.1.4 Pump dimensions PN16

	aa	ab	zb	zd	zg	zh	vh						
							80 90S/L	100L 112M	132S/M	160M/L 180M/L	200L	225S/M	250M 280S/M
32-160	65	32	167	375	220	250	356	375	425				
32-200	80	32	177	385	220	280	406	406	425	475			
40-160	80	40	177	375	220	250	356	375	425	475			
40-200	80	40	192	385	220	280	406	406	425	475			
40-250	100	40	202	435	250	315	457	457	457	475	525		
50-160	80	50	192	390	220	250	356	375	425	475			
50-200	100	50	202	385	250	280	406	406	425	475	525		
50-250	100	50	202	435	240	315	457	457	457	475	525	575	
65-160	125	65	242	440	240	250	356	375	425	475	525		
65-200	125	65	222	410	240	280	406	406	425	475	525		
65A-250	125	65	242	435	240	315	457	457	457	475	525	575	
65-315	125	65	242	475	240	315	508	508	508	508	540	590	690
80-160	150	80	232	435	350	250	356	375	425	475	525		
80-200	150	80	252	435	350	280	406	406	425	475	525	575	675
80-250	150	80	252	465	350	315	457	457	457	475	525	575	675
80A-250	150	80	252	465	350	315	457	457	457	475	525	575	675
80-315	150	80	252	475	350	315		508	508	508	540	590	690
80-400	150	80	252	505	350	405			660	660	660	660	
100C-200	150	100	252	450	350	280		406	425	475	525	575	675
100-250	150	100	252	485	350	315		457	457	475	525	575	675
100-315	150	100	252	495	350	315		508	508	508	540	590	690
100-400	150	100	252	505	350	375			660	660	660	660	690
125-250	150	125	267	505	280	355		457	457	475	525	575	675
125-315	150	125	277	515	280	355			508	508	540	590	690
125-400	150	125	277	505	280	400			660	660	660	660	690
150-200	150	150	300	510	280	315		406	425	475			
150-315	200	150	342	580	350	400			508	508	540	590	690
150-400	200	150	342	600	350	450				660	660	660	690

	sl								
	80	90S/L	100L 112M	132S/M	160M/L 180M/L 200L	225S	225M		250M 280S/M
poles						04	02	04	
32-160	565	575	585	605					
32-200	565	575	585	605	635				
40-160	565	575	585	605	635				
40-200	565	575	585	605	635				
40-250	680	690	700	720	750		750		
50-160	565	575	585	605	635				
50-200	565	575	585	605	635		635		
50-250	680	690	700	720	750		750		
65-160	670	680	690	710	740		740		
65-200	670	680	690	710	740		740		
65A-250		690	700	720	750		750		

	sl								
	80	90S/L	100L 112M	132S/M	160M/L 180M/L 200L	225S	225M		250M 280S/M
poles						04	02	04	
65-315		720	730	750	780		780		810
80-160		680	690	710	740		740		
80-200		690	700	720	750		750		780
80-250		690	700	720	750		750		780
80A-250		690	700	720	750		750		780
80-315			730	750	780		780		810
80-400				750	780	810		810	
100C-200			700	720	750		750		780
100-250			730	750	780		780		810
100-315			730	750	780	810	780	810	810
100-400				750	780	810		810	810
125-250			730	750	780	810		810	810
125-315				750	780	810		810	810
125-400				750	780	810		810	810
150-200			700	720	750				
150-315				750	780	810		810	810
150-400					780	810		810	810

	80	90S	90L	100L	112M	132S	132M	160M	160L	180M	180L	200L	225S	225M	250M	280S/M
	F165			F215		F265		F300				F350	F400		F500	
sv(*)	286	308	332	366	392	450	488	548	592	626	662	754	768	792	1000	1160

(*): Motor length based on DIN 42677, could be different due to applied motor make.

8.1.5 Pump dimensions PN10

	aa	ab	zb	zd	zg	zh	vh				
							132S/M	160M/L 180M/L	200L	225S/M	250M 280S/M
200-200	200	200	498	700	500	400	457	475	525		
250B-315	250	250	533	800	600	500		508	540	590	690

	sl				
	132S/M	160M/L 180M/L 200L	225S	225M	250M 280S/M
poles			04	04	
200-200	720	750			
250B-315		780	810	810	810

	132S	132M	160M	160L	180M	180L	200L	225S	225M	250M	280S/M
	F265		F300				F350	F400		F500	
sv(*)	450	488	548	592	626	662	754	768	792	1000	1160

(*): Motor length based on DIN 42677, could be different due to applied motor make.

8.2 Pump dimensions - bearing group 4 (NG, B)

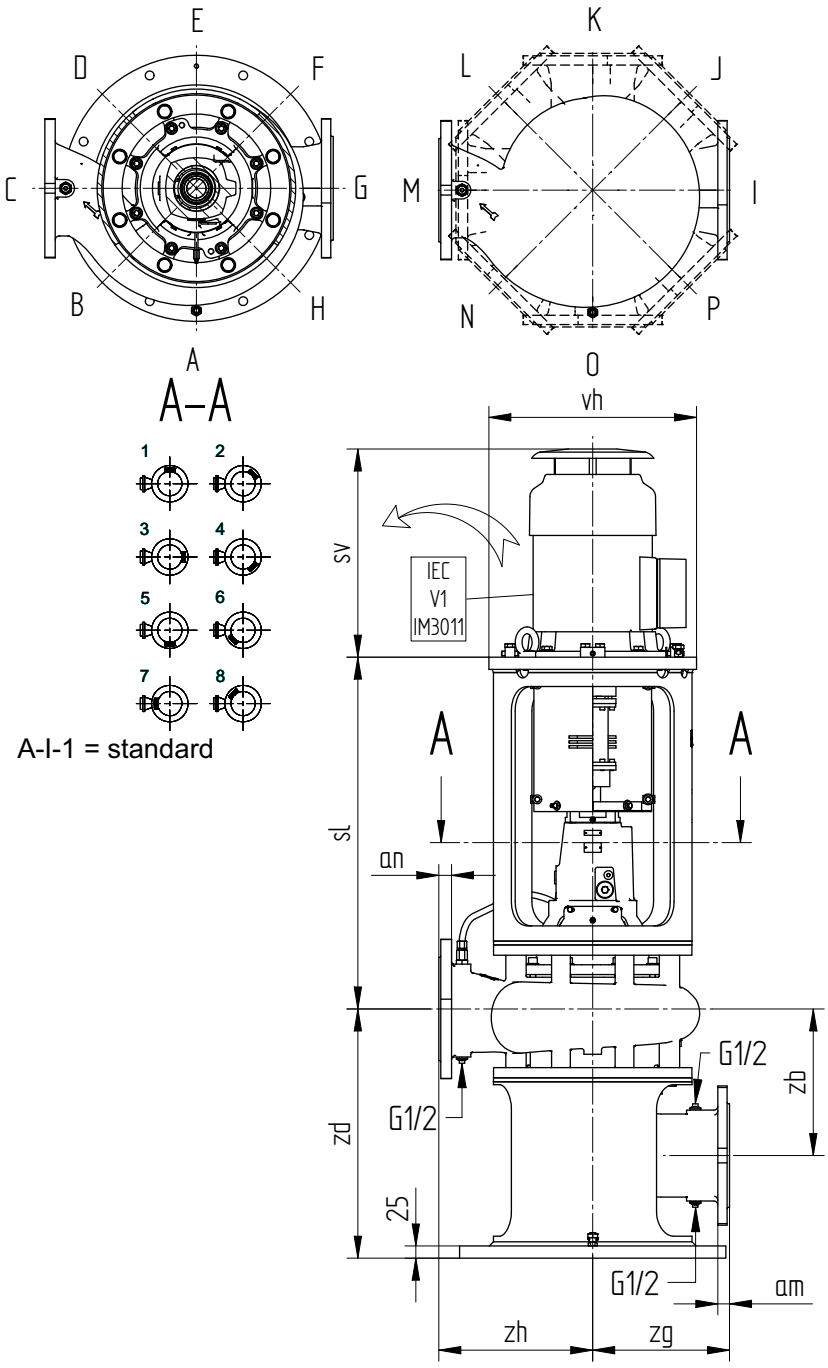

Figure 15: Pump dimensions.

Standard:

- disassembly opening lantern: pos A
- suction bend: pos I
- junction box electric motor: pos 1

8.2.1 Dimensions delivery flange

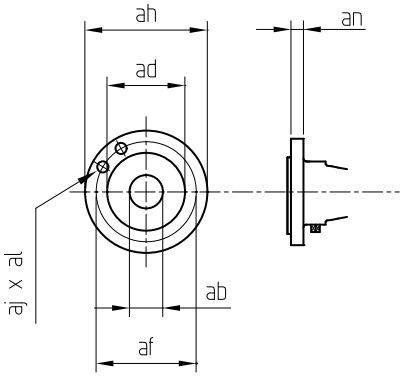

Figure 16: Dimensions delivery flange.

ISO 7005 PN10					
ab	**ad**	**af**	**ah**	**aj x al**	**an**
125	184	210	250	8 x 19	26
150	211	240	285	8 x 23	26
200	266	295	340	8 x 23	30
250	319	350	405	12 x 23	32
300	370	400	445	12 x 23	32

8.2.2 Dimensions suction flange

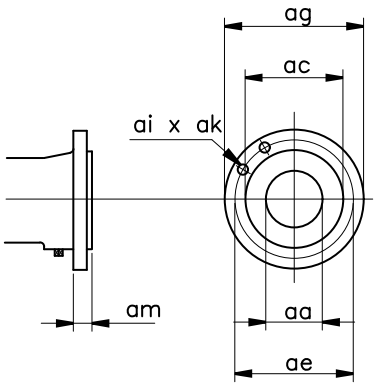

Figure 17: Dimensions suction flange.

ISO 7005 PN10					
aa	**ac**	**ae**	**ag**	**ai x ak**	**am**
200	268	295	340	8 x 23	30
250	319	350	395	12 x 23	32
300	370	400	445	12 x 23	32
300	370	400	445	12 x 23	32

8.2.3 Dimensions foot support

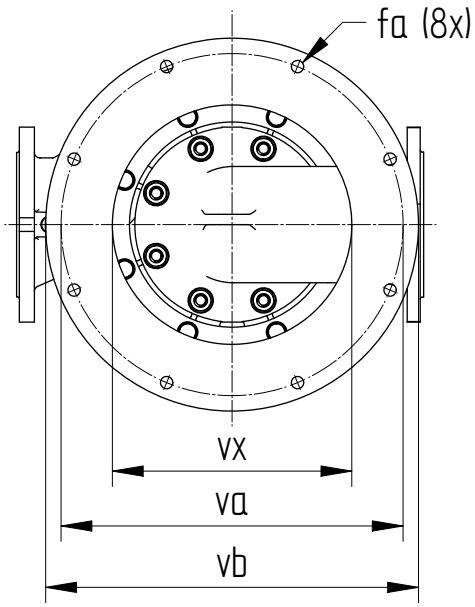

Figure 18: Dimensions foot support.

fa	va	vb	vx	pump type
22	750	800	550	200-250, 200-315, 250-250, 250-315, 300-250, 300-315
22	850	900	600	150B-400, 200-400
22	950	1000	700	125-500, 150-500

8.2.4 Pump dimensions PN10

	aa	ab	zb	zd	zg	zh	vh						
							132S/M	160M/L 180M/L	200L	225S/M	250M 280S/M	315S/M /L/LX	355M
125-500	200	125	337	600	350	500			813	813	813	813	930
150B-400	250	150	357	700	600	500			711	711	711	790	
150-500	250	150	357	700	600	550					813	813	930
200-250	200	200	342	750	350	425		660	660	660	690		
200-315	250	200	357	750	600	450	660	660	660	660	690	800	
200-400	300	200	397	750	700	550			711	711	711	790	930
250-250	300	250	452	800	700	550		660	660	660	690	800	
250-315	300	250	437	750	700	500			660	660	690	800	
300-250	300	300	387	750	700	550				660	690	800	
300-315	300	300	442	750	700	550				660	690	800	

	sl							
	132S/M	160M/L 180M/L 200L	225S	225M	250M 280S/M	315S/M/L	315LX	355M
poles			04	04		04	04	04
125-500		990	1020	1020	1020	1050	1050	1090
150B-400		1000	1030	1030	1030	1060	1060	
150-500				1025	1025	1055	1055	1095
200-250		1005	1032	1035	1035			
200-315	975	1005	1035	1035	1035	1065		
200-400		1055	1085	1085	1085	1115	1115	1155
250-250		1075	1105	1105	1105	1135		
250-315		1060	1090	1090	1090	1120		
300-250			1110	1110	1110	1140		
300-315				1110	1110	1140		

	132S	132M	160M	160L	180M	180L	200L	225S	225M	250M	280S	280M	315S/M/L/LX	355M
	F265		F300				F350	F400		F500			F600	F740
sv(*)	450	488	548	592	626	662	754	768	792	1000	1160		1270	1360

(*): Motor length based on DIN 42677, could be different due to applied motor make.

8.3 Pump dimensions - bearing groups 0, 1, 2, 3 (R)

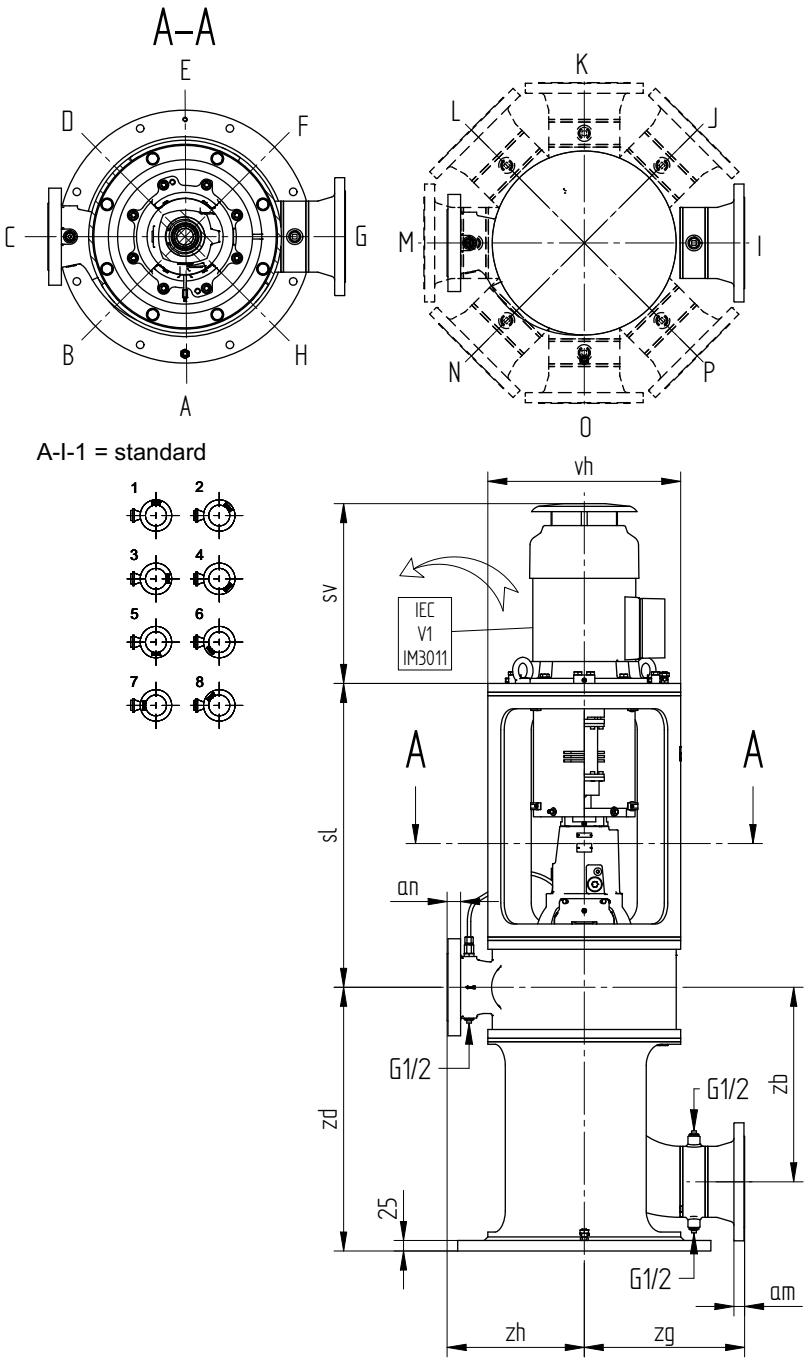

Figure 19: Pump dimensions.

Standard:

- disassembly opening lantern: pos A
- suction bend: pos I
- junction box electric motor: pos 1

8.3.1 Dimensions delivery flange

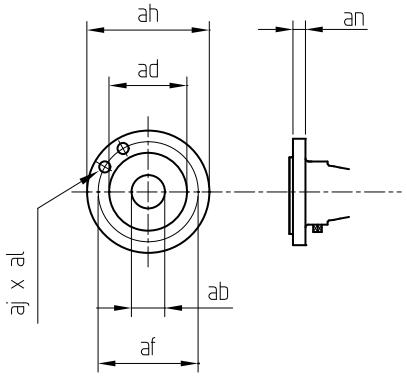

Figure 20: Dimensions delivery flange.

ISO 7005 PN16					
ab	**ad**	**af**	**ah**	**aj x al**	**an**
40	84	110	150	4 x 18	22
50	99	125	165	4 x 18	24
65	118	145	185	8 x 18	26
80	132	100	200	8 x 18	31
100	156	180	220	8 x 18	32
150	211	240	285	8 x 22	28
200	284	295	340	12 x 22	42

ISO 7005 PN20 (ASME B16.5 150 lbs RF)					
ab	**ad**	**af**	**ah**	**aj x al**	**an**
40	73	99	130	4 x 16	22
50	92	121	150	4 x 18	24
65	105	140	180	4 x 18	26
80	127	153	190	4 x 18	31
100	158	191	230	8 x 18	32
150	216	242	280	8 x 22	28
200	270	299	345	8 x 22	42

8.3.2 Dimensions suction flange

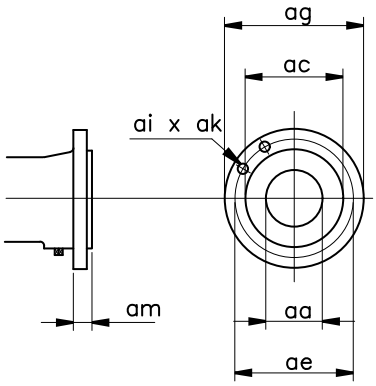

Figure 21: Dimensions suction flange.

