

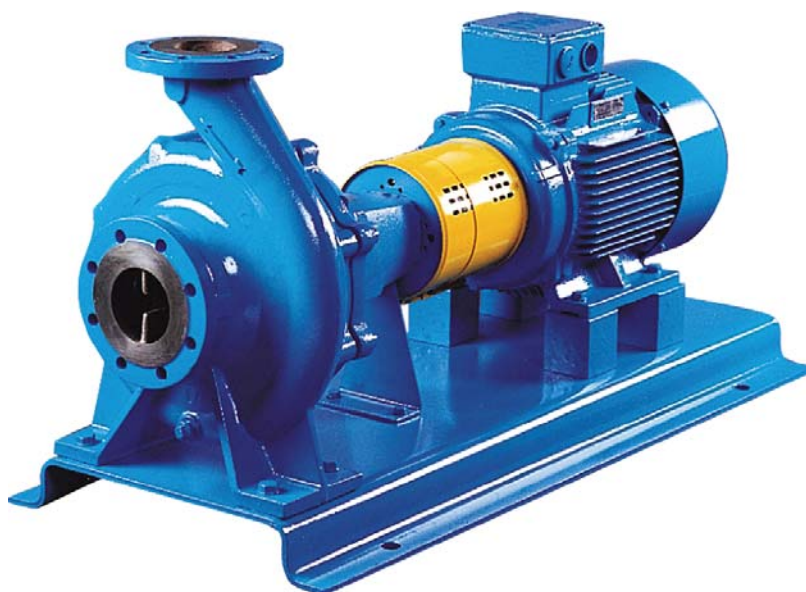
CombiNorm

Horizontal centrifugal pump according to EN 733 (DIN 24255)

CN/EN (1906) 6.8

Original 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 productfamilies CombiBloc, CombiBlocHorti, CombiChem, CombiLine, CombiLineBloc and CombiNorm 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"
- standards EN-ISO 12100 part 1 & 2, EN 809

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 the requirements of Directive 2006/42/EC (as altered most recently).

EC Declaration of conformity

(Directive 2009/125/EC, Annex VI and Commission Regulation (EU) No 547/2012)
(Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water pumps)

Manufacturer

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

Hereby declares that all listed pumps member of product families CombiBloc, CombiBlocHorti, CombiChem, CombiLine, CombiLineBloc and CombiNorm are in conformity with the provisions of Directive 2009/125/EC and Commission Regulation (EU) No 547/2012 and the following standard:

- EN 16480

Declaration of incorporation

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

Manufacturer

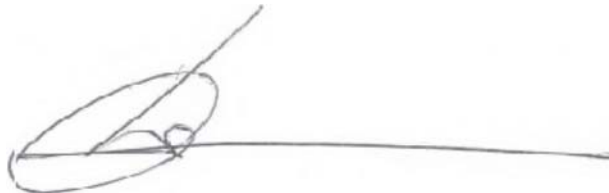
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hereby declares that the partly completed pump (Back-Pull-Out unit), member of productfamilies CombiBloc, CombiBlocHorti, CombiChem, CombiLine, CombiLineBloc and CombiNorm is in conformity with the following standards:

- EN-ISO 12100 parts 1 & 2, 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 that directive.

Assen, January 1st 2019

A handwritten signature in black ink, consisting of a large, stylized loop followed by a long horizontal line extending to the right.

B. Peek,
Managing Director

Instruction manual

All technical and technological information in this manual as well as possible drawings made available by us remain our property and shall not be used (otherwise than for the operation of this pump), copied, duplicated, made available to or brought to the notice of third parties without our prior written consent.

SPXFLOW 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.

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Order form for spare parts

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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 and figure 2.



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!

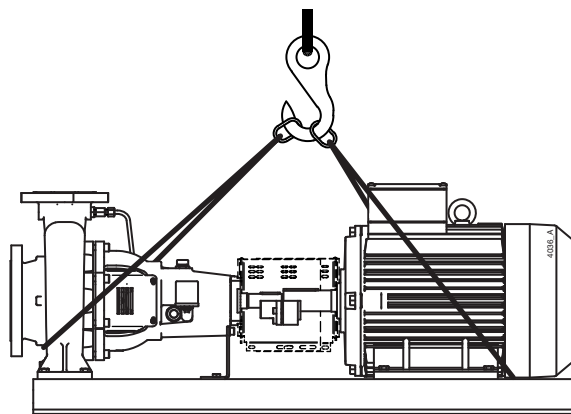


Figure 1: Lifting instructions for pump unit.

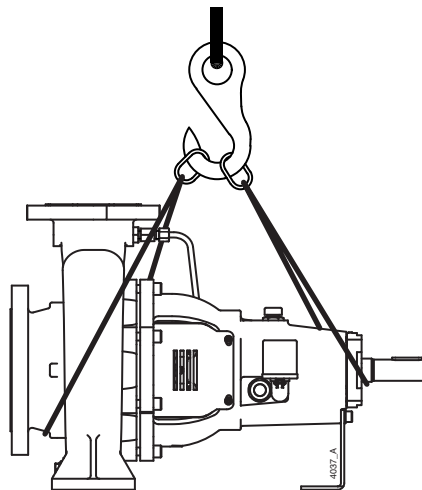


Figure 2: Lifting instructions for single pump.

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 CombiNorm is a range of horizontal non-self-priming centrifugal pumps according to EN 733 (DIN 24255). The hydraulic application area however is larger because of a extended number of available pump types.

Flange dimensions, bolt circle and number of holes comply with ISO 7005 PN16.

The pump is driven by a standard IEC foot 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 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 paragraph 10.4 "Maximum allowable working pressures".
- 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!

2.3 Type code

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

Example: **CN 40C-200 G1 M2 L1**

Pump family	
CN	CombiNorm
Pump size	
40C-200	diameter discharge connection [mm] - nominal impeller diameter [mm]
Pump casing material	
G	cast iron
B	bronze
NG	nodular cast iron
Impeller material	
1	cast iron
2	bronze
6	stainless steel
Shaft sealing	
S1	stuffing box packing
S2	stuffing box packing, with shaft sleeve
S3	stuffing box packing, with shaft sleeve and lantern ring
S4	stuffing box packing, with shaft sleeve and cooling jacket
M1	mechanical seal, unbalanced
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	
L1	2 sealed deep groove ball bearings, grease lubricated (2RSH)
L2	double row angular contact ball bearing (bearing group 4: 2 angular contact ball bearings) + cylindrical roller bearing, grease lubricated
L3	2 deep groove ball bearings, oil-bath lubricated
L4	double row angular contact ball bearing (bearing group 4: 2 angular contact ball bearings) + cylindrical roller bearing, oil-bath lubricated
L5	2 sealed deep groove ball bearings, grease lubricated (2RSH), adjustable
L6	2 deep groove ball bearings, oil-bath lubricated, adjustable

2.4 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

2.5 Bearing groups

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

Table 1: *Bearing group division.*

Bearing groups							
0	0+	1	2	2V	3	3V	4
25-125	25-160	32-125	40A-315	200-160	80-400	300-200	125-500
		32C-125	50-315		100-400		150B-400
		32-160	65A-250		125-315		150-500
		32C-160	65-315		125-400		200-250
		32-200	80C-200		150-250		200-315
		32C-200	80-250		150-315		200-400
		32-250	80A-250		150-400		250-250
		40C-125	80-315		250-200		250-315
		40C-160	100-160				300-250
		40C-200	100C-200				300-315
		40-250	100C-250				
		50C-125	100-315				
		50C-160	125-250				
		50C-200	150-160				
		50-250	150-200				
		65C-125	200-200				
		65C-160					
		65C-200					
		80C-160					
		125-125					
		150-125					

2.6 Construction

The pump has a modular design. The main components are:

- Pump casing / impeller
- Shaft sealing
- Bearing

Each bearing group has only one corresponding pump shaft, fit to accommodate all bearing configurations.

Pump types 25-125, 25-160, 200-160, 300-200, 125-500 and 150-500 have a special shaft.

Furthermore, the pumps have been standardised in groups featuring the same connection for pump cover and bearing bracket. These groups are identified by the nominal impeller diameters. The bearing bracket is mounted to the pump casing, with the pump cover clamped inbetween. Pump types 125-500 and 150-500 have the bearing bracket mounted to the pump cover.

For every combination of shaft size and nominal impeller diameter there is one pump cover design and one bearing bracket design. The bearing bracket of bearing group 4 consists of two parts, a bearing bracket and a lantern piece.

2.6.1 Pump casing / impeller

This concerns the parts that are exposed to the pumped liquid. For each individual pump type there is only one design of the pump casing and the impeller. The pump casing is available in cast iron and bronze, the impeller is available in cast iron, bronze or stainless steel. All pump types have a closed impeller design, except for pump types 25-125 and 25-160, which have a half-open impeller design, running close to the pump casing with a 0,5 mm clearance.

2.6.2 Shaft seal

The shaft seal is available in various variants. There are 4 stuffing box packing configurations, 7 mechanical seal configurations and 4 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.

In configurations featuring a shaft sleeve, the shaft is not in contact with the liquid handled (dry shaft design).

2.6.3 Bearing

Bearing groups 1, 2 and 3 can be supplied with 2 deep groove ball bearings or a double row angular contact ball bearing combined with a cylindrical roller bearing, either grease- or oil lubricated. The bearing configuration of bearing group 4 always consists of two angular contact ball bearings in "O" arrangement, combined with a cylindrical roller bearing. Pump types 25-125 and 25-160 can be supplied with 2 deep groove ball bearings or 2 paired deep groove ball bearings and a cylindrical roller bearing; both configurations fitted in an bearing holder to axially adjust the clearance of the half-open impeller.

All bearing types may be grease- or oil lubricated. The grease lubricated deep groove ball bearings are sealed and do not require any maintenance (2RSH bearings). For relubricating purposes the grease-lubricated, double row angular contact ball bearings and cylindrical roller bearings have been fitted with a grease nipple on the bearing cover.

2.7 Ecodesign Minimum Efficiency Requirements Water Pumps

- Directive 2005/32/EC of the European Parliament and of the Council;
- Commission regulation (EU) No 547/2012 Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water pumps.

2.7.1 Introduction

SPX Flow Technology Assen B.V. is an associate member of the HOLLAND PUMP GROUP, an associate member of EUROPUMP, the organization of European pump manufacturers.

Europump promotes the interest of the European pump industry with the European institutions.

Europump welcomes the aim of the European Commission to reduce eco-impact of products in the European Union. Europump is fully aware of the eco-impact of pumps in Europe. For many years the ecopump initiative is one of the strategic columns in the work of Europump. From the first of January 2013 the regulation is coming into force concerning minimum required efficiencies of rotodynamic water pumps. The regulation sets minimum efficiency requirements on water pumps set out under the Ecodesign Directive for energy related products. This regulation mainly addresses manufacturers of water pumps placing these products on the European market. But as a consequence customers may also be affected by this regulation. This document gives necessary information related to the coming into force of the water pump regulation EU 547/2012.

2.7.2 Implementing Directive 2009/125/EC

- Definitions:

“This Regulation establishes eco-design requirements for the placing on the market of rotodynamic water pumps for pumping clean water, including where integrated in other products.”

“Water pump” is the hydraulic part of a device that moves clean water by physical or mechanical action and is of one of the following designs:

- End suction own bearing (ESOB);
- End suction close coupled (ESCC);
- End suction close coupled inline (ESCCi);
- Vertical multistage (MS-V);
- Submersible multistage (MSS);”

‘*End suction water pump*’ (ESOB) means a glanded single stage end suction rotodynamic water pump designed for pressures up to 1600 kPa (16 bar), with a specific speed n_s between 6 and 80 rpm, a minimum rated flow of 6 m³/h, a maximum shaft power of 150 kW, a maximum head of 90 m with nominal speed of 1450 rpm and a maximum head of 140 m with nominal speed of 2900 rpm;

‘*End suction close coupled water pump*’ (ESCC) is an end suction water pump of which the motor shaft is extended to become also the pump shaft;

‘*End suction close coupled inline water pump*’ (ESCCi) means a water pump of which the water inlet of the pump is on the same axis as the water outlet of the pump;

‘*Vertical multistage water pump*’ (MS-V) means a glanded multistage ($i > 1$) rotodynamic water pump in which the impellers are assembled on a vertical rotating shaft, which is designed for pressures up to 2500 kPa (25 bar), with a nominal speed of 2900 rpm and a maximum flow of 100 m³/h;

'Submersible multistage water pump' (MSS) means a multistage ($i > 1$) rotodynamic water pump with a nominal outer diameter of 4" (10,16 cm) or 6" (15,24 cm) designed to be operated in a borehole at nominal speed of 2900 rpm, at operating temperatures within a range of 0°C and 90°C;

This Regulation shall not apply to:

- 1 water pumps designed specifically for pumping clean water at temperatures below -10°C or above +120°C;
- 2 water pumps designed only for fire-fighting applications;
- 3 displacement water pumps;
- 4 self-priming water pumps.

▪ Enforcement:

In order to enforce this there will be a **Minimum Efficiency Index** (M.E.I.) criteria set for the above list of pumps.

The MEI is a dimensionless figure that is derived from a complex calculation based on the efficiencies at BEP (Best Efficiency Point), 75% BEP & 110% BEP, and the specific speed. The range is used so that manufacturers do not take an easy option of providing good efficiency at one point i.e. BEP.

The value ranges from 0 to 1,0 with the lower value being less efficient, this provides the basis of eliminating the less efficient pumps starting with 0,10 in 2013 (the lowest 10%) and 0,40 (the lowest 40%) in 2015.

The MEI value of 0,70 is classed benchmark for the most efficient pumps in the market at the time of developing the directive.

The milestones for the MEI values are as follows;

- 1 1st January 2013 all pumps shall have a minimum MEI value of 0,10;
- 2 1st January 2015 all pumps shall have a minimum MEI value of 0,40.

The most important point of this is that unless the pumps comply then they will not be allowed to have a CE marking.

▪ Part Load Performance

It is common practice that pumps spend much of their time working away from their rated duty, and efficiency can fall off rapidly below the 50% duty point, any scheme should take account of this real life performance. However, manufacturers need a pump efficiency classification scheme that makes it impossible to design pumps with a steep fall off in efficiency either side of the BEP point in order to claim a higher efficiency than would be typical of real life operation.

▪ 'House of Efficiency'

The decision scheme 'House of Efficiency' takes into account design and application purposes as well as the pump minimum efficiency dependence on flow. The minimum acceptable efficiency is therefore different for each pump type. The pass-or-fail scheme is based on two criteria A and B.

Criterion A is the pass-or-fail minimum efficiency requirement at the best efficiency point (BEP) of the pump:

$$\eta_{\text{Pump}}(n_s, Q_{\text{BEP}}) \geq \eta_{\text{BOTTOM}}$$

Where

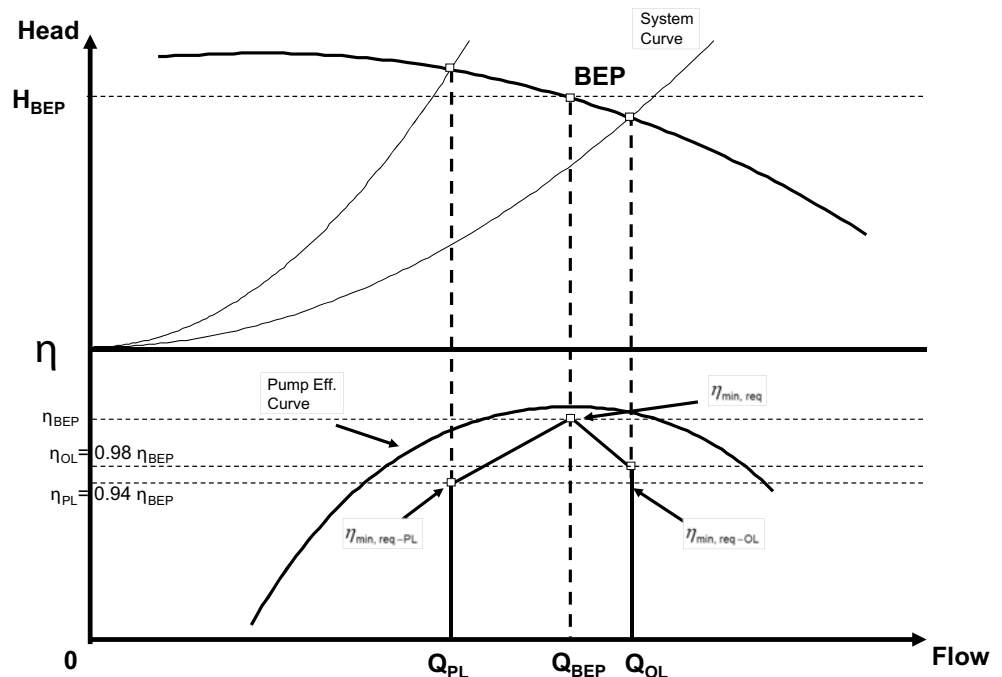
$$n_s = n_N \times \frac{\sqrt{Q_{\text{BEP}}}}{H_{\text{BEP}}^{0.75}}$$

Criterion B is the pass-or-fail minimum efficiency requirement at part load (PL) and at overload (OL) of the pump:

$$\eta_{\text{BOTTOM-PL,OL}} \geq x \cdot \eta_{\text{BOTTOM}}$$

Therefore a method is devised what is called a “house of efficiency” scheme that also requires pumps to pass efficiency thresholds at 75% and 110% of rated flow. The advantage of this is that pumps will be penalised for poor efficiency away from rated efficiency, hence it will take account of real life pump duties. It should be stated that while the scheme may appear complicated at first sight, in practice it has been easy for the manufacturers to apply the scheme to their pumps.

Figure 3: House of Efficiency



2.7.3 Energy Efficient Pump Selection

In selecting the pump, care should be taken to ensure that the duty point required is as close as possible to the pump's Best Efficiency Point (BEP). Different heads and flows can be achieved by changing the diameter of the impeller and thereby eliminating unnecessary energy loss.

The same pump can be offered at different motor speeds to allow the pump to be used over a much wider range of duties. For instance, changing from 4-pole motor to 2-pole motor will enable the same pump to deliver twice as much peak flow at 4 times the head.

Variable speed drives allow the pump to operate efficiently over a wide range of speeds hence duties in an energy efficient manner. They are particularly useful in systems where is a variation in required flow.

A very useful tool for energy efficient pump selection is the downloadable software program "Hydraulic Investigator 2" from the SPXFLOW website.

Hydraulic Investigator is the selection guide for centrifugal pumps and search by pump family and pump type starting from entering required capacity and head. Further refine the pump curves to find the pump that meets your specification.

The default setting of applicable pump types is prioritized on highest efficiency. In the standard automated selection procedure the optimum (trimmed) impeller diameter is calculated already, where applicable. Manually the rotating speed can be adjusted as well when a variable speed drive is preferred.

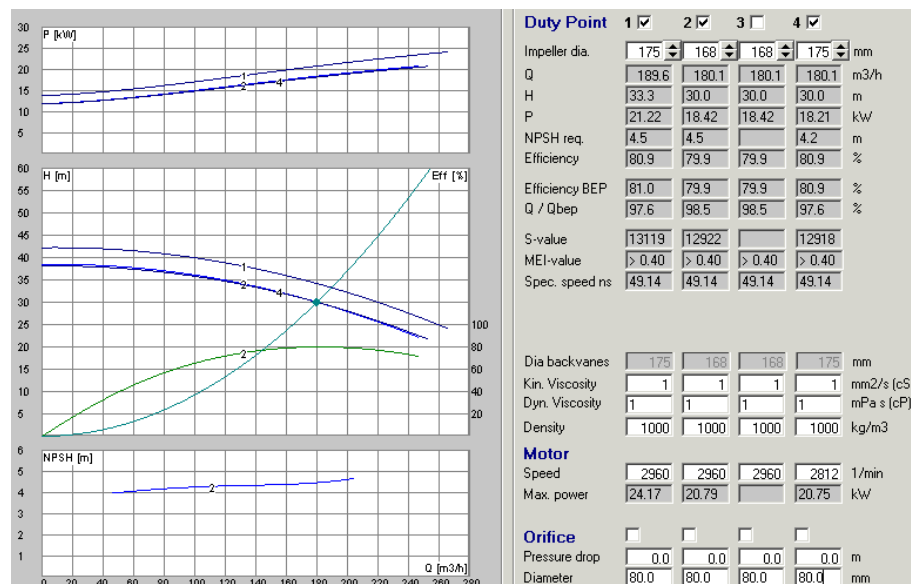
Example:

Curve 1: performance at maximum impeller diameter and 2960 rpm;

Curve 2: performance at required duty point (180 m³/h, 30 m) with trimmed impeller, power consumption 18,42 kW;

Curve 4: performance at required duty point with maximum impeller diameter and reduced rotating speed (2812 rpm), power consumption 18,21 kW.

Figure 4: Hydraulic Investigator 2



2.7.4 Scope of Implementing Directive 2009/125/EC

The following SPX Flow Technology products are in the scope of the directive:

- CombiNorm (ESOB)
- CombiChem (ESOB)
- CombiBloc (ESCC)
- CombiBlocHorti (ESCC)
- CombiLine (ESCCi)
- CombiLineBloc (ESCCi)

Pumps with half-open impeller are excluded from the scope of the directive. Half-open impellers are designed for pumping liquids containing solids.

The vertical multistage pump range MCV(S) is out of the scope of the directive, these pumps are designed for pressures up to 4000 kPa (40 bar).

Submersible multistage pumps are not available in the SPXFLOW product portfolio.

2.7.5 Product information

Name plate, example:

Figure 5: Name plate

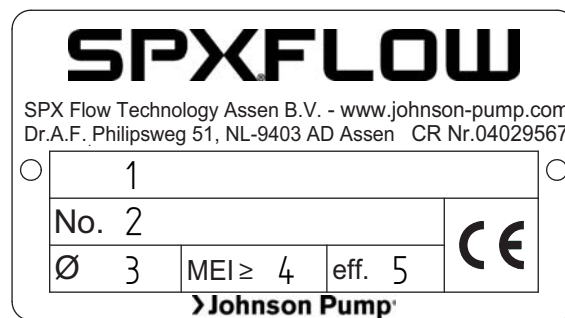


Table 2: Name plate

1	CN 40C-200 G1 M2 L1	Product type and size
2	19-001160	Year and serial number
3	202 mm	Fitted impeller diameter
4	0,40	Minimum Efficiency Index at max. impeller diameter
5	[xx.x]% or [-,-]%	Efficiency for trimmed impeller diameter

Figure 6: Name plate

SPXFLOW		13		CE			
SPX Flow Technology Assen B.V. Dr. A.F. Philipsweg 51, NL-9403 AD Assen		Johnson Pump CR Nr. 04029567 www.johnson-pump.com					
Type	1						
Q	2	m ³ /h	∅	8	n	14	min ⁻¹
H	3	m	MEI ≥	9	T	15	°C
p max.	4	bar	eff. 10	p test	16	bar	
No.	5		item no.	17			
Order No.	11						
Bearing No.	12						
	6						
	7						

Table 3: Name plate

1	CN 40C-200 G1 M2 L1	Product type and size
2	35 m ³ /h	Rated capacity
3	50 m	Rated head
4	10 bar	Maximum allowable pressure
5	19-001160	Year and serial number
6		Type of bearing
7		Type of bearing
8	202 mm	Fitted impeller diameter
9	0,40	Minimum Efficiency Index at max. impeller diameter
10	[xx.x]% or [-,-]%	Efficiency for trimmed impeller diameter
11	H123456	Pump order number
12		Additional information
13	2013	Year of manufacturing
14	2900 min ⁻¹	Running speed
15	40 °C	Operating temperature
16	15 bar	Hydrostatic test pressure
17	P-01	Customers reference number

Figure 7: Name plate ATEX certified

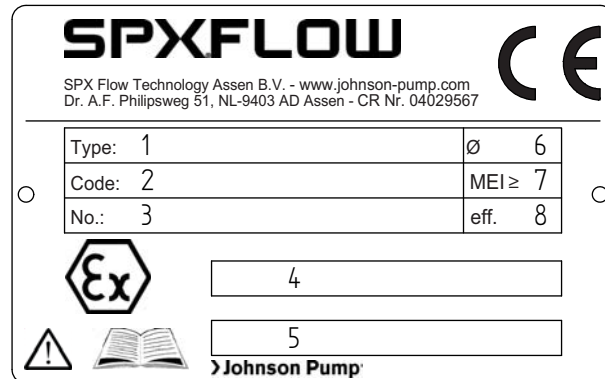


Table 4: Name plate ATEX certified

1	CN 40C-200	Product type and size
2	G1 M2 L1	Smartcode
3	19-001160	Year and serial number
4	II 2G c T3-T4	Ex marking
5	KEMA03 ATEX2384	Certificate number
6	202 mm	Fitted impeller diameter
7	0,40	Minimum Efficiency Index at max. impeller diameter
8	[xx.x]% or [-,-]%	Efficiency for trimmed impeller diameter

1 Minimum efficiency index, MEI:

Table 5: MEI value

Material	Speed [rpm]	MEI value according prEN16480		Remarks
		Cast iron / Nodular Cast iron	Bronze ¹⁾	
25-125	2900			Outside scope
25-160	2900			Outside scope
32-125	2900	> 0,40	> 0,40	
32C-125	2900	> 0,40	> 0,40	
32-160	2900	> 0,40	> 0,40	
32A-160	2900	> 0,40	> 0,40	
32C-160	2900	> 0,40	> 0,40	
32-200	2900	> 0,40	> 0,40	
32C-200	2900	> 0,40	> 0,40	
32-250	2900	> 0,40	> 0,40	
40C-125	2900	> 0,40	> 0,40	
40C-160	2900	> 0,40	> 0,40	
40C-200	2900	> 0,40	> 0,40	
40-250	2900	> 0,40	> 0,40	
40A-315	2900	> 0,40	> 0,40	
50C-125	2900	> 0,40	> 0,40	

Table 5: MEI value

Material	Speed [rpm]	MEI value according prEN16480		Remarks
		Cast iron / Nodular Cast iron	Bronze ¹⁾	
50C-160	2900	> 0,40	> 0,40	
50C-200	2900	> 0,40	> 0,40	
50-250	2900	> 0,40	> 0,40	
50-315	2900	> 0,40	> 0,40	
65C-125	2900	> 0,40	> 0,40	
65C-160	2900	> 0,40	> 0,40	
65C-200	2900	> 0,40	> 0,40	
65A-250	2900	> 0,40	> 0,40	
65-315	1450	> 0,40	> 0,40	
80C-160	2900	> 0,40	> 0,40	
80C-200	2900	> 0,40	> 0,40	
80-250	2900	> 0,40	> 0,40	
80A-250	2900	> 0,40	> 0,40	
80-315	1450	> 0,40	> 0,40	
80-400	1450	> 0,40	> 0,40	
100-160	2900	> 0,40	> 0,40	
100C-200	2900	> 0,40	> 0,40	
100C-250	2900	> 0,40	> 0,40	
100-315	1450	> 0,40	> 0,40	
100-400	1450	> 0,40	> 0,40	
125-125	1450			Not available
125-250	1450	> 0,40	> 0,40	
125-315	1450	> 0,40	> 0,40	
125-400	1450	> 0,40	> 0,40	
125-500	1450	> 0,40	> 0,40	
150-125	1450	---	---	Outside scope, ns > 80 rpm
150-160	1450			Not available
150-200	1450	> 0,40	> 0,40	
150-250	1450			Not available
150-315	1450			Not available
150-400	1450	> 0,40	> 0,40	
150B-400	1450	> 0,40	> 0,40	
150-500	1450	---	---	Outside scope, P > 150 kW
200-160	1450	---	---	Outside scope, ns > 80 rpm
200-200	1450	> 0,40	> 0,40	
200-250	1450			Not available
200-315	1450			Not available
200-400	1450			Not available
250-200	1450	> 0,40	> 0,40	
250-250	1450	---	---	Outside scope, ns > 80 rpm
250-315	1450			Not available

Table 5: MEI value

Material	Speed [rpm]	MEI value according prEN16480		Remarks
		Cast iron / Nodular Cast iron	Bronze ¹⁾	
300-200	1450	---	---	Outside scope, ns > 80 rpm
300-250	1450	> 0,40	> 0,40	
300-315	1450			Not available

1) impeller or pump in bronze

- 2 The benchmark for most efficient water pumps is $MEI \geq 0,70$.
- 3 Year of manufacture; the first 2 positions (= the last 2 positions of the year) of the serial number of the pump as marked on the rating plate. An example and explanation is given in paragraph 2.7.5 "Product information" of this document.
- 4 Manufacturer:

SPX Flow Technology Assen B.V.
 Registration number at Chamber of Commerce 04 029567
 Dr. A.F. Philipsweg 51
 9403 AD Assen
 The Netherlands
- 5 Product type and size identifier are marked on the rating plate. An example and explanation is given in paragraph 2.7.5 "Product information" of this document.
- 6 The hydraulic pump efficiency of the pump with trimmed impeller diameter is marked on the rating plate, either the efficiency value [xx.x]% or [-.]%.
- 7 Pump curves, including efficiency characteristics, are published in the downloadable software program "Hydraulic Investigator 2" from the SPXFLOW website. For downloading "Hydraulic Investigator 2" go to <http://www.spxflow.com/en/johnson-pump/resources/hydraulic-investigator/> The pump curve for the delivered pump is part of the related customer order documentation package separate from this document.
- 8 The efficiency of a pump with a trimmed impeller is usually lower than that of a pump with the full impeller diameter. The trimming of the impeller will adapt the pump to a fixed duty point, leading to reduced energy consumption. The minimum efficiency index (MEI) is based on the full impeller diameter.
- 9 The operation of this water pump with variable duty points may be more efficient and economic when controlled, for example, by the use of a variable speed drive that matches the pump duty to the system.
- 10 Information relevant for disassembly, recycling or disposal at end-of-life is described in paragraph 2.9 "Re-use", paragraph 2.10 "Scrapping" and chapter 7 "Disassembly and assembly".

11 The benchmark efficiency Fingerprint Graphs are published for:

MEI = 0,40	MEI = 0,70
ESOB 1450 rpm	ESOB 1450 rpm
ESOB 2900 rpm	ESOB 2900 rpm
ESCC 1450 rpm	ESCC 1450 rpm
ESCC 2900 rpm	ESCC 2900 rpm
ESCCi 1450 rpm	ESCCi 1450 rpm
ESCCi 2900 rpm	ESCCi 2900 rpm
Multistage Vertical 2900 rpm	Multistage Vertical 2900 rpm
Multistage Submersible 2900 rpm	Multistage Submersible 2900 rpm

Benchmark efficiency graphs are available under <http://www.europump.org/efficiencycharts>.

2.8 Application area

The application area globally looks as follows:

Table 6: Application area.

	Maximum value
Capacity	1500 m ³ /h
Discharge head	140 m
System pressure	16 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 paragraph 10.4 "Maximum allowable working pressures".

2.9 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!

2.10 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.
- Behind the cooling air inlet of the motor there must be a free area of at least 1/4 of the electric motor diameter, to ensure unobstructed air supply.

3.4 Mounting

3.4.1 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".

3.4.2 Assembling a pump unit

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

- 1 Fit both halves of the coupling to the pump shaft and the motor shaft respectively. For tightening moment of the set screw see paragraph 10.3.3 "Tightening moments set screw from coupling".
- 2 If size **db** of the pump, see figure 38 or figure 39, is not equal to the IEC size of the motor, level up the difference by placing properly sized spacers under the pump or under the motor feet.
- 3 Place the pump on the base plate. Fix the pump to the base plate.
- 4 Place the electric motor on the base plate. Move the motor to obtain a gap of 3 mm between both coupling halves.
- 5 Place copper shims under the feet of the electric motor. Fix the electric motor to the base plate.
- 6 Align the coupling in accordance with the following instructions.

3.4.3 Alignment of the coupling

- 1 Place a ruler (A) on the coupling. Place or remove as many copper shims as is necessary to bring the electric motor to the correct height so that the straight edge touches both coupling halves over the entire length, see figure 8.

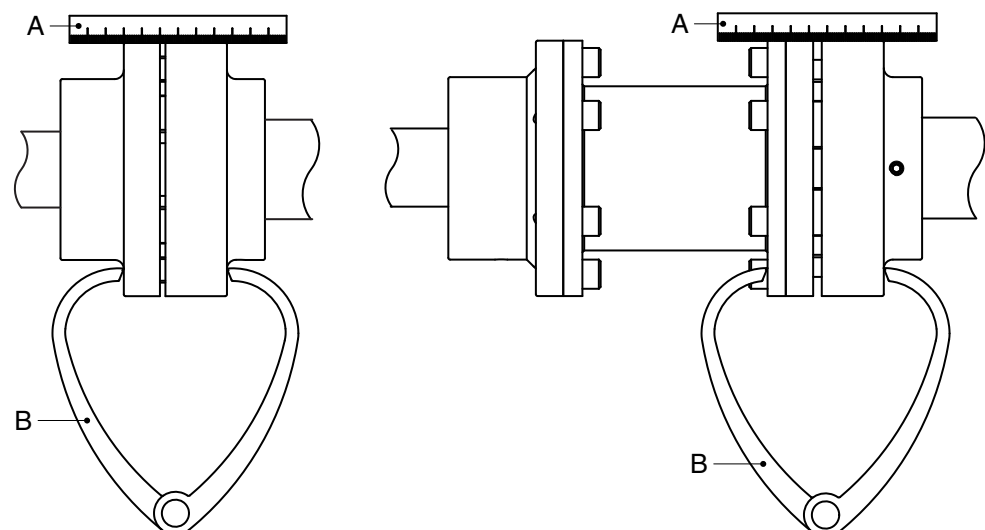


Figure 8: Aligning the coupling by means of a ruler and a pair of outside calipers.

- 2 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.
- 3 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 8.
- 4 Fit the guard. See paragraph 7.4.4 "Assembling 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 7. See also figure 9.

Table 7: Alignment tolerances

External diameter of coupling [mm]	V				Va _{max} - Va _{min} [mm]	Vr _{max} [mm]
	min [mm]		max [mm]			
81-95	2	5*	4	6*	0,15	0,15
96-110	2	5*	4	6*	0,18	0,18
111-130	2	5*	4	6*	0,21	0,21
131-140	2	5*	4	6*	0,24	0,24
141-160	2	6*	6	7*	0,27	0,27
161-180	2	6*	6	7*	0,30	0,30
181-200	2	6*	6	7*	0,34	0,34
201-225	2	6*	6	7*	0,38	0,38

*) = coupling with spacer

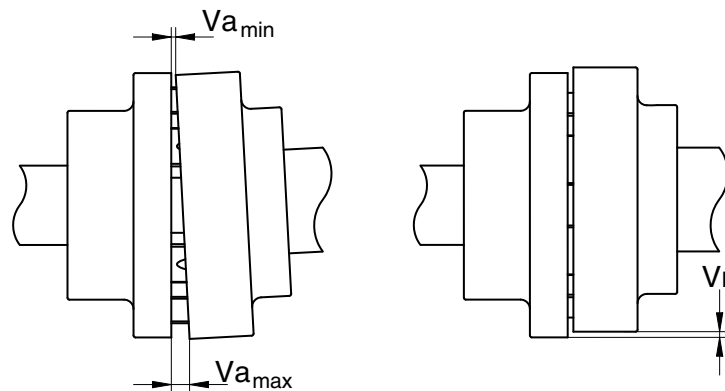


Figure 9: Alignment tolerances standard coupling.

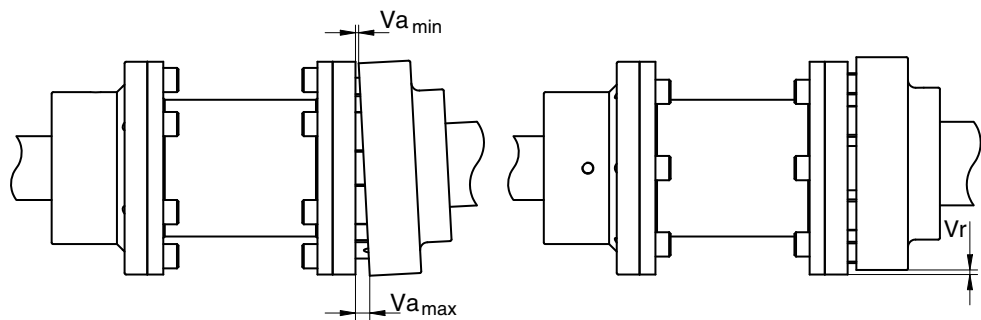


Figure 10: Alignment tolerances spacer coupling.

3.5 Piping

- The piping to the suction and delivery connections must fit exactly and must not be subject to stress during operation. For the maximum allowable forces and moments on the pump flanges see paragraph 10.9 "Permissible forces and moments on the flanges".
- 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 11.

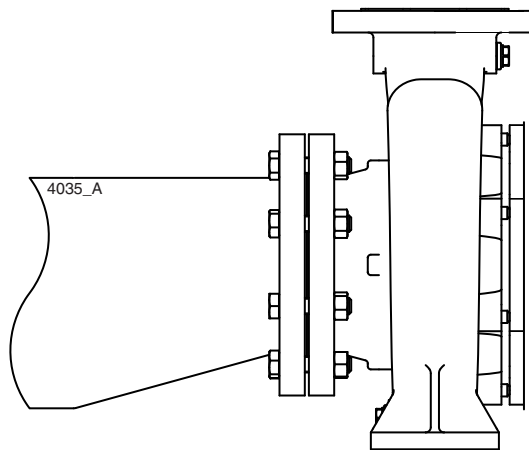


Figure 11: Eccentric reducer to suction flange.

- The maximum allowable system pressure is stated in paragraph 10.4 "Maximum allowable working pressures". If there is a risk that this pressure might be exceeded, for instance because of an excessive inlet pressure, appropriate measures should be taken by mounting a safety valve in the piping.
- 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

- Fit any parts that may have been supplied separately.
- If the liquid does not flow towards the pump, fit a foot valve at the bottom of the suction pipe. If necessary, 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 to prevent internal pump parts from being damaged by foreign matter. If the risk of damage continues to exist, fit a permanent filter.
- In case the pump is provided with a cooling jacket (shaft seal configurations S4, MW2, MW3), connect the cooling jacket to the supply and return lines of the cooling system.
- In case the shaft seal is provided with a buffer pressure system (shaft seal configuration CD3), connect this system to the buffer liquid supply.
- 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.