ISO 7005 PN16					
aa	**ac**	**ae**	**ag**	**ai x ak**	**am**
80	138	160	200	8 x 18	20
100	158	180	220	8 x 18	20
125	188	210	250	8 x 18	22
150	212	240	285	8 x 22	22
200	268	295	340	12 x 22	24

ISO 7005 PN20 (ASME B16.5 150 lbs RF)					
aa	**ac**	**ae**	**ag**	**ai x ak**	**am**
80	127	152	191	4 x 19	24
100	157	191	230	8 x 19	24
125	186	216	254	8 x 22	24
150	216	241	279	8 x 22	25
200	270	299	343	8 x 22	29

8.3.3 Dimensions foot support

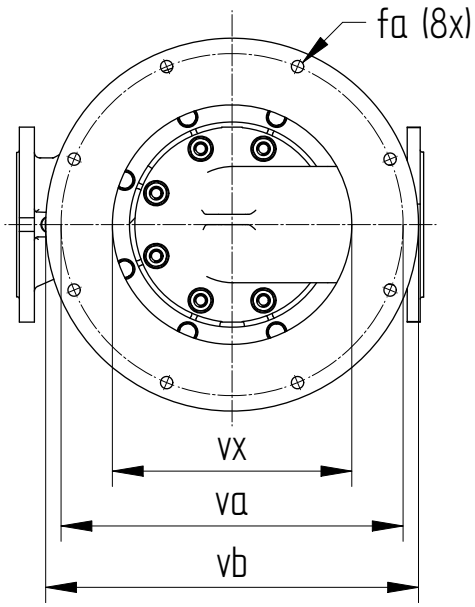

Figure 22: Dimensions foot support.

fa	va	vb	vx	pump type
18	460	500	300	50AC-125
18	500	545	350	40-200, 65A-200
18	555	600	400	100C-200, 40A-250, 50A-250, 80-250, 80A-250
18	600	650	450	200-200
18	660	710	500	100A-315, 100B-315
22	750	800	550	150-400

8.3.4 Pump dimensions PN16/PN20

	aa	ab	zb PN16	zb PN20	zd	zg	zh	vh						
								80 90S/L	100L 112M	132S/M	160M/L 180M/L	200L	225S/M	250M 280S/M
50AC-125	80	50	215,7	241	375	325	250	356	375	425				
40-200	80	40	230,7	256	395	325	280	406	406	425	475			
40A-250	100	40	255,9	275	435	350	315	457	457	457	475	525		
50A-250	100	50	262,2	282	435	350	315	457	457	457	475	525	575	
65A-200	125	65	301,2	326	500	450	280	406	406	425	475	525		
80-250	150	80	363,8	398	575	480	315	457	457	457	475	525	575	675
80A-250	150	80	363,8	398	575	480	315	457	457	457	475	525	575	675
100A-315	150	100	363,8	398	586	480	375		559	559	559	559	590	690
100C-200	150	100	427,5	462	625	350	325		457	457	475	525	575	675
100B-315	150	100	363,8	398	600	480	375		559	559	559	559	590	690
150-400	200	150	511	550	780	450	450				660	660	660	690
200-200	200	200	571	610	800	450	400			508	508	540		

	sl								
	80	90S/L	100L 112M	132S/M	160M/L 180M/L 200L	225S	225M		250M 280S/M
poles						04	02	04	
50AC-125	565	575	585	605					
40-200	565	575	585	605	635				
40A-250	680	690	700	720	750				
50A-250	680	690	700	720	750		750		
65A-200	670	680	690	710	740				
80-250		690	700	720	750		750		780
80A-250		690	700	720	750		750		780
100A-315			730	750	780		780		810
100C-200			700	720	750		750		780
100B-315			730	750	780	810	780		810
150-400					780	810		810	810
200-200				750	780				

	80	90S	90L	100L	112M	132S	132M	160M	160L	180M	180L	200L	225S	225M	250M	280S/M
	F165			F215		F265		F300				F350	F400		F500	
sv(*)	286	308	332	366	392	450	488	548	592	626	662	754	768	792	1000	1160

(*): Motor length based on DIN 42677, could be different due to applied motor make.

8.4 Dimensions of shaft sealing configuration MQ2-MQ3-CQ3

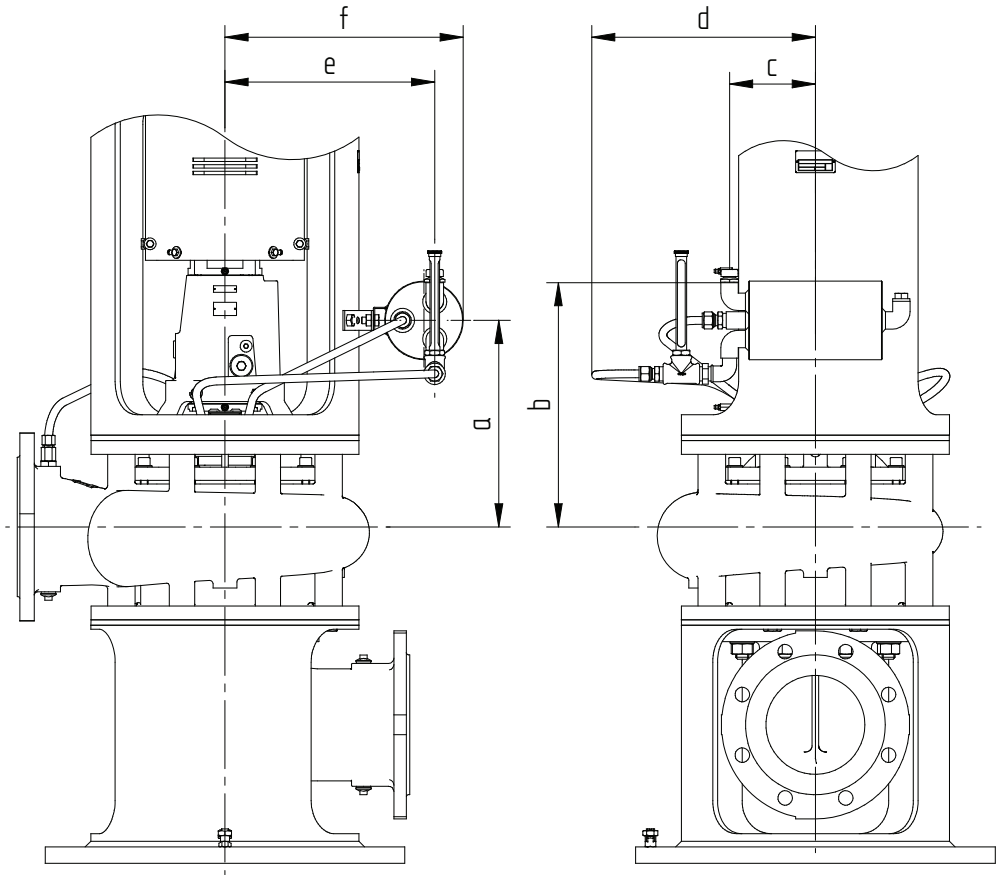

Figure 23: Shaft sealing configuration MQ2-MQ3-CQ3.

CFU	M2	L	a	b	c	d	e	f
32-160	35	55	230	295	130	340	290	334
32-200	35	55	230	295			318	361
50AC-125	35	55	230	295			290	334
40-160	35	55	230	295			290	334
40-200	35	55	230	295			318	361
40-250	35	65	230	295			346	389
40A-250	35	65	230	295			346	389
50-160	65	55	260	325			290	334
50-200	35	55	230	295			318	361
50-250	35	65	230	295			346	389
50A-250	35	65	230	295			346	389
65-160	65	55	260	325			290	334
65-200	65	55	260	325			318	361
65A-200	65	55	260	325			318	361
65A-250	60	65	255	320			346	389
65-315	75	85	270	335			373	416
80-160	85	55	280	345			290	334

CFU	M2	L	a	b	c	d	e	f
80-200	90	65	285	350	130	340	318	361
80-250	60	65	255	320			346	389
80A-250	60	65	255	320			346	389
80-315	85	85	280	345			373	416
100A-315	75	85	270	335			399	442
80-400	85	85	280	345			453	496
100C-200	90	65	285	350			318	361
100C-200	90	65	285	350			346	389
100-250	90	65	285	350			346	389
100-315	75	85	270	335			373	416
100B-315	75	85	270	335			399	442
100-400	85	85	280	345			453	496
125-250	90	65	285	350			346	389
125-315	85	85	280	345			373	416
125-400	85	85	280	345			453	496
125-500	90	90	285	350			531	574
150-200	110	65	310	370			318	361
150-315	85	85	280	345			373	416
150-400	85	85	280	345			453	496
150-400R	85	85	280	345			478	521
150B-400	120	100	315	380			478	521
150-500	140	95	335	400			531	574
200-200	120	65	315	380			346	389
200-200R	115	65	310	375			373	416
200-250	140	95	335	400			453	496
200-315	130	105	325	390			453	496
200-400	140	105	335	400			478	521
250-250	175	115	370	435			453	496
250-315	140	110	335	400			453	496
250B-315	115	85	310	375			373	416
300-250	180	130	375	440			453	496
300-315	180	130	375	440			453	496

9 Parts

9.1 Ordering parts

9.1.1 Order form

You can use the order form included in this manual for ordering parts.

When ordering parts always quote the following data:

1 Your **address**.

2 The **quantity, the item number and the description** of the part.

3 The **pump number**. The pump number is stated on the label on the cover of this manual and on the type plate of the pump.

4 In the event of different electric motor voltage you should state the correct voltage.

9.1.2 Recommended spare parts

Parts marked with a * are recommended spare parts.

9.2 Pump G/B, bearing group 1-2-3

9.2.1 Sectional drawing

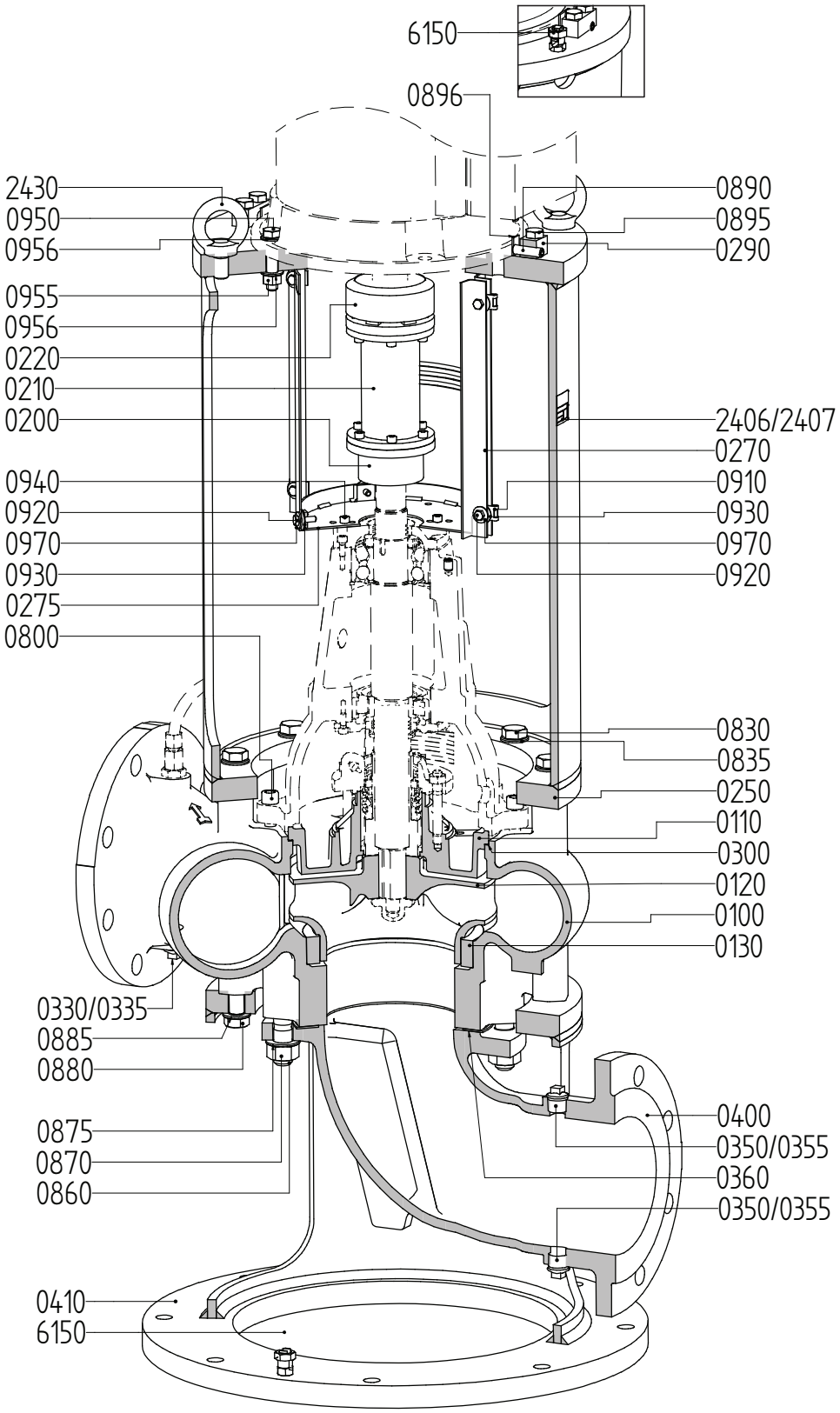

Figure 24: Sectional drawing

9.2.2 Parts list

Item	Quantity	Description	Material					
			G1	G2	G3	G6	B2	B3
0100	1	pump casing	cast iron				bronze	
0110	1	stuffing box cover	cast iron				bronze	
0120*	1	impeller	c.i.	bronze	alu.brz	st.st.	bronze	alu.brz
0130*	1	wear ring	c.i.	bronze				
0200	1	coupling half, pump side	cast iron					
0210	1	spacer	cast iron					
0220	1	coupling half, motor side	cast iron					
0250	1	lantern piece	steel					
0270	1	guard	stainless steel					
0275	1	assembly plate	stainless steel					
0290	4	adjusting cam	steel					
0300*	1	gasket	- -					
0330	1	plug	cast iron				stainless steel	
0335	1	sealing ring	PTFE					
0350	2	plug	steel				stainless steel	
0360	1	gasket	rubber					
0400	1	suction bend	steel				duplex	
0410	1	support	steel					
0800	4/8/12**	Allen screw	steel					
0830	8	bolt	stainless steel					
0835	8	washer	stainless steel					
0860	***	stud	steel					
0870	***	nut	steel					
0875	***	washer	stainless steel					
0880	8	bolt	stainless steel					
0885	8	washer	stainless steel					
0890	4	set screw / Allen screw	stainless steel					
0895	8	bolt	stainless steel					
0896	4	protection plate	stainless steel					
0910	4	speed nut	stainless steel					
0920	8	bolt	stainless steel					
0930	8	washer	stainless steel					
0940	4	Allen screw	stainless steel					
0950	4/8***	bolt	stainless steel					
0955	4/8***	washer	stainless steel					
0956	4/8***	nut	stainless steel					
0970	8	washer	stainless steel					
2406	1	name plate	stainless steel					
2407	4	rivet	stainless steel					
2430	2	lifting eye bolt	stainless steel					
6150	2	earthing boss	copper alloy					

c.i. = cast iron, alu.brz = aluminium bronze, st.st. = stainless steel
** Quantity depends on pump type
*** Quantity depends on pump type / motor

9.2.3 Sectional drawing 200-200 / 250B-315

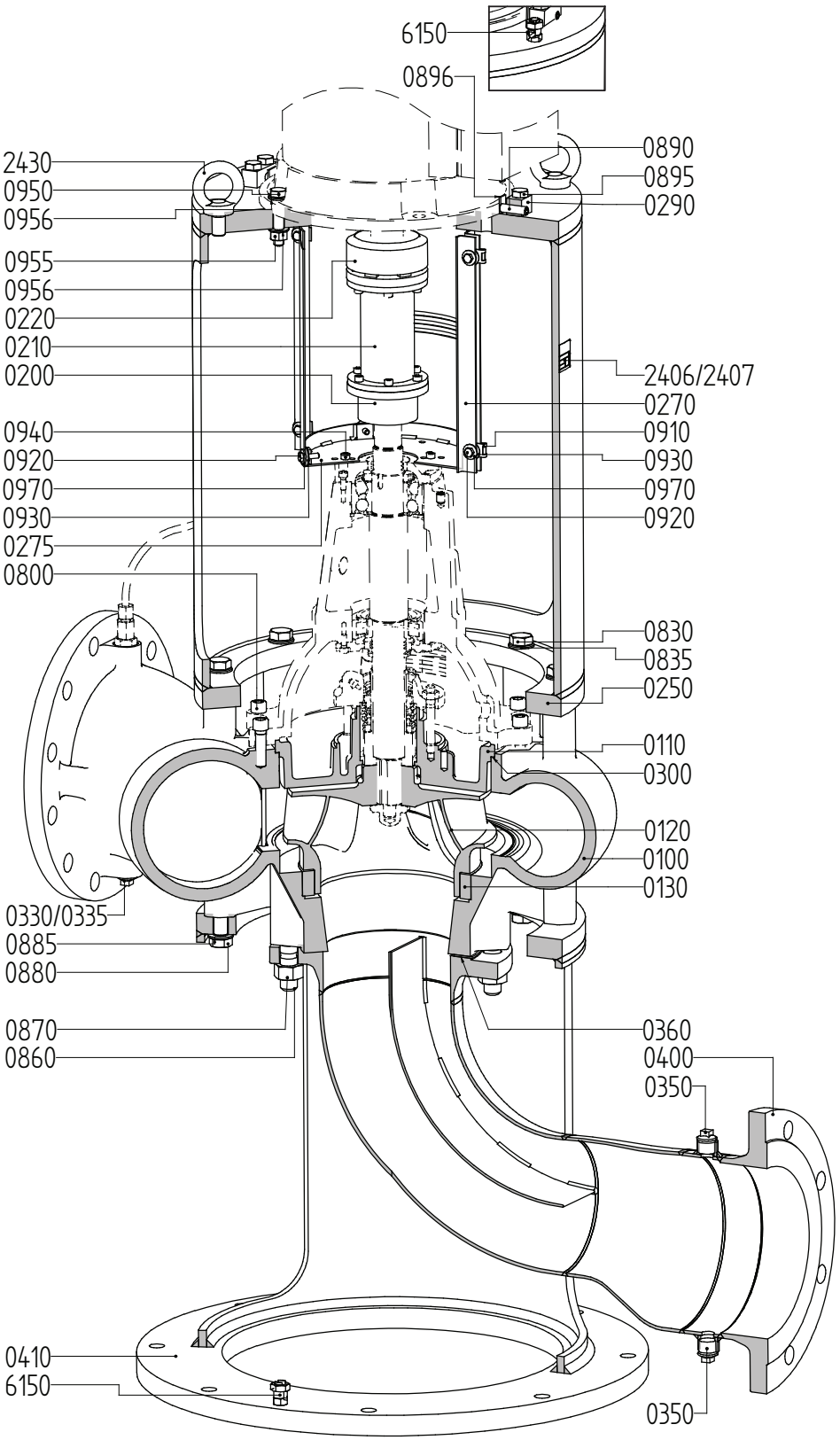

Figure 25: Sectional drawing 200-200 / 250B-315.

9.2.4 Parts list 200-200 / 250B-315

Item	Quantity	Description	Material					
			G1	G2	G3	G6	B2	B3
0100	1	pump casing	cast iron				bronze	
0110	1	stuffing box cover	cast iron				bronze	
0120*	1	impeller	c.i.	bronze	alu.brz	st.st.	bronze	alu.brz
0130*	1	wear ring	c.i.	bronze				
0200	1	coupling half, pump side	cast iron					
0210	1	spacer	cast iron					
0220	1	coupling half, motor side	cast iron					
0250	1	lantern piece	steel					
0270	1	guard	stainless steel					
0275	1	assembly plate	stainless steel					
0290	4	adjusting cam	steel					
0300*	1	gasket	- -					
0330	1	plug	cast iron				stainless steel	
0335	1	sealing ring	PTFE					
0350	2	plug	steel				stainless steel	
0360	1	gasket	rubber					
0400	1	suction bend	steel				duplex	
0410	1	support	steel					
0800	4/8/12**	Allen screw	steel					
0830	8	bolt	stainless steel					
0835	8	washer	stainless steel					
0860	4/8***	stud	steel					
0870	4/8***	nut	steel					
0880	8	bolt	stainless steel					
0885	8	washer	stainless steel					
0910	4	speed nut	stainless steel					
0890	4	set screw / Allen screw	stainless steel					
0895	8	bolt	stainless steel					
0896	4	protection plate	stainless steel					
0920	8	bolt	stainless steel					
0930	8	washer	stainless steel					
0940	4	Allen screw	stainless steel					
0950	***	bolt	stainless steel					
0955	***	washer	stainless steel					
0956	***	nut	stainless steel					
0970	8	washer	stainless steel					
2406	1	name plate	stainless steel					
2407	4	rivet	stainless steel					
2430	2	lifting eye bolt	stainless steel					
6150	2	earthing boss	copper alloy					

c.i. = cast iron, alu.brz = aluminium bronze, st.st. = stainless steel
** Quantity depends on pump type
*** Quantity depends on pump type / motor

9.3 Pump R, bearing group 1-2-3

9.3.1 Sectional drawing

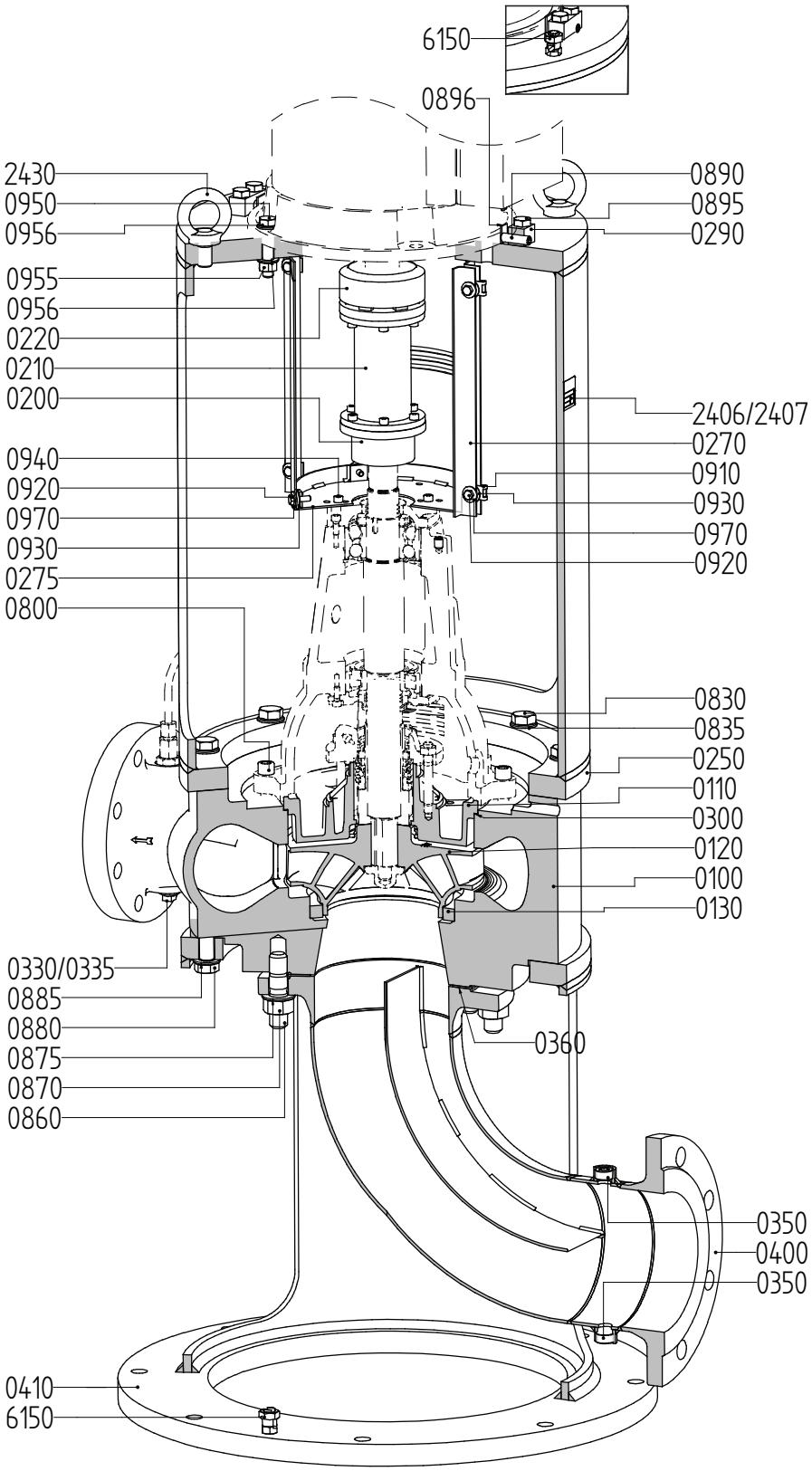

Figure 26: Sectional drawing.

9.3.2 Parts list

Item	Quantity	Description	Material
			R6
0100	1	pump casing	stainless steel
0110	1	stuffing box cover	stainless steel
0120*	1	impeller	stainless steel
0130*	1	wear ring	stainless steel
0200	1	coupling half, pump side	cast iron
0210	1	spacer	cast iron
0220	1	coupling half, motor side	cast iron
0250	1	lantern piece	steel
0270	1	guard	stainless steel
0275	1	assembly plate	stainless steel
0290	4	adjusting cam	steel
0300*	1	gasket	- -
0330	1	plug	stainless steel
0335	1	sealing ring	PTFE
0350	2	plug	stainless steel
0360	1	gasket	rubber
0400	1	suction bend	stainless steel
0410	1	support	steel
0800	4/8/12**	Allen screw	stainless steel
0830	8	bolt	stainless steel
0835	8	washer	stainless steel
0860	***	stud	steel
0870	***	nut	steel
0875	***	washer	steel
0880	8	bolt	stainless steel
0885	8	washer	stainless steel
0890	4	set screw / Allen screw	stainless steel
0895	8	bolt	stainless steel
0896	4	protection plate	stainless steel
0910	4	speed nut	stainless steel
0920	8	bolt	stainless steel
0930	8	washer	stainless steel
0940	4	Allen screw	stainless steel
0950	4/8***	bolt	stainless steel
0955	4/8***	washer	stainless steel
0956	4/8***	nut	stainless steel
0970	8	washer	stainless steel
2406	1	name plate	stainless steel
2407	4	rivet	stainless steel
2430	2	lifting eye bolt	stainless steel
6150	2	earthing boss	copper alloy

** Quantity depends on pump type

*** Quantity depends on pump type / motor

9.4 Pump NG/B, bearing group 4

9.4.1 Sectional drawing

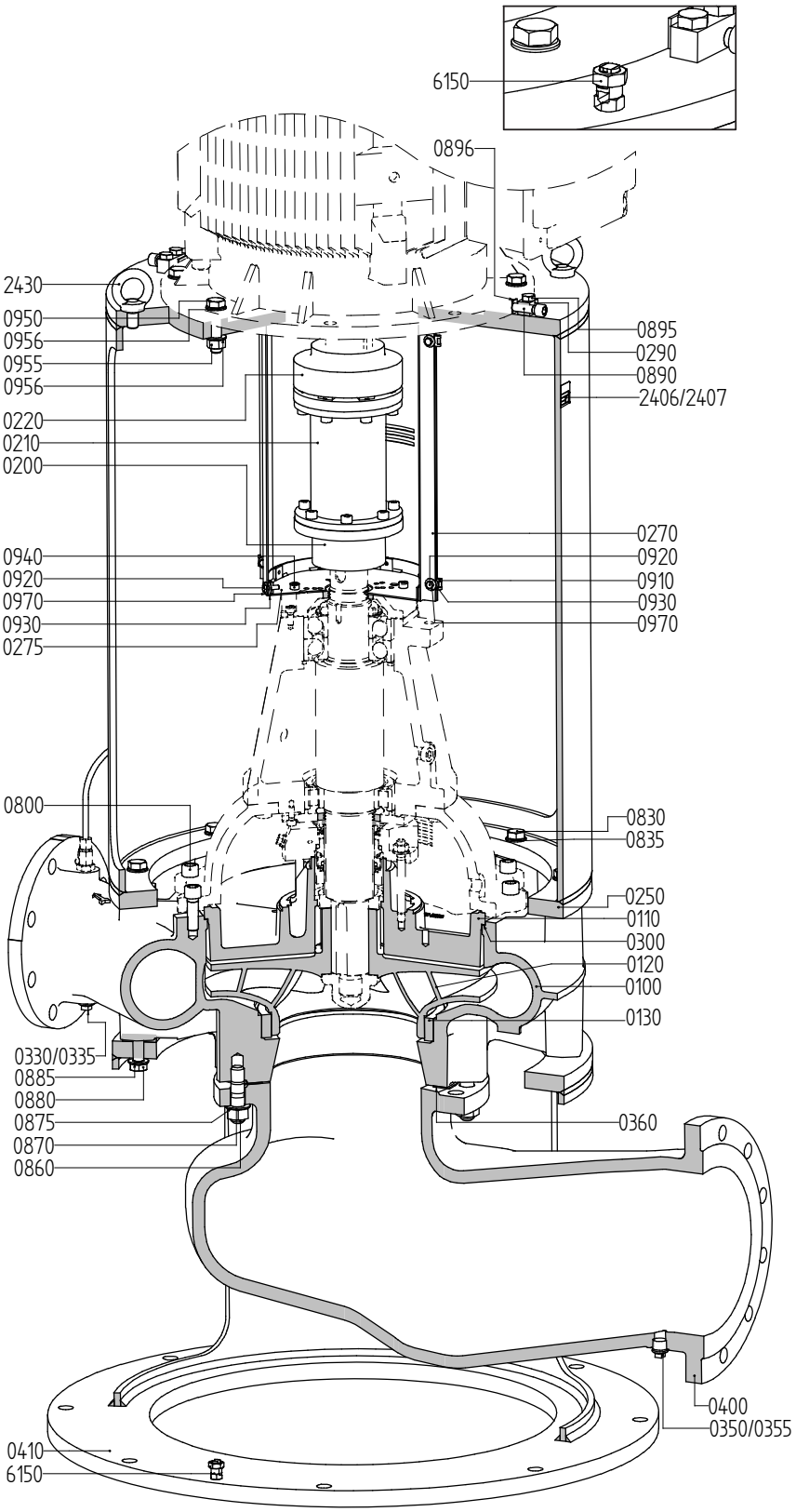

Figure 27: Sectional drawing.

9.4.2 Parts list

Item	Quantity	Description	Material				
			NG1	NG2	NG3	B2	B3
0100	1	pump casing	nodular cast iron			bronze	
0110	1	stuffing box cover	nodular cast iron			bronze	
0120*	1	impeller	c.i.	bronze	alu.brz	st.st.	bronze
0130*	1	wear ring	c.i.	bronze			
0200	1	coupling half, pump side	cast iron				
0210	1	spacer	cast iron				
0220	1	coupling half, motor side	cast iron				
0250	1	lantern piece	steel				
0270	1	guard	stainless steel				
0275	1	assembly plate	stainless steel				
0290	4	adjusting cam	steel				
0300*	1	gasket	- -				
0330	1	plug	cast iron			stainless steel	
0335	1	sealing ring	copper				
0350	1	plug	steel				st.st.
0355	1	sealing ring	copper			gylon	
0360	1	gasket	- -				
0400	1	suction bend	cast iron			bronze	
0410	1	support	steel				
0800	8/12/16**	Allen screw	steel				
0830	8	bolt	stainless steel				
0835	8	washer	stainless steel				
0860	12/16**	stud	stainless steel				
0870	12/16**	nut	stainless steel				
0875	12/16**	washer	stainless steel				
0880	8	bolt	stainless steel				
0885	8	washer	stainless steel				
0890	4	set screw / Allen screw	stainless steel				
0895	8	bolt	stainless steel				
0896	4	protection plate	stainless steel				
0910	4	speed nut	stainless steel				
0920	8	bolt	stainless steel				
0930	8	washer	stainless steel				
0940	4	Allen screw	stainless steel				
0950	4/8***	bolt	stainless steel				
0955	4/8***	washer	stainless steel				
0956	4/8***	nut	stainless steel				
2406	1	name plate	stainless steel				
2407	4	rivet	stainless steel				
2430	2	lifting eye bolt	stainless steel				
6150	2	earthing boss	copper alloy				

c.i. = cast iron, alu.brz = aluminium bronze, st.st. = stainless steel

** Quantity depends on pump type

*** Quantity depends on motor

9.5 Sectional drawing bearing bracket

9.5.1 Sectional drawing bearing bracket, bearing group 1-2-3

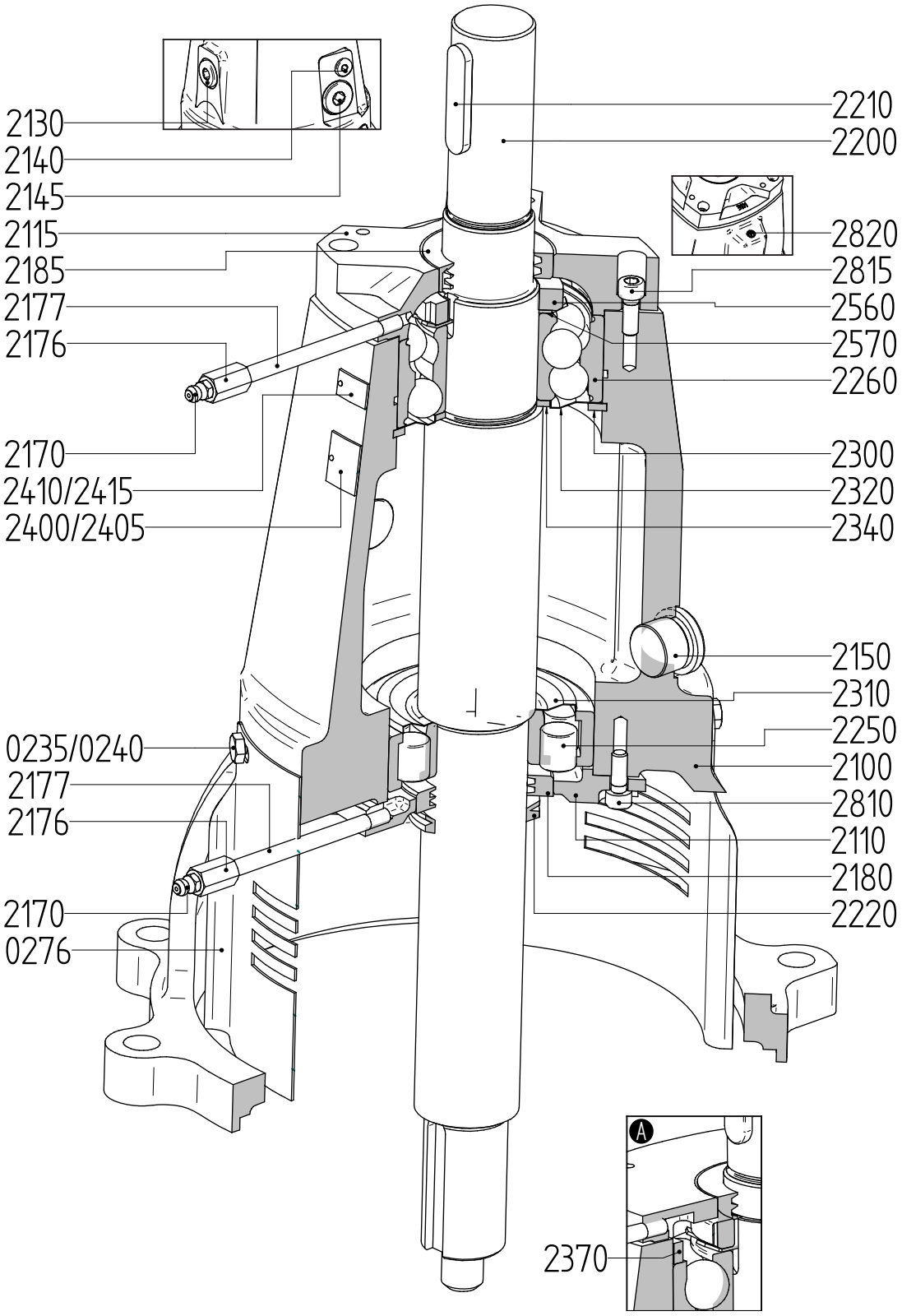

Figure 28: Sectional drawing bearing bracket, bearing group 1-2-3 (A = for bearing group 3).

9.5.2 Parts list bearing bracket, bearing group 1-2-3

Item	Quantity	Description	Material						
			G1	G2	G3	G6	B2	B3	R6
0235	4	bolt	stainless steel						
0240	4	washer	stainless steel						
0276	2	seal guard	stainless steel						
2100	1	bearing bracket	cast iron						
2110	1	bearing cover	cast iron						
2115	1	bearing cover	cast iron						
2130	1	plug	steel						
2140	1	plug	steel						
2145	1	plug	steel						
2150	1	plug	steel						
2170	2	grease nipple	stainless steel						
2176	2	socket	stainless steel						
2177	2	pipe	stainless steel						
2180	1	oil seal	bronze						
2185	1	oil seal	bronze						
2200*	1	pump shaft	steel alloy						
2210*	1	coupling key	steel						
2220*	1	deflector	rubber						
2250*	1	cylindrical roller bearing	- -						
2260*	1	double row angular contact ball bearing							
2300*	1	inner circlip	spring steel						
2310	1	Nilos ring	steel						
2320	1	Nilos ring	steel						
2340	1	adjusting ring	steel						
2370**	1	spacer sleeve	steel						
2400	1	name plate	stainless steel						
2405	2	rivet	stainless steel						
2410	1	arrow plate	aluminium						
2415	2	rivet	stainless steel						
2560	1	lock nut	steel						
2570	1	locking washer	steel						
2810	4	Allen screw	stainless steel						
2815	4	Allen screw	stainless steel						
2820	1	set screw	stainless steel						

** Applies only to bearing group 3

9.5.3 Sectional drawing bearing bracket, bearing group 4

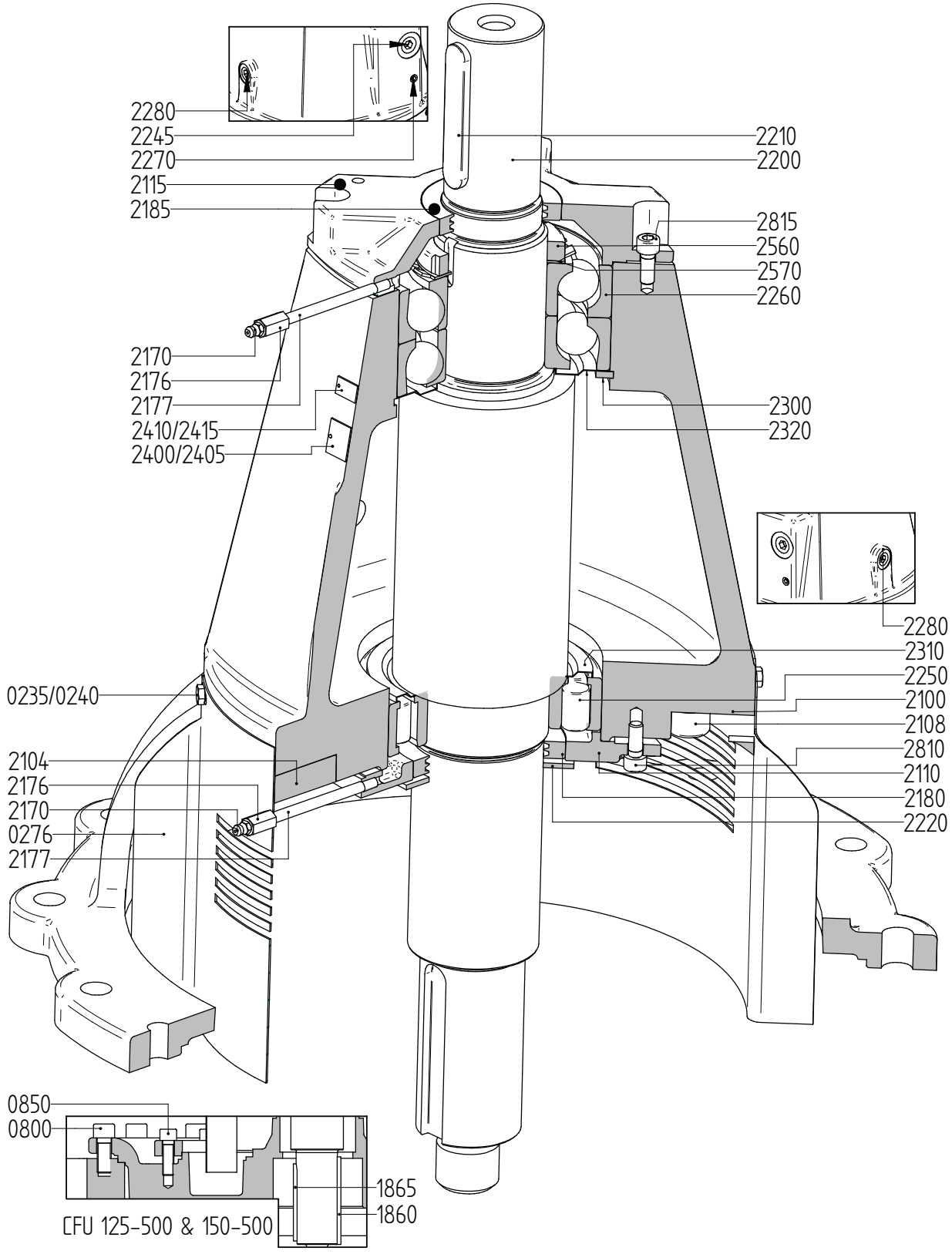

Figure 29: Sectional drawing bearing bracket, bearing group 4.