3.8 Combustion engine

3.8.1 Safety

If the pump set is designed with a combustion engine, the manual for the engine should be included in the delivery. If the manual is missing we urgently request you to contact us immediately.

- Irrespective of the manual, the following points should be observed for all combustion engines:
- Comply with the local safety regulations.
- The exhaust of combustion gases must be screened off to prevent incidental contact.
- The starting device should automatically be disengaged after the engine has been started.
- The maximum speed of the engine set by us should **not** be changed.
- Before starting the engine check the oil level.

3.8.2 Sense of rotation

The sense of rotation of combustion engine and pump is indicated by means of an arrow on the combustion engine and the pump casing. Verify whether the sense of rotation of the combustion engine is the same as that of the pump.

4 Commissioning

4.1 Inspection of the pump

- Construction with stuffing box packing: Remove the seal guards (0276). Check whether the nuts (1810) have not been over tightened. If necessary, loosen these nuts and tighten them again by hand. Fit the seal guards (0276).
- 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

Pump driven by an electric motor:

- Check whether the fuses have been mounted.

Pump driven by a combustion engine:

- Check whether the room in which the engine is placed is well ventilated.
- Check whether the exhaust of the engine is not obstructed.
- Before starting the engine check the oil level.
- **Never run the engine in a closed room.**

4.3 Pumps with oil-bath lubricated bearings L3 - L4 - L6

!

Pumps provided with oil-bath lubricated bearings (L3, L4 and L6) are shipped without oil and must be filled with oil prior to commissioning the pump!

For the specification of the oil to be used, see paragraph 10.1 "Lubricants".

- 1 Remove the oil filler cap (2130).
- 2 Fill the bearing bracket through the oil filling orifice till the oil shows in the constant level oiler.
- 3 Fit the oil filler cap.
- 4 Top up the constant level oiler entirely.

4.4 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).

4.5 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.

4.5.1 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 10.8 "Pressure near the impeller hub for shaft sealing groups S.. and CD3"**.
- Shaft seal configuration with cooling jacket **S4, MW2, MW3** must be connected to an external cooling liquid system.

4.5.2 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.

4.6 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.

4.7 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!

4.8 Adjustment of shaft sealing

4.8.1 Stuffing box packing

After the pump is started, the stuffing box packing will show a certain amount of leakage. Because of the expansion of the packing fibres, this leakage will gradually decrease. Make sure that the stuffing box packing never runs dry. To prevent this, loosen the nuts (1810) to the extent that the stuffing box packing leaks by drops. As soon as the pump has reached the proper temperature (and leakage is still too much) the gland can be adjusted permanently:

- 1 Tighten both nuts, one after the other, a quarter turn.
- 2 Wait 15 minutes after each adjustment before making the next adjustment.
- 3 Continue in this way until an acceptable leakage by drops has been attained (10/20 cm³/h).
- 4 Fix the seal guards (0276).



Adjustment of stuffing box packing has to be done with running pump. Take great care not to touch moving parts.

4.8.2 Mechanical seal

- A mechanical seal may never show visible leakage.

4.9 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.

4.10 Noise

The noise production of a pump depends to a great extent on the operating conditions. The values stated in paragraph 10.11 "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 Stuffing box packing

Do not tighten the nuts (1810) any more after the running-in period and adjustment. If in time the stuffing box packing starts to leak excessively, new packing rings have to be mounted instead of further tightening the nuts!

5.2.2 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.

5.2.3 Quenched shaft seals MQ2 - MQ3

Regularly check the liquid level of the quench liquid tank.

5.2.4 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 10.8 "Pressure near the impeller hub for shaft sealing groups S.. and CD3" for this value.

5.3 Lubrication of the bearings

5.3.1 Grease-lubricated bearings L1 - L2 - L5

- Bearing brackets with two grease packed ball bearings (L1, L5) do not require any maintenance.
- The grease lubricated version with a double row angular contact ball bearing and a cylindrical roller bearing (L2) 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 "Lubricants".

5.3.2 Oil-bath lubricated bearings L3 - L4 - L6

- During operation the constant level oiler should never be empty. Take care to top up timely.
- The oil should be changed once a year. If the oil temperature is higher than 80°C, the oil should be changed more often. For recommended oils and quantities see paragraph 10.1 "Lubricants".



**Make sure the used oil is discharged safely.
See to it that it doesn't get into the environment.**

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.
- 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 8: Most frequently occurring failures.

Most common faults	Possible causes, see Table 9.
Pump delivers no liquid	1 2 3 4 5 6 7 8 9 10 11 13 14 17 19 20 21 29
Pump has insufficient volume flow	1 2 3 4 5 6 7 8 9 10 11 13 14 15 17 19 20 21 28 29
Pump has insufficient head	2 4 5 13 14 17 19 28 29
Pump stops after start up	1 2 3 4 5 6 7 8 9 10 11
Pump has higher power consumption than normal	12 15 16 17 18 22 23 24 25 26 27 32 34 38 39
Pump has lower power consumption than normal	13 14 15 16 17 18 20 21 28 29
The stuffing box packing is leaking excessively	6 7 23 25 26 30 31 32 33 43
Packing rings or mechanical seal have to be replaced to often	6 7 23 25 26 30 32 33 34 36 41
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 34 37 38 39 40 42

Table 9: 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
5	The pump takes in air through the stuffing box packing
6	The flush or quench water line to the stuffing box packing is not connected or obstructed
7	The lantern ring in the stuffing box packing has been mounted wrongly
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	Casing wear ring faulty or worn out
29	Damaged impeller
30	Pump shaft or shaft sleeve on the spot of the packing rings or seal faces of the mechanical seal are worn out or damaged
31	Worn out or dried out packing rings
32	Not well packed stuffing box packing or bad mounting of the mechanical seal
33	Stuffing box packing type or mechanical seal not suitable for the pumped liquid or operation circumstances
34	Gland or mechanical seal cover has been tightened too much or crookedly
35	No water cooling of packing rings at high temperatures
36	Quenching or flushing liquid to the packing rings or 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
41	Impurities in the liquid get into the stuffing box packing
42	Too high axial force because of worn dorsal blades or excessive inlet pressure
43	Excessive pressure in stuffing box packing space due to too much play in the throttling bush, blocked by-pass or worn dorsal blades

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 Draining



Make sure no liquid or oil gets into the environment!

7.3.1 Liquid draining

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 (0310).
- 3 If harmful liquids are pumped wear protective gloves, shoes, glasses, etc., and thoroughly flush the pump.
- 4 Refit the drain plug.

7.3.2 Oil draining

If the pump is designed with oil-lubricated bearings:

- 1 Remove the oil drain plug (2150).
- 2 Drain the oil.
- 3 Refit the oil drain plug.



If possible, wear protective gloves. Regular contact with oil products may result in allergic reactions.

7.4 Back-Pull-Out system

The pumps are designed with a Back-Pull-Out system. If the pump unit is designed with a spacer-coupling, just remove the spacer. After that the bearing bracket with the entire rotating part can be removed. This means that almost the whole pump can be dismantled without having to detach the suction and delivery piping. The motor remains in its position.

If the pump unit does not have a spacer coupling, the motor has to be removed from the foundation before disassembly.

7.4.1 Disassembling the guard

- 1 Loosen bolts (0960). See figure 15.
- 2 Remove both jackets (0270). See figure 13.

7.4.2 Disassembling the Back-Pull-Out unit

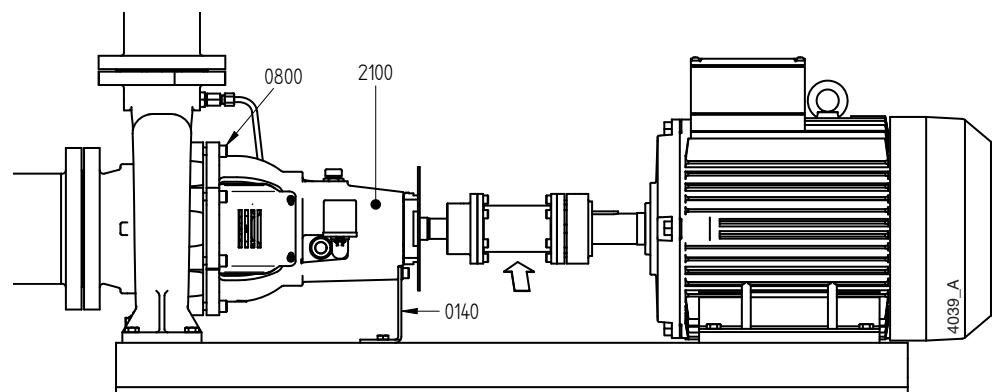


Figure 12: Back-Pull-Out principle.

- 1 Mounted with spacer coupling: Remove the spacer. Else: Remove the electric motor.
- 2 Disconnect possible flushing and/or cooling lines.
- 3 Loosen the bracket support (0140) from the base plate, see figure 12.
- 4 Remove the Allen screws (0800).
- 5 Pull the entire bearing bracket (2100) from the pump casing. The entire bearing bracket of large pumps is very heavy. Support it with a beam or hang it in a pulley sling.
- 6 Remove the coupling half from the pump shaft with a coupling puller and remove the coupling key (2210).
- 7 Unscrew bolts (0940) and remove the assembly plate (0275) from the bearing cover (2115). For versions L5/L6: Unscrew bolts (0940) and remove the assembly plate (0275) from the bearing holder (2840). See figure 16.

7.4.3 Assembling the Back-Pull-Out unit

- 1 Fit a new gasket (0300) into the pump casing and fit the entire bearing bracket back into the pump casing. Tighten the Allen screws (0800) crosswise.
- 2 Fix the bearing support (0140) on the base plate.
- 3 Reconnect the flushing and/or cooling lines.
- 4 Fit the assembly plate (0275) to the bearing cover (2115) with bolts (0940).
For versions L5/L6: fit the assembly plate (0275) to the bearing holder (2840) with bolts (0940). See figure 16.
- 5 Fit the coupling key (2210) and fit the coupling half onto the pump shaft.
- 6 Place the motor back in its place or fit the spacer of the spacer coupling.
- 7 Check the alignment of pump and motor shaft, see paragraph 3.4.3 "Alignment of the coupling". If necessary, realign.

7.4.4 Assembling the guard

- 1 Fit the jacket (0270) at motor side. The annular groove must be located at motor side.

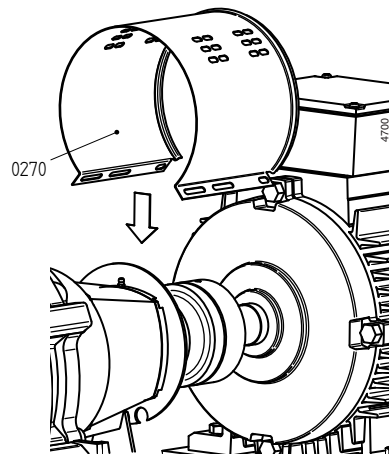


Figure 13: Fitting the jacket at motor side.

- 2 Place the assembly plate (0280) over the motor shaft and fit it into the annular groove of the jacket.

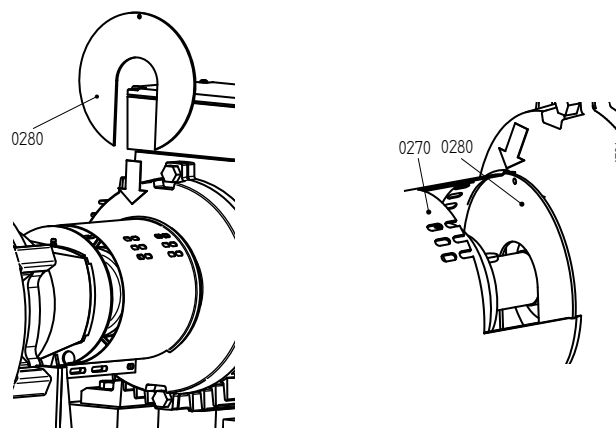


Figure 14: Fitting the assembly plate at motor side.

3 Close the jacket and fit bolt (0960). See figure 15.

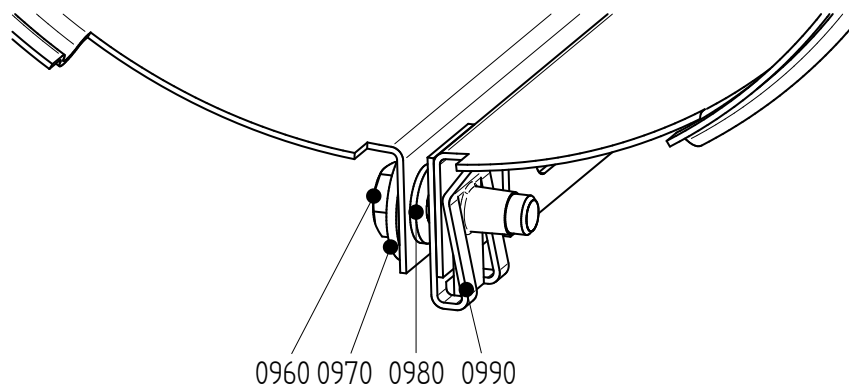


Figure 15: Fitting jacket.

4 Fit the jacket (0270) at pump side. Place it over the present jacket at motor side. The annular groove must be located at pump side.

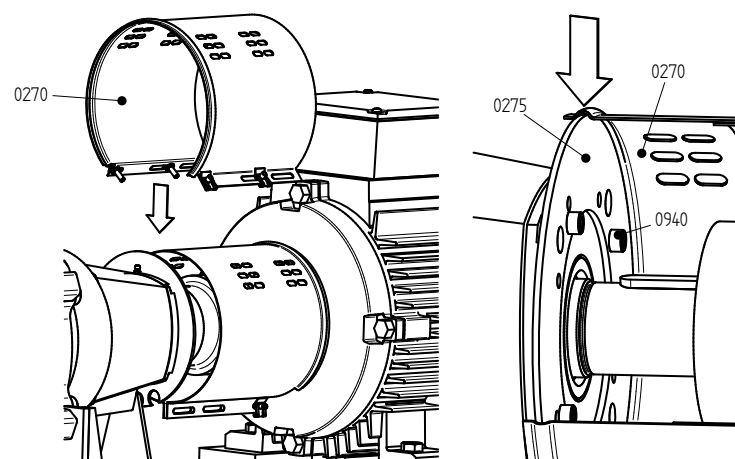


Figure 16: Fitting the jacket at pump side.

5 Close the jacket and fit a bolt (0230) and fit bolt (0960). See figure 15.

6 Slide the jacket at motor side towards the motor as far as possible. Fix both jackets with bolt (0960).

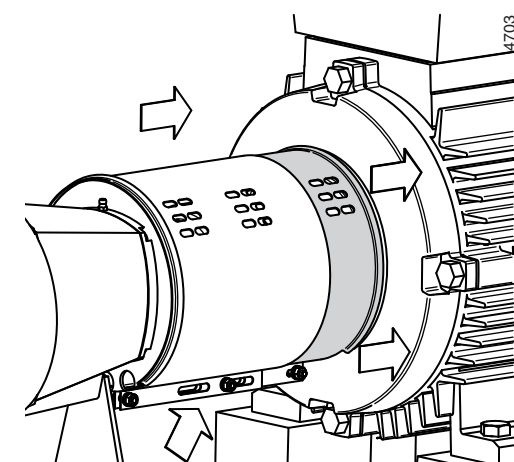


Figure 17: Adjusting the jacket at motor side.

7.5 Replacing 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.

7.5.1 Disassembling the impeller

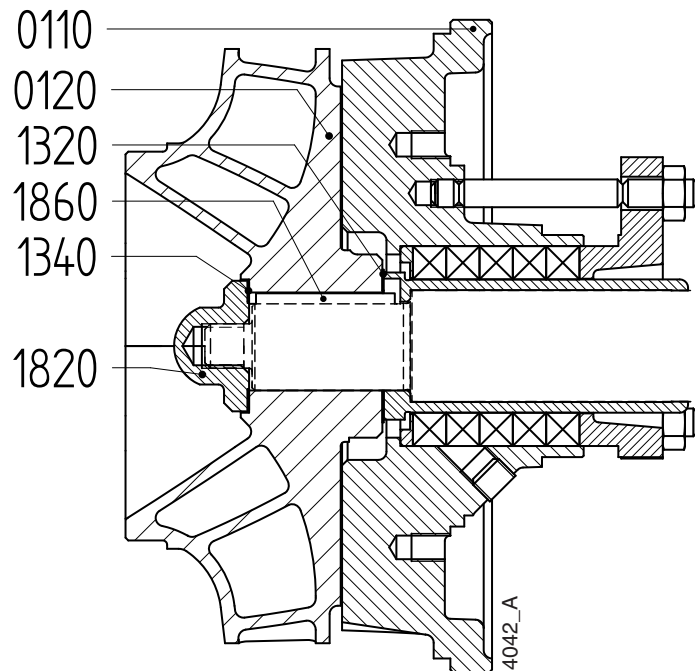


Figure 18: Disassembling the impeller.

The item numbers used are referring to figure 18.

- 1 Remove the Back-Pull-Out unit, see paragraph 7.4.2 "Disassembling the Back-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 Remove the impeller (0120) with a pulley puller, or wrest the impeller by inserting for instance 2 big screwdrivers between the impeller and the pump cover (0110).
- 4 Remove the gasket (1320) (N.a. for S1-M1).
- 5 Remove the impeller key (1860). For pump type 125-500 and 150-500: remove the impeller keys (1860) and (1865).

7.5.2 Mounting the impeller

- 1 Place the impeller key (1860) in the key way of the pump shaft. For pump type 125-500 and 150-500: place the impeller keys (1860) and (1865).
- 2 Fit the gasket (1320) (N.a. for S1-M1).
- 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) (N.a. for S1-M1).
- 6 Put a drop of Loctite 243 on the thread and fit the cap nut. For tightening moment of the nut see paragraph 10.3.2 "Tightening moments for cap nut".

7.5.3 Disassembling the wear ring

After removing the Back-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.

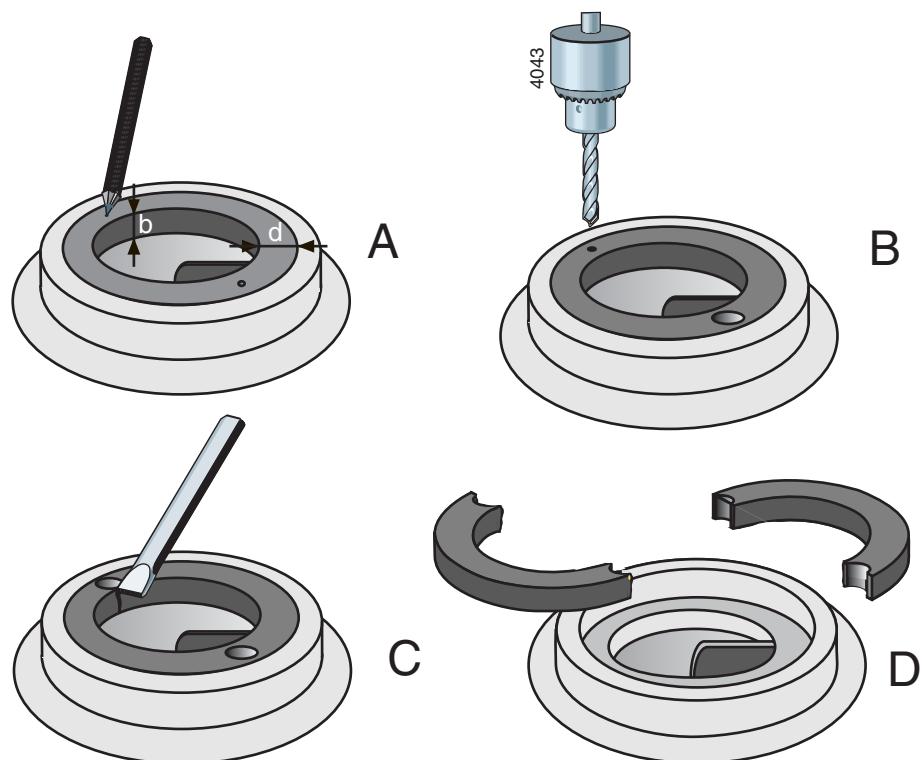


Figure 19: Removal of wear ring.

- 1 Measure the thickness (d) and the width (b) of the ring, see figure 19 A.
- 2 Make a centre hole in the middle of the edge of the ring at two opposite points, see figure 19 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 19 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 19 D.
- 5 Clean the pump casing and carefully remove all bore dust and metal splinters.

7.5.4 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!**

7.6 Stuffing box packing S1, S2, S3, S4

7.6.1 Instruction for assembling and disassembling stuffing box packing

➤ *First read the following instructions regarding stuffing box packing. Follow these instructions closely when removing and mounting stuffing box packing.*

- For removing old packing rings your supplier can supply a special packing puller. See figure 20.

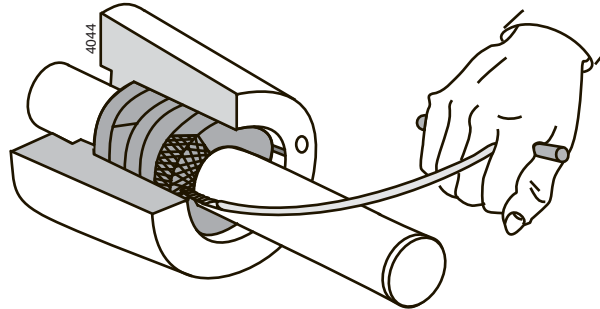


Figure 20: Removal of packing rings with a packing puller.

- Only use packing rings with the right dimensions.
- Grease the stuffing box, the shaft sleeve and the packing rings with some graphite grease or silicon grease. For the allowed grease types see paragraph 10.1.3 "Grease".
- Bend the new packing rings open axially. See figure 21.

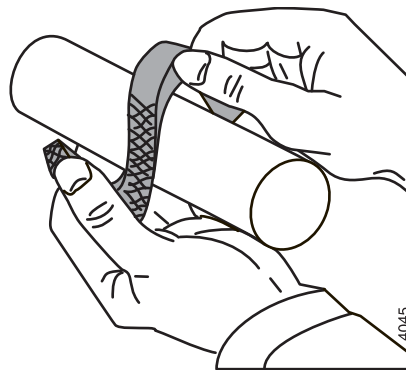


Figure 21: Axially bending open packing rings.

- For pressing the packing rings down, use a halve piece of tube with the right dimensions.

7.6.2 Replacing the stuffing box packing S1, S2, S3, S4

To replace the stuffing box packing it is not necessary to disassemble the pump. The pump should however be drained, see paragraph 7.3 "Draining".

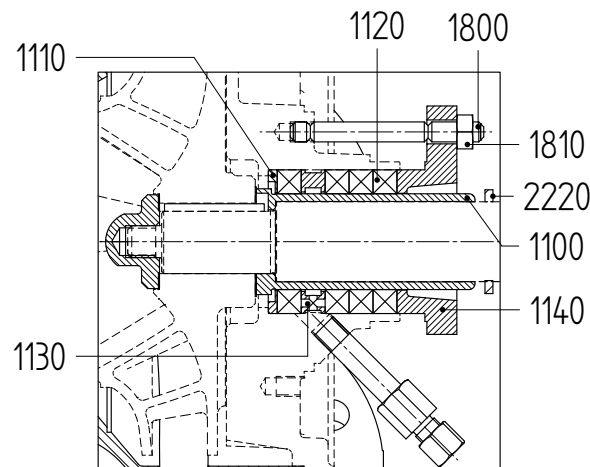


Figure 22: Stuffing box packing S1, S2, S3 and S4.

The item numbers used are referring to figure 22.

- 1 Loosen the nuts (1810) and push the gland (1140) (125-500 + 150-500: gland (1140) and gland cap (1145)) backward as far as possible.
- 2 Remove the old packing rings (1120) and (for S3) the lantern ring (1130).
- 3 Clean the packing space properly.
- 4 Check whether the shaft sleeve (1100) or the pump shaft (2200) is damaged. If so, you still have to disassemble the pump. Then proceed with paragraph 7.6.4 "Disassembling the shaft sleeve".

7.6.3 Mounting a new stuffing box packing S1, S2, S3, S4

- 1 Bend the first packing ring open and put it around the shaft sleeve (1100) resp. the pump shaft (2200). Press it strongly against the bottom ring (1110) at the bottom of the stuffing box.
- 2 For S3: fit the lantern ring (1130).
- 3 Fit the subsequent rings one by one. Press them down properly. Make sure that the cuts of the rings are positioned 90° turned in relation to each other.
- 4 Press the gland (125-500 + 150-500: gland (1140) and gland cap (1145)) against the last packing ring and tighten the nuts (1810) by turns by hand.
- 5 For adjustment of the gland see paragraph 4.8.1 "Stuffing box packing".

7.6.4 Disassembling the shaft sleeve

- 1 Disassemble the impeller, see paragraph 7.5.1 "Disassembling the impeller".
- 2 Pull the shaft sleeve (1100) from the pump shaft.
- 3 Remove the splash ring (2220).

7.6.5 Mounting the shaft sleeve

- 1 Slide the shaft sleeve over the pump shaft. Watch the position of the key ways in the shaft sleeve in respect of those in the pump shaft.
- 2 Fit the impeller and other parts, see paragraph 7.5.2 "Mounting the impeller" and paragraph 7.6.3 "Mounting a new stuffing box packing S1, S2, S3, S4".
- 3 Fit the splash ring (2220).

7.7 Mechanical seals M1, 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 M1

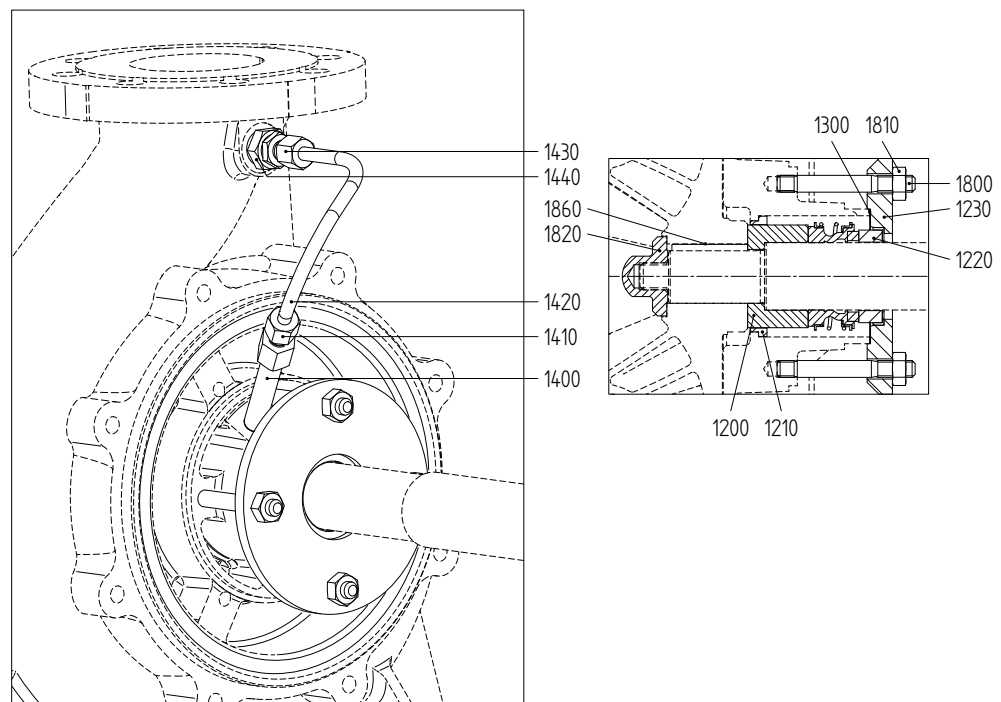


Figure 23: Mechanical seal M1.

The item numbers used are referring to figure 23.

- 1 Remove the impeller, see paragraph 7.5.1 "Disassembling the impeller".
- 2 Remove the seal guards (0276).
- 3 Remove the nuts (1810) and push the mechanical seal cover (1230) backward.
- 4 Mark the position of the pump cover (0110) in relation to the bearing bracket (2100). Knock the pump cover loose and remove it.
- 5 Pull the shaft sleeve (1200) from the pump shaft and remove the rotating part of the mechanical seal from the shaft sleeve.
- 6 Pull the mechanical seal cover (1230) off the pump shaft and push the counter-ring out of the cover.

7.7.3 Assembling a mechanical seal M1

➤ *Special tools: the seal group M1 is easily mounted by using a special conical mounting bush. The mounting bush covers the sharp edges on the shaft, which means that the risk of damaging the seal during assembly is reduced. See figure 24.*

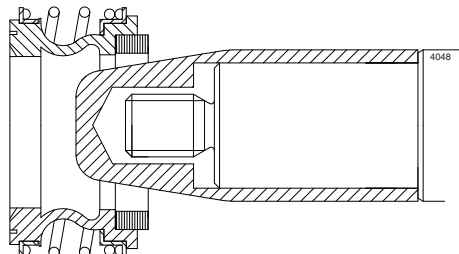


Figure 24: Special mounting bush.

- 1 Ensure the shaft sleeve (1200) and the throttling bush (1210) (if present) are undamaged. 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. 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 pump shaft. The bellows should slide smoothly over the shaft. Put some glycerine or silicon spray on it.
- 6 Fit the pump cover in the right position in the fitting edge of the bearing bracket. **Check whether the pump cover is at right angles to the pump shaft.**
- 7 Fit the mechanical seal cover (1230) to the pump cover. Check the position in view of the connection points. Tighten the nuts (1810) crosswise. The cover should not be placed oblique.
- 8 Mount the shaft sleeve (1200). For pump types 200-160 and 300-200 the shaft sleeve (1200) has to be adjusted according to distance Y, see figure 25.
- 9 Fit the seal guards (0276).
- 10 Fit the impeller and other parts, see paragraph 7.5.2 "Mounting the impeller"

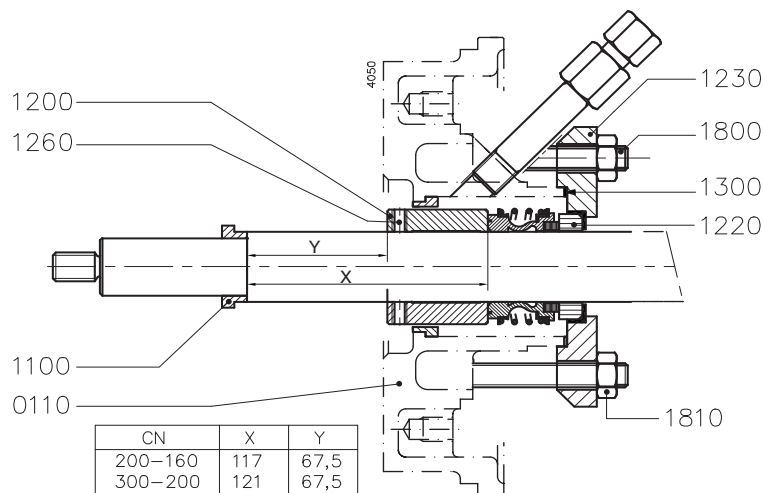


Figure 25: Adjusting the shaft sleeve of 200-160 and 300-200.

7.7.4 Disassembling a mechanical seal M2-M3

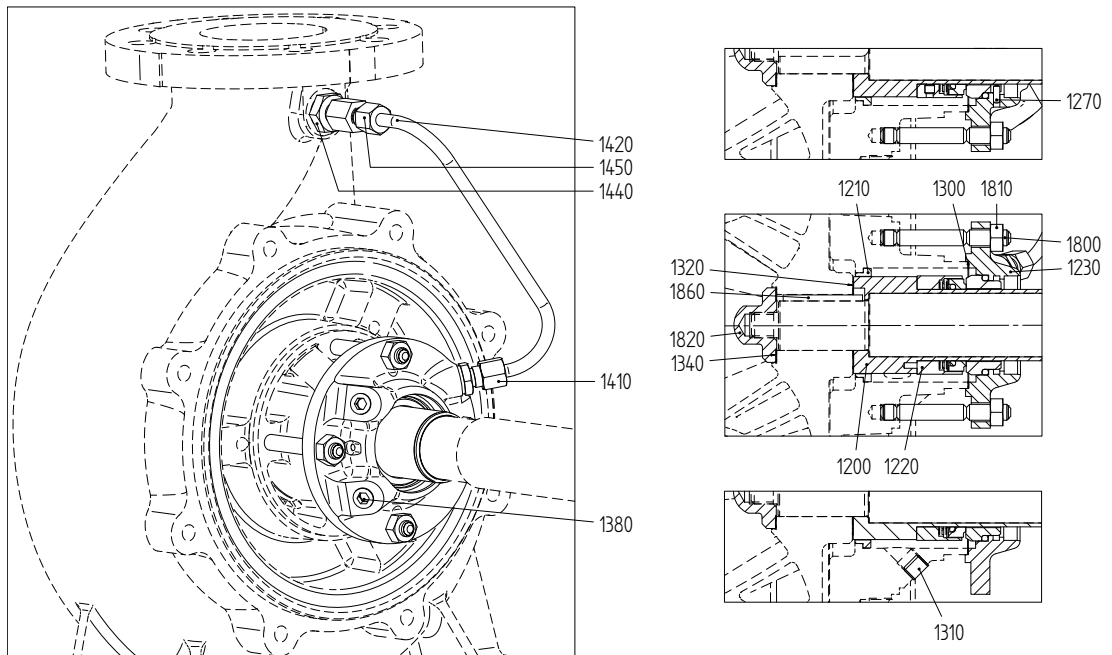


Figure 26: Mechanical seal M2-M3.

The item numbers used are referring to figure 26.

- 1 Remove the impeller, see paragraph 7.5.1 "Disassembling the impeller"
- 2 Remove the seal guards (0276).
- 3 Remove the nuts (1810) and push the mechanical seal cover (1230) backward.
- 4 Mark the position of the pump cover (0110) in relation to the bearing bracket (2100). Knock the pump cover loose and remove it.
- 5 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.
- 6 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

7.7.5 Assembling a mechanical seal M2-M3

- 1 Ensure the shaft sleeve (1200) and the throttling bush (1210) (if present) are undamaged. 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 pump cover in the right position in the fitting edge of the bearing bracket.
Check whether the pump cover is at right angles to the pump shaft.
- 8 Fit the mechanical seal cover (1230) to the pump 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 seal guards (0276).
- 10 Fit the impeller and other parts, see paragraph 7.5.2 "Mounting the impeller".

7.7.6 Disassembling a mechanical seal MQ2-MQ3

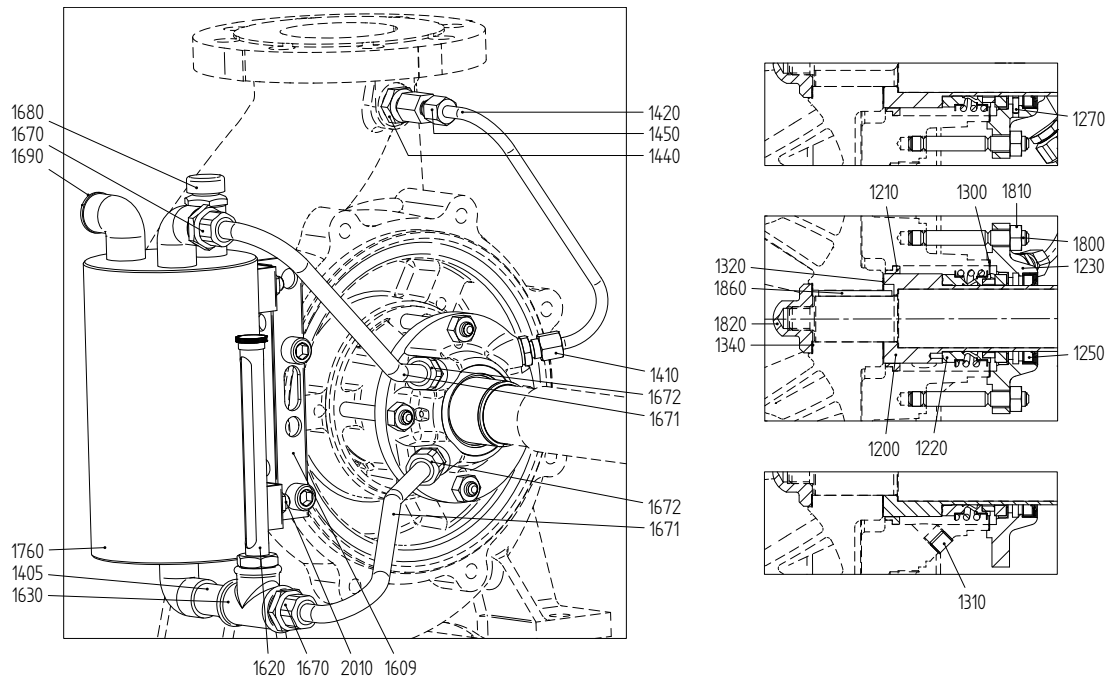


Figure 27: Mechanical seal MQ...

The item numbers used are referring to figure 27.

- 1 Remove the impeller, see paragraph 7.5.1 "Disassembling the impeller"
- 2 Remove the seal guards (0276).
- 3 Remove the nuts (1810) and push the mechanical seal cover (1230) backward.
- 4 Mark the position of the pump cover (0110) in relation to the bearing bracket (2100). Knock the pump cover loose and remove it.
- 5 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.
- 6 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.

7.7.7 Assembling a mechanical seal MQ2-MQ3

- 1 Ensure the shaft sleeve (1200) and the throttling bush (1210) (if present) are undamaged. 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 pump cover in the right position in the fitting edge of the bearing bracket. **Check whether the pump cover is at right angles to the pump shaft.**
- 9 Fit the mechanical seal cover (1230) to the pump 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 seal guards (0276).
- 11 Fit the impeller and other parts, see paragraph 7.5.2 "Mounting the impeller".