9.5.4 Parts list bearing bracket, bearing group 4

Item	Quantity	Description	Material				
			NG1	NG2	NG3	B2	B3
0235	4	bolt	stainless steel				
0240	4	washer	stainless steel				
0276	2	seal guard	stainless steel				
0850**	12	Allen screw					
1860	1	key	stainless steel				
1865**	1	key	stainless steel				
2100	1	bearing bracket	cast iron				
2104	1	lantern piece	cast iron				
2108	8	allen screw	steel				
2110	1	bearing cover	cast iron				
2115	1	bearing cover	cast iron				
2170	2	grease mipple	stainless steel				
2176	2	socket	stainless steel				
2177	2	pipe	stainless steel				
2180	1	oil seal	bronze				
2185	1	oil seal	bronze				
2200*	1	pump shaft	steel alloy				
2210*	1	coupling key	steel				
2220*	1	deflector	rubber				
2245	1	plug	steel				
2250*	1	cylindrical roller bearing	- -				
2260*	2	angular contact ball bearing	- -				
2270	1	plug	steel				
2280	2	plug	steel				
2300*	1	inner circlip	spring steel				
2310	1	Nilos ring	steel				
2320	1	Nilos ring	steel				
2400	1	name plate	stainless steel				
2405	2	rivet	stainless steel				
2410	1	arrow plate	aluminium				
2415	2	rivet	stainless steel				
2560	1	lock nut	steel				
2570	1	locking washer	steel				
2810	4	Allen screw	stainless steel				
2815	4	Allen screw	stainless steel				

** Applies only to 125-500 and 150-500

9.6 Shaft sealing group M2

9.6.1 Mechanical seal M7N

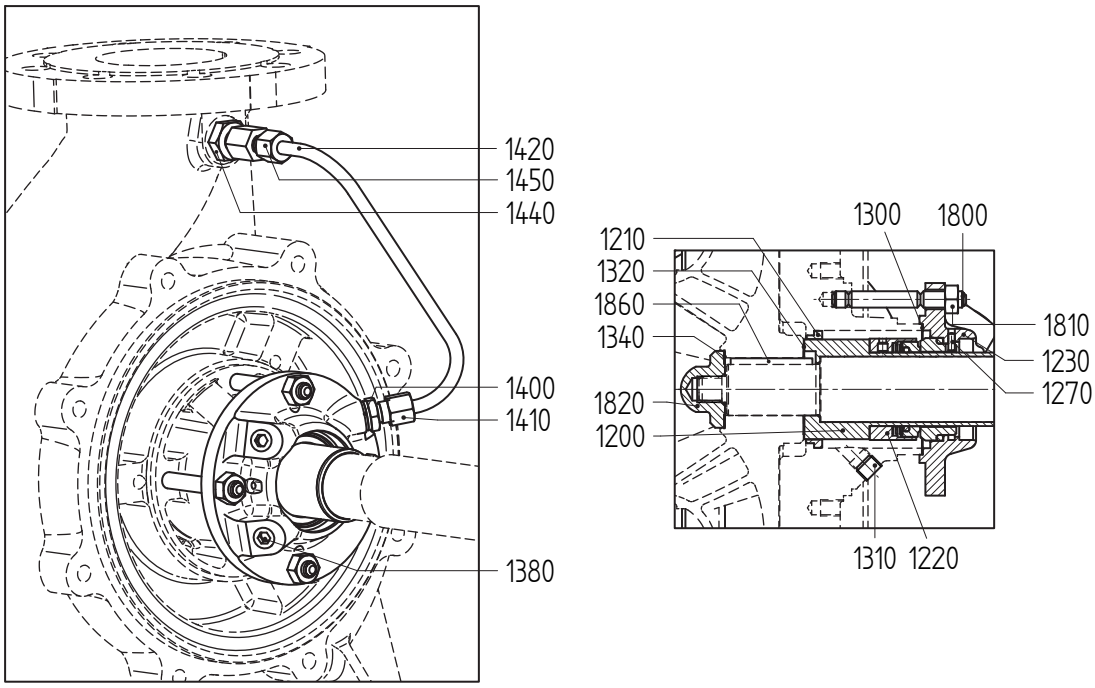

Figure 30: Mechanical seal M7N.

9.6.2 Mechanical seal MG12-G60

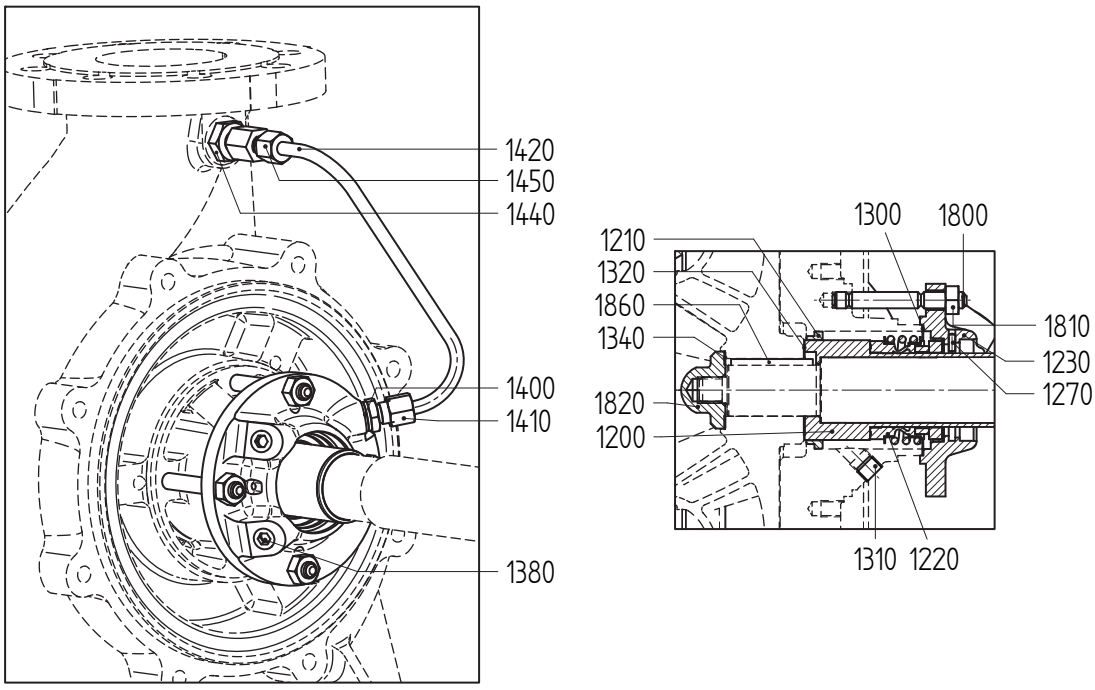

Figure 31: Mechanical seal MG12-G60.

9.6.3 Parts list shaft sealing group M2

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1210*	1	throttling bush	stainless steel
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	stainless steel
1270	1	locking pin	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1380	2	plug	stainless steel
1400	1	sealing ring	PTFE
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	impeller key	stainless steel

9.7 Shaft sealing group M3

9.7.1 Mechanical seal HJ92N

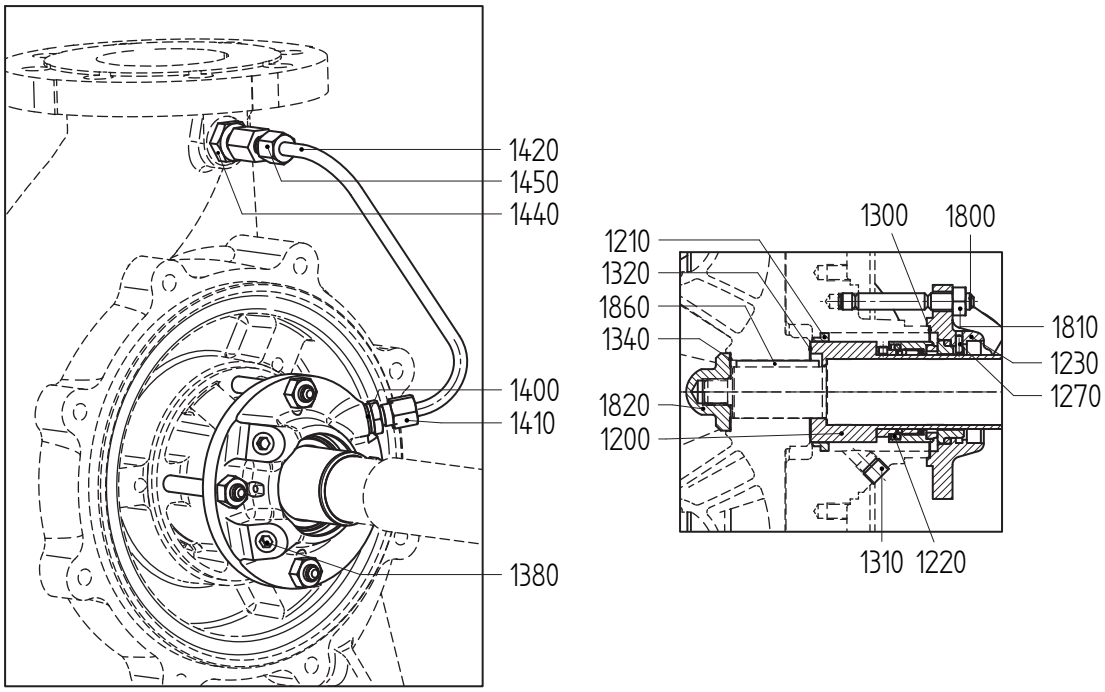

Figure 32: Mechanical seal HJ92N.

9.7.2 Parts list mechanical seal HJ92N

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1210*	1	throttling bush	stainless steel
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	stainless steel
1270	1	locking pin	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1380	2	plug	stainless steel
1400	1	sealing ring	PTFE
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	impeller key	stainless steel

9.8 Shaft sealing group MW2

9.8.1 Mechanical seal M7N

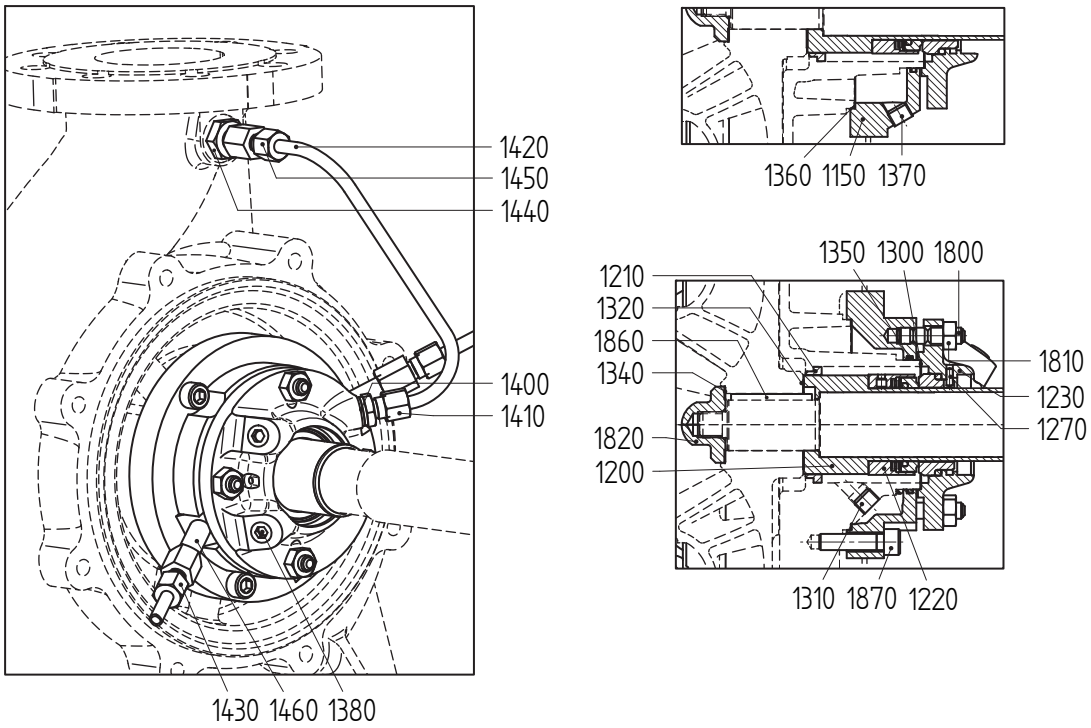

Figure 33: Mechanical seal MW2 - M7N.

9.8.2 Mechanical seal MG12-G60

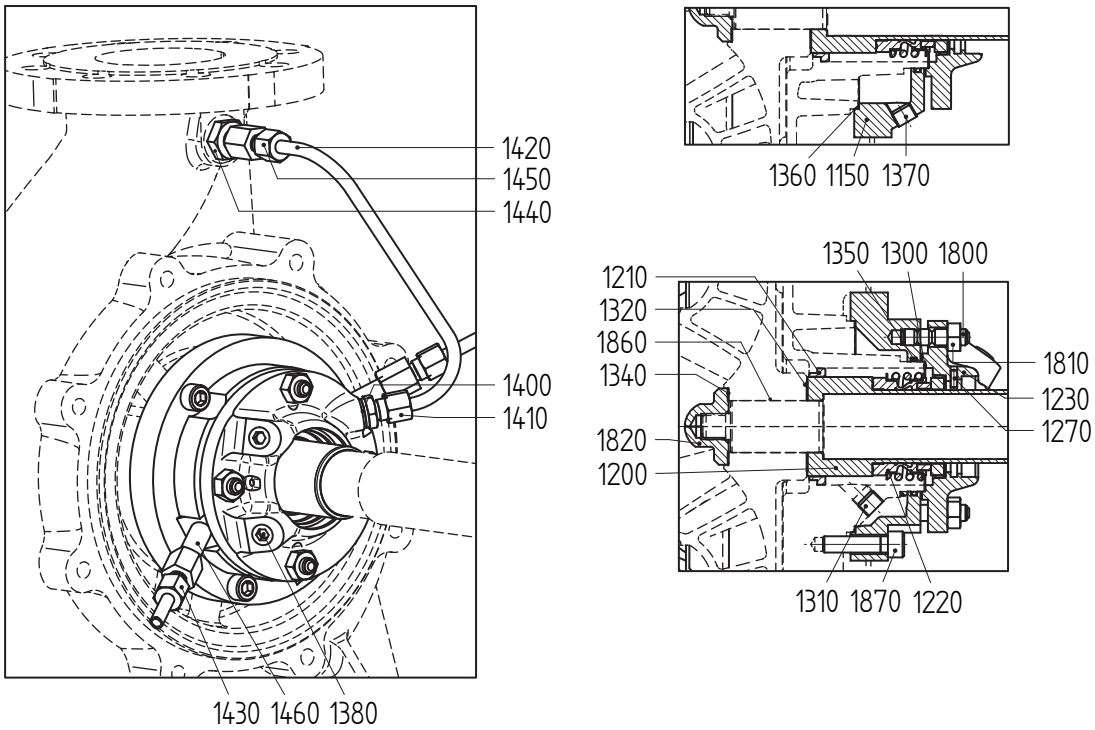

Figure 34: Mechanical seal MW2 - MG12-G60.

9.8.3 Parts list shaft sealing group MW2

Item	Quantity	Description	Material
1150	1	cooling jacket	cast iron
1200*	1	shaft sleeve	stainless steel
1210*	1	throttling bush	stainless steel
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	stainless steel
1270	1	locking pin	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1350	1	O-ring	rubber
1360*	1	gasket	-
1370	2	plug	stainless steel
1380	2	plug	stainless steel
1400	1	sealing ring	PTFE
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1430	2	male connector	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1460	2	pipe nipple	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	impeller key	stainless steel
1870	3	Allen screw	stainless steel

9.9 Shaft sealing group MW3

9.9.1 Mechanical seal HJ92N

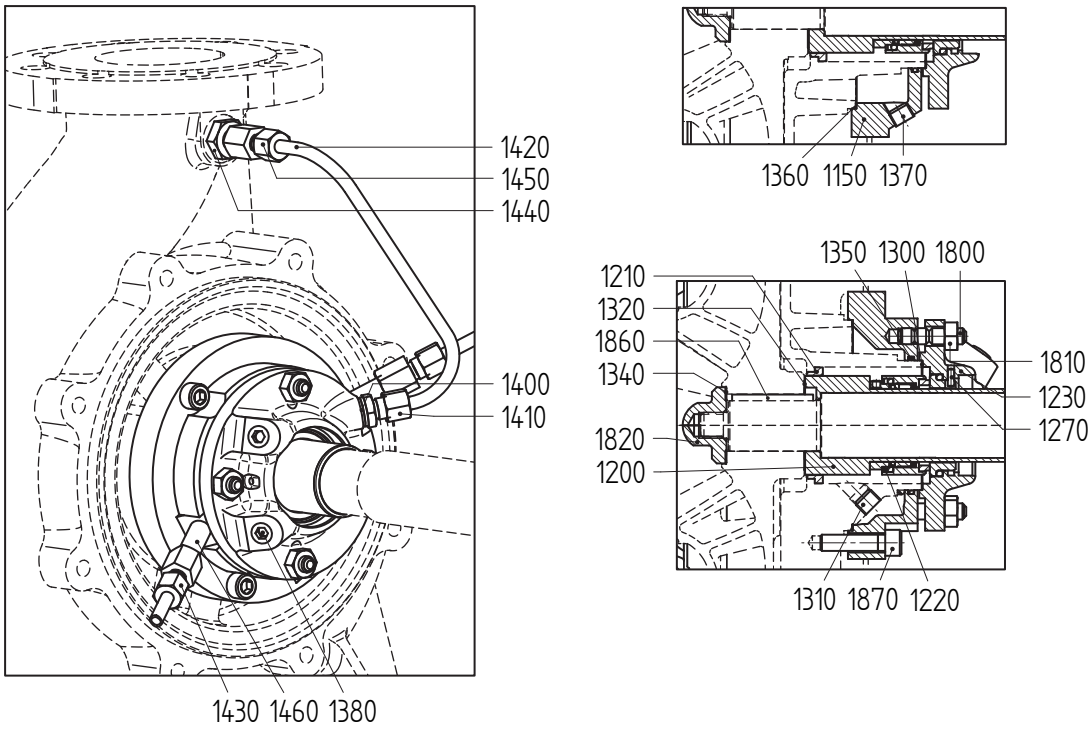

Figure 35: Mechanical seal MW3 - HJ92N.

9.9.2 Parts list shaft sealing group MW3

Item	Quantity	Description	Material
1150	1	cooling jacket	cast iron
1200*	1	shaft sleeve	stainless steel
1210*	1	throttling bush	stainless steel
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	stainless steel
1270	1	locking pin	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1350	1	O-ring	rubber
1360*	1	gasket	-
1370	1	plug	stainless steel
1380	2	plug	stainless steel
1400	1	sealing ring	PTFE
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1430	2	male connector	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1460	2	pipe nipple	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	impeller key	stainless steel
1870	3	Allen screw	stainless steel

9.10 Shaft sealing group MQ2

9.10.1 Mechanical seal MQ2 - M7N

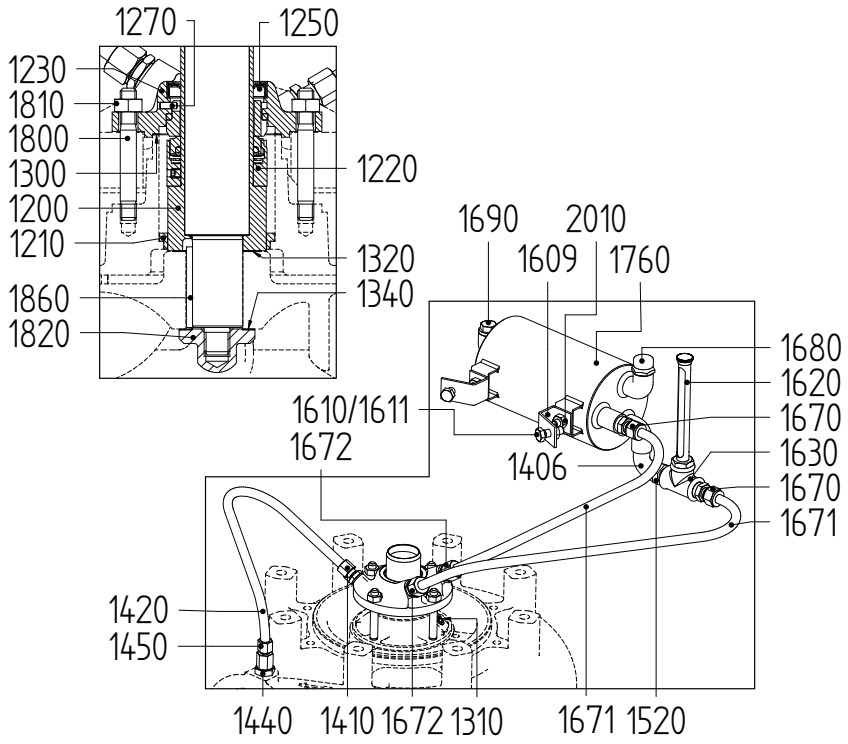

Figure 36: Mechanical seal MQ2 - M7N.

9.10.2 Mechanical seal MQ2 - MG12-G60

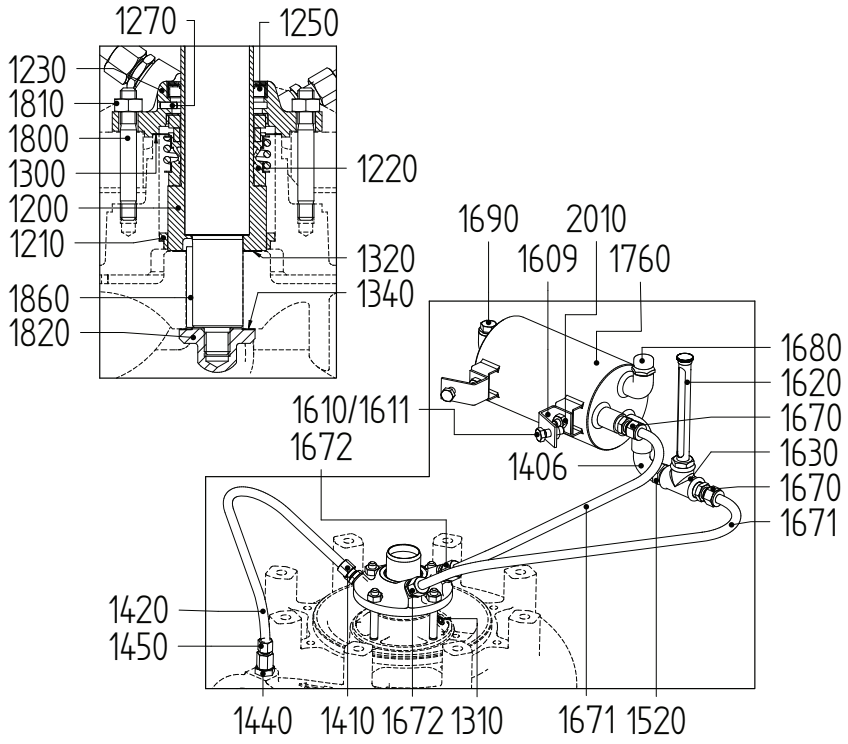

Figure 37: Mechanical seal MQ2 - MG12-G60.

9.10.3 Parts list shaft sealing group MQ2 - M7N / MG12-G60

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel + QPQ
1210*	1	throttling bush	stainless steel
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	stainless steel
1250*	1	PS-seal	PTFE
1270	1	locking pin	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1406	1	elbow	stainless steel
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1520	1	double nipple	stainless steel
1609	1	tank support	steel
1620	1	liquid level indicator	brass
1630	1	tee	stainless steel
1670	2	male connector	stainless steel
1671	1	pipe	stainless steel
1672	2	male connector	stainless steel
1680	1	filling plug	-
1690	1	plug	stainless steel
1760	1	tank	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
2010	2	nut	stainless steel

QPQ = Quench-Polish-Quench

9.11 Shaft sealing group MQ3 - HJ92N

9.11.1 Mechanical seal MQ3 - HJ92N

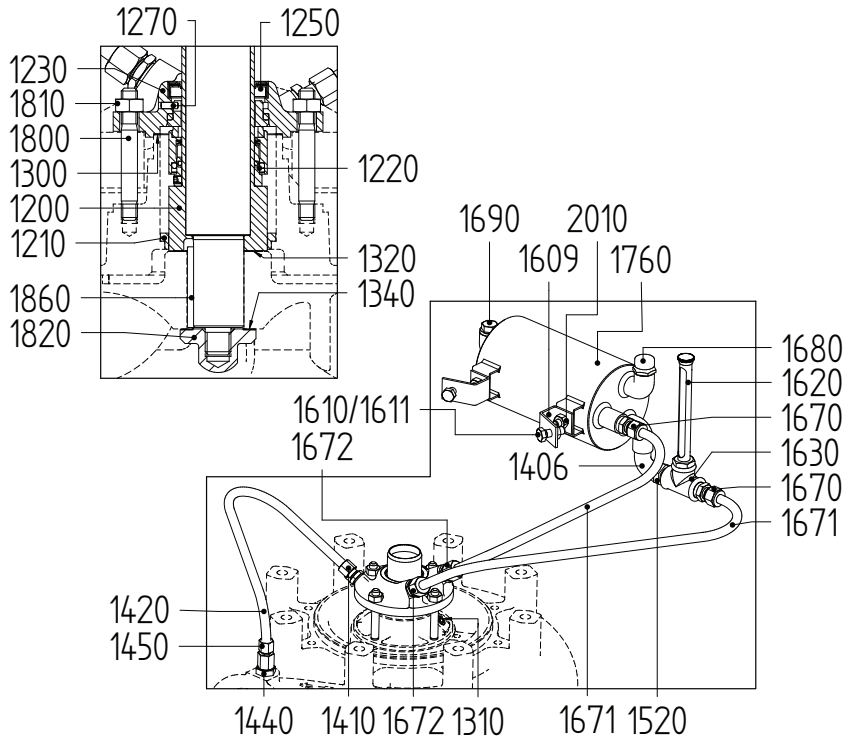

Figure 38: Mechanical seal MQ3 - HJ92N.

9.11.2 Parts list shaft sealing group MQ3 - HJ92N

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel + QPQ
1210*	1	throttling bush	stainless steel
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	stainless steel
1250*	1	PS-seal	PTFE
1270	1	locking pin	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1406	1	elbow	stainless steel
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1520	1	double nipple	stainless steel
1609	1	tank support	steel
1620	1	liquid level indicator	brass
1630	1	tee	stainless steel
1670	2	male connector	stainless steel
1671	1	pipe	stainless steel
1672	2	male connector	stainless steel
1680	1	filling plug	-
1690	1	plug	stainless steel
1760	1	tank	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
2010	2	nut	stainless steel

QPQ = Quench-Polish-Quench

9.12 Shaft sealing group C2

9.12.1 Cartridge seal C2 - UNITEX

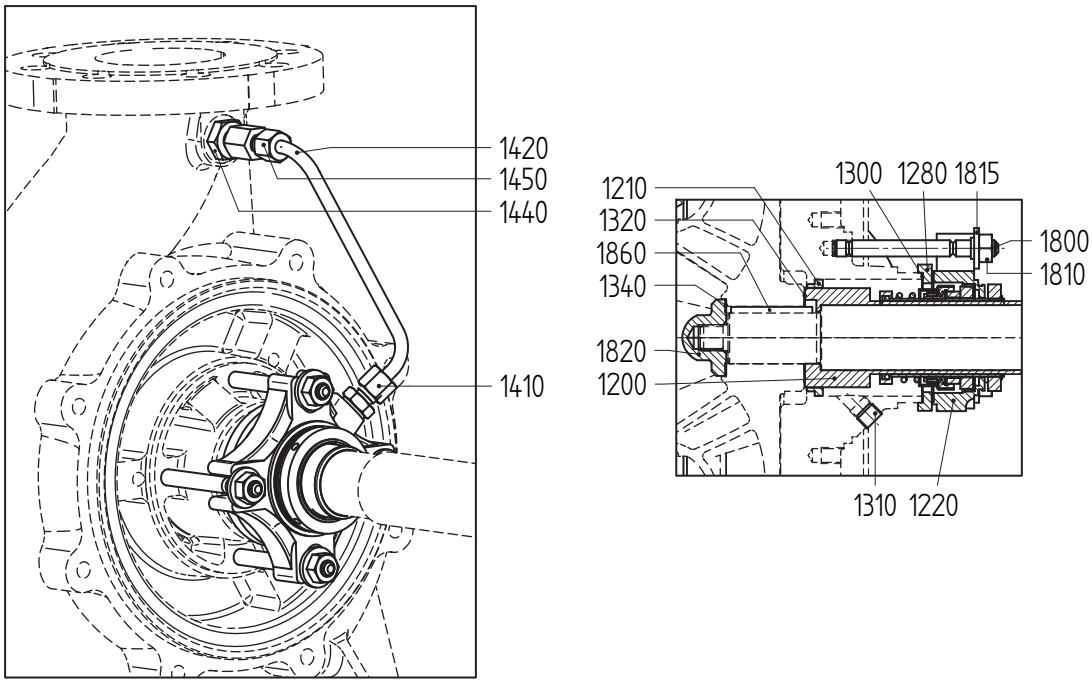

Figure 39: Mechanical seal C2 - UNITEX.

9.12.2 Parts list shaft sealing group C2 - UNITEX

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1210*	1	throttling bush	stainless steel
1220*	1	cartridge seal	-
1280	1	reducing ring	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1815	4	washer	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	impeller key	stainless steel

9.13 Shaft sealing group C3

9.13.1 Cartridge seal C3 - CARTEX SN

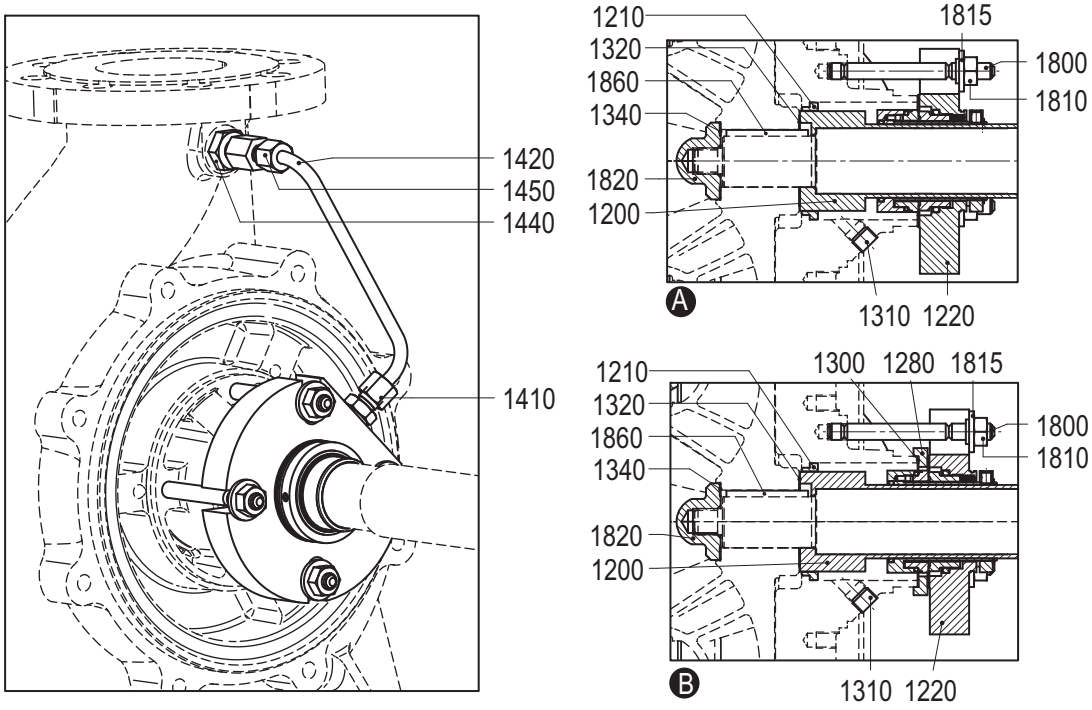

Figure 40: Mechanical seal C3 - CARTEX SN (A = br.gr 1 and 2, B = br.gr. 3).

9.13.2 Parts list shaft sealing group C3 - CARTEX SN

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1210*	1	throttling bush	stainless steel
1220*	1	cartridge seal	-
1280	1	reducing ring	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1815	4	washer	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	impeller key	stainless steel

Item 1280 and 1300 only for bearing group 3.

9.14 Shaft sealing group CQ3

9.14.1 Cartridge seal CQ3 - CARTEX QN

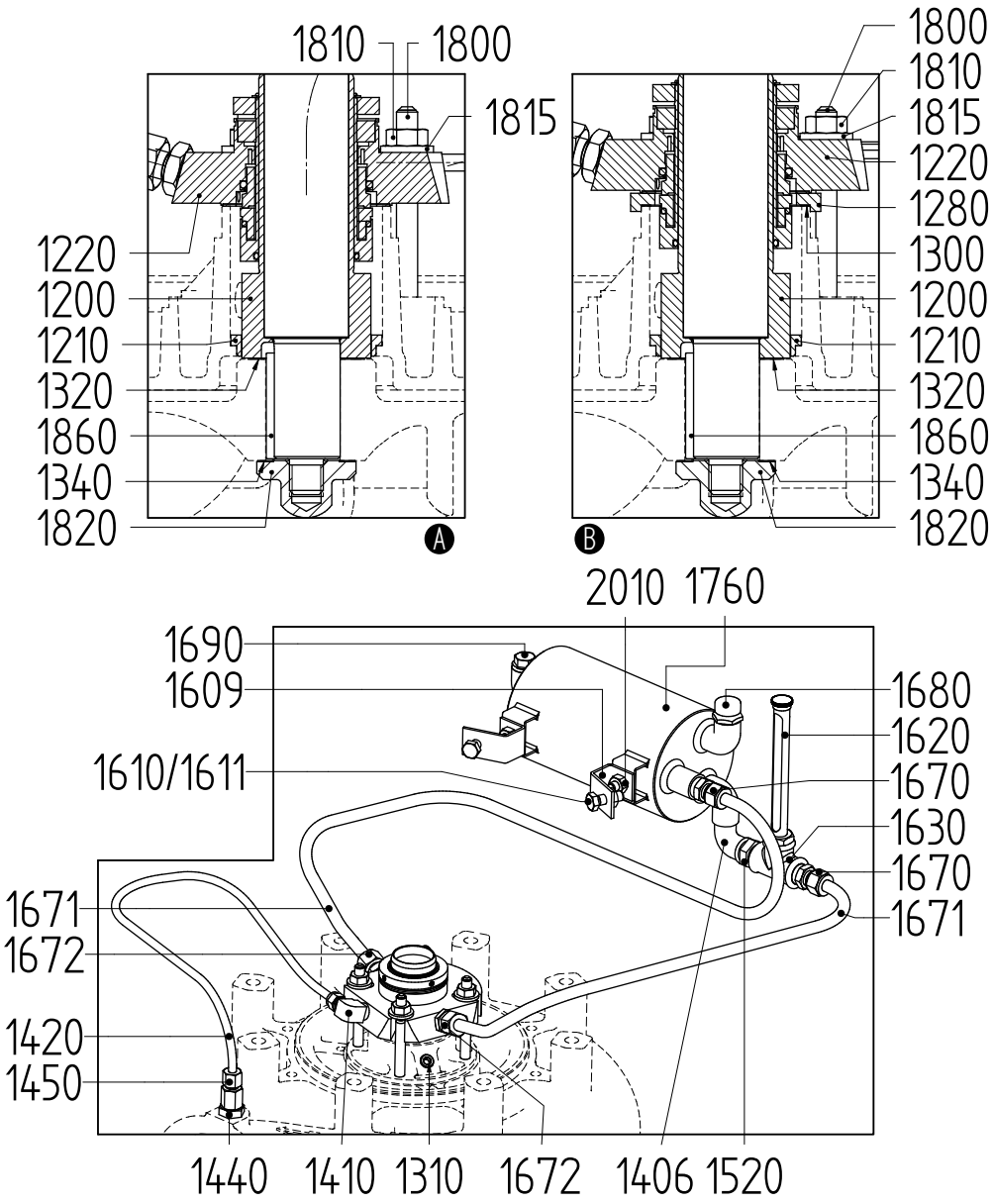

Figure 41: Mechanical seal CQ3 - CARTEX QN (A = br.gr 1 and 2, B = br.gr. 3).

9.14.2 Parts list shaft sealing group CQ3 - CARTEX QN

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1210*	1	throttling bush	stainless steel
1220*	1	cartridge seal	-
1280	1	reducing ring	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1406	1	elbow	stainless steel
1410	1	male connector	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	stainless steel
1520	1	double nipple	stainless steel
1609	2	tank support	steel
1610	2	bolt	stainless steel
1611	2	nut	stainless steel
1620	1	liquid level indicator	brass
1630	1	tee	stainless steel
1670	2	male connector	stainless steel
1671	1	pipe	stainless steel
1672	2	male connector	stainless steel
1680	1	filling plug	-
1690	1	plug	stainless steel
1760	1	tank	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1815	4	washer	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
2010	2	nut	stainless steel

Item 1280 and 1300 only for bearing group 3.