7.7.8 Disassembling a mechanical seal MW2-MW3

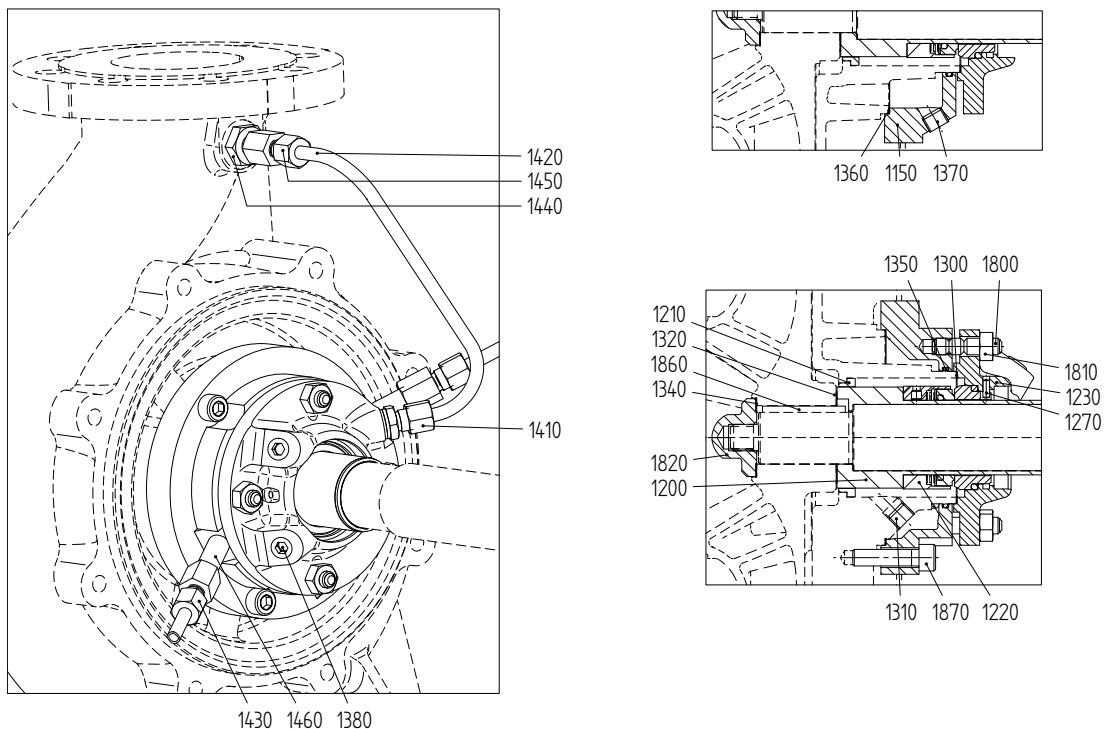


Figure 28: Mechanical seal MW...

The item numbers used are referring to figure 28.

- 1 Remove the impeller, see paragraph 7.5.1 "Disassembling the impeller"
- 2 Remove the seal guards (0276).
- 3 Remove the Allen screws (1870) and push the cooling jacket (1150) with the mechanical seal cover backward.
- 4 Mark the position of the pump cover (0110) in relation to the bearing bracket (2100). Knock the pump cover loose and remove it.
- 5 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.
- 6 Pull the cooling jacket (1150) with the mechanical seal cover off the pump shaft. Remove the O-ring (1350) and inspect its condition. Replace it if necessary.
- 7 Unscrew the nuts (1810) and remove the mechanical seal cover (1230) from the cooling jacket.
- 8 Push the counter-ring of the mechanical seal through the shaft passage inward out of the cover.

7.7.9 Assembling a mechanical seal MW2-MW3

- 1 Ensure the shaft sleeve (1200) and the throttling bush (1210) are undamaged. 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 pump cover in the right position in the fitting edge of the bearing bracket. **Check whether the pump cover is at right angles to the pump shaft.**
- 10 Fit the cooling jacket (1150) to the pump 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 seal guards (0276).
- 12 Fit the impeller and other parts, see paragraph 7.5.2 "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

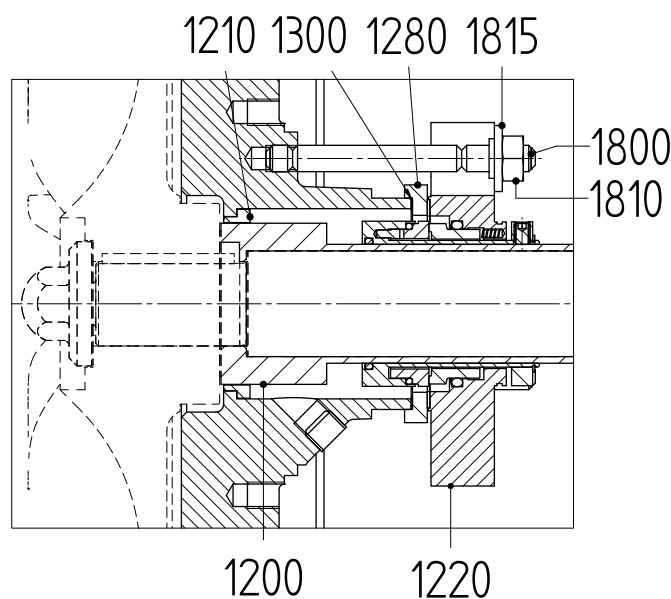


Figure 29: Cartridge seals C...

- 1 Remove the seal guards (0276).
- 2 Re-fit the centering tabs on the cover of the seal cartridge into the groove in the seal collar in order to immobilise the cartridge seal.
- 3 Disassemble the impeller, see paragraph 7.5.1 "Disassembling the impeller".
- 4 Remove the nuts (1810) and washers (1815) and pull the seal cartridge (1220) backward.
- 5 Mark the position of the pump cover (0110) in relation to the bearing bracket (2100). Knock the pump cover loose and remove it (only for bearing group 3) including the reducing ring (1280) and gasket (1300).
- 6 Pull the entire seal cartridge from the pump shaft.

7.8.3 Assembling a cartridge seal

- 1 Put the bearing bracket in upright position (impeller side up).
- 2 Push the seal cartridge and (only for bearing group 3) reducing ring onto the pump shaft.
- 3 Place a new gasket (1300) (only for bearing group 3).
- 4 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.**
- 5 Fit the (only for bearing group 3) reducing ring (1280), gasket (1300) and seal cartridge (1220) to the pump cover. Check the position in view of the connection points. Fit the washers and tighten the nuts (1810) crosswise. The cover should not be placed oblique.
- 6 Fit the impeller and other parts, see paragraph 7.5.2 "Mounting the impeller".
- 7 Release the centering tabs of the seal cartridge, turn them halfway round and secure them again against the seal cover. The shaft must now be able to rotate freely.
- 8 Fit the seal guards (0276).

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).

7.10 Bearing configurations L1, L2, L3, L4

7.10.1 Disassembling bearing L1 (grease-lubricated, standard)

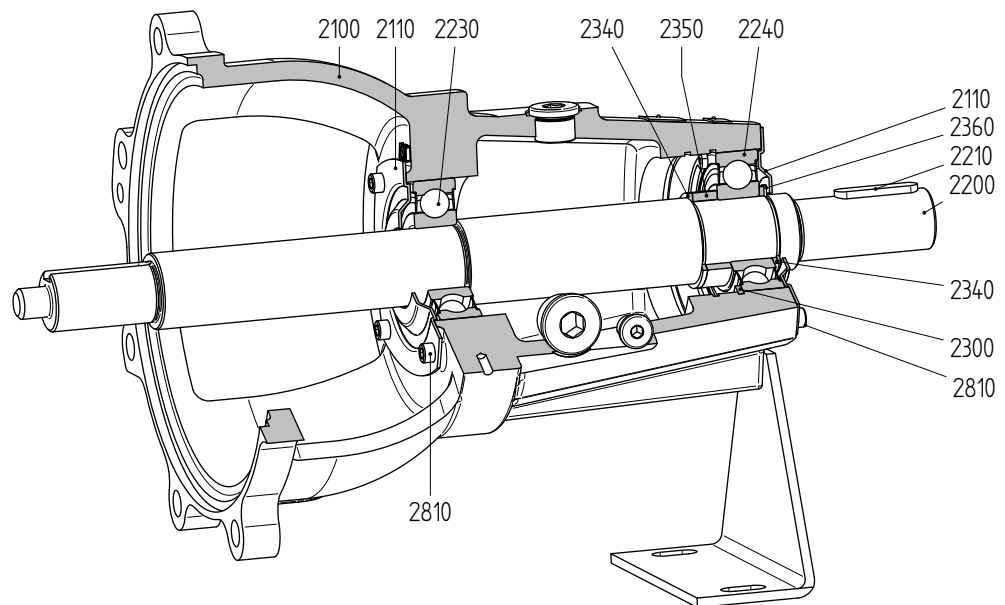


Figure 30: Bearing L1 (grease-lubricated, standard).

The item numbers used are referring to figure 30.

- 1 Dismantle the impeller and the shaft seal.
- 2 Remove the coupling with a coupling puller and remove the coupling key (2210).
- 3 Unscrew the Allen screws (2810) and remove the bearing covers (2110).
- 4 Check to ensure that the oil seals (2180) are undamaged. Replace them if necessary.
- 5 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.
- 6 Remove the inner circlip (2300) as soon as the first bearing (2240) is out of the bearing bracket. Subsequently remove the pump shaft with the bearings from the bearing bracket.
- 7 Remove the outer circlip (2360) and the adjusting ring (2340).
- 8 Remove the bearings from the pump shaft.
- 9 Remove the spacer sleeve (2350) and adjusting ring (2340).

7.10.2 Assembling bearing L1

- 1 Clean the interior of the bearing bracket properly.
- 2 Fit the inner circlip (2300), the adjusting ring (2340) and the spacer sleeve (2350) on the pump shaft.
- 3 Preheat the bearings and fit them on the pump shaft. Make sure they are positioned straight on the pump shaft and push them firmly against the shaft shoulder and against the spacer sleeve (2350). **Let the bearings cool down!**
- 4 Place the adjusting ring (2340) and fit the outer circlip (2360).
- 5 Fit the pump shaft with bearings, starting from the motor side, in the bearing bracket. Knock at the shaft end at the coupling side until the foremost bearing (2230) slides through the bearing bore. After each knock rotate the pump shaft one turn to prevent bearing damage.
- 6 Fit the inner circlip (2300) **in the first groove.**
- 7 Carefully knock the pump shaft further into the bearing bracket until the outer ring of the bearing (2240) touches the inner circlip (2300). **The pump shaft with the bearings should go into the bearing bracket straight!**
- 8 Fit the bearing covers (2110) and fix them with Allen screws (2810).
- 9 Fit the shaft seal and the impeller.

7.10.3 Disassembling bearing L3 (oil-lubricated, standard)

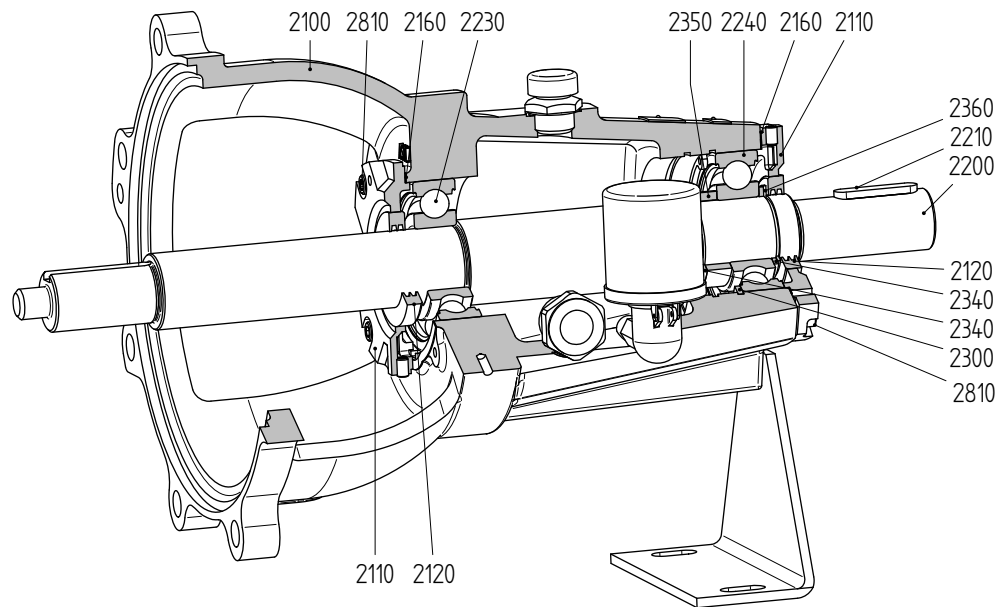


Figure 31: Bearing L3 (oil-lubricated, standard).

The item numbers used are referring to figure 31.

- 1 Dismantle the impeller and the shaft seal.
- 2 Remove the coupling with a coupling puller and remove the coupling key (2210).
- 3 Unscrew the Allen screws (2810) and remove the bearing covers (2110), the gaskets (2160) and the spacer sleeve (2370).
- 4 Check to ensure that the oil catchers (2120 and 2125) are undamaged. Replace them if necessary.
- 5 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.
- 6 Remove the inner circlip (2300) as soon as the first bearing (2240) is out of the bearing bracket. Subsequently remove the pump shaft with the bearings from the bearing bracket.
- 7 Remove the outer circlip (2360) and the adjusting ring (2340).
- 8 Remove the bearings from the pump shaft.
- 9 Remove the spacer sleeve (2350) and adjusting ring (2340).

7.10.4 Assembling bearing L3

- 1 Clean the interior of the bearing bracket properly.
- 2 Fit the inner circlip (2300), the adjusting ring (2340) and the spacer sleeve (2350) on the pump shaft.
- 3 Preheat the bearings and fit them on the pump shaft. Make sure they are positioned straight on the pump shaft and push them firmly against the shaft shoulder and against the spacer sleeve (2350). **Let the bearings cool down!**
- 4 Place the adjusting ring (2340) and fit the outer circlip (2360).
- 5 Fit the pump shaft with bearings, starting from the motor side, in the bearing bracket. Knock at the shaft end at the coupling side until the foremost bearing (2230) slides through the bearing bore. After each knock rotate the pump shaft one turn to prevent bearing damage.
- 6 Fit the inner circlip (2300) **in the first groove!**
- 7 Carefully knock the pump shaft further into the bearing bracket until the outer ring of the bearing (2240) touches the inner circlip (2300). **The pump shaft with the bearings should go into the bearing bracket straight!**
- 8 Fit the bearing covers (2110) with gaskets (2160) and fix them with Allen screws (2810).
- 9 Fit the shaft seal and the impeller.

7.10.5 Disassembling bearing L2 (grease-lubricated, reinforced)

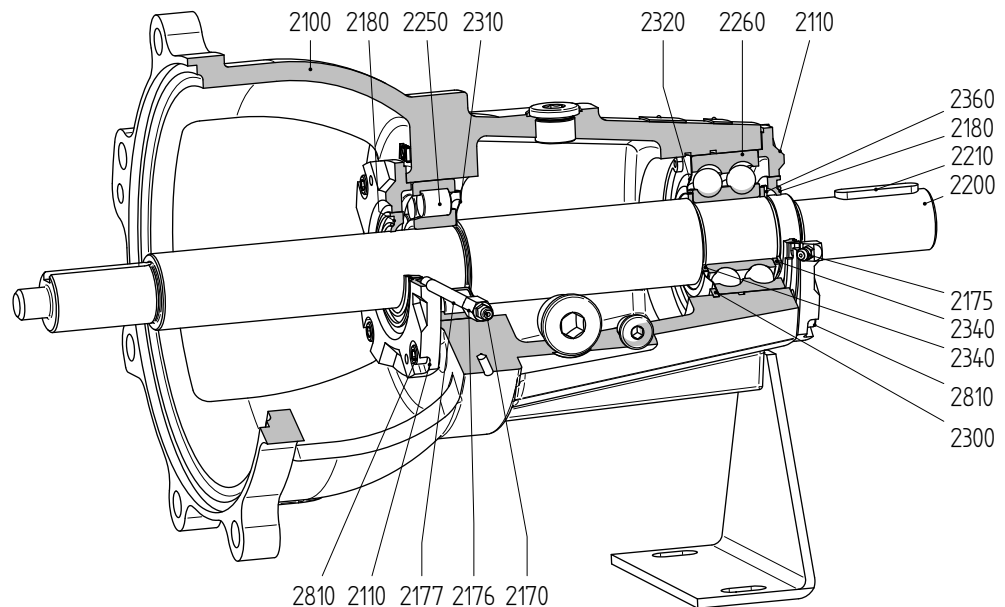


Figure 32: Bearing L2 (grease-lubricated, reinforced).

The item numbers used are referring to figure 32.

- 1 Dismantle the impeller and the shaft seal.
- 2 Remove the coupling with a coupling puller and remove the coupling key (2210).
- 3 Remove pipe (2177) from bearing cover (2110).
- 4 Unscrew the Allen screws (2810) and remove the bearing covers (2110).
- 5 Check to ensure that the oil seals (2180) are undamaged. Replace them if necessary.
- 6 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.
- 7 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.
- 8 Remove the outer circlip (2360) and the adjusting ring (2340).
Bearing group 4: Knock the lip of the locking washer (2570) out of the lock nut (2560) and loosen the lock nut.
- 9 Remove the bearings from the pump shaft.
- 10 Remove the adjusting ring (2340) (n.a. for bearing group 4), the Nilos rings (2320 and 2310) and the inner circlip (2300).

7.10.6 Assembling bearing L2

- 1 Clean the interior of the bearing bracket properly.
- 2 Subsequently fit the Nilos ring (2310), the inner circlip (2300) and the Nilos ring (2320) on the pump shaft. **Make sure the Nilos rings are positioned properly!**
- 3 Fit the adjusting ring (2340) on the pump shaft (n.a. for bearing group 4).
- 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 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 Place the adjusting ring (2340) and fit the outer circlip (2360).
Bearing group 4: 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 locked 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 bearing covers (2110) and fix them with Allen screws (2810).
- 12 Fit the pipe (2177) into bearing cover (2110).
- 13 Fit the shaft seal and the impeller.

7.10.7 Disassembling bearing L4 (oil lubricated, reinforced)

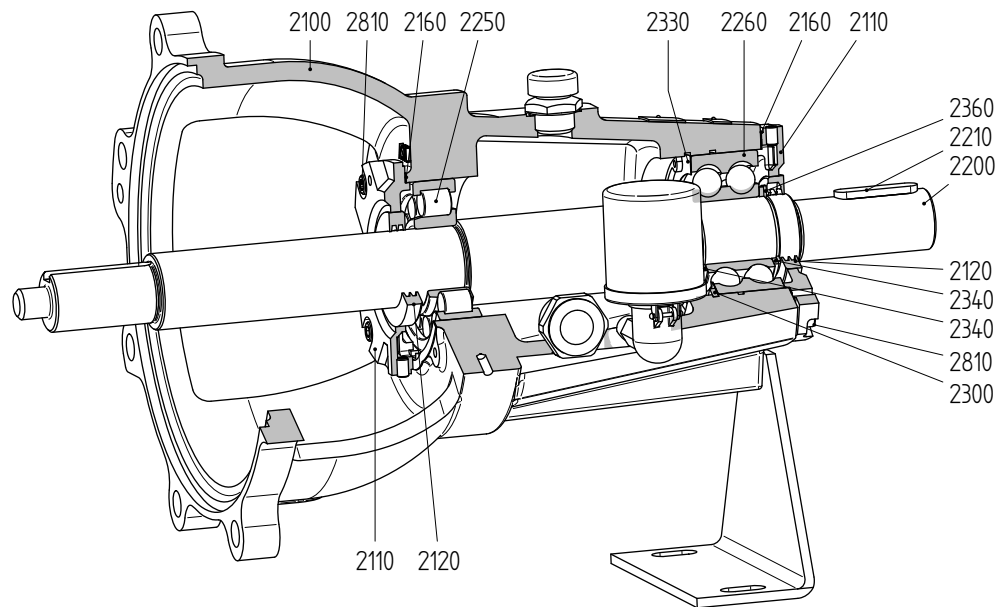


Figure 33: Bearing L4 (oil lubricated, reinforced).

The item numbers used are referring to figure 33.

- 1 Dismantle the impeller and the shaft seal.
- 2 Remove the coupling with a coupling puller and remove the coupling key (2210).
- 3 Unscrew the Allen screws (2810) and remove the bearing covers (2110), the gaskets (2160) and the spacer sleeve (2370).
- 4 Check to ensure that the oil catchers (2120 and 2125) are undamaged. Replace them if necessary.
- 5 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.
- 6 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.
- 7 Remove the outer circlip (2360) and the adjusting ring (2340).
Bearing group 4: Knock the lip of the locking washer (2570) out of the lock nut (2560) and loosen the lock nut. Remove the bearings from the pump shaft.
- 8 Remove adjusting ring (2330) and adjusting ring (2340) (n.a for bearing group 4) and the inner circlip (2300).

7.10.8 Assembling bearing L4

- 1 Clean the interior of the bearing bracket properly.
- 2 Fit the inner circlip (2300), the adjusting ring (2330) and the adjusting ring (2340) (n.a for bearing group 4) on the pump shaft.
- 3 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 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!
- 4 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!
- 5 Place the adjusting ring (2340) and fit the outer circlip (2360).
Bearing group 4: 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.
- 6 Fit the pump shaft with bearings, starting from the motor side, in the bearing bracket. Fit the inner circlip (2300) **in the second groove.**
- 7 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 adjusting ring (2330) is now locked between the bearing and the inner circlip.
- 8 Fit the outer ring of the cylindrical roller bearing. This ring should go into the bearing bracket **straight.**
- 9 Fit the bearing covers (2110) with gaskets (2160) and fix them with Allen screws (2810).
- 10 Fit the shaft seal and the impeller.

7.11 Bearing of 25-125 and 25-160

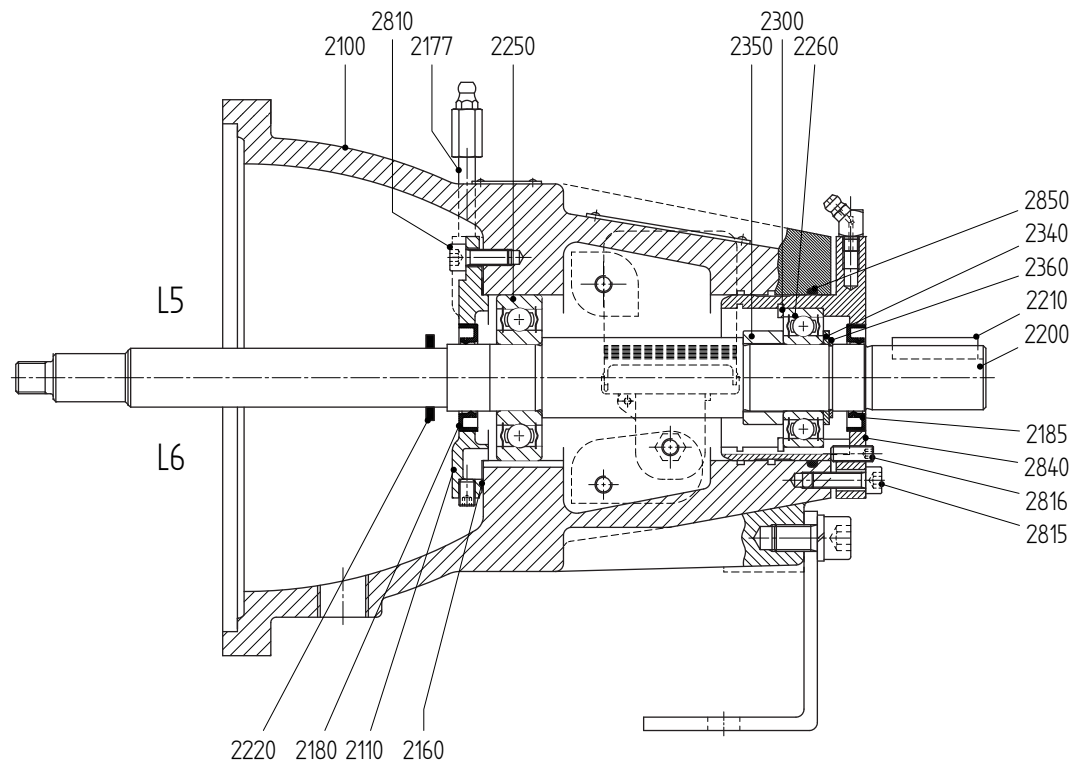


Figure 34: Bearing L5-L6 of 25-125, 25-160).

7.11.1 Disassembly of bearing L5 (standard, grease-lubricated, adjustable)

The item numbers used are referring to figure 34.

- 1 Dismantle the impeller and the shaft seal.
- 2 Remove the splash ring (2220).
- 3 Remove pipe (2177) from bearing cover (2110).
- 4 Unscrew the Allen screws (2810 and 2815) and remove the bearing cover (2110).
- 5 Knock at the impeller side of the pump shaft (2200), until the bearing holder (2840) with the bearing (2260) comes out of the bearing bracket. Use a plastic hammer to avoid damage to the thread. Remove the pump shaft with the bearings from the bearing bracket.
- 6 Remove the coupling with a coupling puller and remove the coupling key (2210).
- 7 Remove the inner circlip (2300) and pull the bearing holder (2840) off the bearings.
- 8 Remove the outer circlip (2360) and the adjusting ring (2340).
- 9 Remove the bearings from the pump shaft.
- 10 Remove the spacer sleeve (2350).
- 11 Remove the O-ring (2850) and inspect its condition. Replace it if necessary.
- 12 Check to ensure that the oil seals (2180 and 2185) are undamaged. Replace them if necessary.

7.11.2 Assembling bearing L5

- 1 Clean the interior of the bearing bracket properly.
- 2 Fit the inner circlip (2300) and the spacer sleeve (2350) onto the pump shaft.
- 3 Preheat the ball bearings and fit them onto the pump shaft. Watch the mounting sequence: **fit the smaller ball bearing at drive side!**
- 4 Make sure they are positioned straight on the pump shaft and press them firmly against the shaft collar and against the spacer sleeve (2350). **Let the bearings cool down!**
- 5 Place the adjusting ring (2340) and fit the outer circlip (2360).
- 6 Place the O-ring (2850) into the groove of the bearing bracket. Apply some glycerine or silicon spray on the O-ring to facilitate the assembly.
- 7 Press the bearing holder (2840) over the smaller ball bearing (2260) and fit the inner circlip (2300) into the bearing holder. Make sure that the inner circlip ends up being positioned correctly in the hindmost groove.
- 8 Fit, from the motor side, the pump shaft with bearings into the bearing bracket. Knock at the shaft end at the coupling side until the first bearing (2250) slides through the bearing bore.
- 9 Carefully knock the pump shaft further into the bearing bracket until the bearing holder (2840) is completely inside the bearing bracket. After each knock rotate the pump shaft one turn to prevent bearing damage. The pump shaft with the bearings has to go straight into the bearing bracket.
- 10 Fit the bearing cover (2110) with gasket (2160) and fix it with Allen screws (2810).
- 11 Fit the splash ring (2220).
- 12 Fit the pipe (2177) into bearing cover (2110).
- 13 Fit the set screws (2816) and the Allen screws (2815) and adjust the axial play. See paragraph 7.12 "Axial adjustment of L5 and L6 bearing construction".
- 14 Fit the shaft seal and the impeller.

7.11.3 Disassembling bearing L6 (reinforced, oil-lubricated, adjustable)

The item numbers used are referring to figure 34.

- 1 Dismantle the impeller and the shaft seal.
- 2 Remove the splash ring (2220).
- 3 Unscrew the Allen screws (2810 and 2815) and remove the bearing cover (2110).
- 4 Knock at the impeller side of the pump shaft (2200), until the bearing holder (2840) with the bearings (2260) comes out of the bearing bracket. Use a plastic hammer to avoid damage to the thread. Remove the pump shaft with the bearings from the bearing bracket.
- 5 Remove the coupling with a coupling puller and remove the coupling key (2210).
- 6 Remove the inner circlip (2300) and pull the bearing holder (2840) off the bearings.
- 7 Remove the outer circlip (2360) and the adjusting ring (2340).
- 8 Remove the bearings from the pump shaft.
- 9 Remove the spacer sleeve (2350).
- 10 Remove the O-ring (2850) and inspect its condition. Replace it if necessary.
- 11 Check to ensure that the oil seals (2180 and 2185) are undamaged. Replace them if necessary.

7.11.4 Assembling bearing L6

- 1 Clean the interior of the bearing bracket properly.
- 2 Fit the inner circlip (2300) and the spacer sleeve (2350) onto the pump shaft.
- 3 Preheat the ball bearings and fit them onto the pump shaft. Watch the mounting sequence: **fit the smaller ball bearing at drive side!**
- 4 Make sure they are positioned straight on the pump shaft and press them firmly against the shaft collar and against the spacer sleeve (2350). **Let the bearings cool down!**
- 5 Place the adjusting ring (2340) and fit the outer circlip (2360).
- 6 Place the O-ring (2850) into the groove of the bearing bracket. Apply some glycerine or silicon spray on the O-ring to facilitate the assembly.
- 7 Press the bearing holder (2840) over the smaller ball bearing (2260) and fit the inner circlip (2300) into the bearing holder. Make sure that the inner circlip ends up being positioned correctly in the hindmost groove.
- 8 Fit, from the motor side, the pump shaft with bearings into the bearing bracket. Knock at the shaft end at the coupling side until the first bearing (2250) slides through the bearing bore.
- 9 Carefully knock the pump shaft further into the bearing bracket until the bearing holder (2840) is completely inside the bearing bracket. After each knock rotate the pump shaft one turn to prevent bearing damage. The pump shaft with the bearings has to go straight into the bearing bracket.
- 10 Fit the bearing cover (2110) with gasket (2160) and fix it with Allen screws (2810).
- 11 Fit the splash ring (2220).
- 12 Fit the set screws (2816) and the Allen screws (2815) and adjust the axial play. See paragraph 7.12 "Axial adjustment of L5 and L6 bearing construction".
- 13 Fit the shaft seal and the impeller.

7.12 Axial adjustment of L5 and L6 bearing construction

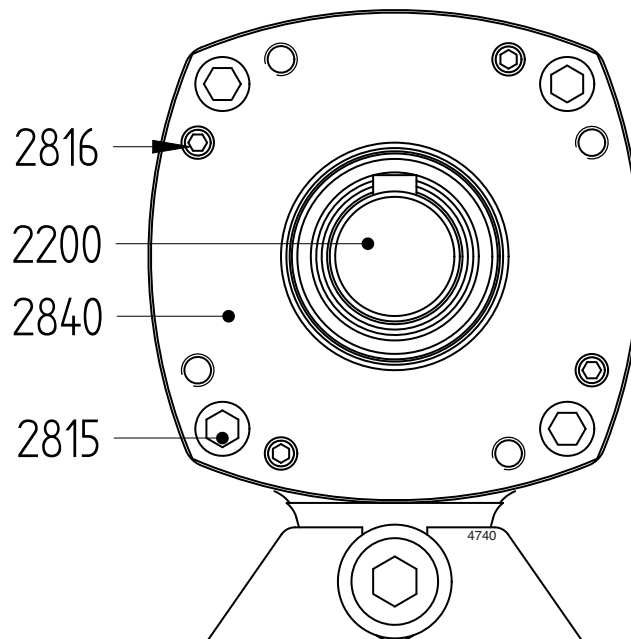


Figure 35: Axial adjustment of L5 and L6 bearing construction.

If a pump with bearing construction L5 or L6 has been disassembled, the axial play between the impeller and the pump casing has to be readjusted after assembly. This play has to be equal on both sides. This adjustment can be done in the following way, see figure 35.

- 1 Unscrew the set screws (2816).
- 2 Tighten the Allen screws (2815) crosswise. As a result of this the bearing holder (2840) with bearings, pump shaft and impeller will move forward. While tightening these screws, turn the pump shaft round by hand. Tighten the Allen screws, until you feel that the impeller is just dragging the pump casing.
- 3 Screw the set screws (2816) into the bearing holder (2840), until they just touch the bearing bracket.
- 4 Unscrew the Allen screws (2815) again.
- 5 Place a dial gauge near the pump shaft and make the ball point touch the end of the pump shaft. Set the dial to zero.
- 6 Tighten the set screws (2816) crosswise, until the dial gauge indicates **0,3 mm**.
- 7 Now tighten the Allen screws (2815) crosswise.
- 8 Check whether all 4 set screws are properly tightened.
- 9 Check whether the pump shaft can easily be turned.

8 Dimensions

8.1 Base plate dimensions and weights

base plate number	[mm]									Weight [kg]
	L	B	fa	fb	fc	fd	fe	ff	fh	
1	800	305	19	6	385	433	120	560	45	20
2	1000	335	19	8	425	473	145	710	63	38
3	1250	375	24	10	485	545	175	900	80	69
4	1250	500	24	10	610	678	175	900	90	79
5	1600	480	24	10	590	658	240	1120	100	107
6	1650	600	24	10	720	788	240	1170	130	129
11	1600	600	28	-	680	740	310	1 x 1000	130	200
12	1600	710	28	-	790	850	310	1 x 1000	130	218
13	1800	600	28	-	680	740	360	1 x 1100	130	225
14	2000	710	28	-	790	850	410	1 x 1200	160	283
15	2250	750	28	-	830	890	235	2 x 900	160	402
16	2350	900	28	-	980	1040	185	2 x 1000	160	440

8.2 Connections

8.2.1 Bearing groups 0, 1, 2, 3

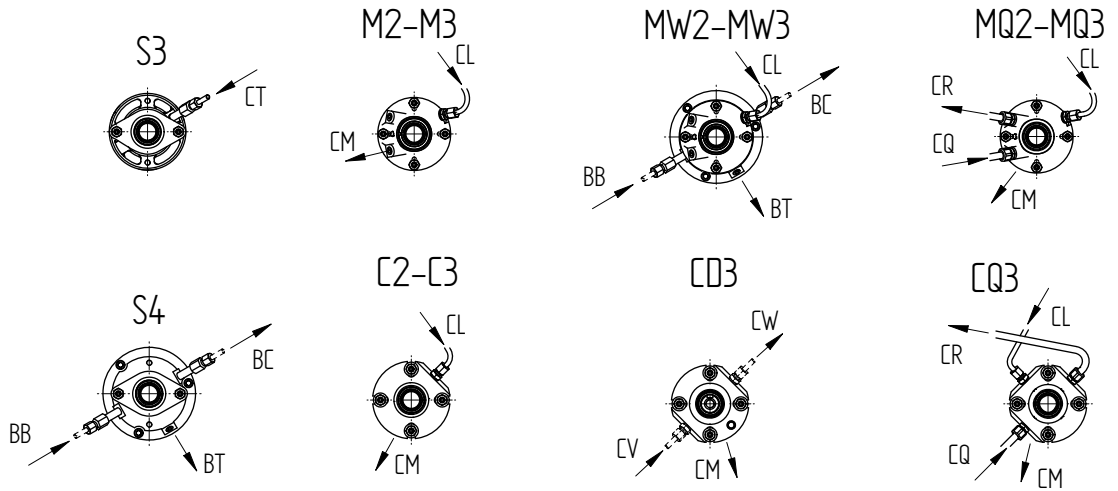


Figure 36: Connections for bearing groups 0, 1, 2, 3.

Table 10: Connections to the pump.

			25-125	25-160
BM	Oil drain		G 1/2	G 1/4
BP	Pump casing drain		G 1/2	G 1/4
BV	Oil filling plug		G 1/2	G 1/4
BW	Constant level oiler		Rp 1/4	Rp 1/4
BZ	Connection discharge flange		G 1/2	G 1/4

Table 11: Connections to the shaft seal.

		M1 S3 S4				M2-M3 MW2-MW3 MQ2-MQ3				C2 UNITEX			C3-CD3-CQ3 CARTEX		
Bearing group		0 0+	1	2	3	0 0+	1	2	3	1	2	3	1	2	3
BB	Cooling water inlet	Rp 1/4-Ø8				Rp 1/4-Ø8				-	-	-	-	-	-
BC	Cooling water outlet	Rp 1/4-Ø8				Rp 1/4-Ø8				-	-	-	-	-	-
BT	Cooling water drain	Rp 1/4				Rp 1/4				-	-	-	-	-	-
CL	Flushing liquid inlet	-				Rp 1/4				1/4 NPT	3/8 NPT	1/4 NPT	3/8 NPT	-	-
CT	Lantern ring inlet	Rp 1/4-Ø8				-				-	-	-	-	-	-
CM	Flushing liquid drain	-				Rp 1/4				Rp 1/4	Rp 1/4	Rp 1/4	Rp 1/4	Rp 1/4	Rp 1/4
CR	Quench outlet	-				Rp 1/4				-	-	1/4 NPT	3/8 NPT	-	-
CQ	Quench inlet	-				Rp 1/4				-	-	1/4 NPT	3/8 NPT	-	-
CV	Barrier liquid inlet	-				-				-	-	1/4 NPT	3/8 NPT	-	-
CW	Barrier liquid outlet	-				-				-	-	1/4 NPT	3/8 NPT	-	-

* SMSS / DMSF

** SSN / CDPN / CDSA / CURC

8.2.2 Bearing group 4

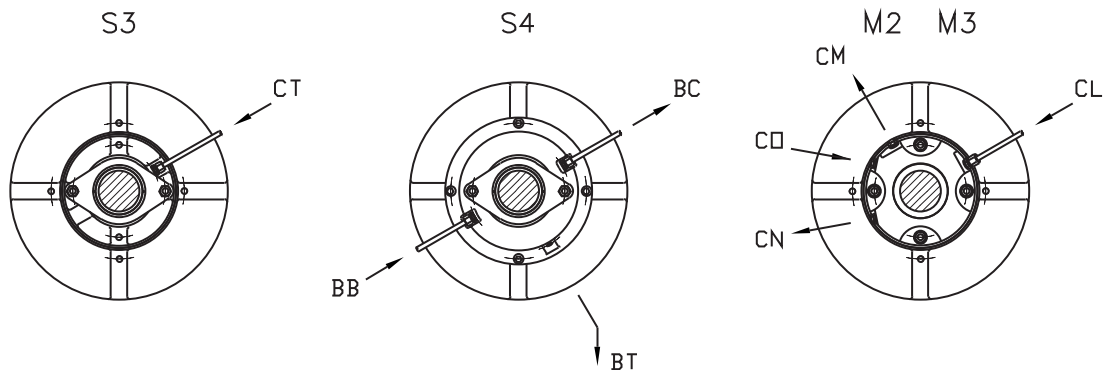


Figure 37: Connections for bearing group 4

Table 12: Connections for bearing group 4.

BB	Cooling water inlet	G 1/4
BC	Cooling water outlet	G 1/4
BM	Oil drain	G 1/2
BT	Cooling water drain	G 1/4
BV	Oil filling plug	G 1/2
BW	Constant level oiler	G 1/4
CL	Flushing liquid inlet	G 1/4
CM	Shaft sealing vent	G 1/4
CN	Quench liquid drain	G 1/4
CO	Quench liquid inlet	G 1/4
CT	Lantern ring inlet	G 1/4

8.3 Pump dimensions - bearing groups 0, 1, 2, 3

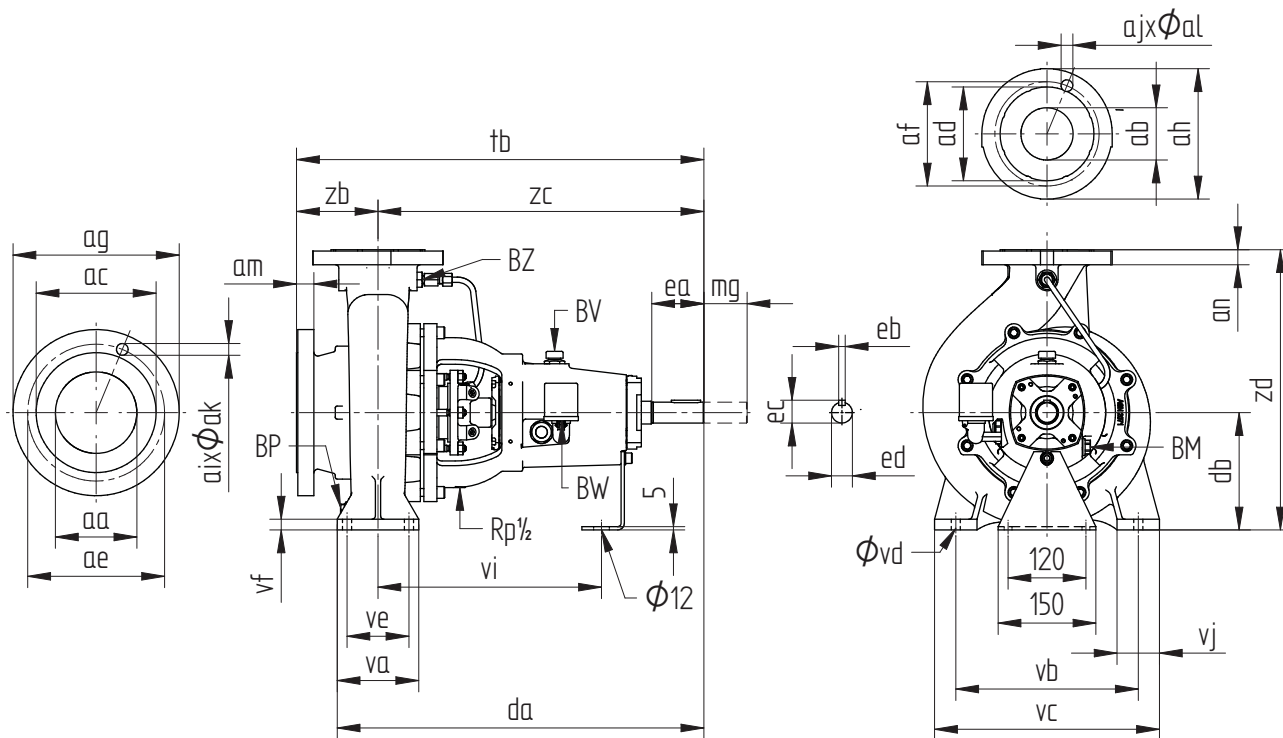


Figure 38: Pump dimensions - bearing groups 0, 1, 2, 3.

ISO 7005 PN6 (ND6 acc to EN 1092-2)											
aa	ab	ac	ad	ae	af	ag	ah	ai x ak	aj x al	am	an
32	25	64,5	50,8	90	75	117,5	108	4 x 14	4 x 11	12	12

ISO 7005 PN16											
aa	ab	ac	ad	ae	af	ag	ah	ai x ak	aj x al	am	an
25	25	68	68	86	86	115	115	4 x 14	4 x 14	14	14
50	32	102	78	125	100	165	140	4 x 18	4 x 18	20	18
65	40	122	88	145	110	185	150	4 x 18	4 x 18	20	18
65	50	122	102	145	125	185	165	4 x 18	4 x 18	20	20
80	50	138	102	160	125	200	165	8 x 18	4 x 18	22	20
80	65	138	122	160	145	200	185	8 x 18	4 x 18	22	20
100	80	158	138	180	160	220	200	8 x 18	8 x 18	22	22
125	80	188	138	210	160	250	200	8 x 18	8 x 18	24	22
100	100	158	158	180	180	220	220	8 x 18	8 x 18	22	22
125	100	188	158	210	180	250	220	8 x 18	8 x 18	24	22
125	125	188	188	210	210	250	250	8 x 18	8 x 18	24	24
150	125	212	188	240	210	285	250	8 x 23	8 x 18	24	24
150	150	212	212	240	240	285	285	8 x 23	8 x 23	24	24

ISO 7005 ≅ EN 1092-2

ISO 7005 PN10											
aa	ab	ac	ad	ae	af	ag	ah	ai x ak	aj x al	am	an
200	150	268	212	295	240	340	285	8 x 23	8 x 23	26	24
200	200	268	268	295	295	340	340	8 x 23	8 x 23	26	26
250	250	320	320	350	350	395	395	12 x 23	12 x 23	28	28
300	300	370	370	400	400	445	445	12 x 23	12 x 23	28	28

ISO 7005 ≅ EN 1092-2

CN	aa	ab	da	db	ea	eb	ec	ed	mg	tb	va	vb	vc	vd	ve	vf	vi	vj	zb	zc	zd	(kg)
25-125	32	25	374	100	45	8	27	24	60	386	100	140	170	12	70	10	225	35	62	324	215	20
25-160	25	25	387	132	45	8	27	24	100	401	100	190	220	14	70	10	239	40	64,5	337	284	34
32-125	50	32	410	112	45	8	27	24	100	440	100	140	190	14	70	10	268	50	80	360	252	32
32C-125	50	32	410	112	45	8	27	24	100	440	100	140	190	14	70	10	268	50	80	360	252	32
32-160	50	32	410	132	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	292	34
32A-160	50	32	410	132	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	292	34
32C-160	50	32	410	132	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	292	34
32-200	50	32	410	160	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	340	35
32C-200	50	32	410	160	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	340	35
32-250	50	32	423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	45
40C-125	65	40	410	112	45	8	27	24	100	440	100	160	210	14	70	10	268	50	80	360	252	32
40C-160	65	40	410	132	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	292	38
40C-200	65	40	410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	340	46
40-250	65	40	423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	55
40A-315	65	40	533	200	75	10	35	32	100	595	125	280	345	14	95	14	346	65	125	470	450	70
50C-125	65	50	410	132	45	8	27	24	110	460	100	190	240	14	70	10	268	50	100	360	292	33
50C-160	65	50	410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	340	40
50C-200	65	50	410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	360	55
50-250	65	50	423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	65
50-315	80	50	533	225	75	10	35	32	100	595	125	280	345	14	95	14	346	65	125	470	505	80
65C-125	80	65	423	160	45	8	27	24	100	460	125	212	280	14	95	10	268	65	100	360	340	44
65C-160	80	65	423	160	45	8	27	24	100	460	125	212	280	14	95	12	268	65	100	360	360	50
65C-200	80	65	423	180	45	8	27	24	140	460	125	250	320	14	95	14	268	65	100	360	405	65
65A-250	80	65	550	200	75	10	35	32	140	570	160	280	360	18	120	14	346	80	100	470	450	85
65-315	80	65	550	225	75	10	35	32	140	595	160	315	400	18	120	16	346	80	125	470	505	95
80C-160	100	80	423	180	45	8	27	24	140	485	125	250	320	14	95	14	268	65	125	360	405	50
80C-200	100	80	533	180	75	10	35	32	140	595	125	280	345	14	95	14	346	65	125	470	430	75
80-250	100	80	550	200	75	10	35	32	140	595	160	315	400	18	120	15	346	80	125	470	480	88
80A-250	100	80	550	200	75	10	35	32	140	595	160	315	400	18	120	15	346	80	125	470	480	88
80-315	100	80	550	250	75	10	35	32	140	595	160	315	400	18	120	16	346	80	125	470	565	115
80-400	125	80	610	280	110	12	45	42	140	655	160	355	435	18	120	18	368	80	125	530	635	150
100-160	125	100	550	200	75	10	35	32	100	595	160	280	360	18	120	15	346	80	125	470	515	85
100C-200	125	100	550	200	75	10	35	32	140	595	160	280	360	18	120	15	346	80	125	470	480	90
100C-250	125	100	550	225	75	10	35	32	140	610	160	315	400	18	120	16	346	80	140	470	505	110
100-315	125	100	550	250	75	10	35	32	140	610	160	315	400	18	120	18	346	80	140	470	565	122
100-400	125	100	630	280	100	12	45	42	140	670	200	400	500	23	150	20	368	100	140	530	635	185
125-125	125	125	423	225	45	8	27	24	100	500	125	250	320	14	95	14	268	65	140	360	525	65
125-250	150	125	550	250	75	10	35	32	140	610	160	315	400	18	120	18	346	80	140	470	605	130
125-315	150	125	630	280	110	12	45	42	140	670	200	400	500	23	150	20	368	100	140	530	635	185
125-400	150	125	630	315	110	12	45	42	140	670	200	400	500	23	150	20	368	100	140	530	715	200
150-125	150	150	440	280	45	8	27	24	140	520	160	315	400	18	120	18	268	80	160	360	680	104
150-160	150	150	550	250	75	10	35	32	100	630	160	315	400	18	120	18	346	80	160	470	565	108
150-200	150	150	550	250	75	10	35	32	140	630	160	315	400	18	120	18	346	80	160	470	565	130
150-250	200	150	630	280	110	12	45	42	140	690	200	400	500	23	150	20	368	100	160	530	680	175
150-315	200	150	630	280	110	12	45	42	140	690	200	450	550	23	150	22	368	100	160	530	680	185
150-400	200	150	630	315	110	12	45	42	140	690	200	450	550	23	150	22	368	100	160	530	765	220
200-160	200	200	570	280	75	10	35	32	140	670	200	400	500	23	150	20	346	100	200	470	680	160
200-200	200	200	570	280	75	10	35	32	100	670	200	400	500	23	150	20	346	100	200	470	680	170
250-200	250	250	630	315	110	12	45	42	140	730	200	450	550	23	150	22	368	100	200	530	765	240
300-200	300	300	630	450	110	12	45	42	140	780	200	500	600	23	150	22	368	100	250	530	1050	365

8.4 Pump dimensions - bearing group 4

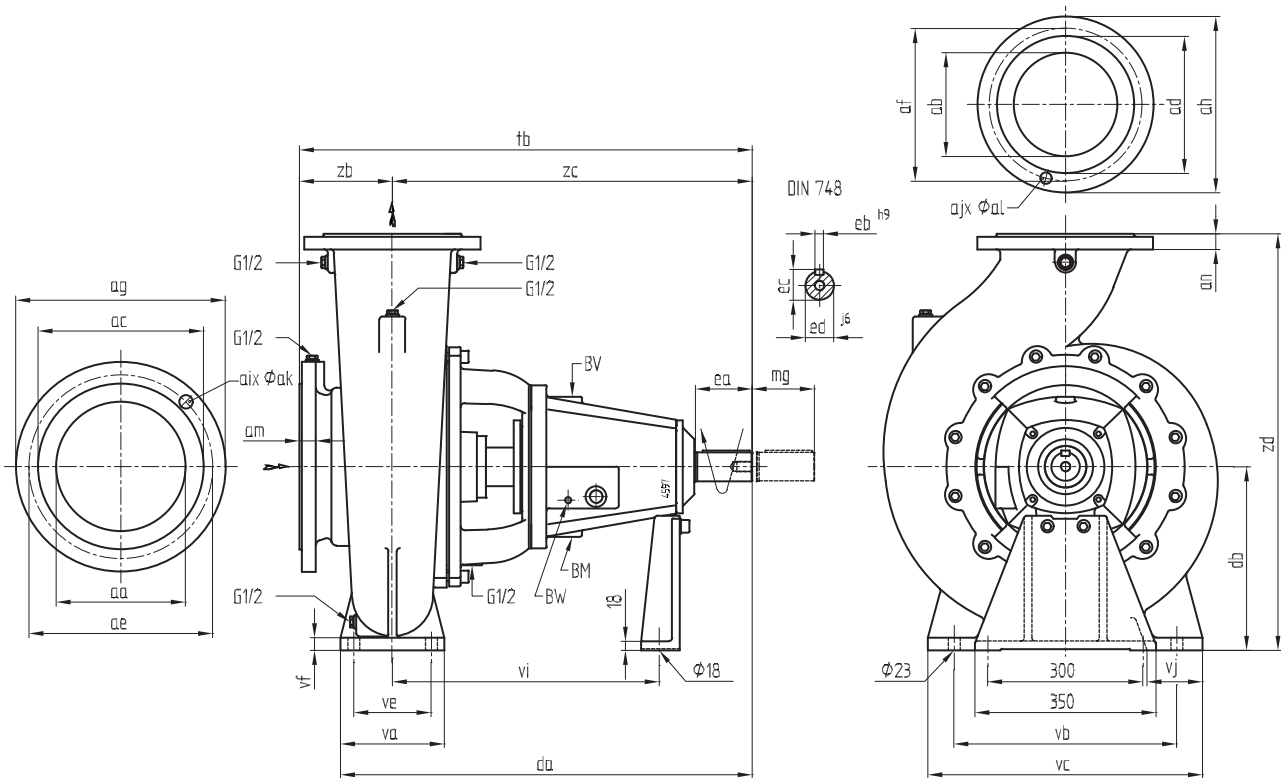


Figure 39: Pump dimensions - bearing group 4.

ISO 7005 PN 16					
aa	ac	ae	ag	ai x ak	am
ab	ad	af	ah	aj x al	an
125	188	210	250	8 x 18	26
150	212	240	285	8 x 22	26
200	268	295	340	12 x 22	30
250	320	355	405	12 x 26	32
300	378	410	460	12 x 26	32

ISO 7005 ≅ EN 1092-2

CN	aa	ab	da	db	ea	eb	ec	ed	mg	tb	va	vb	vc	vd	ve	vf	vi	vj	zb	zc	zd	[kg]
125-500	200	125	780	400	110	16	59	55	200	880	200	560	660	23	150	25	500	105	200	680	900	430
150B-400	250	150	790	355	110	16	59	55	200	890	200	430	530	23	150	25	510	105	200	690	855	380
150-500	250	150	785	450	110	16	59	55	200	915	200	560	660	23	150	25	505	105	230	685	1000	420
200-250	250	200	796	355	110	16	59	55	200	956	200	430	530	23	150	25	516	105	260	696	780	340
200-315	250	200	795	355	110	16	59	55	200	875	200	430	530	23	150	25	515	105	180	695	805	350
200-400	300	200	795	400	110	16	59	55	250	925	200	560	660	23	150	25	515	105	230	695	950	470
250-250	300	250	816	400	110	16	59	55	250	976	200	560	660	23	150	25	536	105	260	716	950	450
250-315	300	250	800	375	110	16	59	55	250	930	200	560	660	23	150	25	520	105	230	700	875	405
300-250	300	300	820	450	110	16	59	55	250	970	200	560	660	23	150	25	540	105	250	720	1000	465
300-315	300	300	820	450	110	16	59	55	250	950	200	560	660	23	150	25	540	105	230	720	1000	475

8.5 Pump-motor unit - bearing groups 0, 1, 2, 3 - with standard coupling

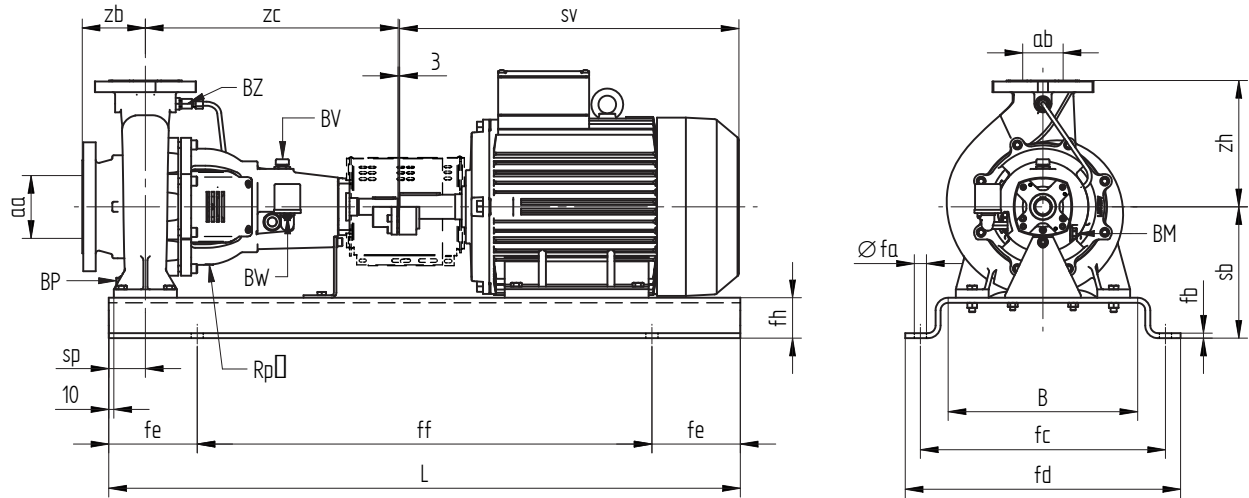


Figure 40: Pump-motor unit - bearing groups 0, 1, 2, 3 - with standard coupling.

Type CN	IEC Motor																											
								71	80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M	315 S		
	aa	ab	sp	zb	zc	zh	sv (*)	254	296	336	348	402	432	486	520	652	672	712	742	790	904	904	1014	1124	1176	1144		
25-125	32	25	60	62	324	115	sb	145	145	145	145	145																
							x	1	1	1	1	1																
25-160	25	25	60	64,5	337	152	sb	177	177	177	177	177	177	177														
							x	1	1	1	1	1	1	1														
32-125	50	32	60	80	360	140	sb	157	157	157	157	157	157															
							x	1	1	1	1	1	1															
32C-125	50	32	60	80	360	140	sb	157	157	157	157	157	157															
							x	1	1	1	1	1	1															
32-160	50	32	60	80	360	160	sb	177	177	177	177	177	177	177														
							x	1	1	1	1	1	1	1														
32A-160	50	32	60	80	360	160	sb	177	177	177	177	177	177	177														
							x	1	1	1	1	1	1	1														
32C-160	50	32	60	80	360	160	sb	177	177	177	177	177	177	177														
							x	1	1	1	1	1	1	1														
32-200	50	32	60	80	360	180	sb	205	205	205	205	205	205	205		223												
							x	1	1	1	1	1	1	1		2												
32C-200	50	32	60	80	360	180	sb	205	205	205	205	205	205	205		223												
							x	1	1	1	1	1	1	1		2												
32-250	50	32	72	100	360	225	sb		243	243	243	243	243	243		243	243											
							x		2	2	2	2	2	2		2	2											
40C-125	65	40	60	80	360	140	sb	157	157	157	157	157	157	177														
							x	1	1	1	1	1	1	1														
40C-160	65	40	60	80	360	160	sb	177	177	177	177	177	177	177		223												
							x	1	1	1	1	1	1	1		2												
40C-200	65	40	60	100	360	180	sb		205	205	205	205	205	205		223												
							x		1	1	1	1	1	1		2												
40-250	65	40	72	100	360	225	sb		243	243	243	243	243	243		243	243	260										
							x		2	2	2	2	2	2		2	2	3										
40A-315	65	40	72	125	470	250	sb				280	280	280	280	280													
							x				3	3	3	3	3													

Type CN								IEC Motor																				
	aa	ab	sp	zb	zc	zh	sv (*)	71	80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M	315 S		
								254	296	336	348	402	432	486	520	652	672	712	742	790	904	904	1014	1124	1176	1144		
50C-125	65	50	60	100	360	160	sb	177	177	177	177	177	177	177		223												
							x	1	1	1	1	1	1	1		2												
50C-160	65	50	60	100	360	180	sb	205	205	205	205	205	205	205		223												
							x	1	1	1	1	1	1	1		2												
50C-200	65	50	60	100	360	200	sb		205	205	205	205	205	205		223	223	260		290								
							x		1	1	1	1	1	1		2	2	3		4								
50-250	65	50	72	100	360	225	sb		243	243	243	243	243	243		243	243	260		290								
							x		2	2	2	2	2	2		2	2	3		4								
50-315	80	50	72	125	470	280	sb				305	305	305	305	305	305												
							x				3	3	3	3	3	3												
65C-125	80	65	72	100	360	180	sb		205	205	205	205	205	205		223												
							x		1	1	1	1	1	1		2												
65C-160	80	65	72	100	360	200	sb		205	205	205	205	205	205		223	223	260		290								
							x		1	1	1	1	1	1		2	2	3		4								
65C-200	80	65	72	100	360	225	sb		243	243	243	243	243	243		243	243	260		290								
							x		2	2	2	2	2	2		2	2	3		4								
65A-250	80	65	90	100	470	250	sb			280	280	280	280	280	280	280	280	280	280	290		315						
							x			3	3	3	3	3	3	3	3	3	3	3	4		4					
65-315	80	65	90	125	470	280	sb				315	315	315	315	315	315	315	315										
							x				4	4	4	4	4	4	4	4	4									
80C-160	100	80	72	125	360	225	sb			243	243	243	243	243		243	243	260		290								
							x			2	2	2	2	2		2	2	3		4								
80C-200	100	80	72	125	470	250	sb			260	260	260	260	260	260	260	260	260		290		315	380	410				
							x			3	3	3	3	3	3	3	3	3		4		4	6	6				
80-250	100	80	90	125	470	280	sb			290	290	290	290	290	290	290	290	290		290		315	380	410				
							x			4	4	4	4	4	4	4	4	4		4		4	6	6				
80A-250	100	80	90	125	470	280	sb			290	290	290	290	290	290	290	290	290		290		315	380	410				
							x			4	4	4	4	4	4	4	4	4		4		4	6	6				
80-315	100	80	90	125	470	315	sb				340	340	340	340	340	340	340	340	340									
							x				4	4	4	4	4	4	4	4	4									
80-400	125	80	90	125	530	355	sb							370	370	370	370	370	370	370	370	380						
							x							4	4	4	4	4	4	4	4	5						
100-160	125	100	90	125	470	315	sb				280	280	280	280		280	280	280		290								
							x				3	3	3	3		3	3	3		4								
100C-200	125	100	90	125	470	280	sb				280	280	280	280	280	280	280	280		290		315	380	410				
							x				3	3	3	3	3	3	3	3		4		4	6	6				
100C-250	125	100	90	140	470	280	sb				315	315	315	315	315	315	315	315		315		315	380	410	410	445		
							x				4	4	4	4	4	4	4	4		4		4	6	6	6	12		
100-315	125	100	90	140	470	315	sb					340	340	340	340	340	340	340	340	340	340							
							x					4	4	4	4	4	4	4	4	4	4							
100-400	125	100	110	140	530	355	sb							370	370	370	370	370	370	370	370	410	410	410				
							x							4	4	4	4	4	4	4	4	6	6	6				
125-125	125	125	72	140	360	300	sb				288	288	288	288		288												
							x				2	2	2	2		2												
125-250	150	125	90	140	470	355	sb				340	340	340	340	340	340	340	340	340	340								
							x				4	4	4	4	4	4	4	4	4	4	4							
125-315	150	125	110	140	530	355	sb							370	370	370	370	370	370	370	370	410	410	410				
							x							4	4	4	4	4	4	4	4	6	6	6				
125-400	150	125	110	140	530	400	sb								405	405	405	405	405	405	405	445	445	445	445			
							x								4	4	4	4	4	4	4	6	6	6	6			

8.6 Pump-motor unit - bearing group 4 - with standard coupling

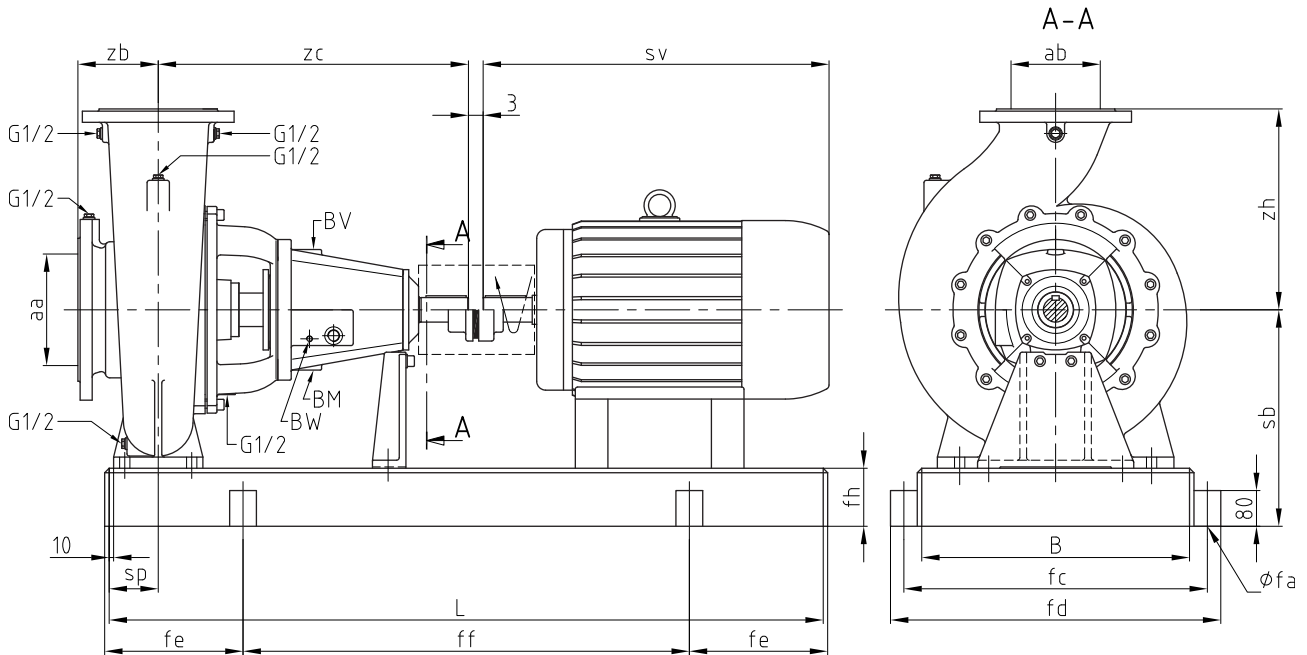


Figure 41: Pump-motor unit - bearing group 4 - with standard coupling.

Type CN	IEC Motor																													
	160		180		180		200		225		225		250		280		280		315		315		315		315		355			
	L	M	L	M	L	M	L	M	L	M	L	M	L	M	L	M	L	M	L	LX	LX	LX	LX	LX	LX	LX	LX	LX	LX	
125-500	200	125	110	200	680	500	sb					530	530	530	530	530	560	560	560	560	560	560	560	560	560	560	560	560	560	560
							x					12	12	12	12	12	14	14	14	14	14	14	14	14	14	14	14	14	16	
150B-400	250	150	110	200	690	500	sb					485	485	485	485	485	485	485	515	515	515	515	515	515	515	515	515	515	515	
							x					11	11	11	11	11	13	14	14	14	14	14	14	14	14	14	14	14	14	
150-500	250	150	110	230	685	550	sb								580	580	610	610	610	610	610	610	610	610	610	610	610	610	610	
							x					12	12	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	16	
200-250	250	200	110	260	696	425	sb	485	485	485	485	485	485	485	485	485														
							x	11	11	11	11	11	11	11	11	11														
200-315	250	200	110	180	695	450	sb			485	485	485	485	485	485	485	515													
							x			11	11	11	11	11	11	13	14													
200-400	300	200	110	230	695	550	sb					530	530	530	530	530	560	560	560	560	560	560	560	560	560	560	560	560	560	
							x					12	12	12	12	12	14	14	14	14	14	14	14	14	14	14	14	14	16	
250-250	300	250	110	260	716	550	sb				530	530	530	530	530	560	560	560	560											
							x				12	12	12	12	12	14	14	14	14											
250-315	300	250	110	230	700	500	sb					505	505	505	505	505	535	535	535	535										
							x					12	12	12	12	12	14	14	14	14										
300-250	300	300	110	250	720	550	sb					580	580	580	580	610	610	610	610											
							x					12	12	12	14	14	14	14	14											
300-315	300	300	110	230	720	550	sb							580	580	610	610	610	610	610	610	610	610	610	610	610	610	610	610	
							x					12	12	12	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	

x = base plate number

(*) Motor length based on DIN 42673, could be different due to applied motor make
ISO 7005 \cong EN 1092-2

8.7 Pump-motor unit - bearing groups 0, 1, 2, 3 - with spacer coupling

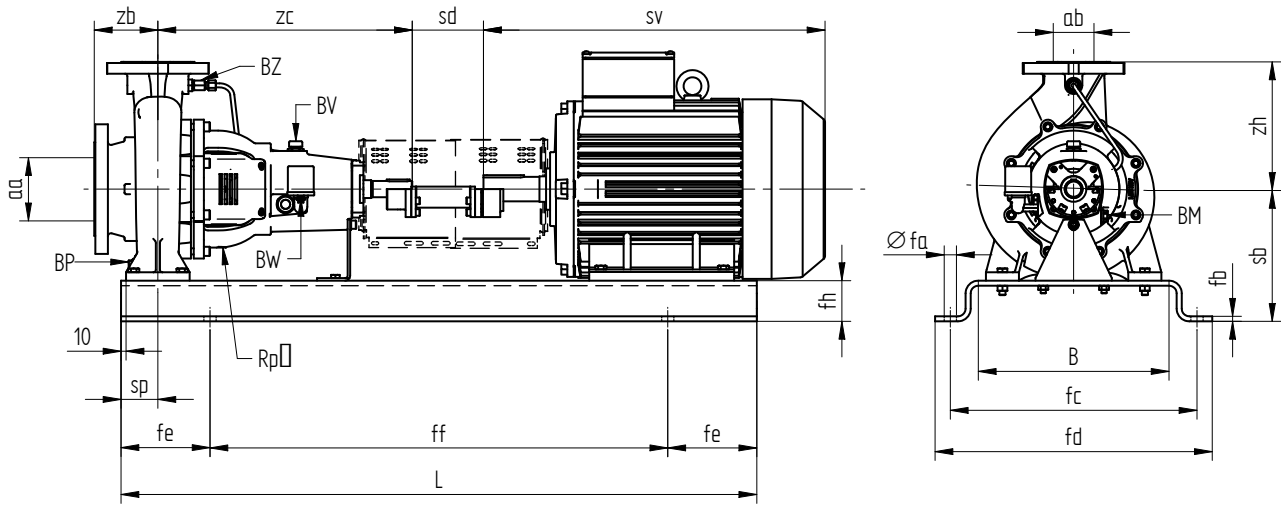


Figure 42: Pump-motor unit - bearing groups 0, 1, 2, 3 - with spacer coupling.

Type CN	IEC Motor																												
									71	80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M	315 S		
	aa	ab	sd	sp	zb	zc	zh	sv (*)	254	296	336	348	402	432	486	520	652	672	712	742	790	904	904	1014	1124	1176	1144		
25-125	32	25	100	60	62	324	115	sb	145	145	145	145	145																
								x	1	1	1	1	1																
25-160	25	25	100	60	64,5	337	152	sb	177	177	177	177	195	195	195														
								x	1	1	1	1	2	2	2														
32-125	50	32	100	60	80	360	140	sb	157	157	157	157	175	175															
								x	1	1	1	1	2	2															
32C-125	50	32	100	60	80	360	140	sb	157	157	157	157	175	175															
								x	1	1	1	1	2	2															
32-160	50	32	100	60	80	360	160	sb	177	177	177	177	195	195	195														
								x	1	1	1	1	2	2	2														
32A-160	50	32	100	60	80	360	160	sb	177	177	177	177	195	195	195														
								x	1	1	1	1	2	2	2														
32C-160	50	32	100	60	80	360	160	sb	177	177	177	177	195	195	195														
								x	1	1	1	1	2	2	2														
32-200	50	32	100	60	80	360	180	sb	205	205	205	205	223	223	223		223												
								x	1	1	1	1	2	2	2		2												
32C-200	50	32	100	60	80	360	180	sb	205	205	205	205	223	223	223		223												
								x	1	1	1	1	2	2	2		2												
32-250	50	32	100	72	100	360	225	sb		243	243	243	243	243	243		260	260											
								x		2	2	2	2	2	2		3	3											
40C-125	65	40	100	60	80	360	140	sb	157	157	157	157	175	175	195														
								x	1	1	1	1	2	2	2														
40C-160	65	40	100	60	80	360	160	sb	177	177	177	177	195	195	195		223												
								x	1	1	1	1	2	2	2		2												
40C-200	65	40	100	60	100	360	180	sb		205	205	205	223	223	223		223												
								x		1	1	1	2	2	2		2												
40-250	65	40	100	72	100	360	225	sb		243	243	243	243	243	243		260	260	260										
								x		2	2	2	2	2	2		3	3	3										
40A-315	65	40	100	72	125	470	250	sb				280	280	280	280														
								x				3	3	3	3														

Type CN									IEC Motor																				
	aa	ab	sd	sp	zb	zc	zh	sv (°)	71	80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M	315 S		
									254	296	336	348	402	432	486	520	652	672	712	742	790	904	904	1014	1124	1176	1144		
50C-125	65	50	100	60	100	360	160	sb	177	177	177	177	195	195	195		223												
								x	1	1	1	1	2	2	2		2												
50C-160	65	50	100	60	100	360	180	sb	205	205	205	205	223	223	223		223												
								x	1	1	1	1	2	2	2		2												
50C-200	65	50	100	60	100	360	200	sb		205	205	205	223	223	223		223	240	260		290								
								x		1	1	1	2	2	2		2	3	3		4								
50-250	65	50	100	72	100	360	225	sb		243	243	243	243	243	243		260	260	260		290								
								x		2	2	2	2	2	2		3	3	3		4								
50-315	80	50	100	72	125	470	280	sb				305	305	305	305	305	305												
								x				3	3	3	3	3	3												
65C-125	80	65	100	72	100	360	180	sb		205	205	223	223	223	223		240												
								x		1	1	2	2	2	2		3												
65C-160	80	65	100	72	100	360	200	sb		205	205	223	223	223	223		240	240	260		290								
								x		1	1	2	2	2	2		3	3	3		4								
65C-200	80	65	140	72	100	360	225	sb		243	243	243	243	243	243		260	260	260		290								
								x		2	2	2	2	2	2		3	3	3		4								
65A-250	80	65	140	90	100	470	250	sb			280	280	280	280	280	280	280	280	280	280	300		325						
								x			3	3	3	3	3	3	3	3	3	3	5	5		5					
65-315	80	65	140	90	125	470	280	sb				315	315	315	315	315	315	315	315										
								x				4	4	4	4	4	4	4	4	4									
80C-160	100	80	140	72	125	360	225	sb			243	243	243	243	243		260	260	260		290								
								x			2	2	2	2	2		3	3	3		4								
80C-200	100	80	140	72	125	470	250	sb			260	260	260	260	260	260	260	260	260		300		325	380	410				
								x			3	3	3	3	3	3	3	3	3		5		5	6	6				
80-250	100	80	140	90	125	470	280	sb			290	290	290	290	290	290	290	290	290		300		325	380	410				
								x			4	4	4	4	4	4	4	4	4		5		5	6	6				
80A-250	100	80	140	90	125	470	280	sb			290	290	290	290	290	290	290	290	290		300		325	380	410				
								x			4	4	4	4	4	4	4	4	4		5		5	6	6				
80-315	100	80	140	90	125	470	315	sb				340	340	340	340	340	340	340	340										
								x				4	4	4	4	4	4	4	4										
80-400	125	80	140	90	125	530	355	sb							370	370	370	380	380	380	380	380							
								x							4	4	4	5	5	5	5	5							
100-160	125	100	100	90	125	470	315	sb			280	280	280	280		280	280	280		300									
								x			3	3	3	3		3	3	3		5									
100C-200	125	100	140	90	125	470	280	sb			280	280	280	280	280	280	280	280		300		325	380	410					
								x			3	3	3	3	3	3	3	3		5		5	6	6					
100C-250	125	100	140	90	140	470	280	sb			315	315	315	315	315	315	315	315		325		325	380	410	410	475			
								x			4	4	4	4	4	4	4	4		5		5	6	6	6	14			
100-315	125	100	140	90	140	470	315	sb				340	340	340	340	340	340	340	350	350	350								
								x				4	4	4	4	4	4	4	5	5	5								
100-400	125	100	140	110	140	530	355	sb							370	370	410	410	410	410	410	410	410	410					
								x							4	4	6	6	6	6	6	6	6	6					
125-125	125	125	100	72	140	360	300	sb			288	288	288	288		305													
								x			2	2	2	2		3													
125-250	150	125	140	90	140	470	355	sb			340	340	340	340	340	340	340	340	350	350									
								x			4	4	4	4	4	4	4	4	5	5									
125-315	150	125	140	110	140	530	355	sb							370	370	410	410	410	410	410	410	410	410					
								x							4	4	6	6	6	6	6	6	6	6					
125-400	150	125	140	110	140	530	400	sb							405	445	445	445	445	445	445	445	445	445	445				
								x							4	6	6	6	6	6	6	6	6	6					
150-125	150	150	140	90	160	360	400	sb				370	370	370															

8.8 Pump-motor unit - bearing group 4 - with spacer coupling

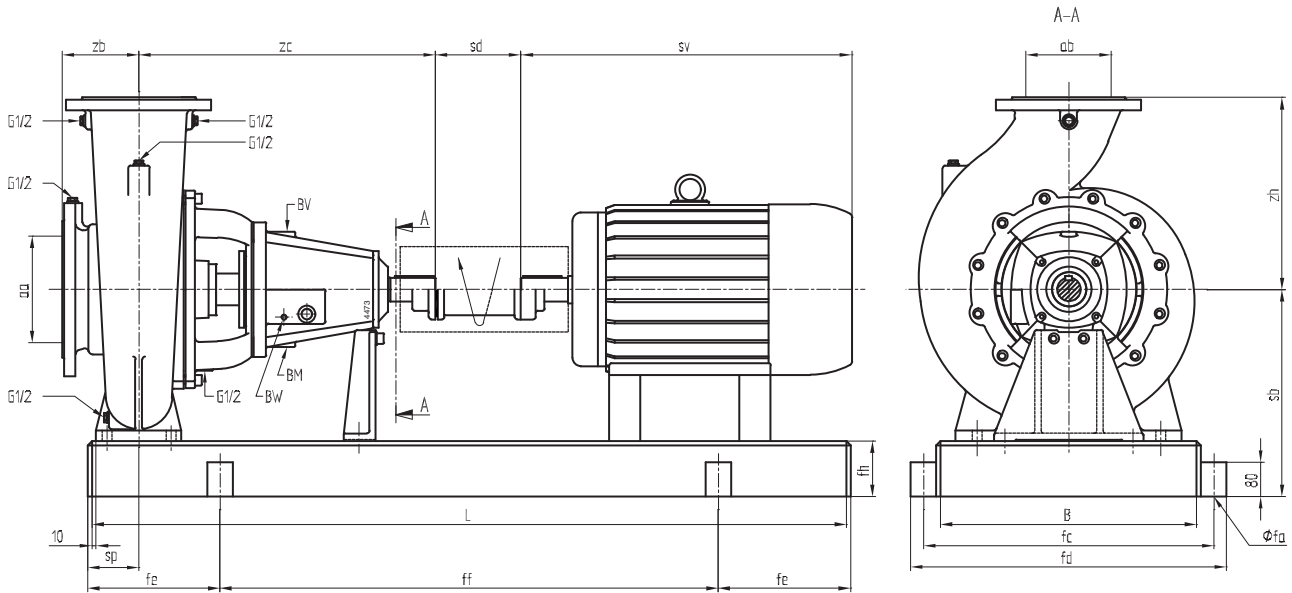


Figure 43: Pump-motor unit - bearing group 4 - with spacer coupling.