9.15 Shaft sealing group CD3

9.15.1 Cartridge seal CD3 - CARTEX DN

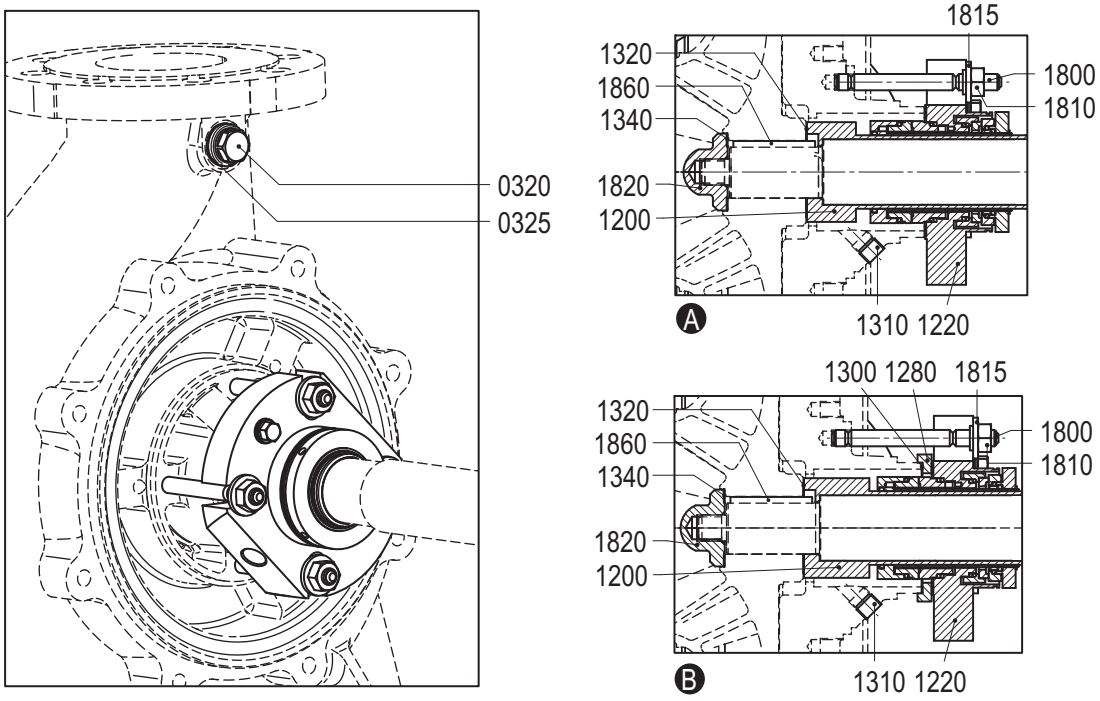

Figure 42: Mechanical seal CD3 - CARTEX DN (A = br.gr 1, B = br.gr. 2 and 3).

9.15.2 Parts list shaft sealing group CD3 - CARTEX DN

Item	Quantity	Description	Material
0320	1	plug	stainless steel
0325	1	sealing ring	PTFE
1200*	1	shaft sleeve	stainless steel
1220*	1	cartridge seal	-
1280	1	reducing ring	stainless steel
1300*	1	gasket	-
1310	1	plug	stainless steel
1320*	1	gasket	-
1340*	1	gasket	-
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1815	4	washer	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	impeller key	stainless steel

Item 1280 and 1300 only for bearing groups 2 and 3.

9.16 Shaft sealing group M2-M3 - bearing group 4

9.16.1 Mechanical seals M2-M3 - bearing group 4

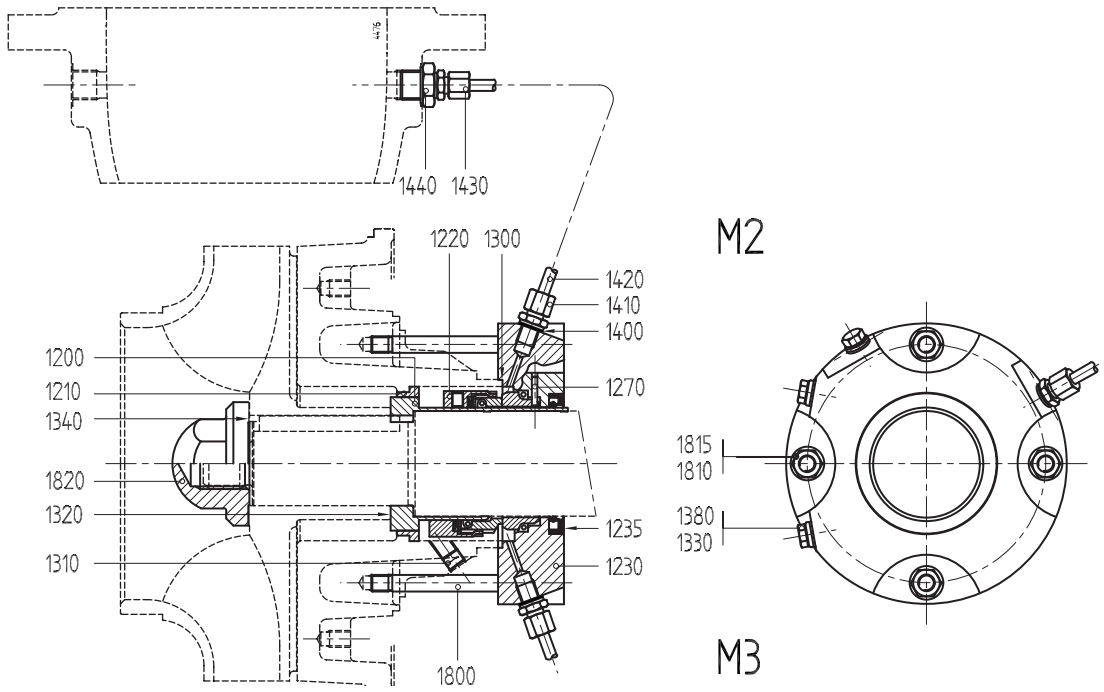

Figure 43: Mechanical seal M2-M3 - bearing group 4.

Parts list mechanical seals M2-M3 - bearing group 4

Item	Quantity		Description	Material	
	M2	M3		cast iron	bronze
1200*	1	1	shaft sleeve	bronze	
1210*	1	1	throttling bush	bronze	
1220*	1	1	mechanical seal	-	
1230	1	1	mechanical seal cover	cast iron	bronze
1235	1	1	oil seal	rubber	
1270	1	1	locking pin	stainless steel	
1300*	1	1	gasket	-	
1310	1	1	plug	steel	stainless steel
1320*	1	1	gasket	-	
1330	3	3	plug	steel	stainless steel
1340*	1	1	gasket	-	
1380	3	3	sealing ring	copper	
1400	1	1	sealing ring	copper	
1410	1	1	male connector	steel	brass
1420	1	1	pipe	stainless steel	
1430	1	1	male connector	brass	
1440	1	1	extension piece	stainless steel	
1800	4	4	stud	stainless steel	
1810	4	4	nut	brass	stainless steel
1815	4	4	washer	steel	stainless steel
1820*	1	1	cap nut	stainless steel	

10 Technical data

10.1 Grease

Table 6: Recommended greases according to NLGI-3 classification.

CASTROL	Spheerol AP3
CHEVRON	MultifaK Premium 3
EXXONMOBIL	Beacon EP 3
	Mobilux EP 3
SHELL	Gadus S2 V100 3
SKF	LGMT 3
TOTAL	Total Lical EP 2

10.1.1 Recommended locking liquids

Table 7: Recommended locking liquids.

Description	Locking liquid
cap nut (1820)	Loctite 243
throttling bush (1210)	Loctite 641
wear ring (0130)	

10.2 Tightening moments

10.2.1 Tightening moments for bolts and nuts

Table 8: Tightening moments for bolts and nuts.

Materials	8.8	A2, A4
Thread	Tightening moment [Nm]	
M6	9	6
M8	20	14
M10	40	25
M12	69	43
M16	168	105
M20	324	180

10.2.2 Tightening moments for cap nut

Table 9: Tightening moments for cap nut (1820).

Size	Tightening moment [Nm]
M12 (bearing group 1)	43
M16 (bearing group 2)	105
M24 (bearing group 3)	220
M36 (bearing group 4)	510

10.3 Maximum allowable working pressures

Table 10: Maximum allowable working pressure [kPa] (according to ISO 7005-2/3)

Materials	Max. temperature [°C]				
	50	120	150	180	200
G	1000	1000	900	840	800
NG	1000	1000	970	940	920
B	1000	1000	1000	1000	-
R	1600	1400	1200	1200	1200

100 kPA = 1 bar

Test pressure: 1,5 x max. working pressure.

Table 11: Maximum operating conditions of the shaft seals

Shaft sealing groups	Max. admissible working pressure [1] [kPa]	Max. temperature [2] [°C]
M2 / MW2 / MQ2 - MG12: water	1200	-20 up to 120 (140 short period)
M2 / MW2 / MQ2 - MG12: chemicals	1600	-20 up to 200
M2 / MW2 / MQ2 - M7N	1600	-50 up to 220
M3 / MW3 / MQ3 - HJ92N	2500	-50 up to 220
M3 / MW3 / MQ3 - HJ997GN	2500	-20 up to 180
C2 Unitex: water	1200	-20 up to 120 (140 short period)
C2 Unitex: chemicals	1200	-20 up to 200
C3 / CQ3 / CD3 Cartex AQ1	2500	-40 up to 220
C3 / CQ3 / CD3 Cartex Q1Q1	1200	-40 up to 220

[1] Max. admissible mechanical seal pressure, max. working pressure for the pump might be lower.

[2] Max. temperature depending on pumped liquid, ask our advise or contact the mechanical seal supplier.

10.4 Maximum working pressure

Table 12: Maximum working pressure.

CFU	Maximum speed		Available shaft sealing groups and maximum working pressure [10^2 kPa] at 50 °C dependent on material variant.									
	G - NG - B	R										
	L2	L2	M2	M3	MW2	MW3	MQ2	MQ3	C2	C3	CD3	CQ3
	[min^{-1}]	[min^{-1}]										
32-160	3600	-	10	10	10	10	10	10	10	10	10	10
32-200	3600	-	10	10	10	10	10	10	10	10	10	10
40-160	3600	-	10	10	10	10	10	10	10	10	10	10
40-200	3600	3600	10	16	10	16	10	16	10	16	16	16
40-250	3000	-	10	10	10	10	10	10	10	10	10	10
40A-250	-	3600	10	16	10	16	10	16	10	16	16	16
50AC-125	-	3600	10	16	-	-	10	16	10	16	16	16
50-160	3600	-	10	10	10	10	10	10	10	10	10	10
50-200	3600	-	10	10	10	10	10	10	10	10	10	10
50-250	3000	-	10	10	10	10	10	10	10	10	10	10
50A-250	-	3600	10	16	10	16	10	16	10	16	16	16
65-160	3600	-	10	10	10	10	10	10	10	10	10	10
65-200	3600	-	10	10	10	10	10	10	10	10	10	10
65A-200	-	3600	10	16	10	16	10	16	10	16	16	16
65A-250	3000	-	10	10	10	10	10	10	10	10	10	10
65-315	2400	-	10	10	10	10	10	10	10	10	10	10
80-160	3600	-	10	10	10	10	10	10	10	10	10	10
80-200	3600	-	10	10	10	10	10	10	10	10	10	10
80-250	3000	3000	10	10	10	10	10	10	10	10	10	10
80A-250	3600	3600	10	16	10	16	10	16	10	16	16	16
80-315	2400	-	10	10	10	10	10	10	10	10	10	10
80-400	2000	-	10	10	10	10	10	10	10	10	10	10
100C-200	3000	-	10	10	10	10	10	10	10	10	10	10
100C-200	-	3000	10	16	10	16	10	16	10	16	16	16
100-250	3000	-	10	10	10	10	10	10	10	10	10	10
100-315	2400	-	10	10	10	10	10	10	10	10	10	10
100A-315	-	3000	10	16	10	16	10	16	10	16	16	16
100B-315	-	3000	10	16	10	16	10	16	10	16	16	16
100-400	2000	-	10	10	10	10	10	10	10	10	10	10
125-250	1800	-	10	10	10	10	10	10	10	10	10	10
125-315	2100	-	10	10	10	10	10	10	10	10	10	10
125-400	1800	-	10	10	10	10	10	10	10	10	10	10
125-500	1500	-	10	10	-	-	-	-	-	-	-	-
150-200	2700	-	10	10	10	10	10	10	10	10	10	10
150-315	1800	-	10	10	10	10	10	10	10	10	10	10
150-400	1800	-	10	10	10	10	10	10	10	10	10	10
150-400	-	1800	10	16	10	16	10	16	10	16	16	16
150B-400	1800	-	10	10	-	-	-	-	-	-	-	-

Table 12: Maximum working pressure.

CFU	Maximum speed		Available shaft sealing groups and maximum working pressure [10² kPa] at 50 °C dependent on material variant.									
	G - NG - B	R										
	L2	L2	M2	M3	MW2	MW3	MQ2	MQ3	C2	C3	CD3	CQ3
	[min^{-1}]	[min^{-1}]										
150-500	1500	-	10	10	-	-	-	-	-	-	-	-
200-200	1800	-	10	16	10	10	10	10	10	10	10	10
200-200	-	1800	10	16	10	16	10	16	10	16	16	16
200-250	2400	-	10	10	-	-	-	-	-	-	-	-
200-315	2400	-	10	10	-	-	-	-	-	-	-	-
200-400	1700	-	10	10	-	-	-	-	-	-	-	-
250-250	1900	-	10	10	-	-	-	-	-	-	-	-
250-315	2000	-	10	10	-	-	-	-	-	-	-	-
250B-315	1800	-	10	10	10	10	10	10	10	10	10	10
300-250	1500	-	10	10	-	-	-	-	-	-	-	-
300-315	1500	-	10	10	-	-	-	-	-	-	-	-

10.5 Higher maximum speed

Possible higher maximum speed than mentioned in Table 12, with reduced impeller diameter:

D_{max} = maximum impeller diameter

Table 13: Higher maximum speed.

		maximum speed [min^{-1}] / impeller diameter [mm]																				
		1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600
80-250	D_{max}	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	254	248	242	236	230	225
125-500	D_{max}	530	509	480	455	432	400																
150-400	D_{max}	414	414	414	414	404	394	385															
150B-400	D_{max}	430	430	430	430	421	399	380	362														
150-500	D_{max}	525	503	475	451																		
200-400	D_{max}	438	438	438	432	419	408	388	368														
250-315	D_{max}	368	368	368	368	368	368	366	356	347	339												
300-250	D_{max}	345	336	324																			
300-315	D_{max}	365	330																				

10.6 Pressure in shaft sealing space for shaft sealing groups M.. and C..

Pressure in shaft sealing space above the inlet pressure and with an external circulation of medium from the delivery side, calculated for a specific mass of 1000 kg/m^3

Table 14: Pressure in shaft sealing space for shaft sealing groups M2-MQ2-MW2-M3-MQ3-MW3-C2-C3-CQ3.

CFU	n[min^{-1}]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
32-160	0,3	0,4	0,7	1,0	1,4	1,8	2,3	2,8	3,4	4,0
32-200	0,3	0,6	0,9	1,3	1,8	2,3	3,0	3,7	4,4	5,3
40-160	0,2	0,4	0,6	0,9	1,2	1,6	2,0	2,5	3,0	3,5
40-200	0,3	0,6	1,0	1,4	1,9	2,5	3,1	3,9	4,7	5,6
40-250	0,5	0,9	1,4	2,0	2,7	3,5	4,5	5,5		
40A-250	0,5	0,9	1,4	2,0	2,7	3,5	4,5	5,5	6,7	7,9
50AC-125	0,2	0,3	0,5	0,7	1,0	1,3	1,6	2,0	2,4	2,8
50-160	0,2	0,4	0,7	1,0	1,3	1,7	2,1	2,6	3,2	3,8
50-200	0,3	0,6	0,9	1,3	1,8	2,4	3,0	3,7	4,5	5,4
50-250	0,5	0,9	1,3	2,0	2,8	3,6	4,6	5,6		
50A-250	0,5	0,9	1,3	2,0	2,8	3,6	4,6	5,6	6,8	8,1
65-160	0,2	0,4	0,6	0,9	1,2	1,6	2,0	2,5	3,0	3,6
65-200	0,3	0,6	0,9	1,4	1,9	2,4	3,1	3,8	4,6	5,5
65A-200	0,3	0,6	0,9	1,4	1,9	2,4	3,1	3,8	4,6	5,5
65A-250	0,5	0,9	1,4	2,0	2,7	3,5	4,4	5,4	6,6	7,8
65-315	0,7	1,3	2,0	2,9	4,0	5,2				
80-160	0,2	0,4	0,6	0,9	1,2	1,5	1,9	2,4	2,9	3,4
80-200	0,3	0,5	0,8	1,1	1,5	2,0	2,5	3,1	3,8	4,5
80-250	0,5	0,9	1,4	2,0	2,8	3,6	4,6	5,6	6,8	
80A-250	0,5	0,9	1,4	2,0	2,8	3,6	4,6	5,6	6,8	
80-315	0,7	1,2	1,9	2,7	3,7	4,8	6,0	7,5		
80-400	1,0	1,8	2,9	4,1	5,6					
100C-200	0,3	0,6	1,0	1,4	1,9	2,4	3,1	3,8		
100-250	0,4	0,8	1,2	1,7	2,3	3,0	3,8	4,7		
100-315	0,7	1,3	2,0	2,9	3,9	5,1				
100A-315	0,7	1,2	1,9	2,7	3,7	4,8	6,0	7,5		
100B-315	0,7	1,3	2,0	2,9	3,9	5,1	6,5	7,7		
100-400	1,3	2,3	3,6	5,2	7,1					
125-250	0,4	0,8	1,2	1,7						
125-315	0,7	1,2	2,0	2,8	3,8					
125-400	1,1	2,0	3,1	4,5						
125-500	1,6	2,8	4,4	6,3	7,0					
150-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3			
150-315	0,8	1,4	2,2	3,2						
150-400	1,3	2,3	3,6	4,2						
150B-400	1,0	1,8	2,8	4,1	4,8					
150-500	1,6	2,9	4,5	5,0						
200-200	0,5	0,8	1,3	1,6						
200-250	0,5	0,8	1,3	1,9	2,5	2,7				
200-315	0,6	1,0	1,6	2,3	3,1	4,1				
200-400	1,0	1,8	2,8	4,0						
250-250	0,5	0,9	1,4	2,0						
250-315	0,6	1,1	1,7	2,5	3,4	3,7				
250B-315	0,8	1,4	2,2	3,2						
300-250	0,6	1,0	1,7							
300-315	0,6	1,1	1,8							

10.7 Pressure near the impeller hub for shaft sealing group CD3

Pressure near the impeller hub above the inlet pressure, calculated for a specific mass of 1000 kg/m^3

Table 15: Pressure near the impeller hub for shaft sealing group CD3.