Type CN	IEC Motor																											
	160		180		180		200		225		225		250		280		315		315		315		315		355			
	L	M	L	M	L	M	L	M	L	M	L	M	L	M	L	M	L	M	L	M	L	LX	LX	S	S	S		
125-500	200	125	200	110	200	680	500	sb					530	560	560	560	560	560	560	560	560	560	560	560	560	560	560	560
								x					12	14	14	14	14	14	14	14	14	14	14	14	14	14	14	16
150B-400	250	150	200	110	200	690	500	sb					485	485	485	485	485	515	515	515	515	515	515	515	515	515	515	
								x					13	13	13	13	13	14	14	14	14	15	15	15	15	15		
150-500	250	150	200	110	230	685	550	sb								610	610	610	610	610	610	610	610	610	610	610	610	610
								x								14	14	14	14	14	14	14	14	14	14	14	14	16
200-250	250	200	200	110	260	696	425	sb	485	485	485	485	485	485	485	485	485											
								x	11	11	11	13	13	13	13	13	13											
200-315	250	200	200	110	180	695	450	sb					485	485	485	485	485	515	515									
								x					11	13	13	13	13	14	14									
200-400	300	200	250	110	230	695	550	sb					560	560	560	560	560	560	560	560	560	560	560	560	560	560	560	560
								x					14	14	14	14	14	14	14	14	15	15	15	15	15	15	15	16
250-250	300	250	250	110	260	716	550	sb					560	560	560	560	560	560	560	560								
								x					14	14	14	14	14	14	14	14								
250-315	300	250	250	110	230	700	500	sb					535	535	535	535	535	535	535	535	535	535	535	535	535	535	535	
								x					14	14	14	14	14	14	14	14	15							
300-250	300	300	250	110	250	720	550	sb					610	610	610	610	610	610	610	610								
								x					14	14	14	14	14	14	14	14								
300-315	300	300	250	110	230	720	550	sb								610	610	610	610	610	610	610	610	610	610	610	610	
								x								14	14	14	14	14	14	15	15	15	15	15	15	

x = base plate number

(*) Motor length based on DIN 42673, could be different due to applied motor make
ISO 7005 ≅ EN 1092-2

8.9 Dimensions of shaft sealing configuration MQ2-MQ3-CQ3

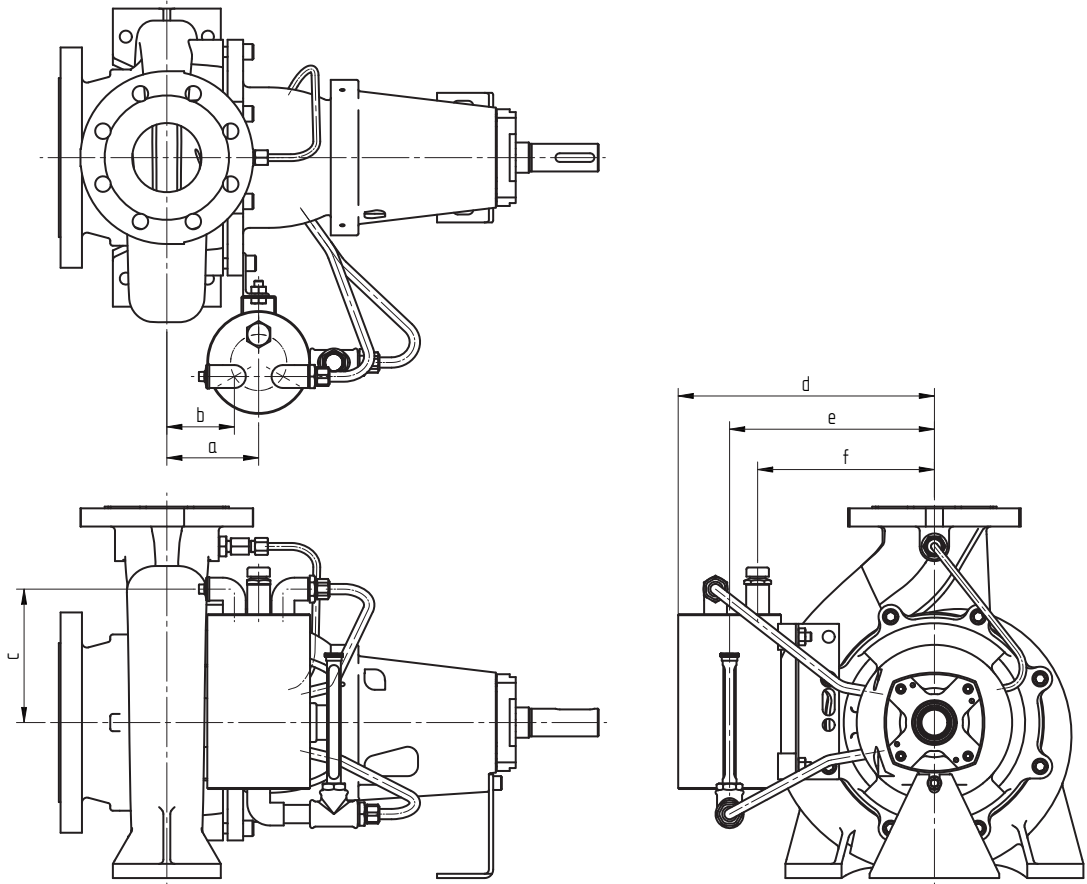


Figure 44: Shaft sealing configuration MQ2-MQ3-CQ3

Table 13: Dimensions of shaft sealing configuration MQ2-MQ3-CQ3

CN	a	b	c	d	e	f
25-125	--	--	--	--	--	--
25-160	--	--	--	--	--	--
32-125	93	65	185	235	175	143
32C-125	93	65	185	235	175	143
32-160	93	65	165	272	212	180
32A-160	93	65	165	272	212	180
32C-160	93	65	165	272	212	180
32-200	93	65	155	297	237	205
32C-200	93	65	155	297	237	205
32-250	105	77	165	327	267	235
40C-125	93	65	185	235	175	143
40C-160	93	65	165	272	212	180
40C-200	93	65	155	297	237	205
40-250	105	77	165	327	267	235
40A-315	133	105	130	345	285	253

Table 13: Dimensions of shaft sealing configuration MQ2-MQ3-CQ3

CN	a	b	c	d	e	f
50C-125	93	65	185	235	175	143
50C-160	93	65	165	272	212	180
50C-200	93	65	155	297	237	205
50-250	105	77	165	327	267	235
50-315	133	105	130	345	285	253
65C-125	93	65	185	235	175	143
65C-160	93	65	165	272	212	180
65C-200	93	65	155	297	237	205
65A-250	108	80	165	327	267	235
65-315	133	105	130	345	285	253
80C-160	93	65	165	272	212	180
80C-200	98	70	155	297	237	205
80-250	108	80	165	327	267	235
80A-250	108	80	165	327	267	235
80-315	133	105	130	345	285	253
80-400	136	108	130	395	335	303
100-160	108	80	155	297	237	205
100C-200	108	80	155	297	237	205
100C-250	108	80	165	327	267	235
100-315	133	105	130	345	285	253
100-400	136	108	130	395	335	303
125-125	93	65	165	272	212	180
125-250	98	70	165	327	267	235
125-315	136	108	130	345	285	253
125-400	136	108	130	395	335	303
150-125	93	65	165	272	212	180
150-160	108	80	155	297	237	205
150-200	108	80	155	297	237	205
150-250	116	88	165	327	267	235
150-315	136	108	130	345	285	253
150-400	136	108	130	395	235	303
150B-400	--	--	--	--	--	--
150-500	--	--	--	--	--	--
200-160	--	--	--	--	--	--
200-200	108	80	165	327	267	235
200-250	--	--	--	--	--	--
200-315	--	--	--	--	--	--
200-400	--	--	--	--	--	--
250-200	136	108	165	327	267	235
250-250	--	--	--	--	--	--
250-315	--	--	--	--	--	--
300-200	--	--	--	--	--	--
300-250	--	--	--	--	--	--
300-315	--	--	--	--	--	--

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 with grease lubricated bearing L1 - bearing groups 1, 2, 3

9.2.1 Sectional drawing L1 - bearing groups 1, 2, 3

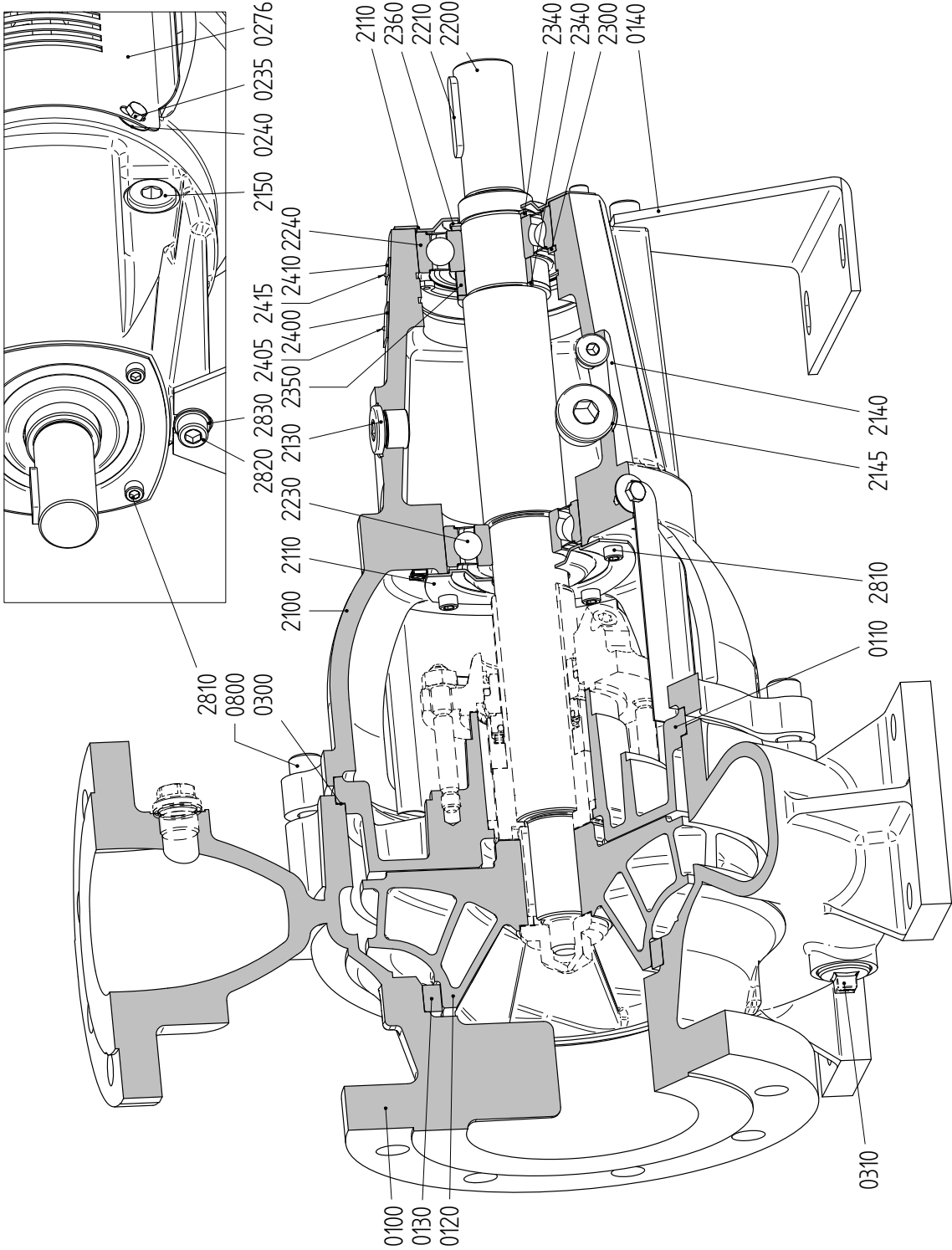


Figure 45: Sectional drawing L1 - bearing groups 1, 2, 3.

9.2.2 Sectional drawing L1 with tapered bore - bearing groups 1, 2, 3

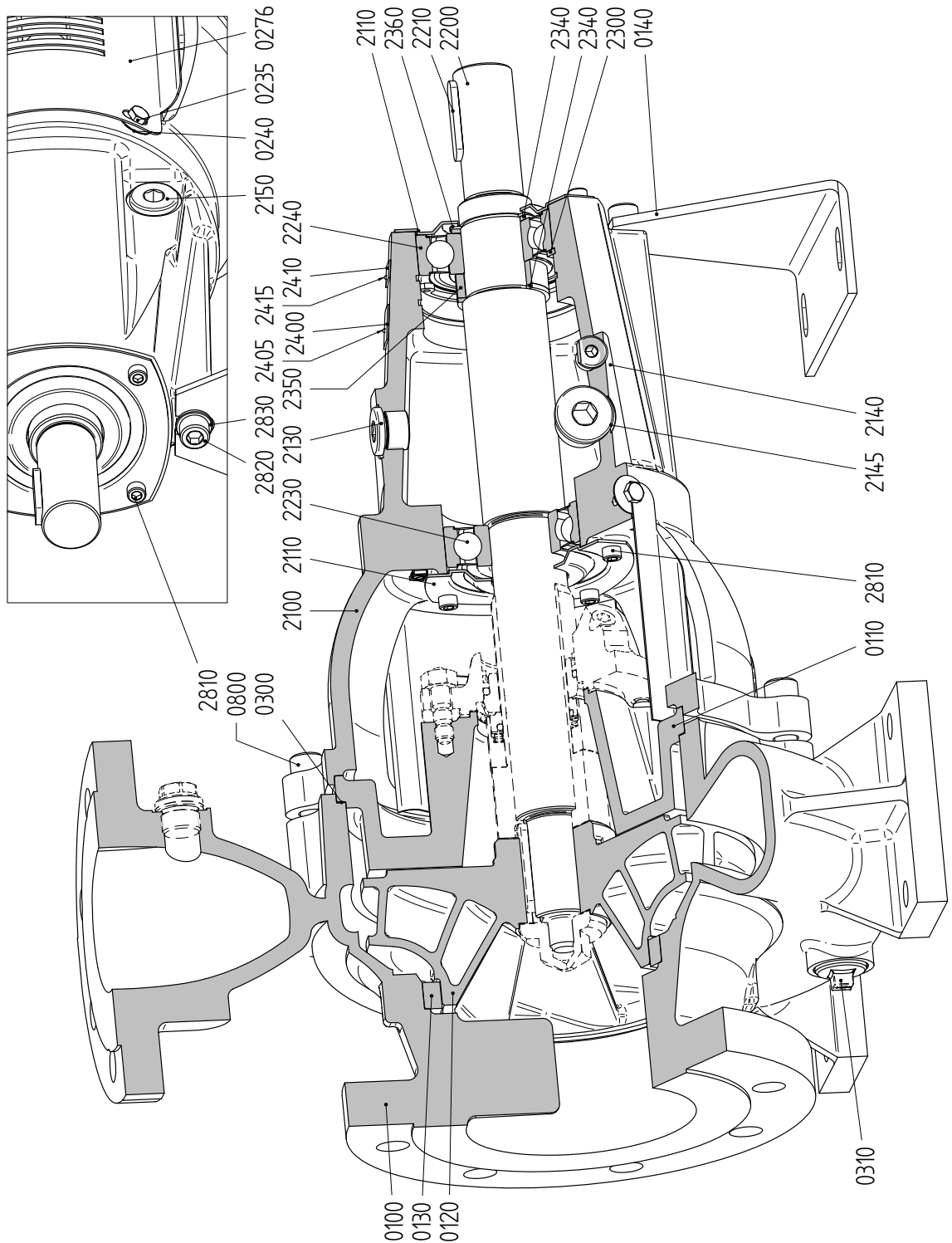


Figure 46: Sectional drawing L1 with tapered bore - bearing groups 1, 2, 3.

9.2.3 Parts list L1 - bearing groups 1, 2, 3

Item	Quantity	Description	Materials					
			G1	G2	G6	NG1	NG2	B2
0100	1	pump casing	cast iron			nodular cast iron		bronze
0110	1	pump cover	cast iron			nodular cast iron		bronze
0120*	1	impeller	c.i.	bronze	st.st.	c.i.	bronze	
0130*	1	wear ring	c.i.	bronze	st.st.	c.i.	bronze	
0140	1	bracket support	steel					
0235	4	bolt	stainless steel					
0240	4	washer	stainless steel					
0276	2	seal guard	stainless steel					
0300*	1	gasket	-					
0310	1	plug	steel					bronze
0800	4/8/12 (*)	Allen screw	steel					st.st.
2100	1	bearing bracket	cast iron					
2110	2	bearing cover	steel					
2130	1	plug	steel					
2140	1	plug	steel					
2145	1	plug	steel					
2150	1	plug	steel					
2200*	1	pump shaft	steel alloy					st.st.
2210*	1	coupling key	steel					
2230*	1	ball bearing	-					
2240*	1	ball bearing	-					
2300*	1	inner circlip	spring steel					
2340	2	adjusting ring	steel					
2350	1	spacer sleeve	steel					
2360*	1	outer circlip	spring steel					
2400	1	name plate	stainless steel					
2405	2	rivet	stainless steel					
2410	1	arrow plate	aluminium					
2415	2	rivet	stainless steel					
2810	8	Allen screw	steel					
2820	1	Allen screw	steel					
2830	1	washer	steel					

c.i. = cast iron, st.st. = stainless steel

Item 0130: not for the pump types of bearing bracket 1, except 32-250.

(*) Quantity depends on pump type.

L1 with tapered bore only in materials G1, G2 and G6.

9.3 Pump with grease lubricated bearing L2 - bearing groups 1, 2, 3

9.3.1 Sectional drawing L2 - bearing groups 1, 2, 3

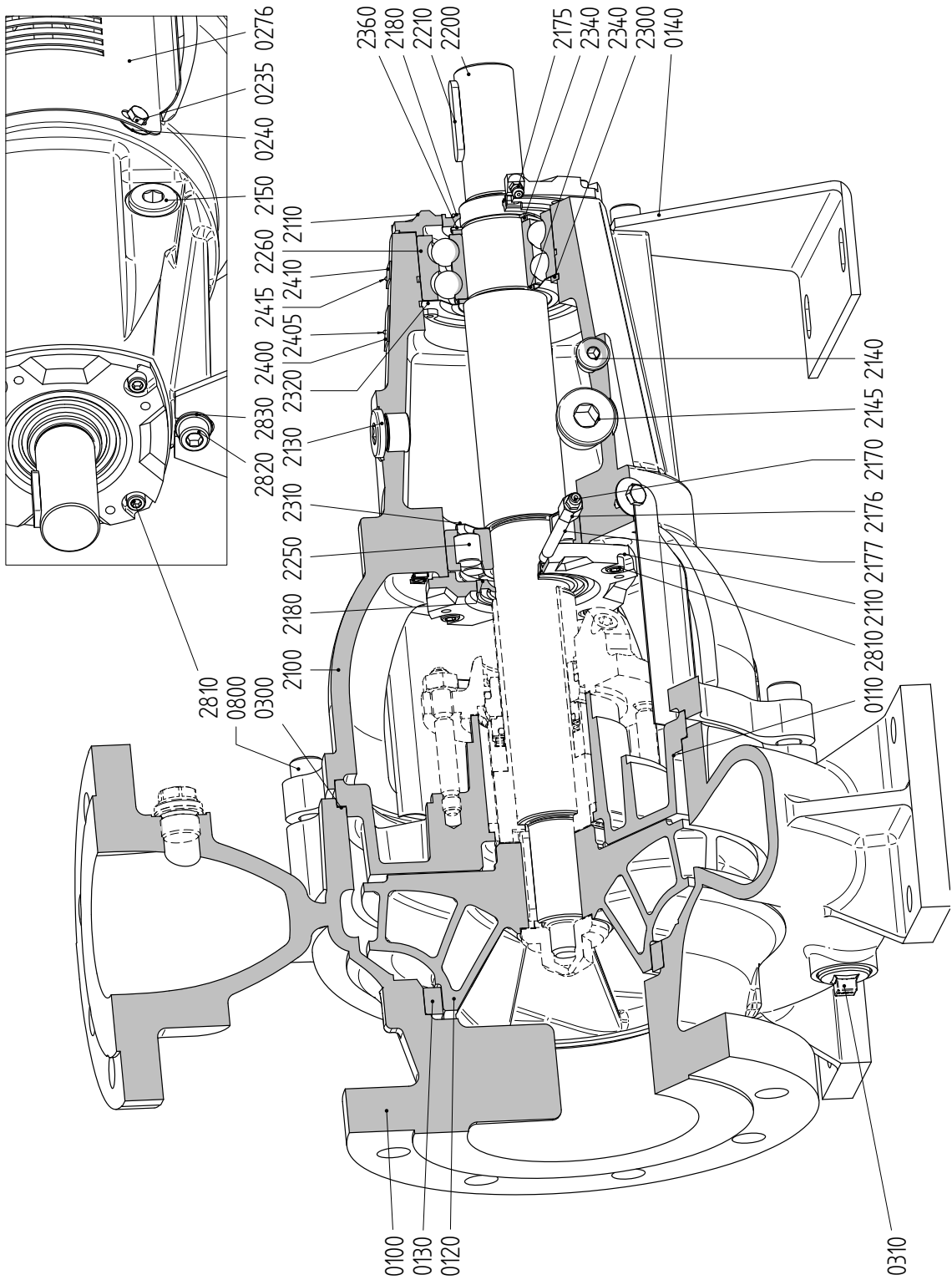


Figure 47: Sectional drawing L2 - bearing groups 1, 2, 3.

9.3.2 Sectional drawing L2 with tapered bore - bearing groups 1, 2, 3

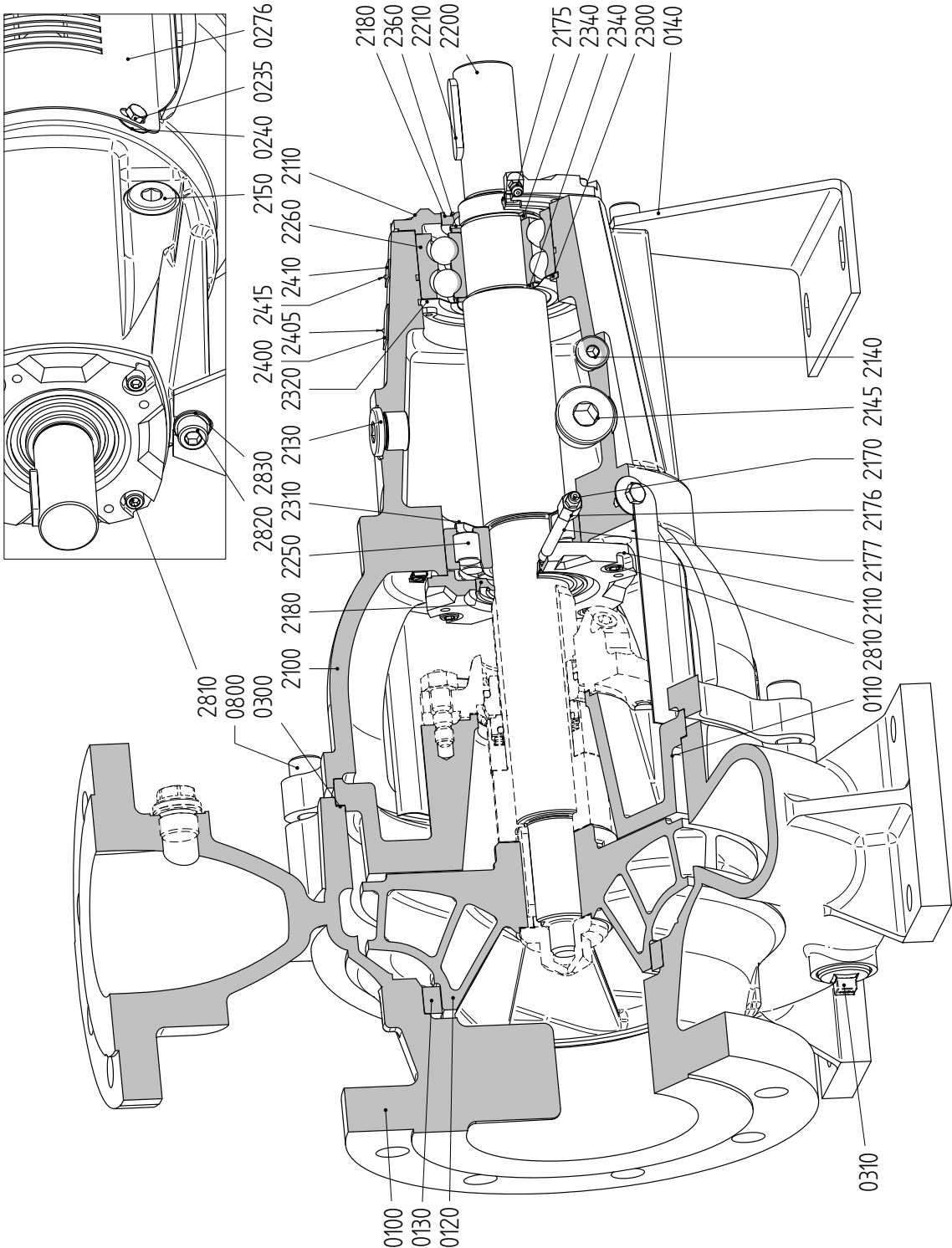


Figure 48: Sectional drawing L2 with tapered bore - bearing groups 1, 2, 3.

9.3.3 Parts list L2 - bearing groups 1, 2, 3

Item	Quantity	Description	Materials					
			G1	G2	G6	NG1	NG2	B2
0100	1	pump casing	cast iron			nodular cast iron		bronze
0110	1	pump cover	cast iron			nodular cast iron		bronze
0120*	1	impeller	c.i.	bronze	st.st.	c.i.	bronze	
0130*	1	wear ring	c.i.	bronze	st.st.	c.i.	bronze	
0140	1	bracket support	steel					
0235	4	bolt	stainless steel					
0240	4	washer	stainless steel					
0276	2	seal guard	stainless steel					
0300*	1	gasket	-					
0310	1	plug	steel					bronze
0800	4/8/12 (*)	Allen screw	steel					st.st.
2100	1	bearing bracket	cast iron					
2110	2	bearing cover	steel					
2130	1	plug	steel					
2140	1	plug	steel					
2145	1	plug	steel					
2150	1	plug	steel					
2170	1	grease nipple	stainless steel					
2175	1	grease nipple	stainless steel					
2176	1	socket	stainless steel					
2177	1	pipe	stainless steel					
2180	2	oil seal	rubber					
2200*	1	pump shaft	steel alloy					st.st.
2210*	1	coupling key	steel					
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	2	adjusting ring	steel					
2360*	1	outer circlip	spring steel					
2400	1	name plate	stainless steel					
2405	2	rivet	stainless steel					
2410	1	arrow plate	aluminium					
2415	2	rivet	stainless steel					
2810	8	Allen screw	steel					
2820	1	Allen screw	steel					
2830	1	washer	steel					

c.i. = cast iron, st.st. = stainless steel

Item 0130: not for the pump types of bearing bracket 1, except 32-250.

(*) Quantity depends on pump type.

L2 with tapered bore only in materials G1, G2 and G6.

9.4 Pump with oil-bath lubricated bearing L3 - bearing groups 1, 2, 3

9.4.1 Sectional drawing L3 - bearing groups 1, 2, 3

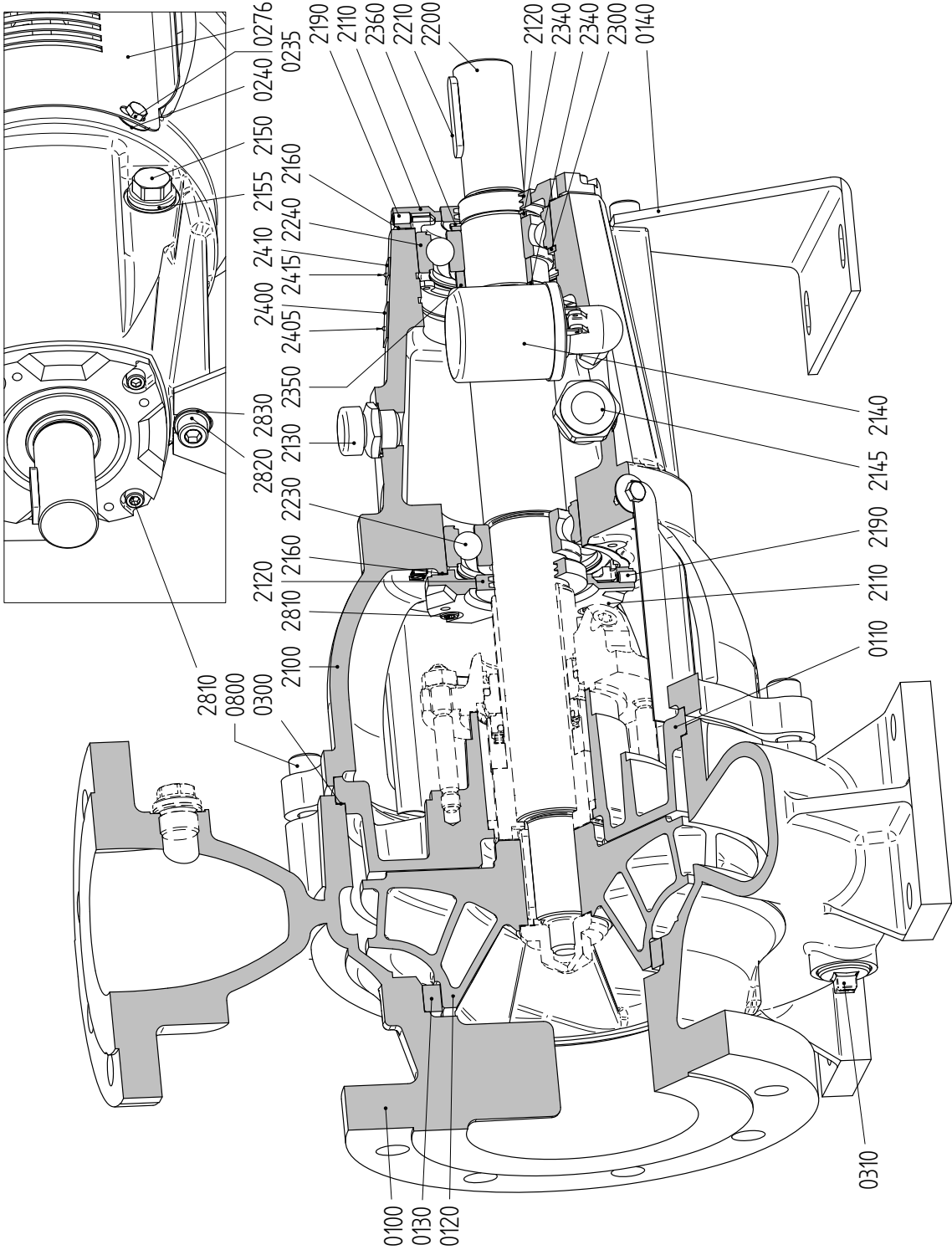


Figure 49: Sectional drawing L3 - bearing groups 1, 2, 3.

9.4.2 Sectional drawing L3 with tapered bore - bearing groups 1, 2, 3

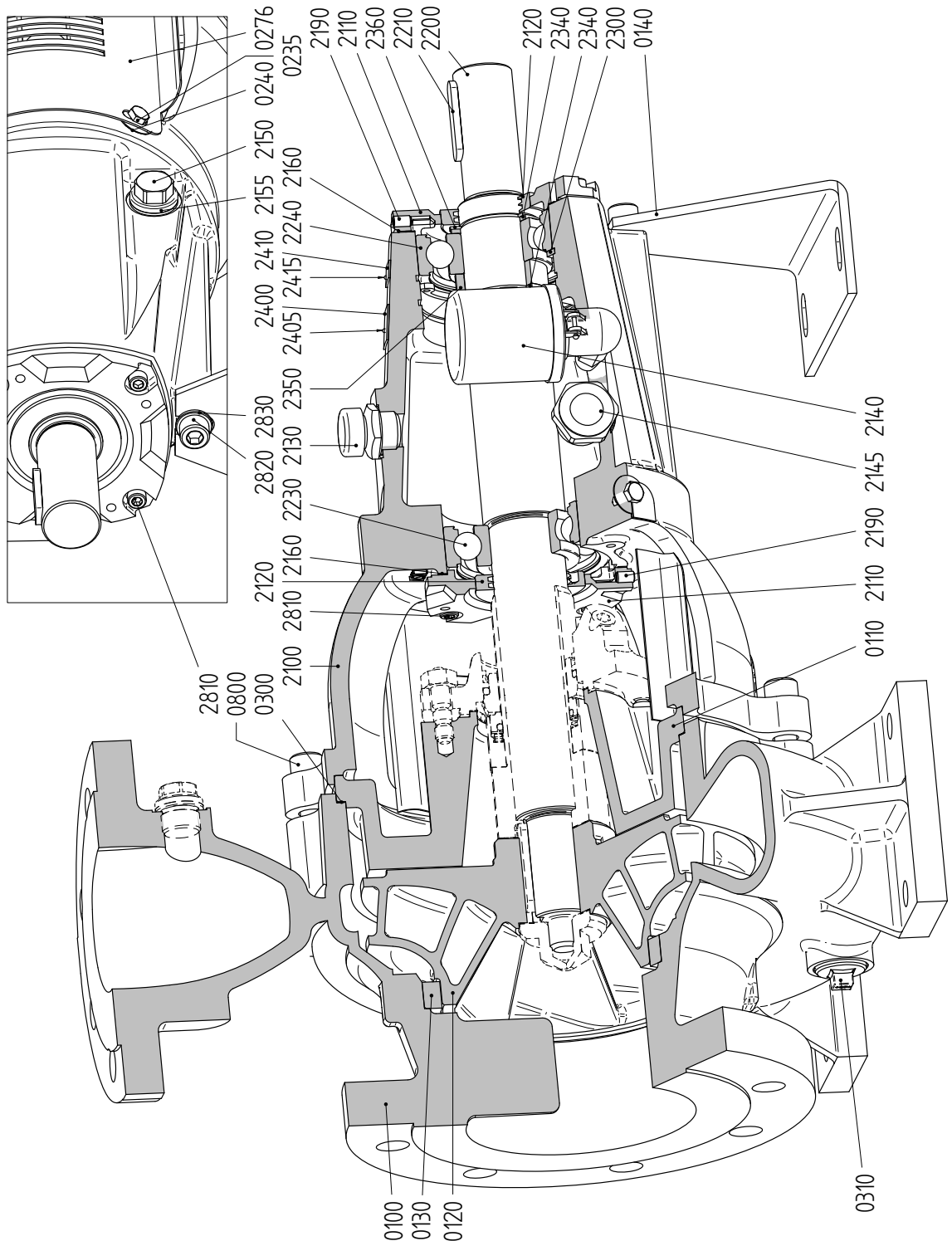


Figure 50: Sectional drawing L3 with tapered bore - bearing groups 1, 2, 3.

9.4.3 Parts list L3 - bearing groups 1, 2, 3

Item	Quantity	Description	Materials					
			G1	G2	G6	NG1	NG2	B2
0100	1	pump casing	cast iron			nodular cast iron		bronze
0110	1	pump cover	cast iron			nodular cast iron		bronze
0120*	1	impeller	c.i.	bronze	st.st.	c.i.	bronze	
0130*	1	wear ring	c.i.	bronze	st.st.	c.i.	bronze	
0140	1	bracket support	steel					
0235	4	bolt	stainless steel					
0240	4	washer	stainless steel					
0276	2	seal guard	stainless steel					
0300*	1	gasket	-					
0310	1	plug	steel					bronze
0800	4/8/12 (*)	Allen screw	steel					st.st.
2100	1	bearing bracket	cast iron					
2110	2	bearing cover	steel					
2120	2	oil catcher	bronze					
2130	1	oil filler cap	steel					
2140	1	constant level oiler	-					
2145	1	oil sight glass	-					
2150	1	magnetic drain plug	steel					
2155		gasket	gylon					
2160*		gasket	-					
2190		set screw	stainless steel					
2200*	1	pump shaft	steel alloy					st.st.
2210*	1	coupling key	steel					
2230*	1	ball bearing	-					
2240*	1	ball bearing	-					
2300*	1	inner circlip	spring steel					
2340	2	adjusting ring	steel					
2350	1	spacer sleeve	steel					
2360*	1	outer circlip	spring steel					
2400	1	name plate	stainless steel					
2405	2	rivet	stainless steel					
2410	1	arrow plate	aluminium					
2415	2	rivet	stainless steel					
2810	8	Allen screw	steel					
2820	1	Allen screw	steel					
2830	1	washer	steel					

c.i. = cast iron, st.st. = stainless steel

Item 0130: not for the pump types of bearing bracket 1, except 32-250.

(*) Quantity depends on pump type.

L3 with tapered bore only in materials G1, G2 and G6.

9.5 Pump with oil-bath lubricated bearing L4 - bearing groups 1, 2, 3

9.5.1 Sectional drawing L4 - bearing groups 1, 2, 3

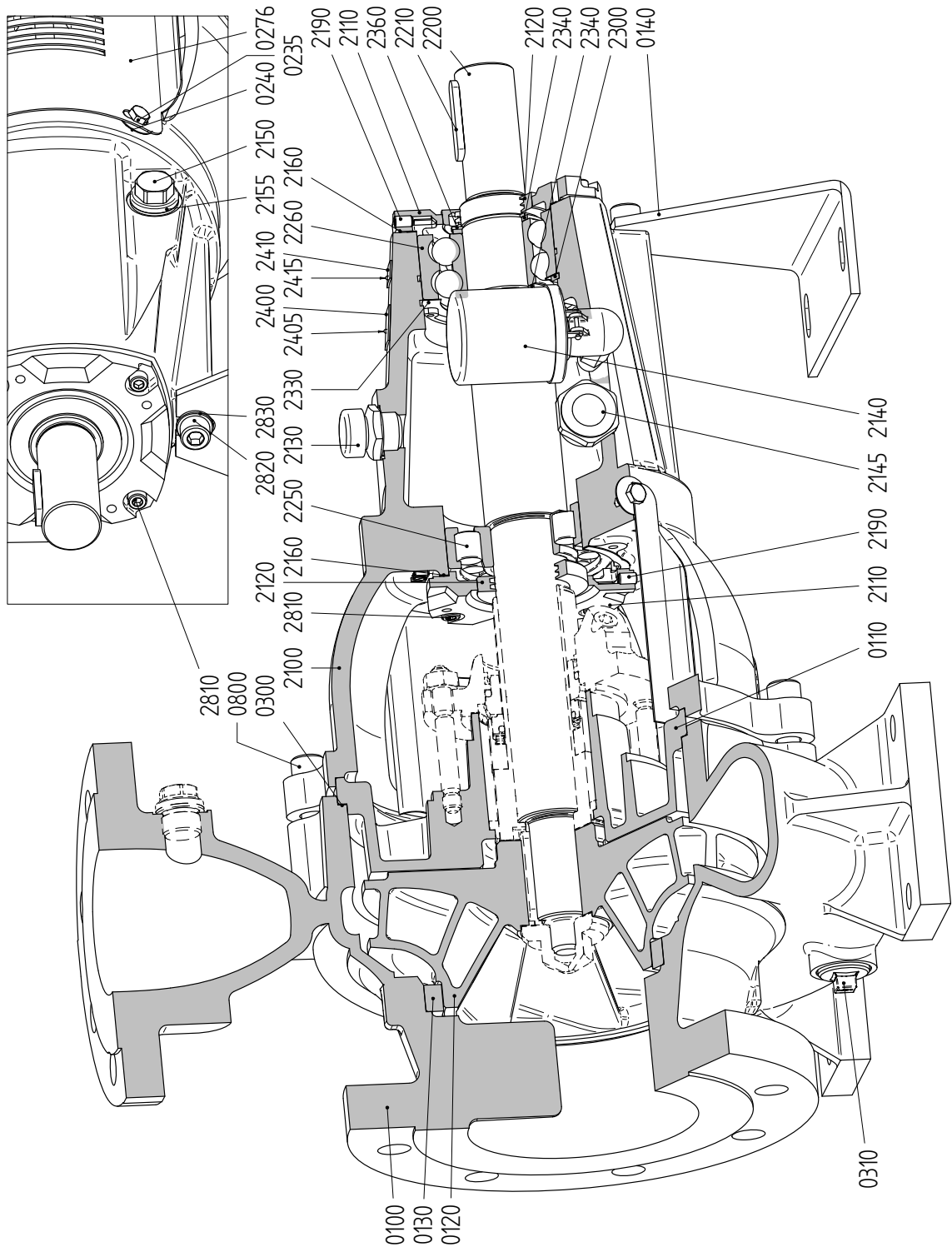


Figure 51: Sectional drawing L4 - bearing groups 1, 2, 3.

9.5.2 Sectional drawing L4 with tapered bore - bearing groups 1, 2, 3

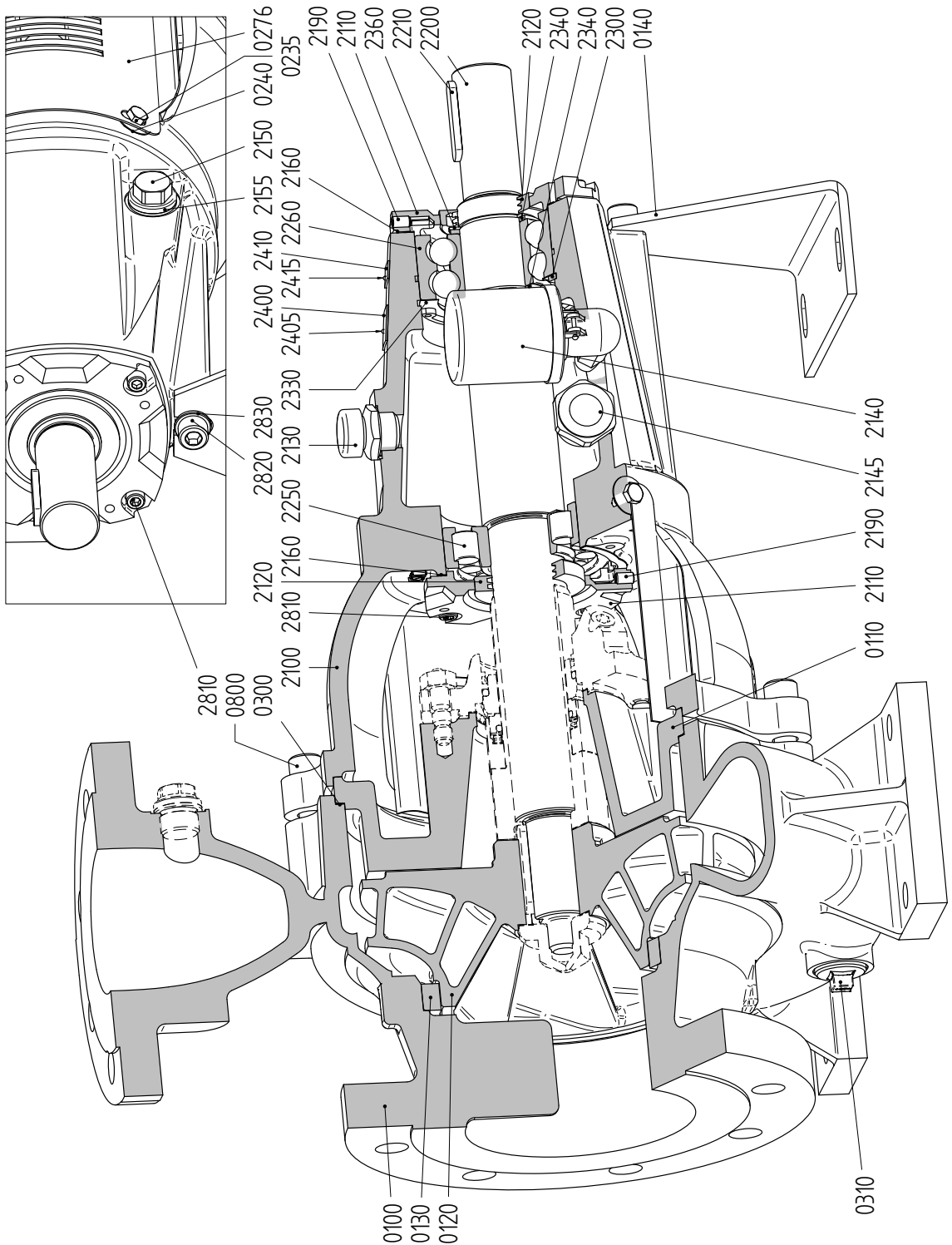


Figure 52: Sectional drawing L4 with tapered bore - bearing groups 1, 2, 3.

9.5.3 Parts list L4 - bearing groups 1, 2, 3

Item	Quantity	Description	Materials					
			G1	G2	G6	NG1	NG2	B2
0100	1	pump casing	cast iron			nodular cast iron		bronze
0110	1	pump cover	cast iron			nodular cast iron		bronze
0120*	1	impeller	c.i.	bronze	st.st.	c.i.	bronze	
0130*	1	wear ring	c.i.	bronze	st.st.	c.i.	bronze	
0140	1	bracket support	steel					
0235	4	bolt	stainless steel					
0240	4	washer	stainless steel					
0276	2	seal guard	stainless steel					
0300*	1	gasket	-					
0310	1	plug	steel					bronze
0800	4/8/12 (*)	Allen screw	steel					st.st.
2100	1	bearing bracket	cast iron					
2110	2	bearing cover	cast iron					
2120*	2	oil catcher	bronze					
2130	1	oil filler cap	steel					
2140	1	constant level oiler	-					
2145	1	oil sight glass	-					
2150	1	magnetic drain plug	steel					
2155	1	gasket	gylon					
2160*	2	gasket	-					
2190	2	set screw	stainless steel					
2200*	1	pump shaft	steel alloy					st.st.
2210*	1	coupling key	steel					
2250*	1	cylindrical roller bearing	-					
2260*	1	double row angular contact ball bearing	-					
2300*	1	inner circlip	spring steel					
2330	1	adjusting ring	steel					
2340	2	adjusting ring	steel					
2360*	1	outer circlip	spring steel					
2400	1	name plate	stainless steel					
2405	2	rivet	stainless steel					
2410	1	arrow plate	aluminium					
2415	2	rivet	stainless steel					
2810	8	Allen screw	steel					
2820	1	Allen screw	steel					
2830	1	washer	steel					

c.i. = cast iron, st.st. = stainless steel

Item 0130: not for the pump types of bearing bracket 1, except 32-250.

(*) Quantity depends on pump type.

L4 with tapered bore only in materials G1, G2 and G6.

9.6.2 Parts list L2 - bearing group 4

Item	Quantity	Description	Material				
			G1	G2	NG1	NG2	B2
0100	1	pump casing	cast iron		nodular c.i.		bronze
0110	1	pump cover	cast iron		nodular c.i.		bronze
0120*	1	impeller	c.i.	bronze	c.i.	bronze	bronze
0130*	1	wear ring	c.i.	bronze	c.i.	bronze	bronze
0140	1	bracket support	cast iron				
0235	4	bolt	stainless steel				
0240	4	washer	stainless steel				
0276	2	seal guard	stainless steel				
0300*	1	gasket	novapress				
0310	1	plug	cast iron				bronze
0330	1	plug	cast iron				bronze
0340	1	plug	cast iron				bronze
0350	1	plug	cast iron				bronze
0800	8/12/16(*)	Allen screw	steel				st.st.
0850**	12	Allen screw	steel				st.st.
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	1	grease nipple	stainless steel				
2175	1	grease nipple	stainless steel				
2176	1	socket	stainless steel				
2177	1	pipe	stainless steel				
2180	1	oil seal	rubber				
2185	1	oil seal	rubber				
2200*	1	pump shaft	steel alloy				st.st.
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				

Item	Quantity	Description	Material				
			G1	G2	NG1	NG2	B2
2415	2	rivet	stainless steel				
2560*	1	lock nut	steel				
2570*	1	locking washer	steel				
2810	4	Allen screw	steel				
2815	4	Allen screw	steel				
2820	2	bolt	steel				
2830	2	washer	steel				

c.i. = cast iron, st.st. = stainless steel

(*) Quantity depends on pump type.

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

9.7 Pump with oil-bath lubricated bearing L4 - bearing group 4

9.7.1 Sectional drawing L4 - bearing group 4

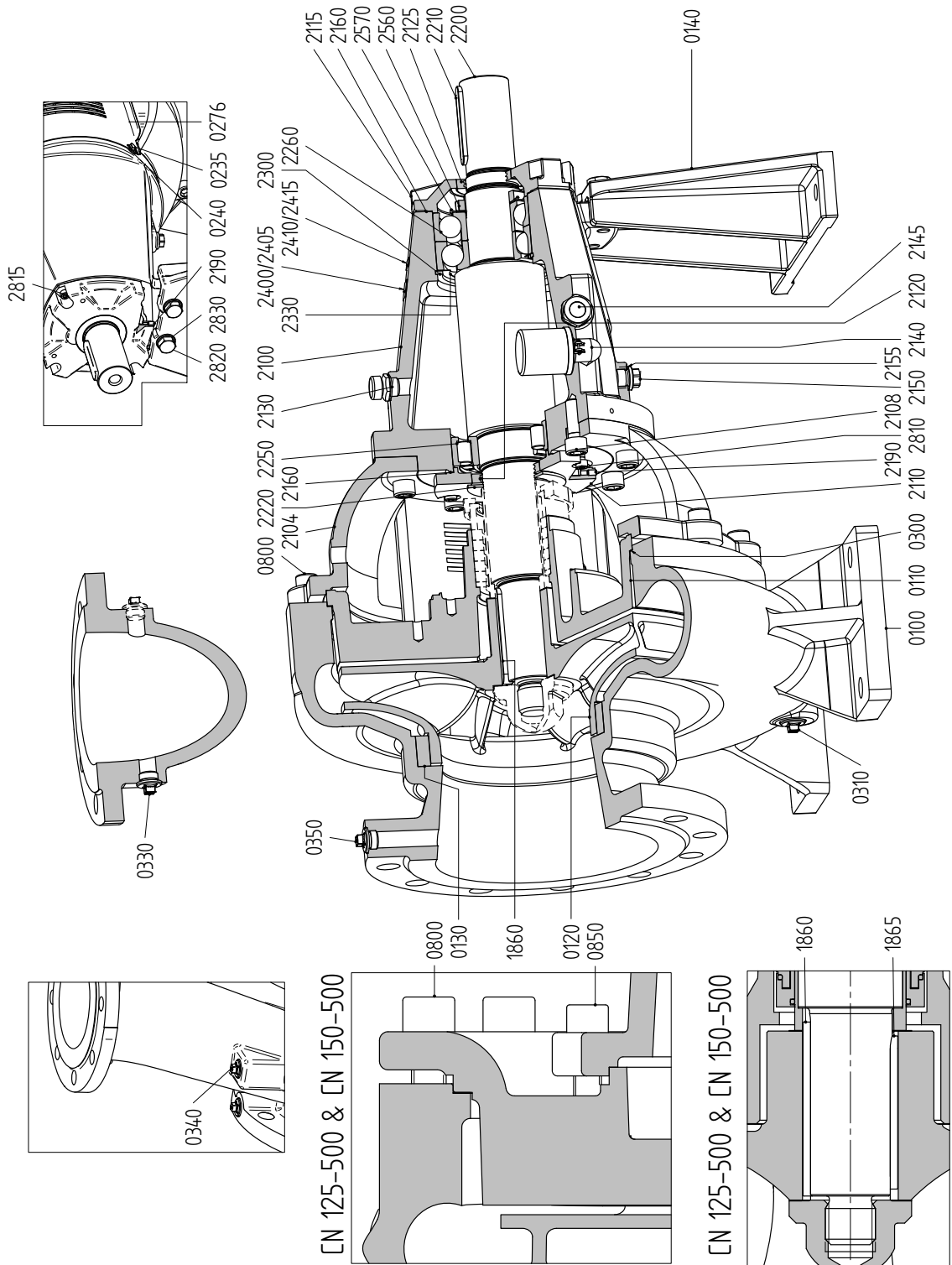


Figure 54: Sectional drawing L4 - bearing group 4.

9.7.2 Parts list L4 - bearing group 4

Item	Quantity	Description	Material					
			G1	G2	NG1	NG2	B2	
0100	1	pump casing	cast iron		nodular c.i.		bronze	
0110	1	pump cover	cast iron		nodular c.i.		bronze	
0120*	1	impeller	c.i.	bronze	c.i.	bronze	bronze	
0130*	1	wear ring	c.i.	bronze	c.i.	bronze	bronze	
0140	1	bracket support	cast iron					
0235	4	bolt	stainless steel					
0240	4	washer	stainless steel					
0276	2	seal guard	stainless steel					
0300*	1	gasket	-					
0310	1	plug	cast iron					bronze
0330	1	plug	cast iron					bronze
0340	1	plug	cast iron					bronze
0350	1	plug	cast iron					bronze
0800	8/12/16 ^(*)	Allen screw	steel					st.st.
0850**	12	Allen screw	steel					st.st.
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					
2120*	1	oil catcher	bronze					
2125*	1	oil catcher	bronze					
2130	1	oil filler cap	aluminium					
2140	1	constant level oiler	-					
2145	1	oil sight glass	-					
2150	1	plug	steel					
2160*	2	gasket	-					
2190	2	set screw	stainless steel					
2200*	1	pump shaft	steel alloy					st.st.
2210*	1	coupling key	steel					
2220*	1	deflector	rubber					
2250*	1	cylindrical roller bearing	-					
2260*	2	angular contact ball bearing	-					
2300*	1	inner circlip	spring steel					
2330	1	adjusting 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	steel					
2815	4	Allen screw	steel					
2820	2	bolt	steel					
2830	2	washer	steel					

c.i. = cast iron, st.st. = stainless steel

(*) Quantity depends on pump type.

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

9.8 Pump with bearing L5 / L6 - 25-...

9.8.1 Sectional drawing L5 / L6 - 25-...

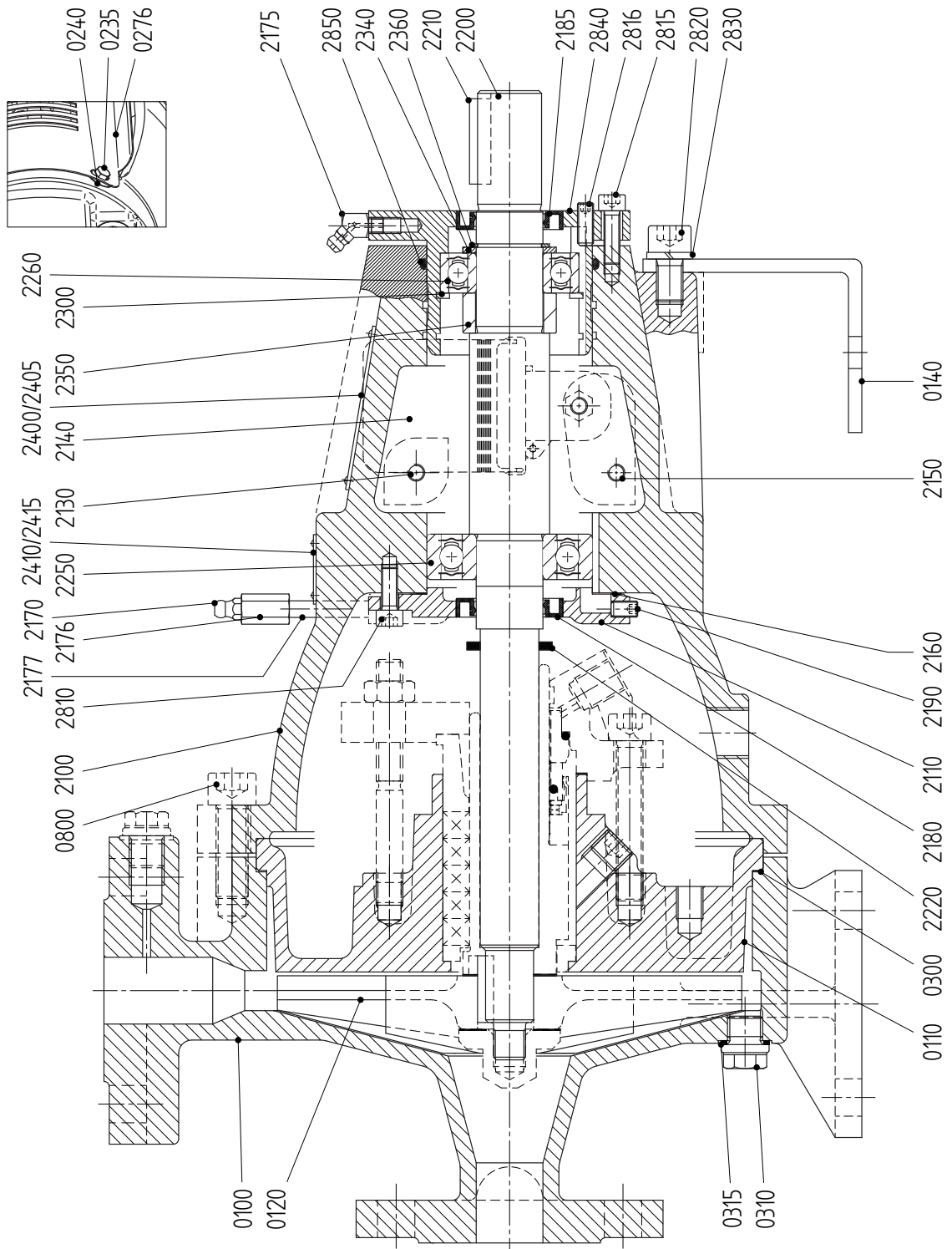


Figure 55: Sectional drawing L5 / L6 - 25-....

9.8.2 Parts list bearing L5 / L6 - 25-...

Item	Quantity		Description	Material
	L5	L6		
0100	1	1	pump casing	cast iron
0110	1	1	pump cover	cast iron
0120*	1	1	impeller	cast iron
0140	1	1	bracket support	steel
0325	4	4	bolt	stainless steel
0240	4	4	washer	stainless steel
0276	2	2	seal guard	stainless steel
0300*	1	1	gasket	- -
0310	1	1	plug	stainless steel
0315	1	1	sealing ring	gylon
0800	4	4	Allen screw	stainless steel
2100	1	1	bearing bracket	cast iron
2110	1	1	bearing cover	cast iron
2130	1	1	plug	plastic
2140	1	-	plug	steel
2140	-	1	constant level oiler	-
2150	1	1	plug	steel
2160*	-	1	gasket	-
2170	1	-	grease nipple	stainless steel
2175	1	-	grease nipple	stainless steel
2176	1	-	socket	stainless steel
2177	1	-	pipe	stainless steel
2180*	2	2	oil seal	NBR
2190	-	2	set screw	stainless steel
2200	1	1	pump shaft	stainless steel
2210	1	1	coupling key	steel
2220	1	1	deflector	rubber
2250	1	1	ball bearing	-
2260	1	1	ball bearing	-
2300	1	1	inner circlip	spring steel
2340	1	1	adjusting ring	steel
2350	1	1	spacer sleeve	steel
2360	1	1	outer circlip	spring steel
2400	1	1	name plate	stainless steel
2405	2	2	rivet	stainless steel
2410	1	1	arrow plate	aluminium
2415	2	2	rivet	stainless steel
2810	4	4	Allen screw	stainless steel
2815	4	4	Allen screw	stainless steel
2816	4	4	set screw	stainless steel
2820	1	1	Allen screw	stainless steel
2830	1	1	washer	stainless steel
2840	1	1	bearing holder	cast iron
2850	-	1	O-ring	NBR

9.9 Stuffing box packing S1

9.9.1 Stuffing box packing S1

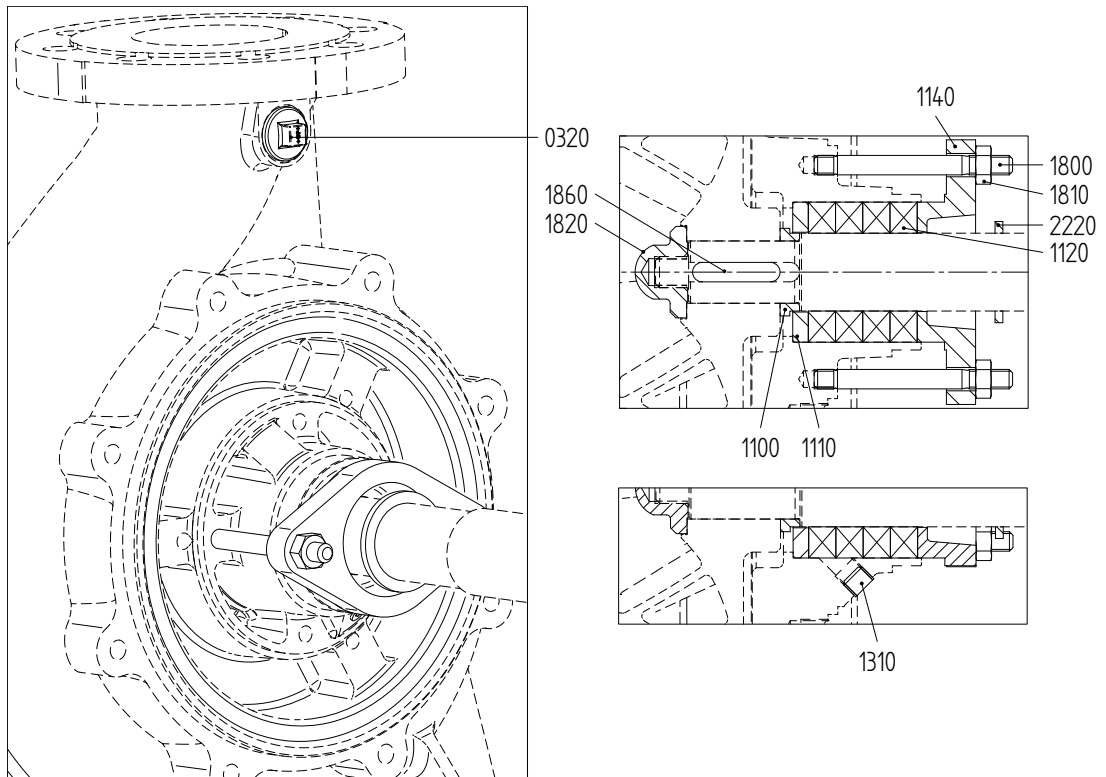


Figure 56: Stuffing box packing S1.

9.9.2 Parts list stuffing box packing S1

Item	Quantity	Description	Materials
0320	1	plug	steel
1100	1	spacer sleeve	steel alloy
1110*	1	bottom ring	brass
1120*	4	packing ring	-
1140	1	gland	cast iron
1310	1	plug	steel
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
2220*	1	deflector	rubber

9.10 Stuffing box packing S1 for 200-160 / 300-200

9.10.1 Stuffing box packing S1 for 200-160 / 300-200

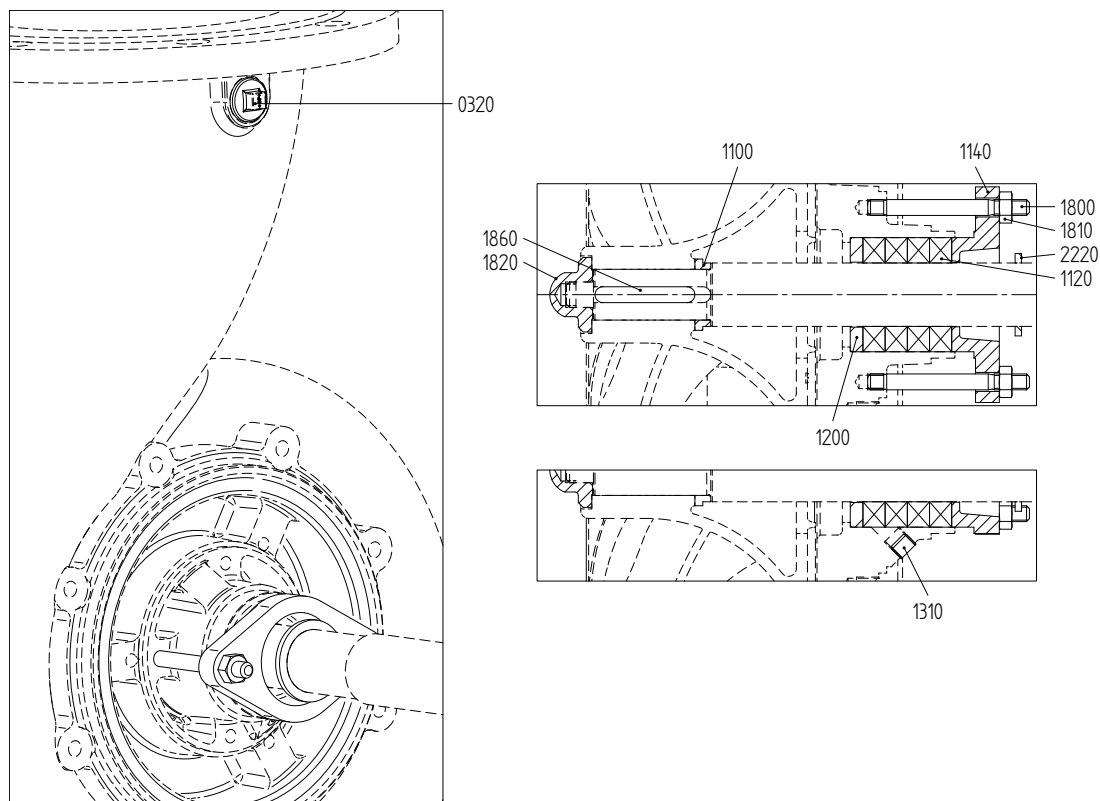


Figure 57: Stuffing box packing S1 for 200-160 / 300-200.

9.10.2 Parts list stuffing box packing S1 for 200-160 / 300-200

Item	Quantity	Description	Materials
0320	1	plug	steel
1100	1	spacer sleeve	steel alloy
1110*	1	bottom ring	brass
1120*	4	packing ring	--
1140	1	gland	cast iron
1310	1	plug	steel
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
2220*	1	deflector	rubber

9.11 Stuffing box packing S2

9.11.1 Stuffing box packing S2

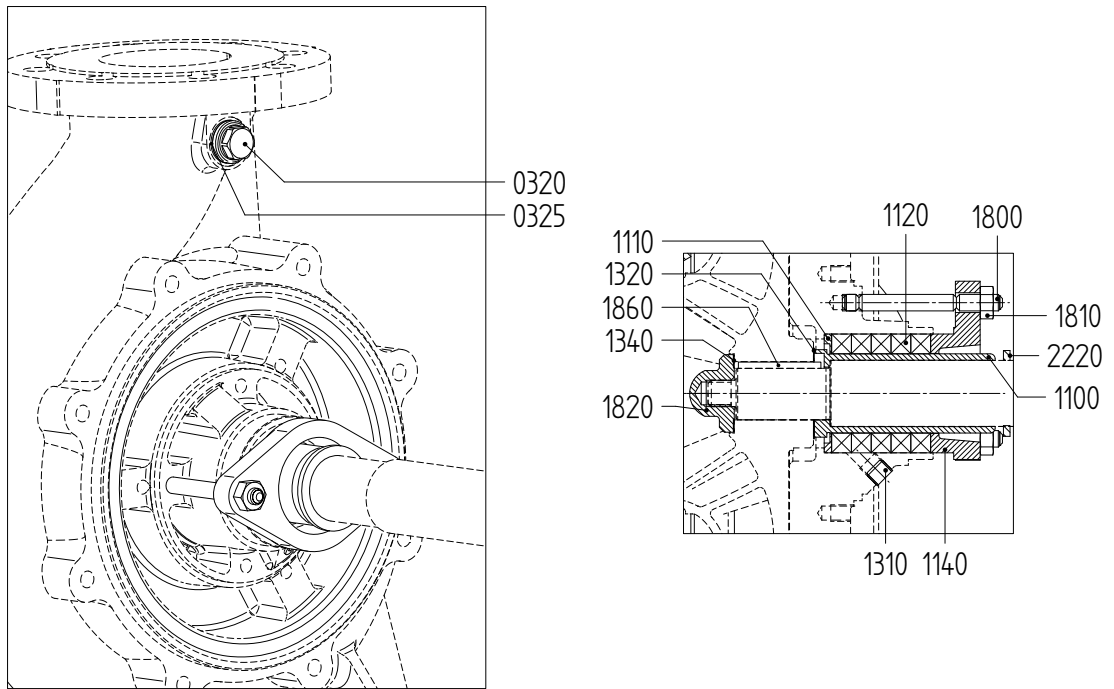


Figure 58: Stuffing box packing S2.

9.11.2 Parts list stuffing box packing S2

Item	Quantity	Description	Material	
			cast iron	bronze
0320	1	plug	steel	bronze
0325	1	sealing ring	copper	
1100*	1	shaft sleeve	stainless steel	
1110*	1	bottom ring	bronze	
1120*	5	packing ring	-	
1140	1	gland	cast iron	bronze
1310	1	plug	steel	stainless steel
1320*	1	gasket	-	
1340*	1	gasket	-	
1800	2	stud	stainless steel	
1810	2	nut	brass	
1820*	1	cap nut	stainless steel	
1860*	1	key	stainless steel	
2220*	1	deflector	rubber	

9.12 Stuffing box packing S2 for 200-160 / 300-200

9.12.1 Stuffing box packing S2 for 200-160 / 300-200

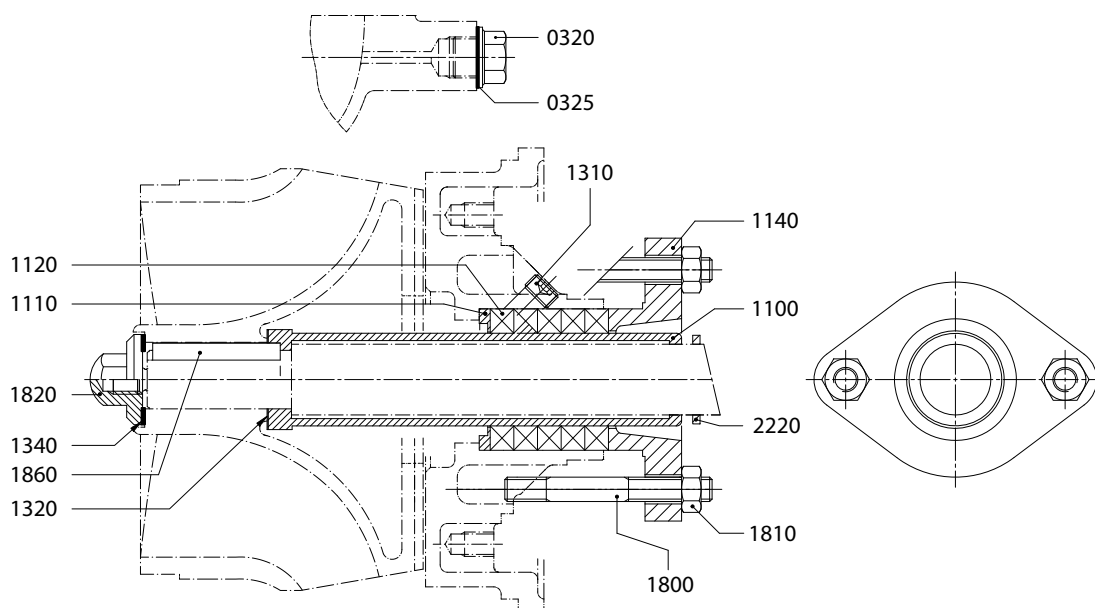


Figure 59: Stuffing box packing S2 for 200-160 / 300-200.

9.12.2 Parts list stuffing box packing S2 for 200-160 / 300-200

Item	Quantity	Description	Materials
1100*	1	shaft sleeve	stainless steel
1110*	1	bottom ring	bronze
1120*	5	packing ring	-
1140	1	gland	cast iron
1310	1	plug	steel
1320*	1	gasket	-
1340*	1	gasket	-
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
2220*	1	deflector	rubber

9.13 Stuffing box packing S3

9.13.1 Stuffing box packing S3

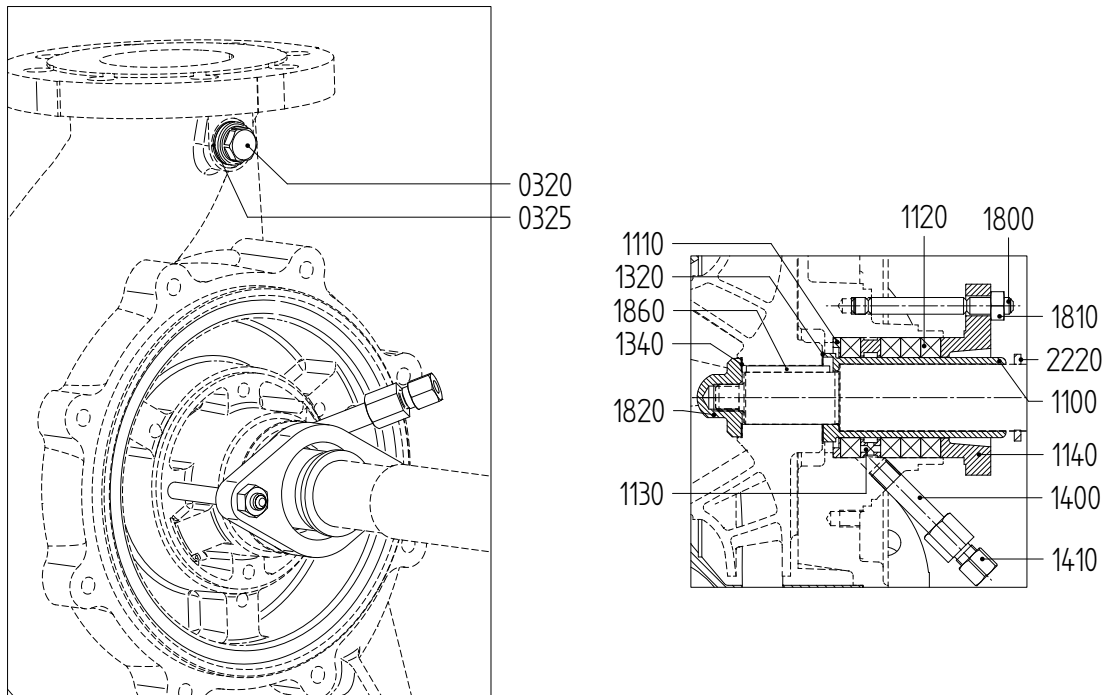


Figure 60: Stuffing box packing S3.