CFU	n[min^{-1}]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
32-160	0,1	0,3	0,4	0,6	0,8	1,0	1,3	1,6	1,9	2,3
32-200	0,1	0,2	0,4	0,5	0,7	1,0	1,2	1,5	1,8	2,1
40-160	0,1	0,2	0,2	0,3	0,5	0,6	0,8	0,9	1,1	1,4
40-200	0,2	0,4	0,6	0,8	1,1	1,5	1,9	2,3	2,8	3,3
40-250	0,3	0,5	0,7	1,1	1,4	1,9	2,4	2,9		
40A-250	0,3	0,5	0,7	1,1	1,4	1,9	2,4	2,9	3,5	4,2
50AC-125	0,1	0,2	0,3	0,4	0,5	0,6	0,8	1,0	1,2	1,4
50-160	0,1	0,2	0,3	0,4	0,5	0,7	0,8	1,0	1,2	1,5
50-200	0,1	0,2	0,3	0,5	0,6	0,8	1,0	1,3	1,6	1,9
50-250	0,3	0,5	0,7	1,1	1,4	1,9	2,4	2,9		
50A-250	0,3	0,5	0,7	1,1	1,4	1,9	2,4	2,9	3,5	4,2
65-160	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,5	0,6	0,7
65-200	0,1	0,2	0,4	0,5	0,7	0,9	1,1	1,4	1,7	2,0
65A-200	0,1	0,2	0,4	0,5	0,7	0,9	1,1	1,4	1,7	2,0
65A-250	0,2	0,3	0,5	0,8	1,0	1,3	1,7	2,1		
65-315	0,4	0,8	1,2	1,7	2,3	3,0	3,8	4,7		
80–160	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,1	0,1
80-200	0,0	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,4	0,5
80-250	0,2	0,3	0,4	0,6	0,8	1,0	1,3	1,6	2,0	
80A-250	0,2	0,3	0,4	0,6	0,8	1,0	1,3	1,6	2,0	
80-315	0,2	0,4	0,7	1,0	1,3	1,7				
80-400	0,4	0,7	1,0	1,5	2,0					
100C-200	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,5		
100-250	0,1	0,2	0,3	0,4	0,5	0,6	0,8	1,0		
100-315	0,7	1,3	2,0	2,9	3,9	5,1				
100A-315	0,2	0,4	0,7	1,0	1,3	1,7	2,2	2,7		
100B-315	0,3	0,5	0,7	1,0	1,4	1,8	2,3	2,9		
100-400	0,6	1,1	1,7	2,5	3,4					
125-250	0,1	0,2	0,3	0,4						
125-315	0,2	0,4	0,6	0,8	1,1					
125-400	0,4	0,7	1,1	1,6	2,2					
125-500	0,9	1,5	2,4	3,4	3,4					
150-200	0,0	0,0	0,0	0,0	0,0	0,0	0,0			
150-315	0,1	0,2	0,4	0,5						
150-400	0,4	0,6	1,0	1,4						
150B-400	0,4	0,7	1,1	1,6	1,6					
150-500	0,8	1,5	2,3	2,0						
200-200	0,0	0,0	0,0	0,1						
200-250	0,1	0,2	0,4	0,5	0,7	0,4				
200-315	0,2	0,3	0,5	0,6	0,9	1,2				
200-400	0,4	0,7	1,0	1,5						
250-250	0,1	0,2	0,4	0,5						
250-315	0,1	0,2	0,4	0,5	0,7					
250B-315	0,1	0,2	0,4	0,5						
300-250	0,1	0,2	0,3							

10.8 Permissible forces and moments on the flanges

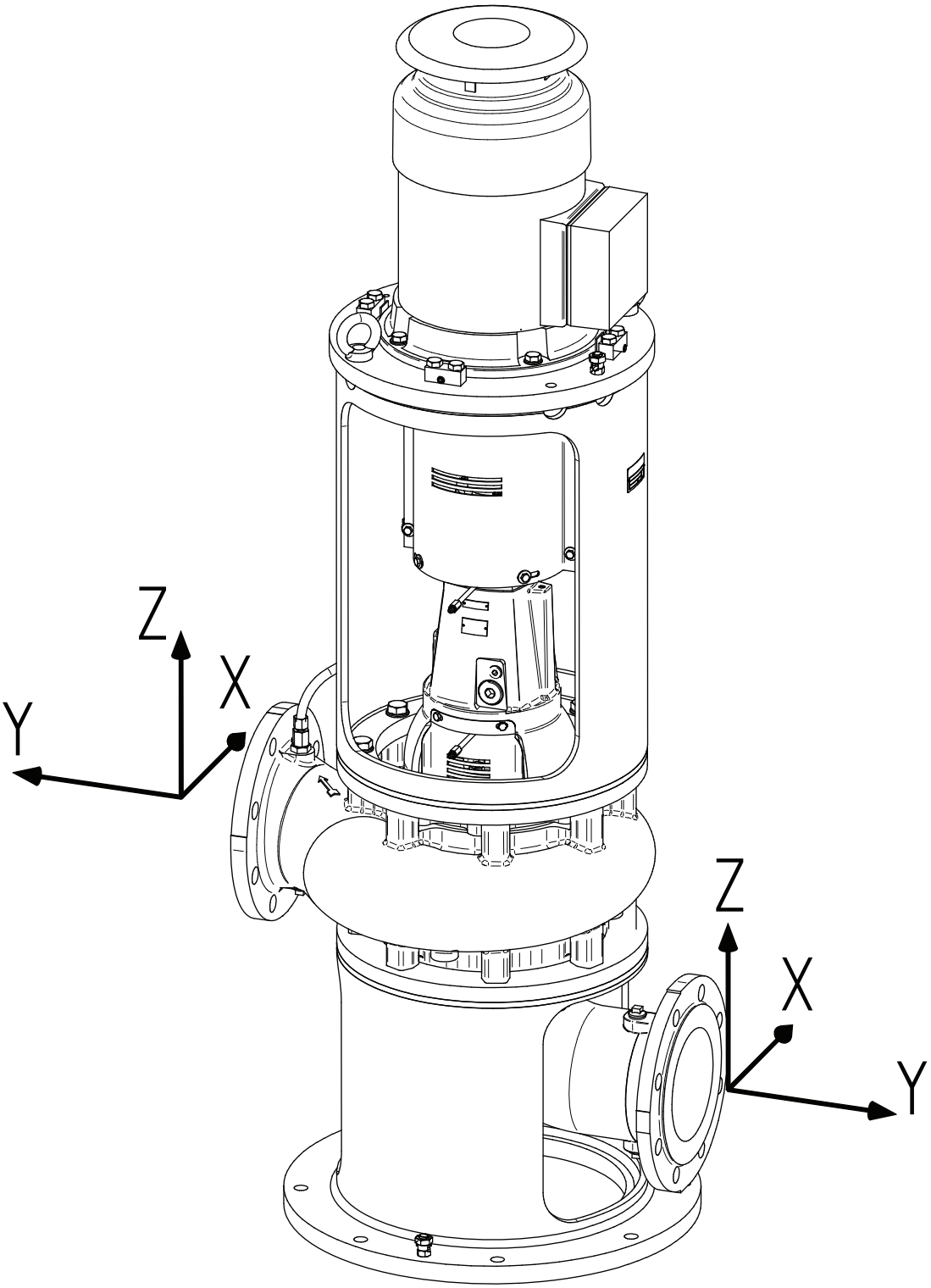

Figure 44: Coordinate system.

Table 16: Permissible forces and moments on the flanges, based on EN-ISO 5199.

CFU		Vertical pump, Side branches at right angles to shaft															
		Suction branche y-axis								Discharge branch y-Axis							
		Force (N)				Moment (N.m)				Force (N)				Moment (N.m)			
		F_y	F_z	F_x	ΣF	M_y	M_z	M_x	ΣM	F_y	F_z	F_x	ΣF	M_y	M_z	M_x	ΣM
32-160	G - B	788	638	694	1238	300	350	500	850	394	319	338	619	125	175	300	550
32-200	G - B	938	769	844	1481	325	400	550	925	394	319	338	619	125	175	300	550
40-160	G - B	938	769	844	1481	325	400	550	925	469	375	413	731	200	275	400	700
40-200	G - B	938	769	844	1481	325	400	550	925	469	375	413	731	200	275	400	700
40-200	R	1875	1538	1688	2963	650	800	1100	1850	938	750	825	1463	400	550	800	1400
40-250	G - B	1256	1013	1125	1969	375	475	625	1050	469	375	413	731	200	275	400	700
40A-250	R	2513	2025	2250	3938	750	950	1250	2100	938	750	825	1463	400	550	800	1400
50AC-125	R	1875	1538	1688	2963	650	800	1100	1850	1238	1013	1125	1950	500	650	900	1550
50-160	G - B	938	769	844	1481	325	400	550	925	619	506	563	975	250	325	450	775
50-200	G - B	1256	1013	1125	1969	375	475	625	1050	619	506	563	975	250	325	450	775
50-250	G - B	1256	1013	1125	1969	375	475	625	1050	619	506	563	975	250	325	450	775
50A-250	R	2513	2025	2250	3938	750	950	1250	2100	1238	1013	1125	1950	500	650	900	1550
65-160	G - B	1481	1200	1331	2325	500	700	800	1275	788	638	694	1238	300	350	500	850
65-200	G - B	1481	1200	1331	2325	500	700	800	1275	788	638	694	1238	300	350	500	850
65A-200	R	2963	2400	2663	4650	1000	1400	1600	2550	1575	1275	1388	2475	600	700	1000	1700
65A-250	G - B	1481	1200	1331	2325	500	700	800	1275	788	638	694	1238	300	350	500	850
65-315	G - B	1481	1200	1331	2325	500	700	800	1275	788	638	694	1238	300	350	500	850
80-160	G - B	1875	1519	1688	2944	625	775	1000	1575	938	769	844	1481	325	400	550	925
80-200	G - B	1875	1519	1688	2944	625	775	1000	1575	938	769	844	1481	325	400	550	925
80-250	G - B	1875	1519	1688	2944	625	775	1000	1575	938	769	844	1481	325	400	550	925
80-250	R	3750	3038	3375	5888	1250	1550	2000	3150	1875	1538	1688	2963	650	800	1100	1850
80A-250	G - B	1875	1519	1688	2944	625	775	1000	1575	938	769	844	1481	325	400	550	925
80A-250	R	3750	3038	3375	5888	1250	1550	2000	3150	1875	1538	1688	2963	650	800	1100	1850
80-315	G - B	1875	1519	1688	2944	625	775	1000	1575	938	769	844	1481	325	400	550	925
80-400	G - B	1875	1519	1688	2944	625	775	1000	1575	938	769	844	1481	325	400	550	925
100C-200	G - B	1875	1519	1688	2944	625	775	1000	1575	1256	1013	1125	1969	375	475	625	1050
100C-200	R	3750	3038	3375	5888	1250	1550	2000	3150	2513	2025	2250	3938	750	950	1250	2100
100-250	G - B	1875	1519	1688	2944	625	775	1000	1575	1256	1013	1125	1969	375	475	625	1050
100-315	G - B	1875	1519	1688	2944	625	775	1000	1575	1256	1013	1125	1969	375	475	625	1050
100A-315	R	1875	1519	1688	2944	1250	1550	2000	3150	1875	1538	1688	2963	650	800	1100	1850
100B-315	G - B	1875	1519	1688	2944	625	775	1000	1575	1256	1013	1125	1969	375	475	625	1050
100-400	G - B	1875	1519	1688	2944	625	775	1000	1575	1256	1013	1125	1969	375	475	625	1050
125-250	G - B	1875	1519	1688	2944	625	775	1000	1575	1481	1200	1331	2325	500	700	800	1275
125-315	G - B	1875	1519	1688	2944	625	775	1000	1575	1481	1200	1331	2325	500	700	800	1275
125-400	G - B	1875	1519	1688	2944	625	775	1000	1575	1481	1200	1331	2325	500	700	800	1275
125-500	NG - B	2513	2025	2250	3919	900	1075	1375	2150	1481	1200	1331	2325	500	700	800	1275
150-200	G - B	1875	1519	1688	2944	625	775	1000	1575	1875	1519	1688	2944	625	775	1000	1575
150-315	G - B	2513	2025	2250	3919	900	1075	1375	2150	1875	1519	1688	2944	625	775	1000	1575
150-400	G - B	2513	2025	2250	3919	900	1075	1375	2150	1875	1519	1688	2944	625	775	1000	1575
150-400	R	5025	4050	4500	7838	1800	2150	2750	4300	3750	3038	3375	5888	1250	1550	2000	3150
150B-400	NG - B	3131	2531	2794	4894	1325	1575	1975	3025	1875	1519	1688	2944	625	775	1000	1575
150-500	NG - B	3131	2531	2794	4894	1325	1575	1975	3025	1875	1519	1688	2944	625	775	1000	1575
200-200	G - B	2513	2025	2250	3919	900	1075	1375	2150	2513	2025	2250	3919	900	1075	1375	2150
200-200	R	5025	4050	4500	7838	1800	2150	2750	4300	5025	4050	4500	7838	1800	2150	2750	4300
200-250	NG - B	2513	2025	2250	3919	900	1075	1375	2150	2513	2025	2250	3919	900	1075	1375	2150
200-315	NG - B	3131	2531	2794	4894	1325	1575	1975	3025	2513	2025	2250	3919	900	1075	1375	2150
200-400	NG - B	3750	3019	3356	5869	1900	2225	2775	4200	2513	2025	2250	3919	900	1075	1375	2150
250-250	NG - B	3750	3019	3356	5869	1900	2225	2775	4200	3131	2531	2794	4894	1325	1575	1975	3025
250-315	NG - B	3750	3019	3356	5869	1900	2225	2775	4200	3131	2531	2794	4894	1325	1575	1975	3025
250B-315	G - B	3131	2531	2794	4894	1325	1575	1975	3025	3131	2531	2794	4894	1325	1575	1975	3025
300-250	NG - B	3750	3019	3356	5869	1900	2225	2775	4200	3750	3019	3356	5869	1900	2225	2775	4200

10.8.1 Hydraulic performance

10.8.2 Performance overview G, NG, B

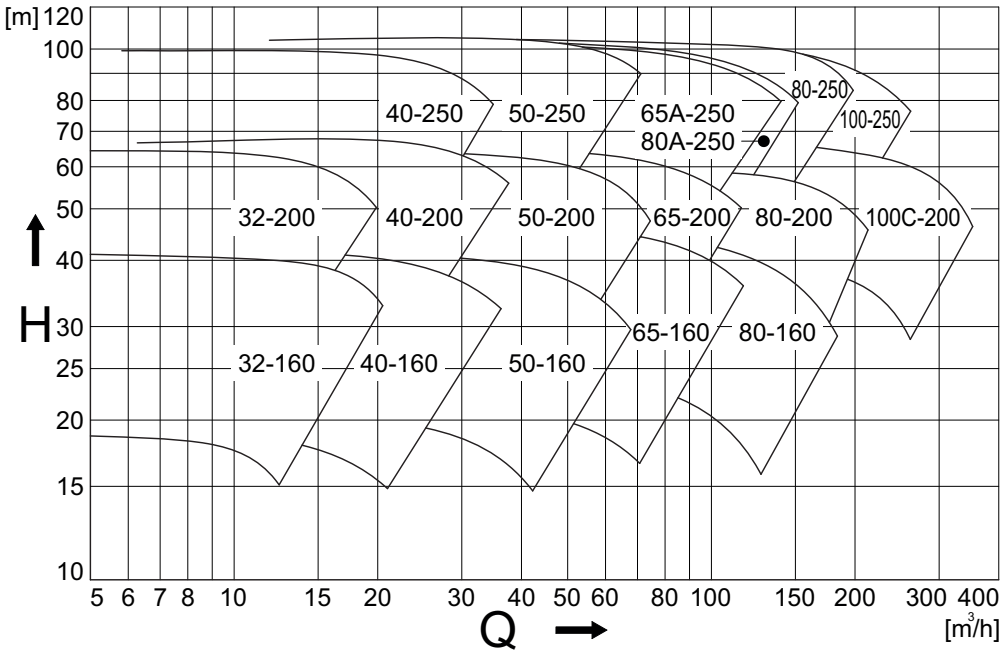

Figure 45: Performance overview 3000 min^{-1} (G, NG, B).

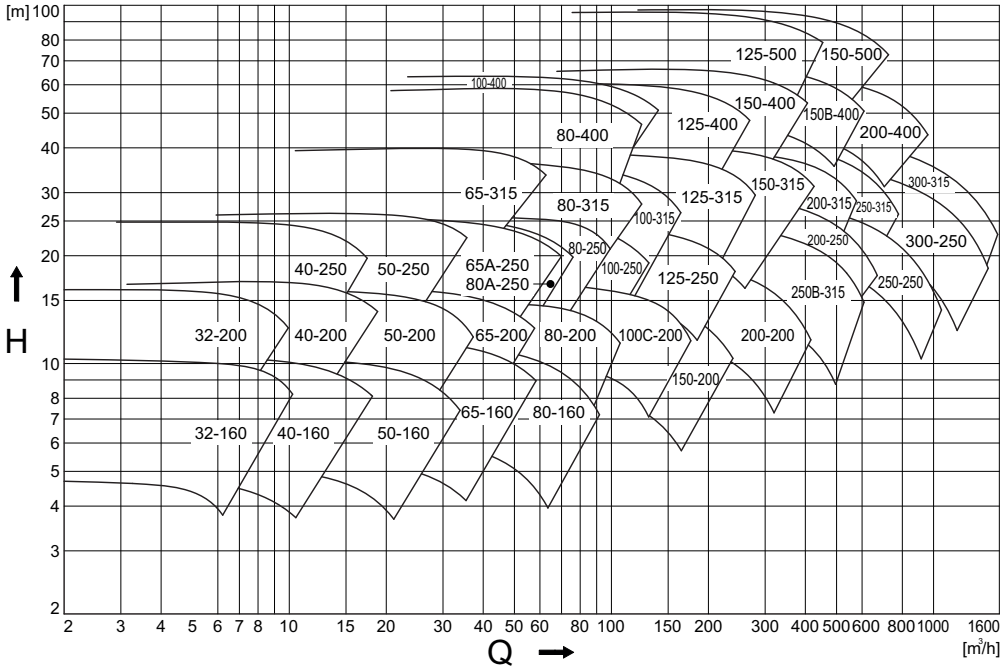

Figure 46: Performance overview 1500 min^{-1} (G, NG, B).

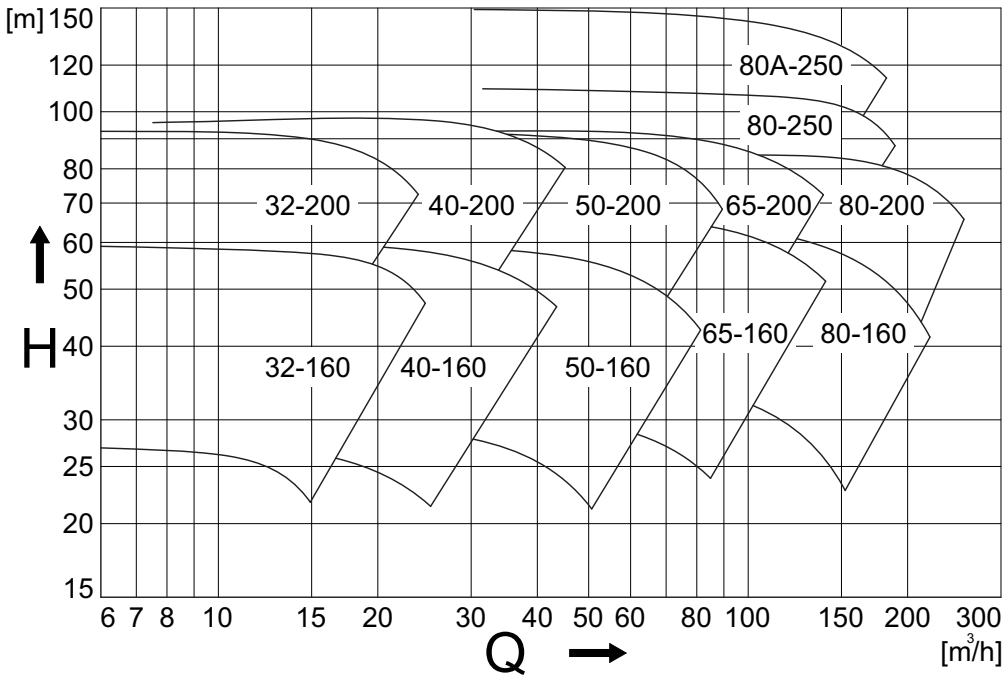

Figure 47: Performance overview 3600 min^{-1} (G, NG, B).