9.13.2 Parts list stuffing box packing S3

Item	Quantity	Description	Material	
			cast iron	bronze
0320	1	plug	steel	stainless steel
0325	1	sealing ring	copper	
1100*	1	shaft sleeve	stainless steel	
1110*	1	bottom ring	bronze	
1120*	4	packing ring	-	
1130*	1	lantern ring	bronze	
1140	1	gland	cast iron	bronze
1320*	1	gasket	-	
1340*	1	gasket	-	
1400	1	pipe nipple	steel	stainless steel
1410	1	pipe union	brass	
1800	2	stud	stainless steel	
1810	2	nut	brass	
1820*	1	cap nut	stainless steel	
1860*	1	key	stainless steel	
2220*	1	deflector	rubber	

9.14 Stuffing box packing S3 for 200-160 / 300-200

9.14.1 Stuffing box packing S3 for 200-160 / 300-200

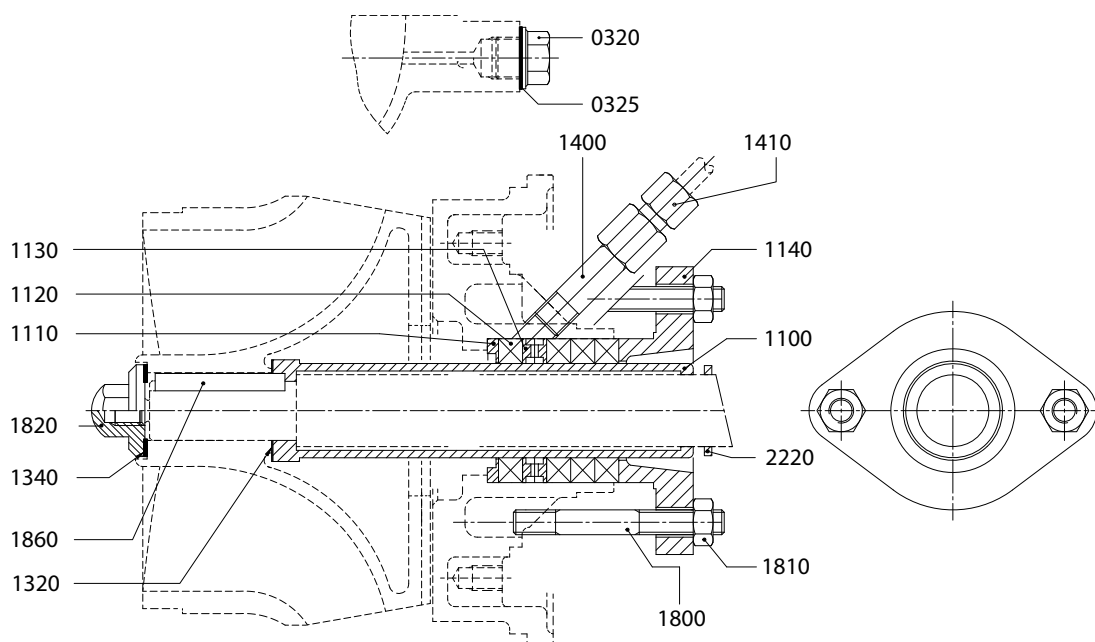


Figure 61: Stuffing box packing S3 for 200-160 / 300-200.

9.14.2 Parts list stuffing box packing S3 for 200-160 / 300-200

Item	Quantity	Description	Materials
1100*	1	shaft sleeve	stainless steel
1110*	1	bottom ring	bronze
1120*	4	packing ring	-
1130*	1	lantern ring	bronze
1140	1	gland	bronze
1320*	1	gasket	-
1340*	1	gasket	-
1400	1	pipe nipple	stainless steel
1410	1	pipe union	brass
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
2220*	1	deflector	rubber

9.15 Stuffing box packing S2 - S3 for bearing group 4

9.15.1 Stuffing box packing S2 - S3 for bearing group 4

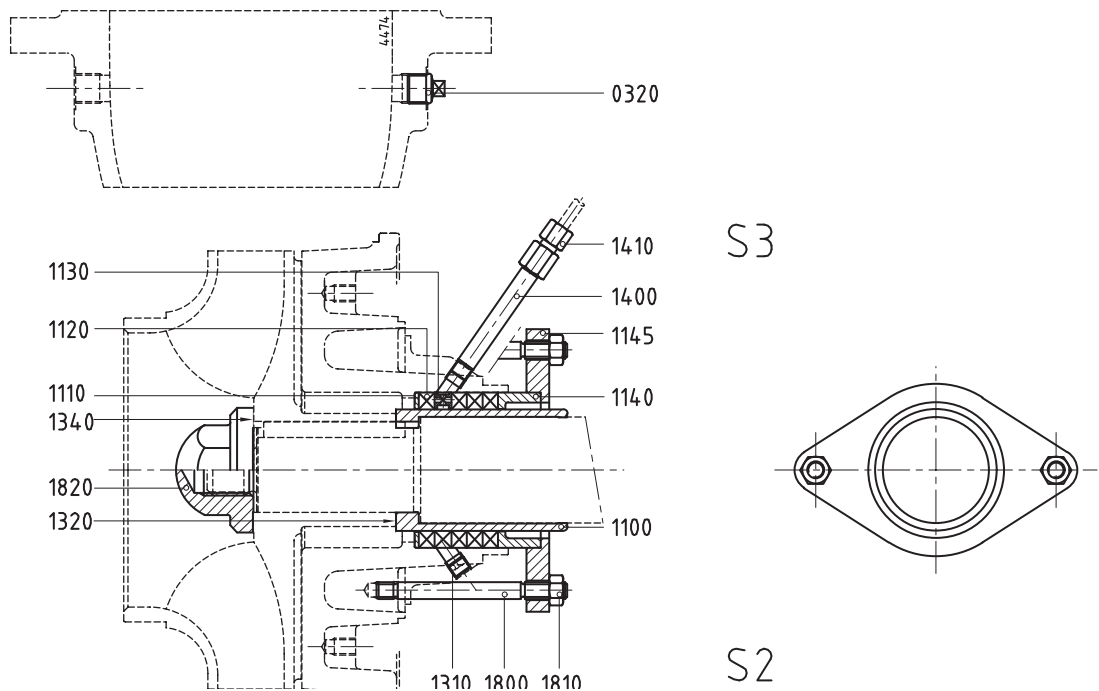


Figure 62: Stuffing box packing S2 - S3 for bearing group 4.

9.15.2 Parts list stuffing box packing S2 - S3 for bearing group 4

Item	Quantity		Description	Material	
	S2	S3		cast iron	bronze
0320	1	1	plug	cast iron	bronze
1100*	1	1	shaft sleeve	stainless steel	
1110*	1	1	bottom ring	bronze	
1120*	5	4	packing ring	-	
1130*	-	1	lantern ring	bronze	
1140	1	1	gland split	cast iron	bronze
1145	1	1	gland cap	cast iron	
1310	1	-	plug	steel	stainless steel
1320*	1	1	gasket	-	
1340*	1	1	gasket	-	
1400	-	1	pipe nipple	steel	stainless steel
1410	-	1	pipe union	brass	
1800	2	2	stud	stainless steel	
1810	2	2	nut	brass	stainless steel
1820*	1	1	cap nut	stainless steel	

9.16 Stuffing box packing S4

9.16.1 Stuffing box packing S4

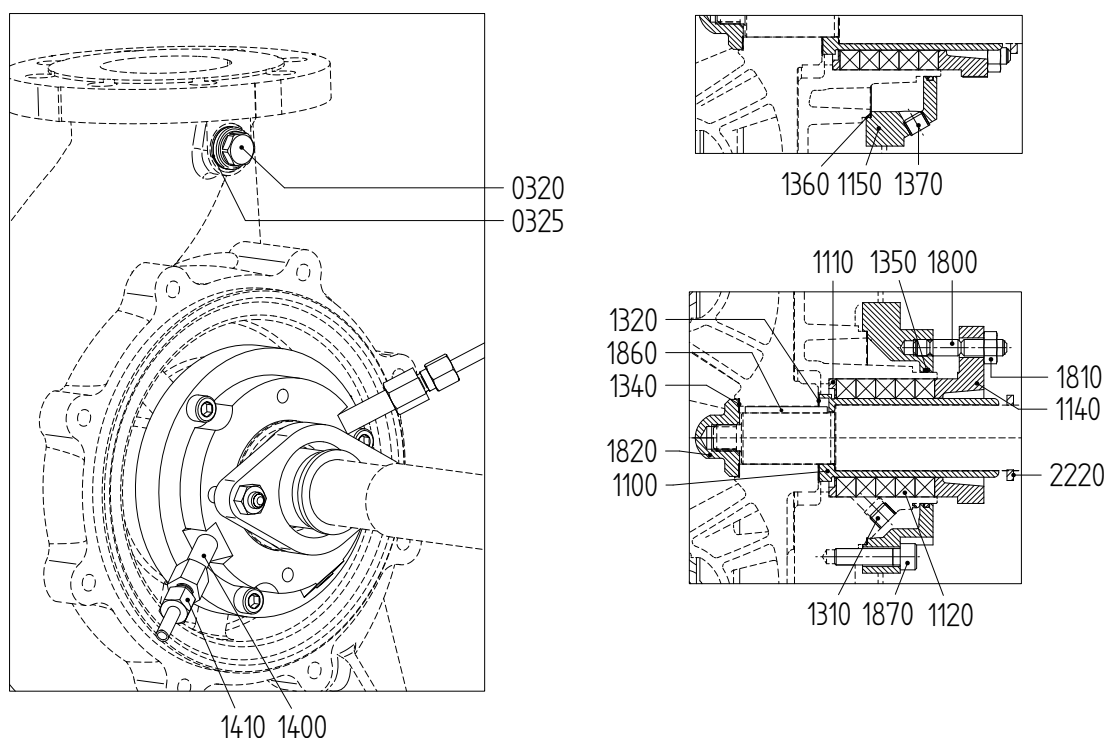


Figure 63: Stuffing box packing S4.

9.16.2 Parts list stuffing box packing S4

Item	Quantity	Description	Material
0320	1	plug	steel
0325	1	sealing ring	copper
1100*	1	shaft sleeve	stainless steel
1110*	1	bottom ring	bronze
1120*	5	packing ring	-
1140	1	gland	cast iron
1150	1	cooling jacket	cast iron
1310	1	plug	steel
1320*	1	gasket	-
1340*	1	gasket	-
1350*	1	O-ring	rubber
1360*	1	gasket	-
1370	1	plug	steel
1400	2	pipe nipple	steel
1410	2	pipe union	brass
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
1870	3	Allen screw	steel
2220*	1	deflector	rubber

9.17 Stuffing box packing S4 for 200-160 / 300-200

9.17.1 Stuffing box packing S4 for 200-160 / 300-200

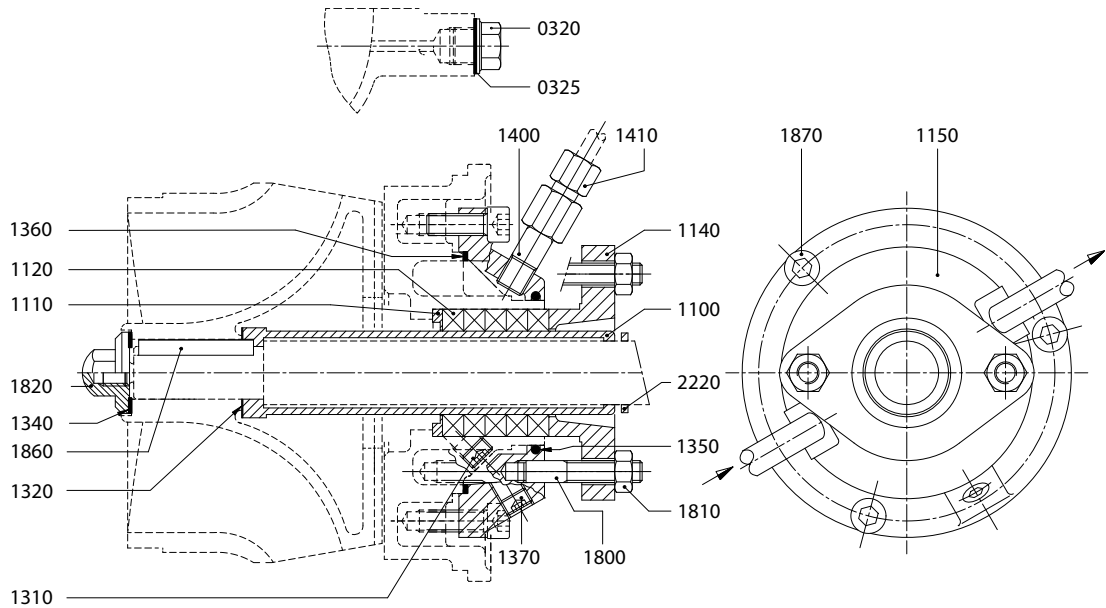


Figure 64: Stuffing box packing S4 for 200-160 / 300-200.

9.17.2 Parts list stuffing box packing S4 for 200-160 / 300-200

Item	Quantity	Description	Materials
1100*	1	shaft sleeve	stainless steel
1110*	1	bottom ring	bronze
1120*	5	packing ring	-
1140	1	gland	cast iron
1150	1	cooling jacket	cast iron
1310	1	plug	steel
1320*	1	gasket	-
1340*	1	gasket	-
1350*	1	O-ring	rubber
1360*	1	gasket	-
1370	1	plug	steel
1400	2	pipe nipple	steel
1410	2	pipe union	brass
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel
1870	3	Allen screw	steel
2220*	1	deflector	rubber

9.18 Stuffing box packing S4 - bearing group 4

9.18.1 Stuffing box packing S4 - bearing group 4

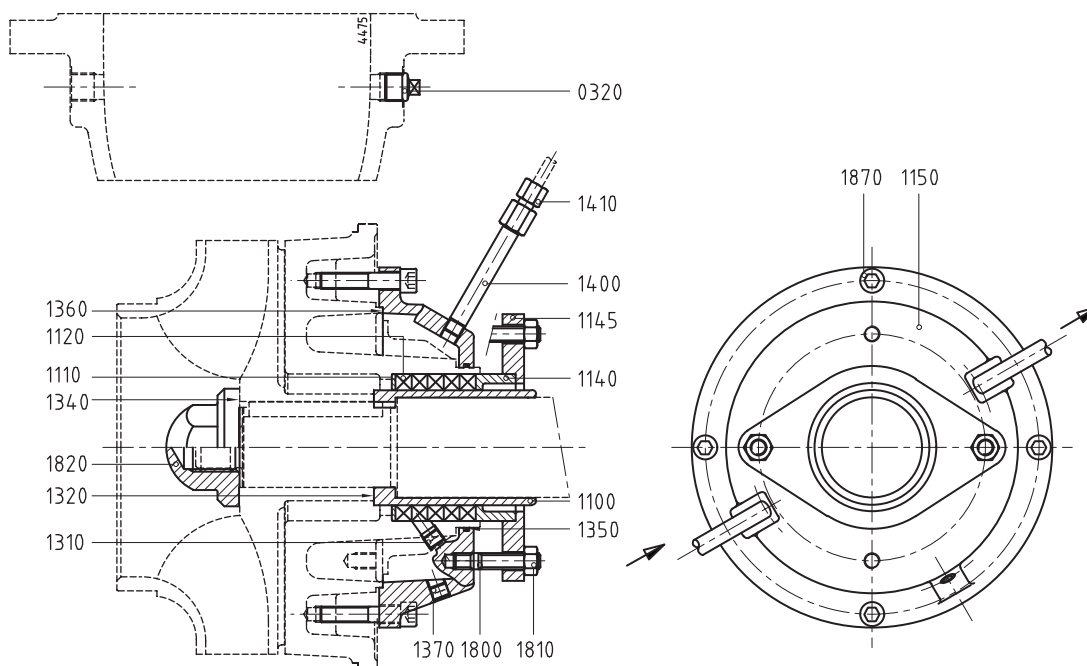


Figure 65: Stuffing box packing S4 - bearing group 4.

9.18.2 Parts list stuffing box packing S4 - bearing group 4

Item	Quantity	Description	Material
0320	1	plug	cast iron
1100*	1	shaft sleeve	stainless steel
1110*	1	bottom ring	bronze
1120*	5	packing ring	-
1140	1	gland split	cast iron
1145	1	gland cap	cast iron
1150	1	cooling jacket	cast iron
1310	1	plug	steel
1320*	1	gasket	-
1340*	1	gasket	-
1350*	1	O-ring	rubber
1360*	1	gasket	-
1370	1	plug	steel
1400	2	pipe nipple	steel
1410	2	pipe union	brass
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	cap nut	stainless steel
1870	4	Allen screw	steel

9.19 Shaft sealing group M1

9.19.1 Mechanical seal MG12-G60

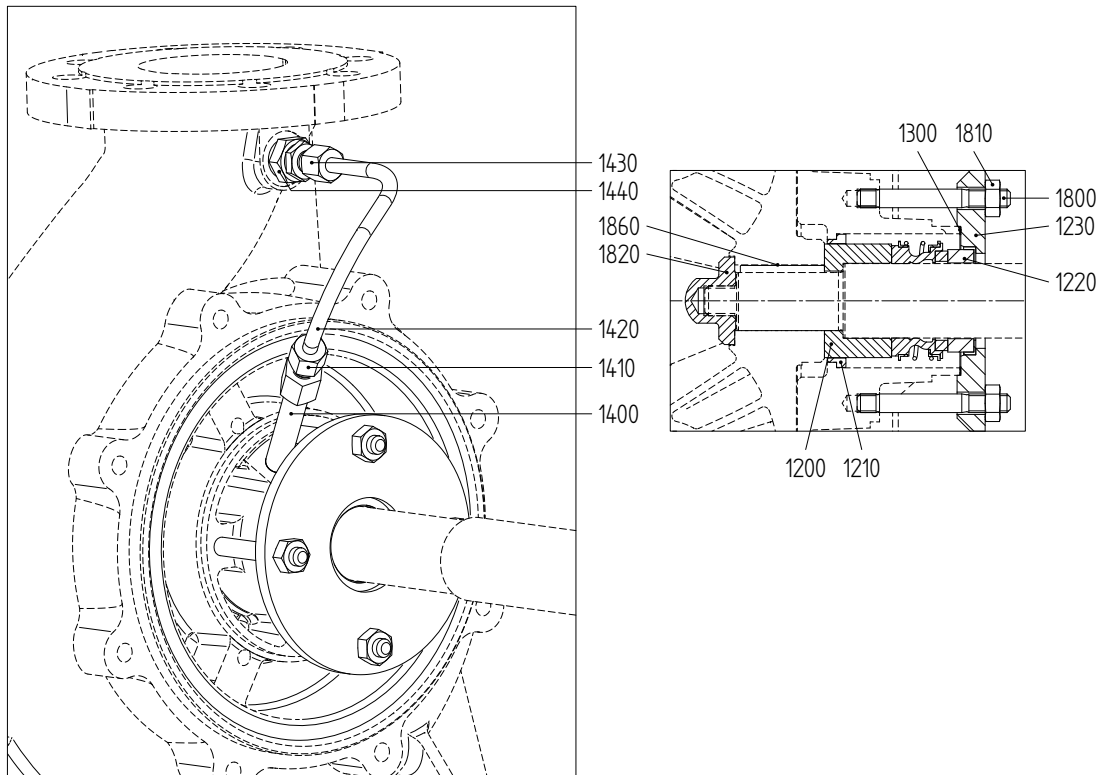


Figure 66: Mechanical seal MG12-G60.

9.19.2 Parts list mechanical seal MG12-G60

Item	Quantity	Description	Materials
1200*	1	shaft sleeve	brass
1210*	1	throttling bush	bronze
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	cast iron
1300*	1	gasket	-
1400	1	pipe nipple	steel
1410	1	pipe union	stainless steel
1420	1	pipe	stainless steel
1430	1	pipe union	brass
1440	1	extension piece	stainless steel
1800	4	stud	stainless steel
1810	4	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel

9.19.3 Mechanical seal MG12-G60 with tapered bore

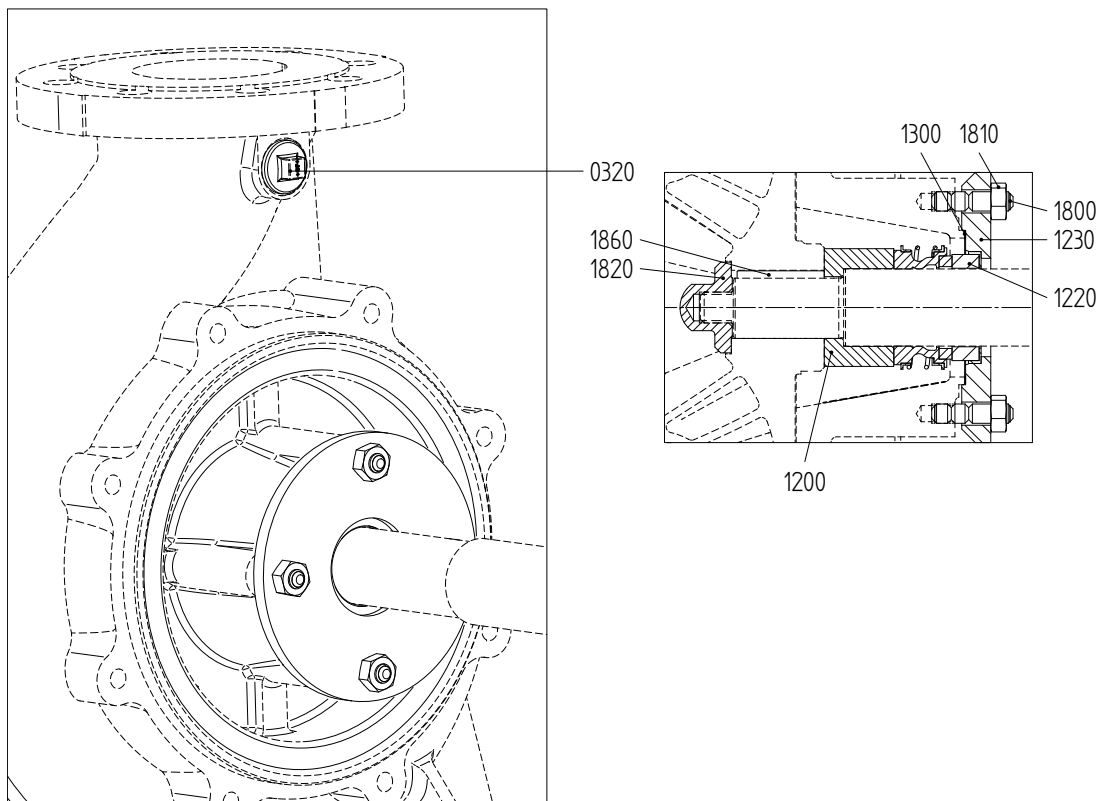


Figure 67: Mechanical seal MG12-G60.

9.19.4 Parts list mechanical seal MG12-G60 with tapered bore

Item	Quantity	Description	Materials
0320	1	plug	steel
1200*	1	shaft sleeve	brass
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	cast iron
1300*	1	gasket	-
1800	4	stud	stainless steel
1810	4	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel

9.20 Shaft sealing group M1 for 200-160 / 300-200

9.20.1 Mechanical seal MG12-G60 for 200-160 / 300-200

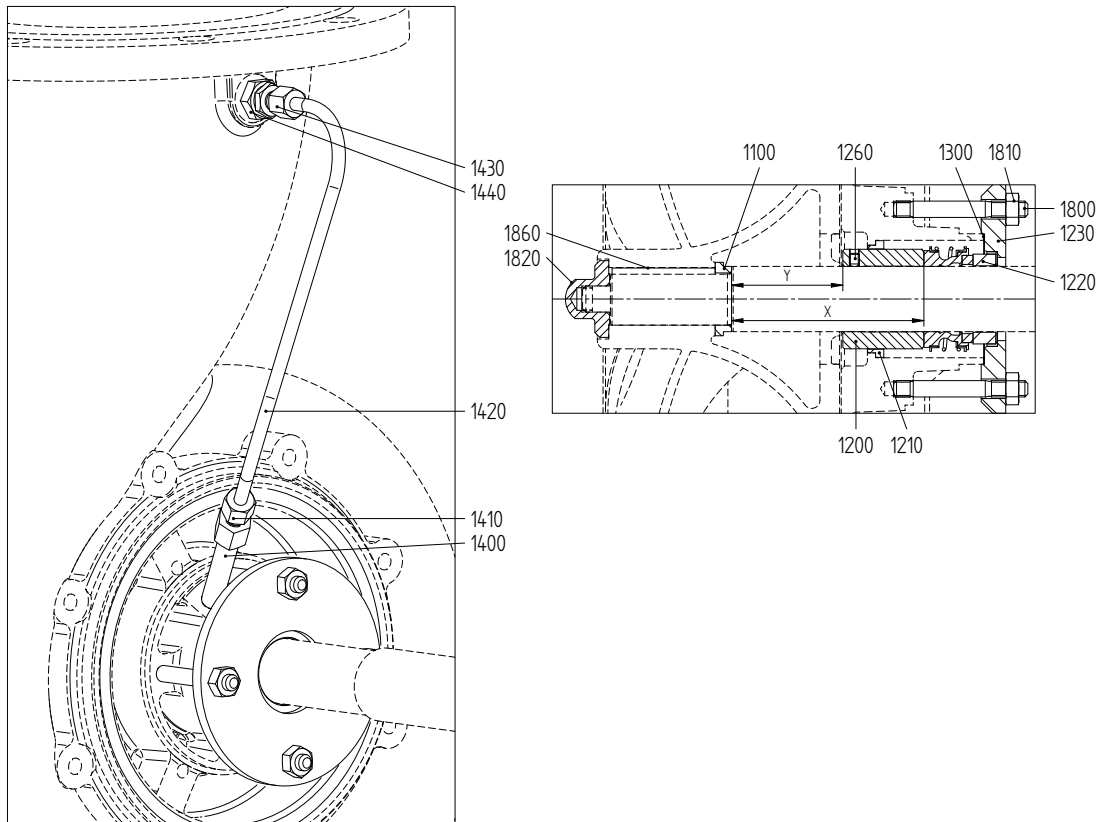


Figure 68: Mechanical seal MG12-G60 for 200-160 / 300-200.

9.20.2 Parts list mechanical seal MG12-G60 for 200-160 / 300-200

Item	Quantity	Description	Materials
1100	1	spacer sleeve	steel alloy
1200*	1	shaft sleeve	bronze
1210*	1	throttling bush	bronze
1220*	1	mechanical seal	- -
1230	1	mechanical seal cover	cast iron
1260*	2	set screw	stainless steel
1300	1	gasket	- -
1400	1	pipe nipple	steel
1410	1	pipe union	brass
1420	1	pipe	copper
1430	1	pipe union	brass
1440	1	extension piece	stainless steel
1800	4	stud	stainless steel
1810	4	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel

9.20.3 Mechanical seal MG12-G60 with tapered bore for 200-160 / 300-200

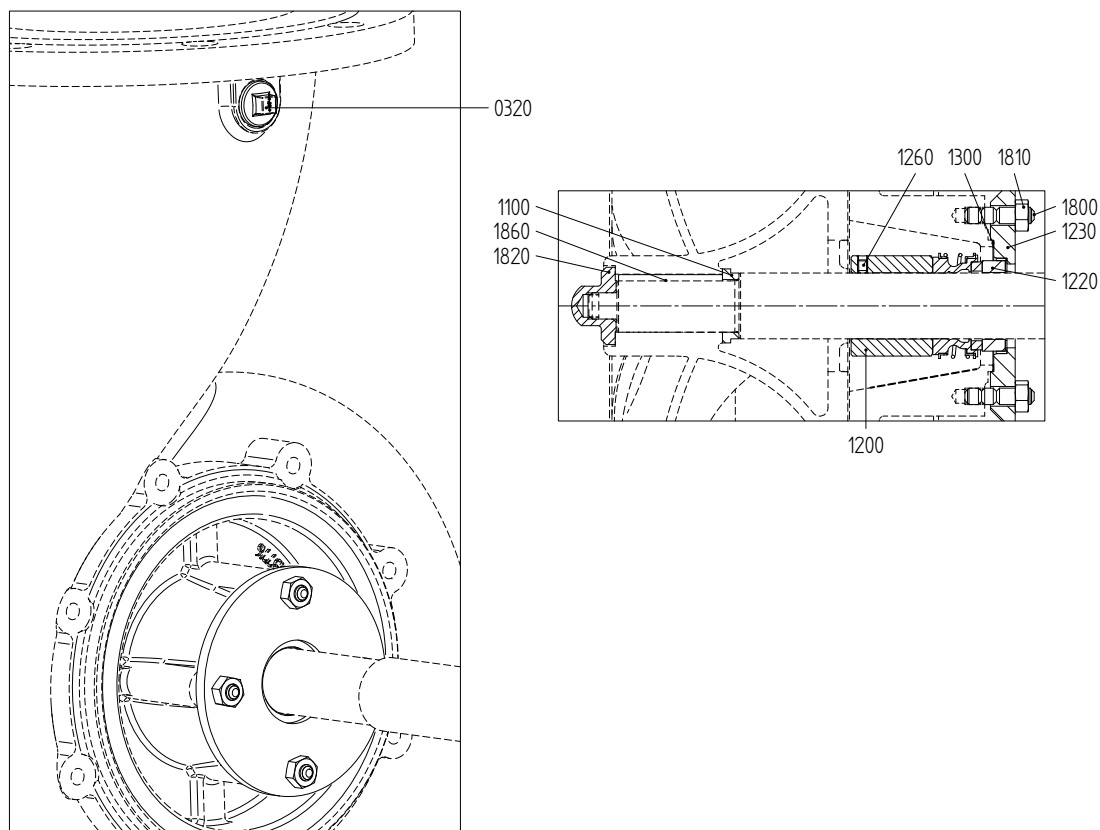


Figure 69: Mechanical seal MG12-G60 for 200-160 / 300-200.

9.20.4 Parts list mechanical seal MG12-G60 with tapered bore for 200-160 / 300-200

Item	Quantity	Description	Materials
0320	1	plug	steel
1100	1	spacer sleeve	steel alloy
1200*	1	shaft sleeve	bronze
1220*	1	mechanical seal	- -
1230	1	mechanical seal cover	cast iron
1260*	2	set screw	stainless steel
1300	1	gasket	- -
1800	4	stud	stainless steel
1810	4	nut	brass
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel

9.21 Shaft sealing group M2

9.21.1 Mechanical seal M7N

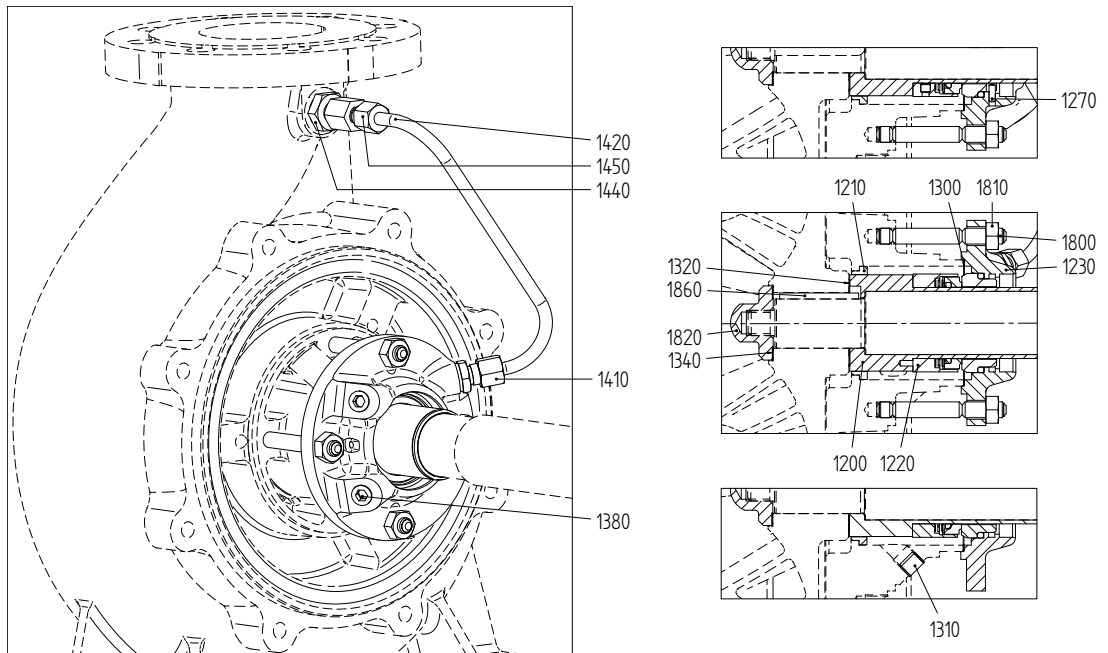


Figure 70: Mechanical seal M7N.

9.21.2 Mechanical seal MG12-G60

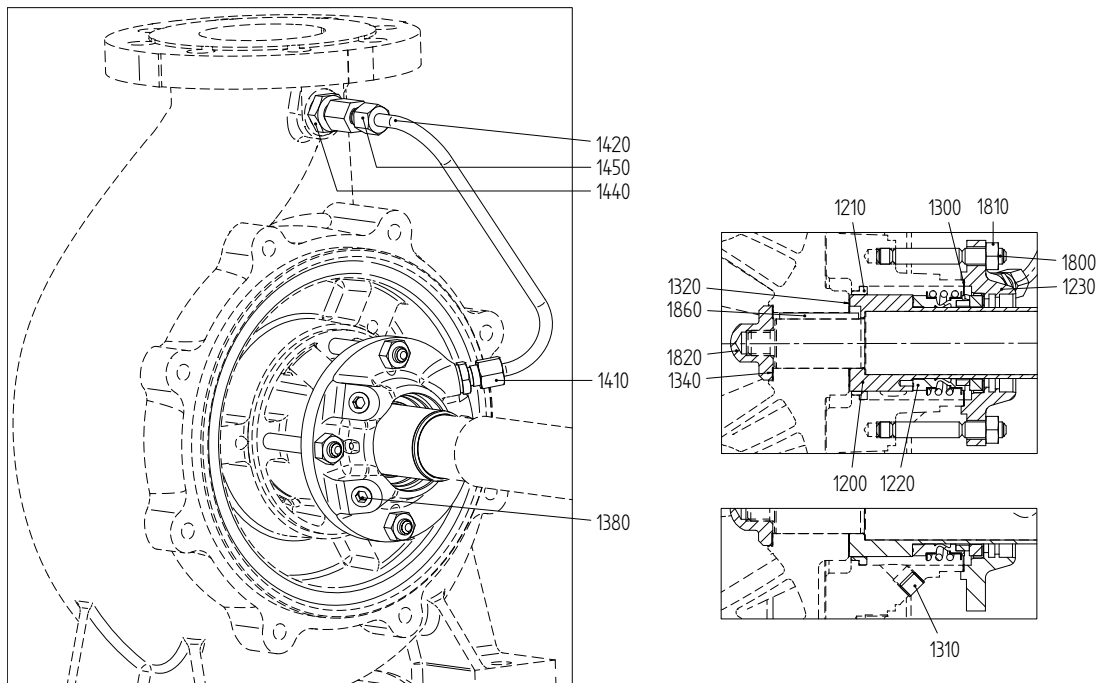


Figure 71: Mechanical seal MG12-G60.

9.21.3 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
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	key	stainless steel

Item 1270 only for M7N.

9.21.4 Mechanical seal M7N with tapered bore

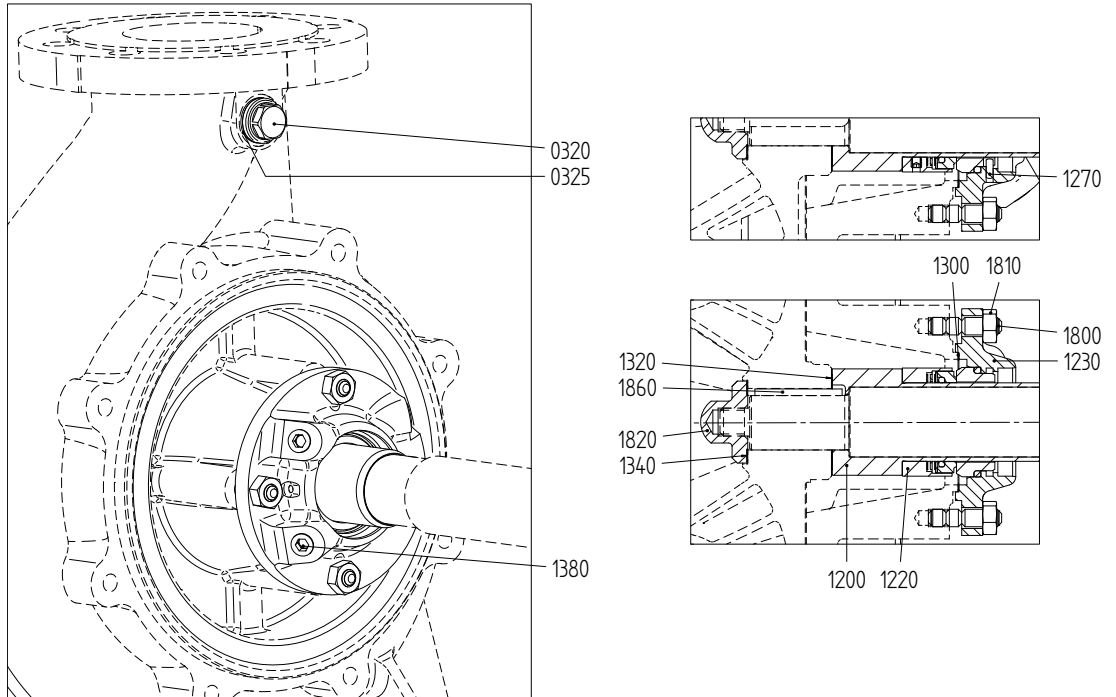


Figure 72: Mechanical seal M7N.