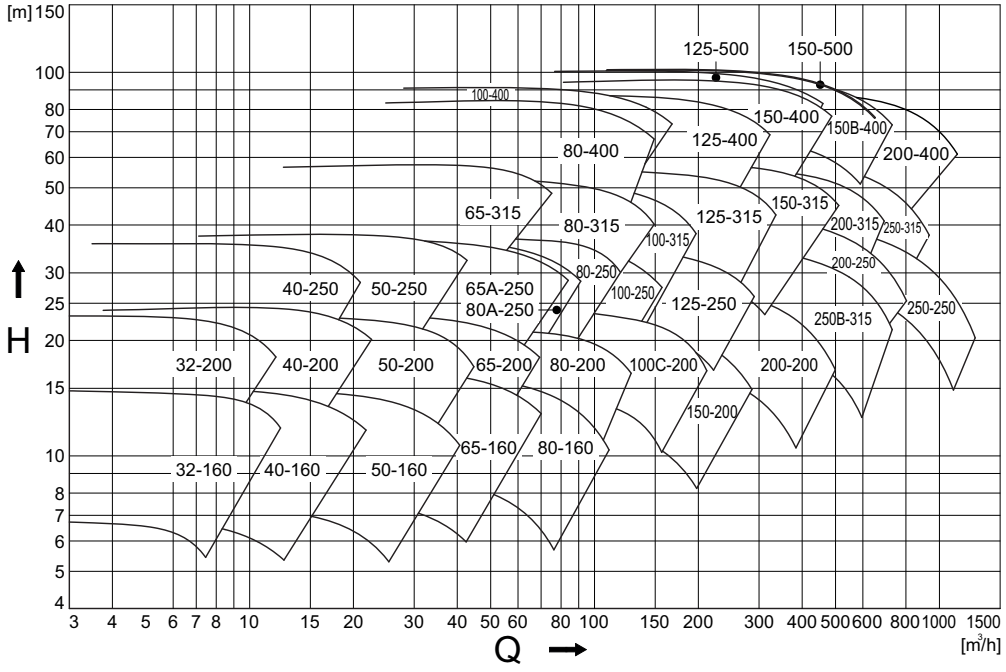

Figure 48: Performance overview 1800 min^{-1} (G, NG, B).

10.8.3 Performance overview R

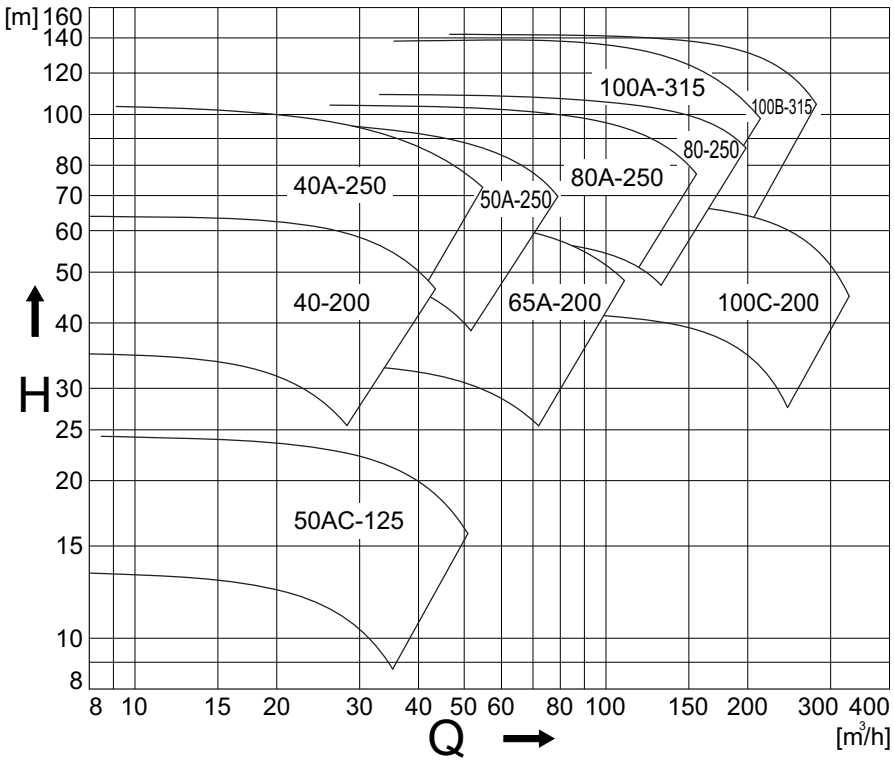

Figure 49: Performance overview 3000 min^{-1} (R).

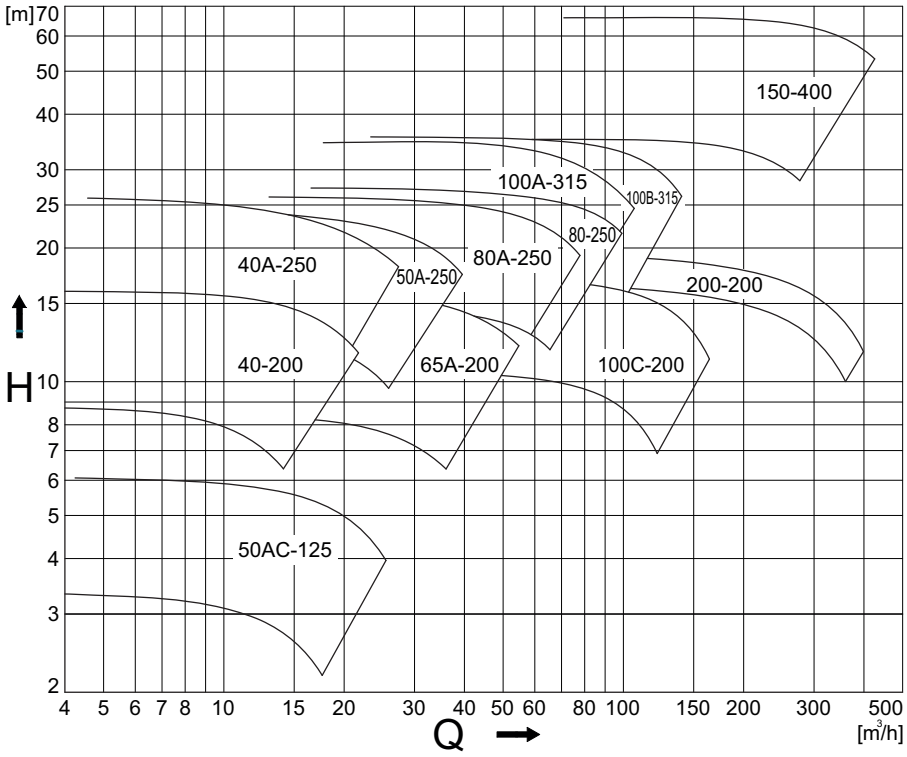

Figure 50: Performance overview 1500 min^{-1} (R).

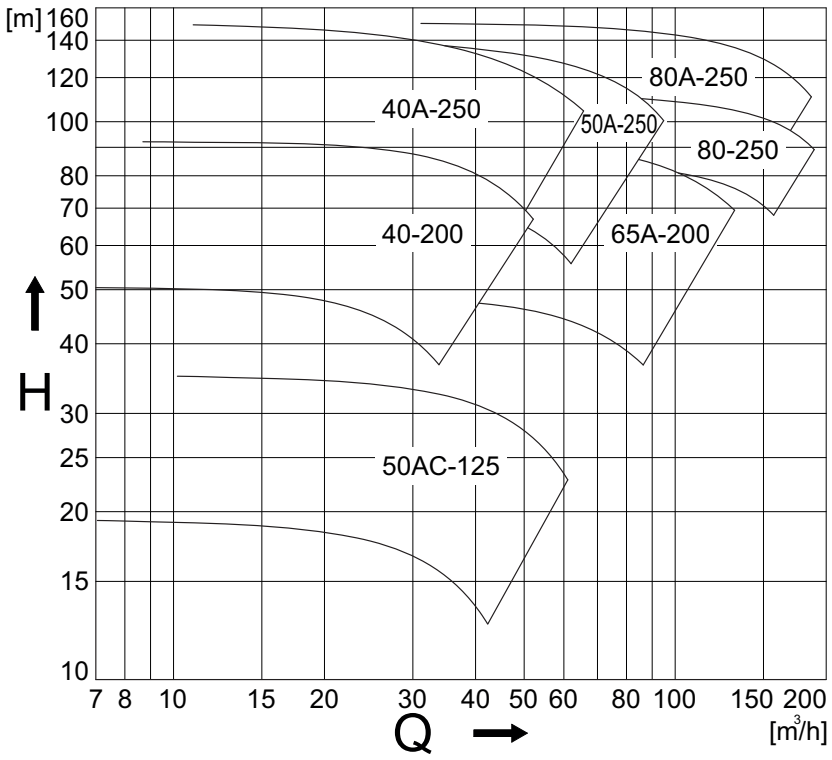

Figure 51: Performance overview 3600 min^{-1} (R).

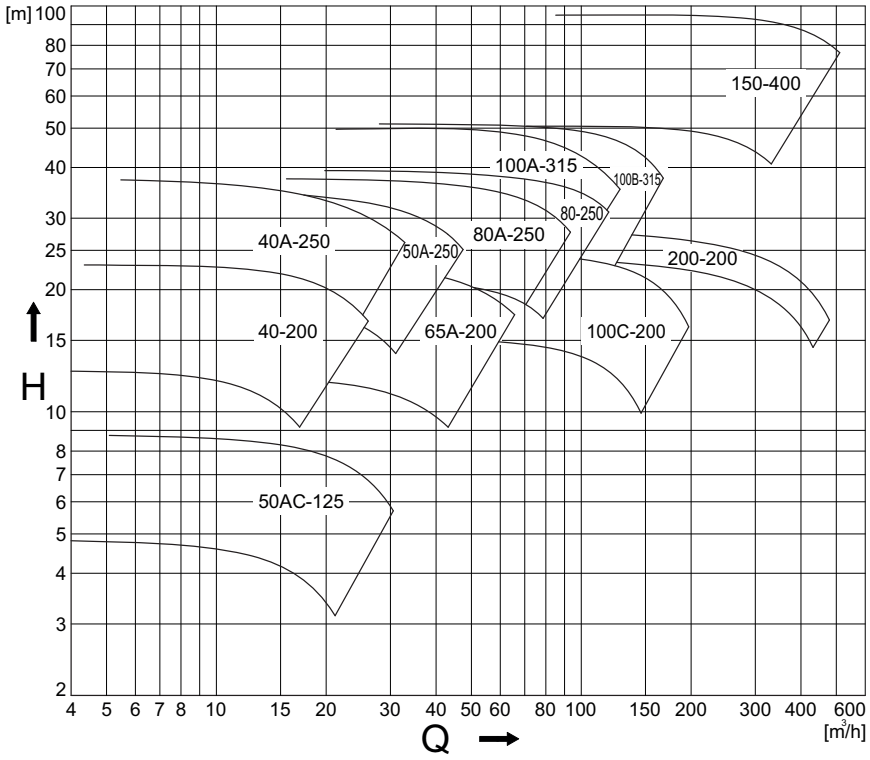

Figure 52: Performance overview 1800 min^{-1} (R).

10.9 Noise data

10.9.1 Pump noise as a function of pump power

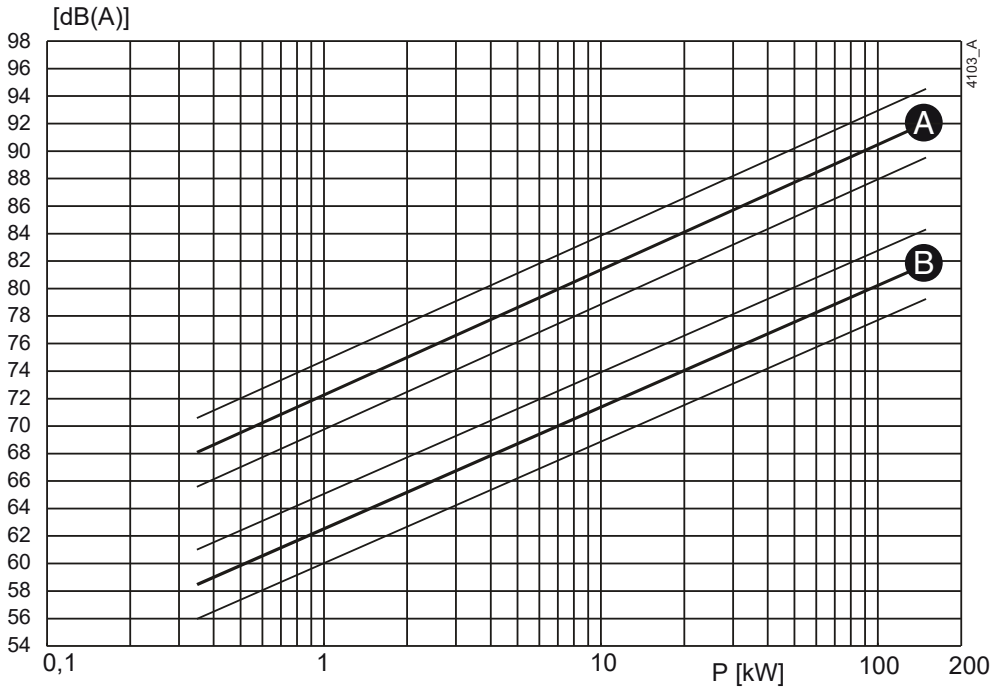

Figure 53: Noise level as function of pump power [kW] at 1450 min^{-1}
A = sound power level, B = sound pressure level.

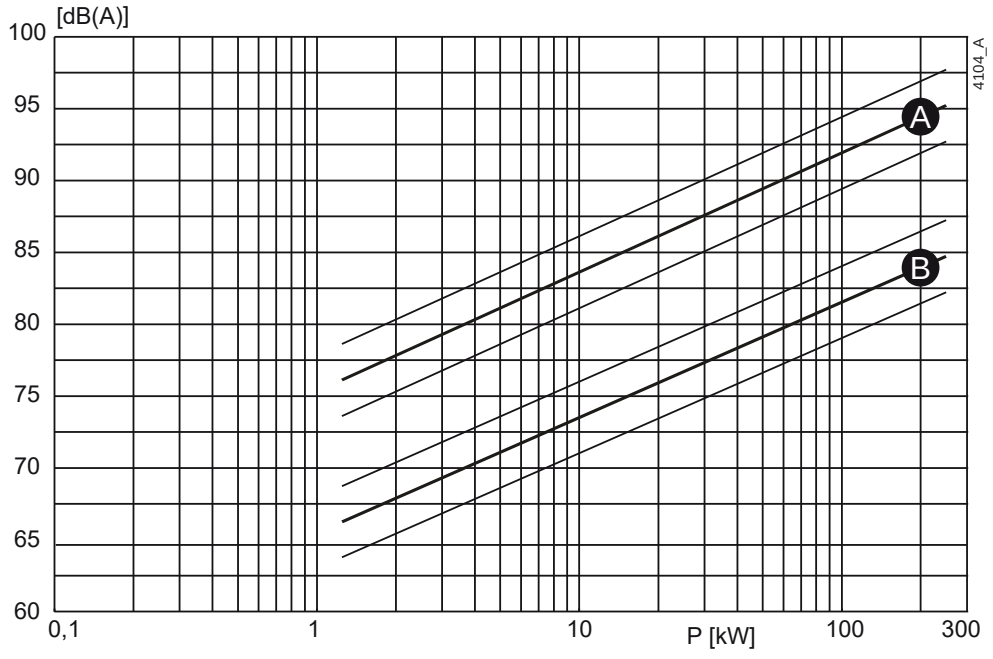

Figure 54: Noise level as function of pump power [kW] at 2900 min^{-1}
A = sound power level, B = sound pressure level.

10.9.2 Noise level of entire pump unit

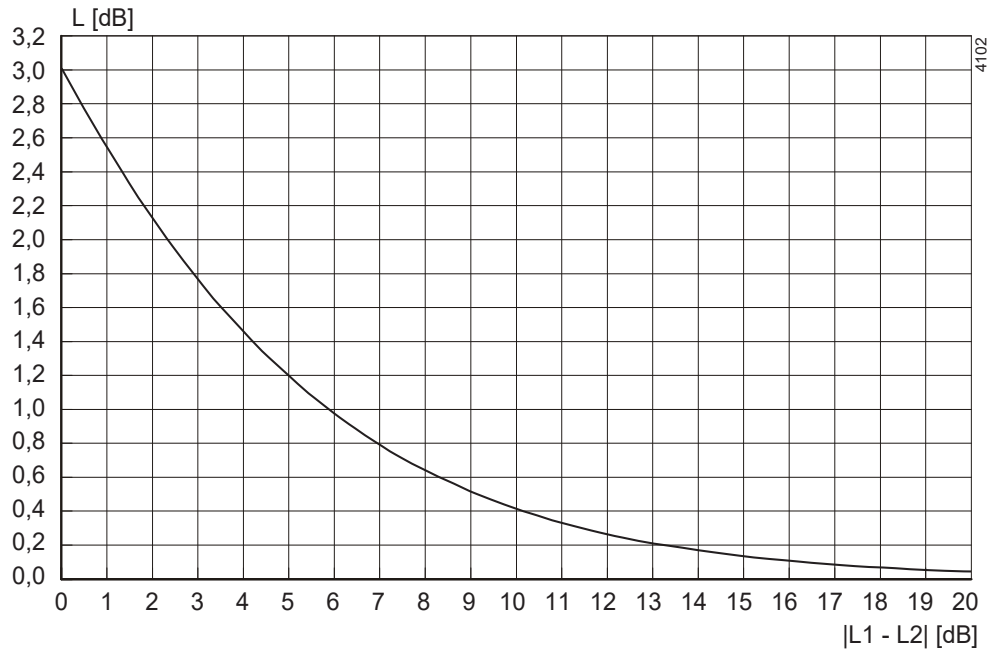

Figure 55: Noise level of entire pump unit.

In order to determine the total noise level of the entire pump unit, the noise level of the motor must be added to that of the pump. This can be easily done by using the graph above.

1 Determine the noise level (L1) of the pump, see figure 53 or figure 54.
2 Determine the noise level (L2) of the motor, see documentation of the motor.
3 Determine the difference between both levels |L1 - L2|.
4 Find the differential value on the |L1 - L2|-axis and go up to the curve.
5 From the curve go left to the L[dB] -axis and read out the value.
6 Add this value to the highest value of both noise levels (L1 or L2).

Example:

1 Pump 75 dB; motor 78 dB.
2 |75-78| = 3 dB.
3 dB on the X-axis = 1,75 dB on the Y-axis.
4 Highest noise level + 1,75 dB = 78 + 1,75 = 79,75 dB.

Index

Order form for spare parts

FAX Nr.	
ADDRESS	

Your order will only be dealt with if this order form has been correctly completed and signed.

Order date:	
Your order number:	
Pump type:	
Execution:	

Quantity	Item. No.	Part	Article number pump

Delivery address:	Invoicing address:

Ordered by:	Signature:	Telephone:

Johnson Pump®

CombiFlex Universal

Vertical centrifugal pump

SPXFLOW®

Dr. A. F. Philipsweg 51
9403 AD Assen
THE NETHERLANDS

P: + 31 (0) 592 37 67 67
F: + 31 (0) 592 37 67 60
E: johnson-pump.nl@spxflow.com

www.spxflow.com/johnson-pump

ISSUED 01/2023
Revision: CFU/EN (2502) 4.4