9.21.5 Mechanical seal MG12-G60 with tapered bore

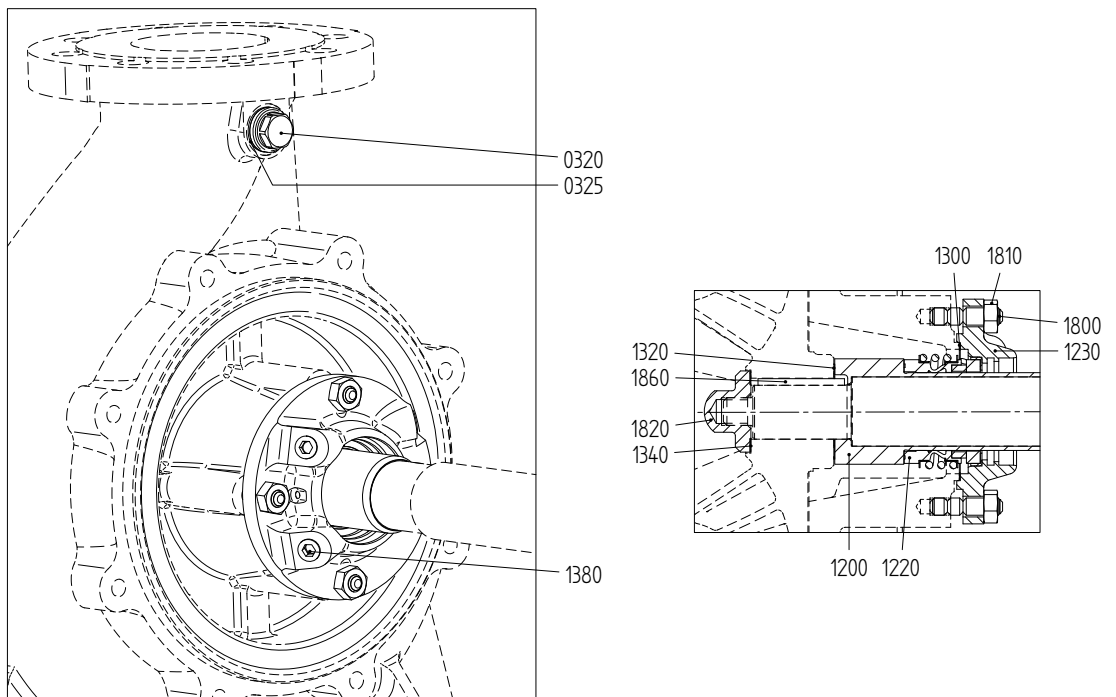


Figure 73: Mechanical seal MG12-G60.

9.21.6 Parts list shaft sealing group M2 with tapered bore

Item	Quantity	Description	Material
0320	1	plug	stainless steel
0325	1	sealing ring	PTFE
1200*	1	shaft sleeve	stainless steel
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	stainless steel
1270	1	locking pin	stainless steel
1300*	1	gasket	-
1320*	1	gasket	-
1340*	1	gasket	-
1380	3	plug	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel

Item 1270 only for M7N.

9.21.7 Mechanical seal M7N with tapered bore and plan 11

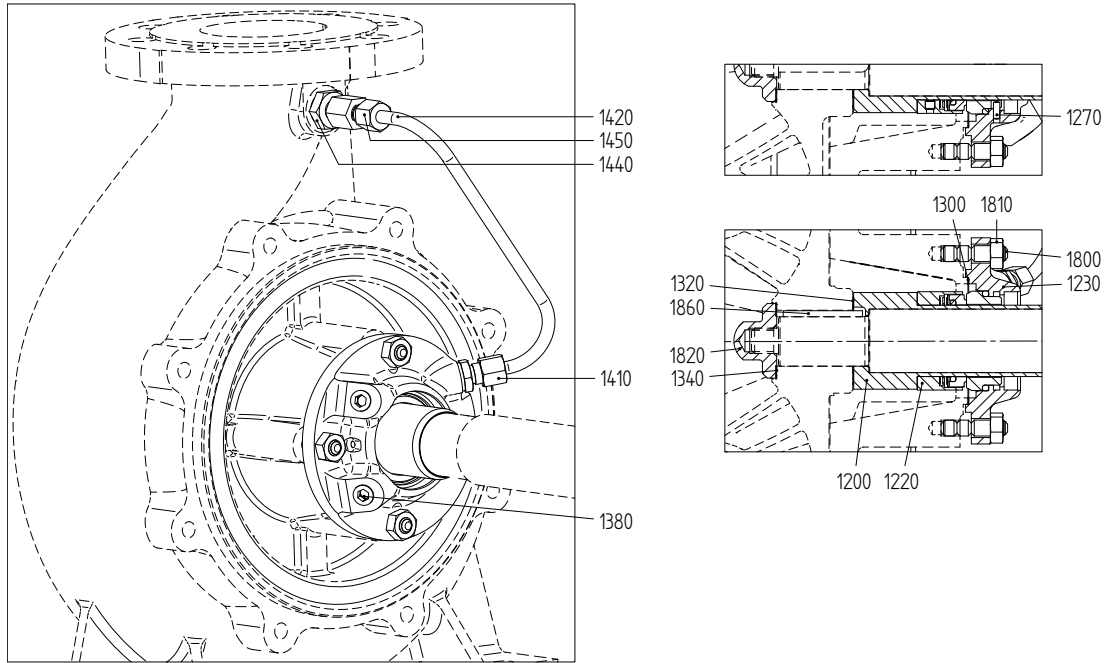


Figure 74: Mechanical seal M7N.

9.21.8 Mechanical seal MG12-G60 with tapered bore and plan 11

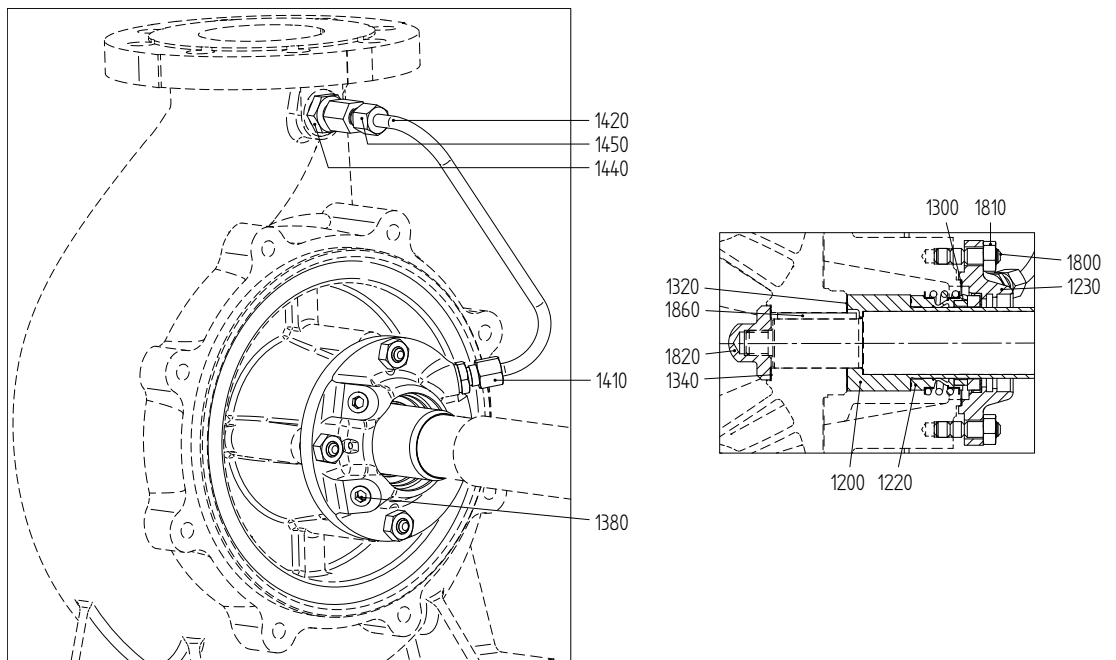


Figure 75: Mechanical seal MG12-G60.

9.21.9 Parts list shaft sealing group M2 with tapered bore and plan 11

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1220*	1	mechanical seal	-
1230	1	mechanical seal cover	stainless steel
1270	1	locking pin	stainless steel
1300*	1	gasket	-
1320*	1	gasket	-
1340*	1	gasket	-
1380	2	plug	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
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel

Item 1270 only for M7N.

9.22 Shaft sealing group M3

9.22.1 Mechanical seal HJ92N

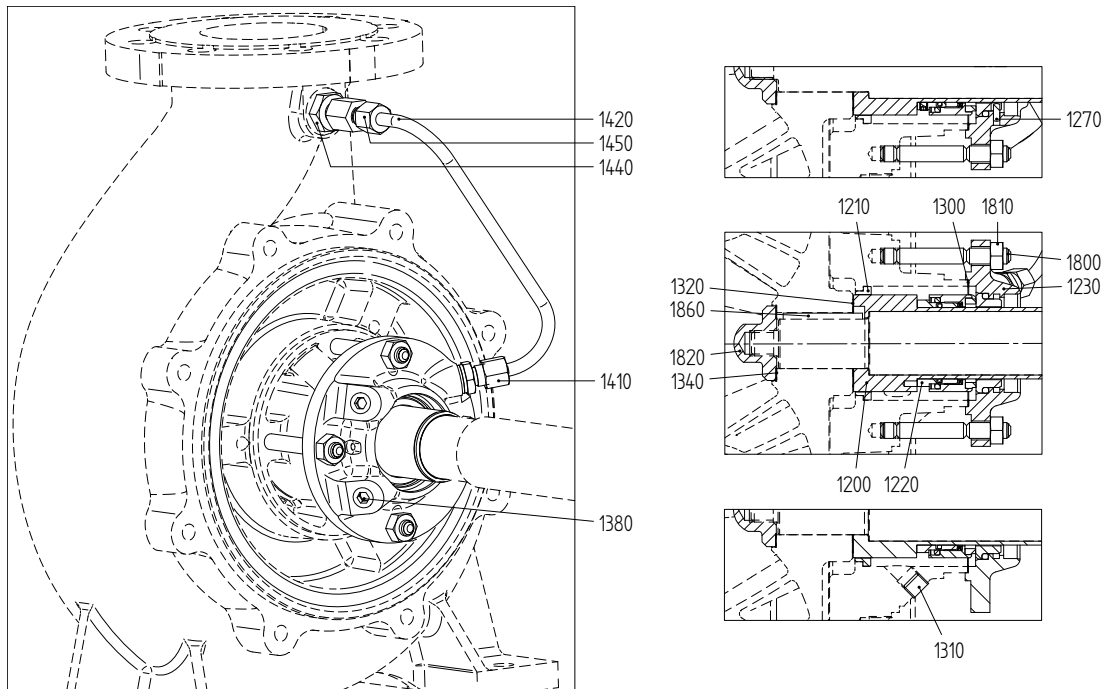


Figure 76: Mechanical seal HJ92N.

9.22.2 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
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	key	stainless steel

9.22.3 Mechanical seal HJ92N with tapered bore

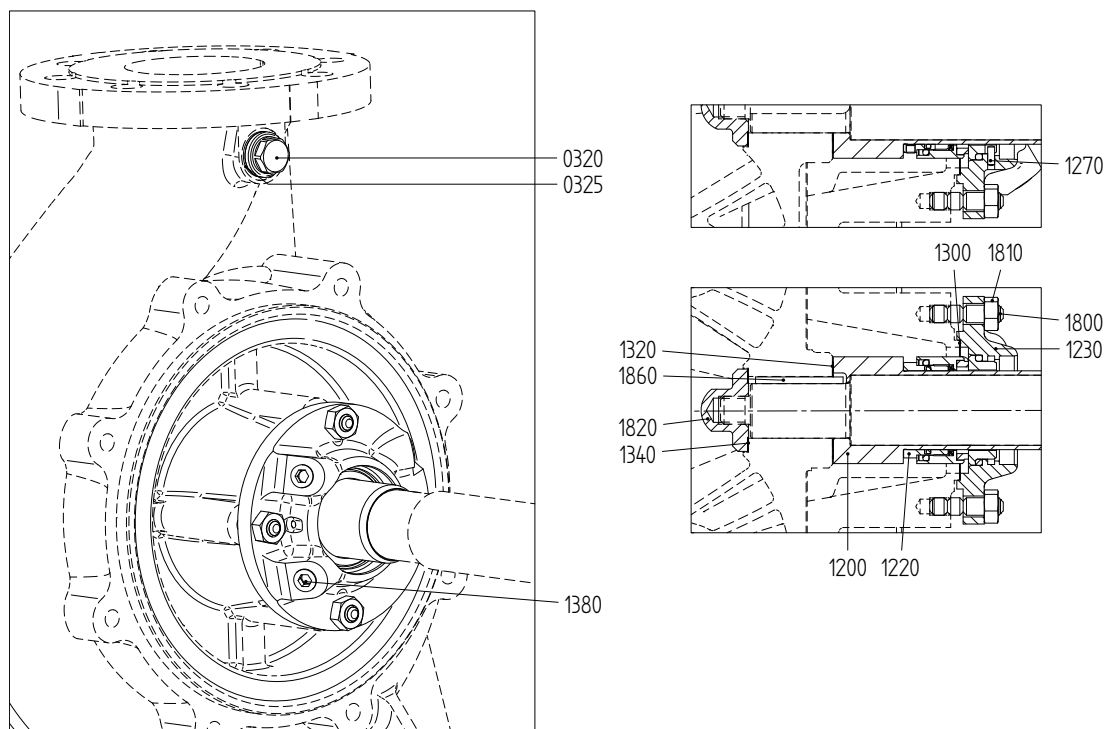


Figure 77: Mechanical seal HJ92N.

9.22.4 Parts list mechanical seal HJ92N with tapered bore

Item	Quantity	Description	Material
0320	1	plug	stainless steel
0325	1	sealing ring	PTFE
1200*	1	shaft sleeve	stainless steel
1220*	1	mechanical seal	--
1230	1	mechanical seal cover	stainless steel
1270	1	locking pin	stainless steel
1300*	1	gasket	--
1320*	1	gasket	--
1340*	1	gasket	--
1380	2	plug	stainless steel
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel

9.22.5 Mechanical seal HJ92N with tapered bore and plan 11

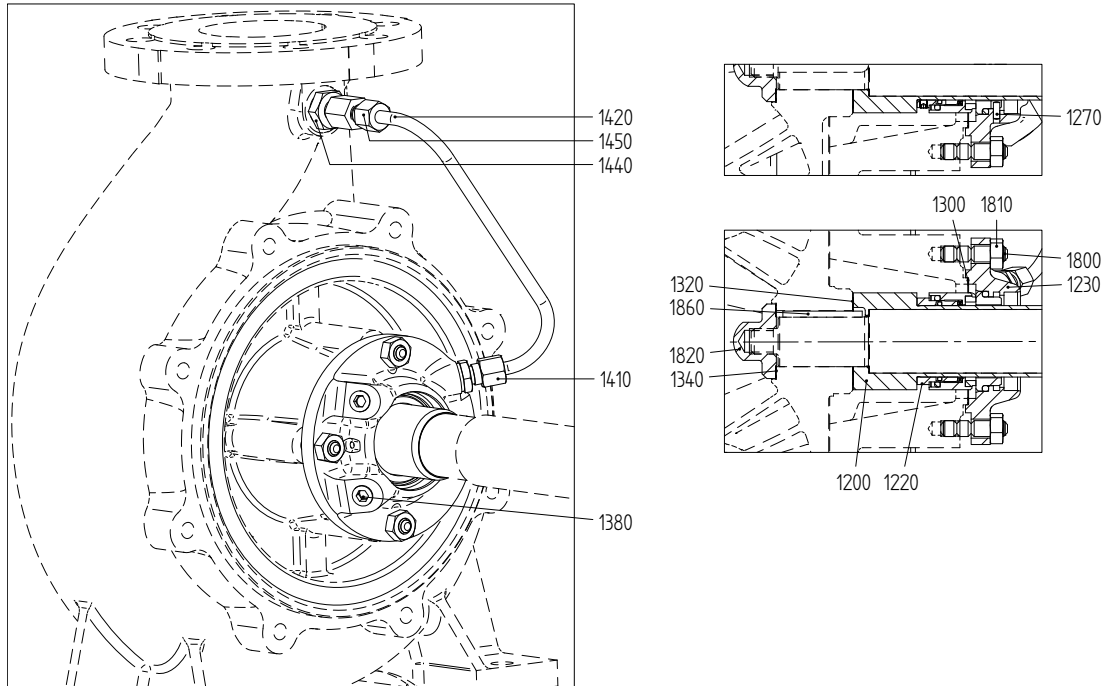


Figure 78: Mechanical seal HJ92N.

9.22.6 Parts list mechanical seal HJ92N with tapered bore and plan 11

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1220*	1	mechanical seal	--
1230	1	mechanical seal cover	stainless steel
1270	1	locking pin	stainless steel
1300*	1	gasket	--
1320*	1	gasket	--
1340*	1	gasket	--
1380	2	plug	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
1800	4	stud	stainless steel
1810	4	nut	stainless steel
1820*	1	cap nut	stainless steel
1860*	1	key	stainless steel

9.23 Shaft sealing group M2-M3 - bearing group 4

9.23.1 Mechanical seals M2-M3 - bearing group 4

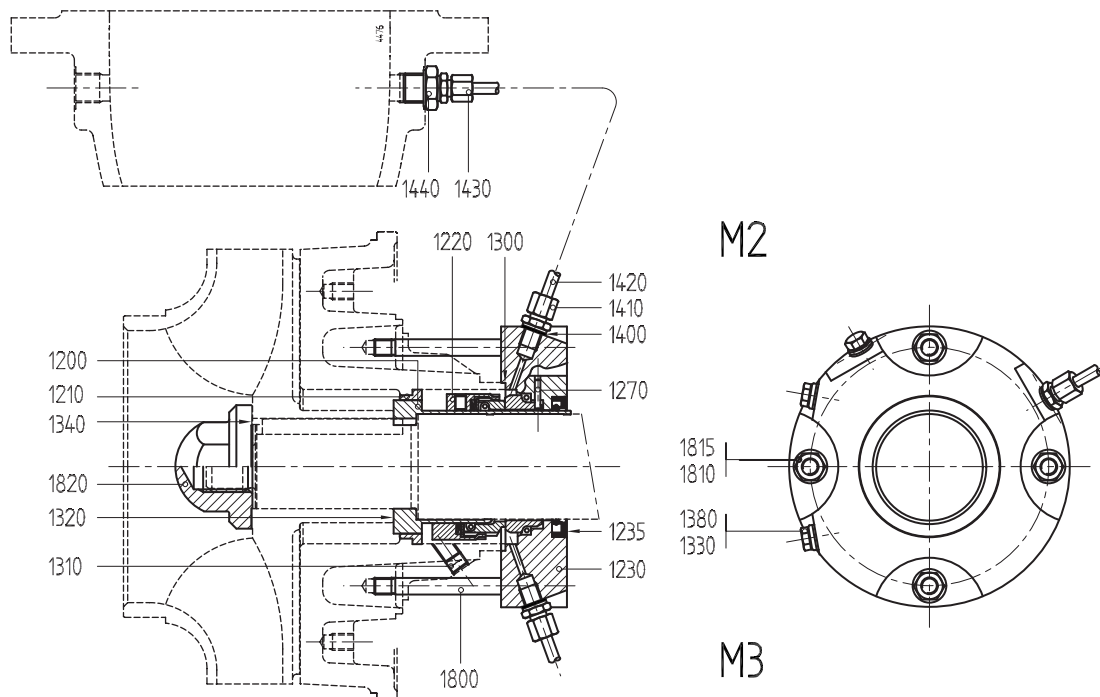


Figure 79: Mechanical seal M2-M3 - bearing group 4.

9.23.2 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	

9.24 Shaft sealing group MQ2

9.24.1 Mechanical seal MQ2 - M7N

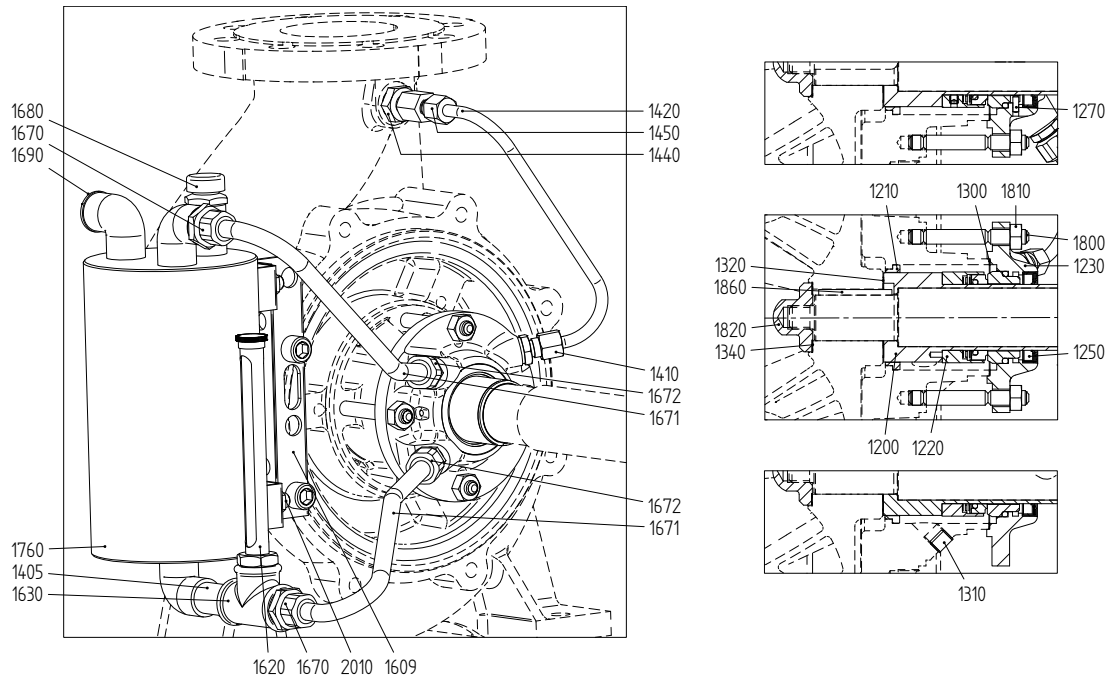


Figure 80: Mechanical seal MQ2 - M7N.

9.24.2 Mechanical seal MQ2 - MG12-G60

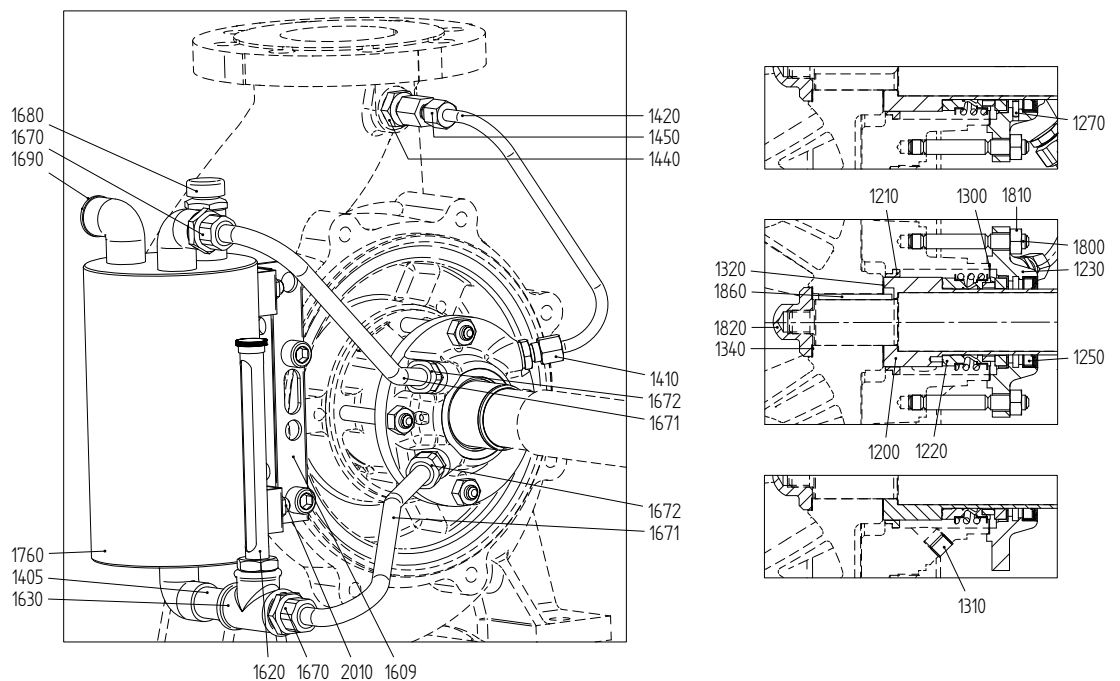


Figure 81: Mechanical seal MQ2 - MG12-G60.

9.24.3 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	-
1405	1	pipe nipple	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
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

9.24.4 Mechanical seal MQ2 - M7N with tapered bore

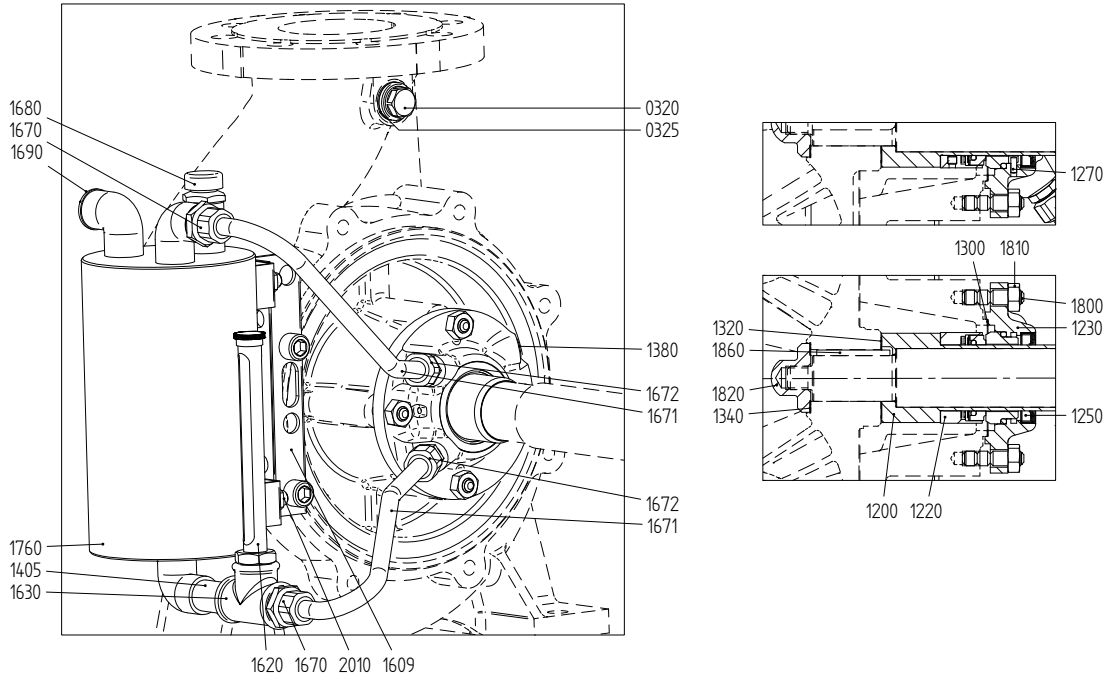


Figure 82: Mechanical seal MQ2 - M7N.

9.24.5 Mechanical seal MQ2 - MG12-G60 with tapered bore

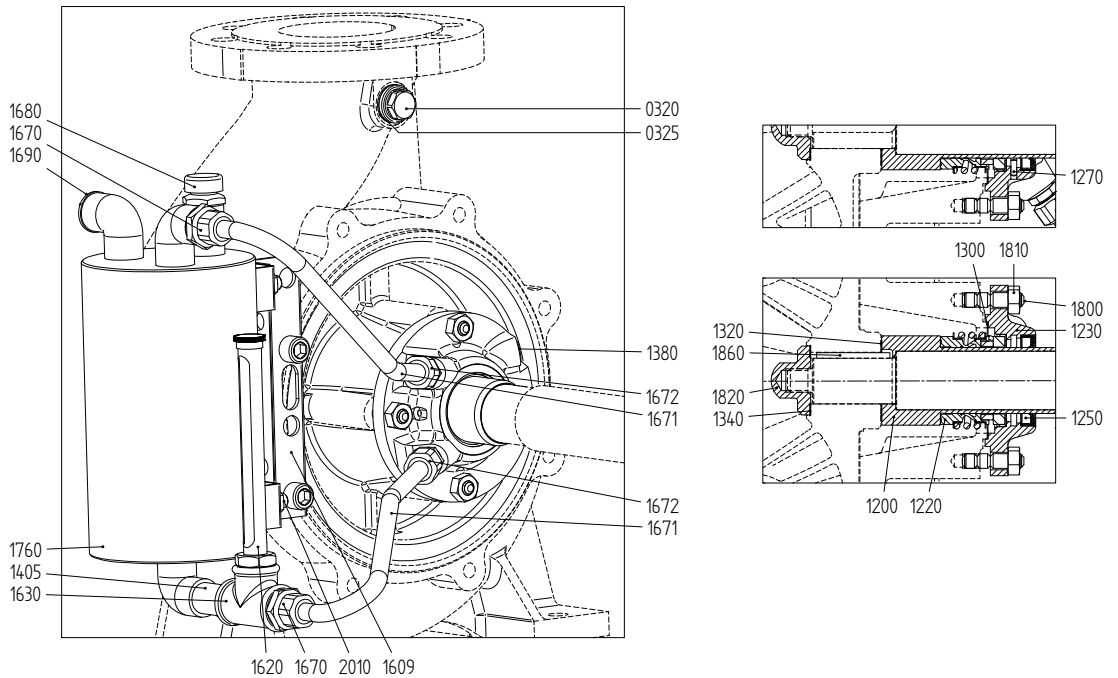


Figure 83: Mechanical seal MQ2 - MG12-G60.

9.24.6 Parts list shaft sealing group MQ2 - M7N / MG12-G60 with tapered bore

Item	Quantity	Description	Material
0320	1	plug	stainless steel
0325	1	sealing ring	PTFE
1200*	1	shaft sleeve	stainless steel + QPQ
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	-
1320*	1	gasket	-
1340*	1	gasket	-
1405	1	pipe 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

9.24.7 Mechanical seal MQ2 - M7N with tapered bore and plan 11

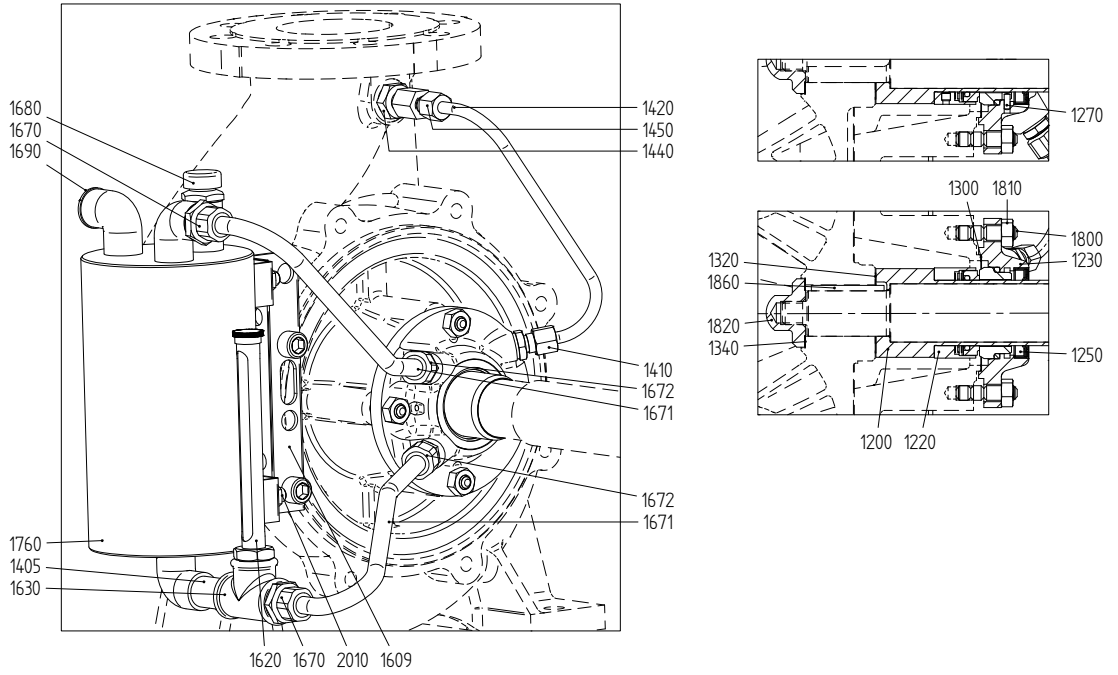


Figure 84: Mechanical seal MQ2 - M7N.

9.24.8 Mechanical seal MQ2 - MG12-G60 with tapered bore and plan 11

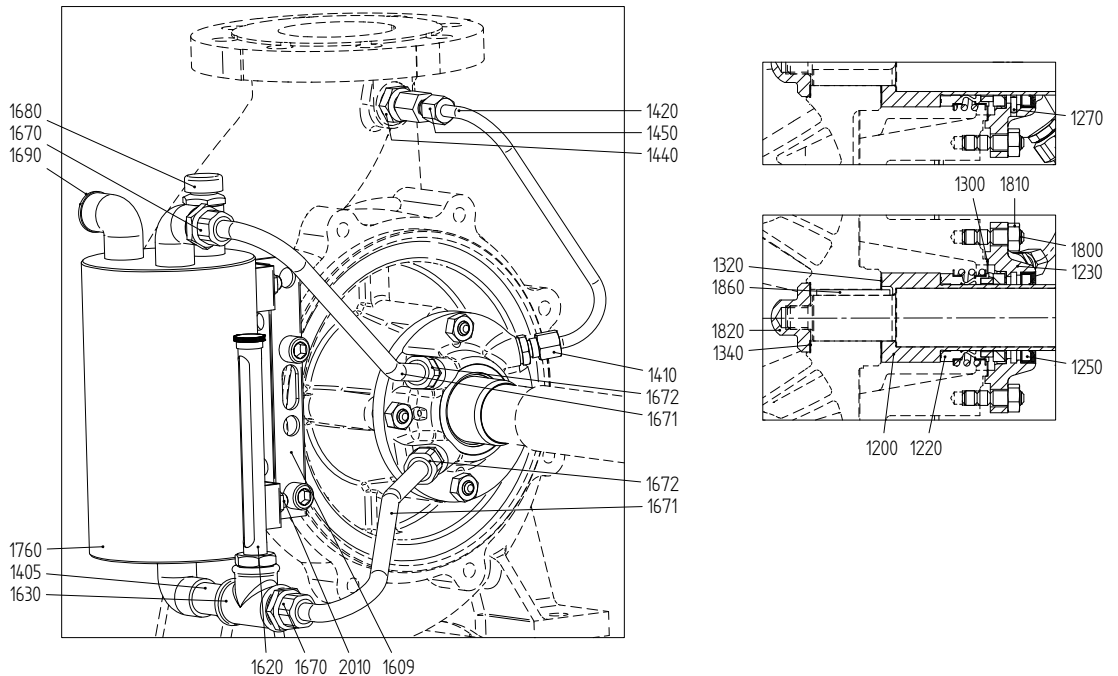


Figure 85: Mechanical seal MQ2 - MG12-G60.

9.24.9 Parts list shaft sealing group MQ2 - M7N / MG12-G60 with tapered bore and plan 11

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel + QPQ
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	-
1320*	1	gasket	-
1340*	1	gasket	-
1405	1	pipe nipple	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
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

9.25.2 Parts list 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	-
1405	1	pipe nipple	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
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

9.25.3 Mechanical seal MQ3 - HJ92N with tapered bore

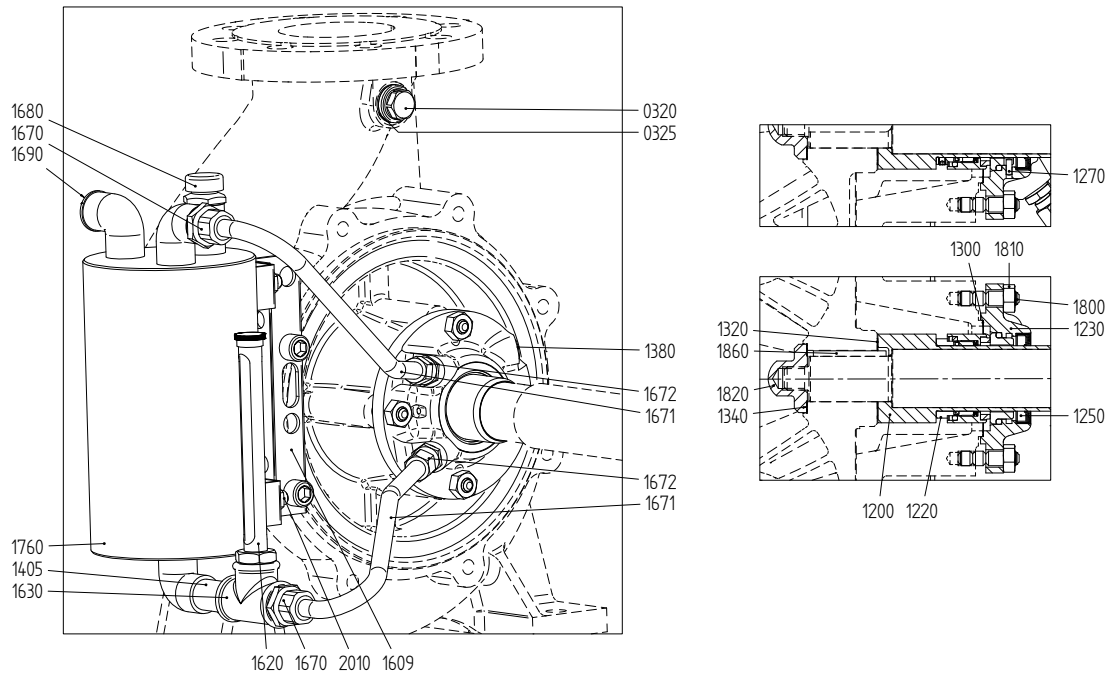


Figure 87: Mechanical seal MQ3 - HJ92N.

9.25.4 Parts list list shaft sealing group MQ3 - HJ92N with tapered bore

Item	Quantity	Description	Material
0320	1	plug	stainless steel
0325	1	sealing ring	PTFE
1200*	1	shaft sleeve	stainless steel + QPQ
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	-
1320*	1	gasket	-
1340*	1	gasket	-
1405	1	pipe 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

9.25.5 Mechanical seal MQ3 - HJ92N with tapered bore and plan 11

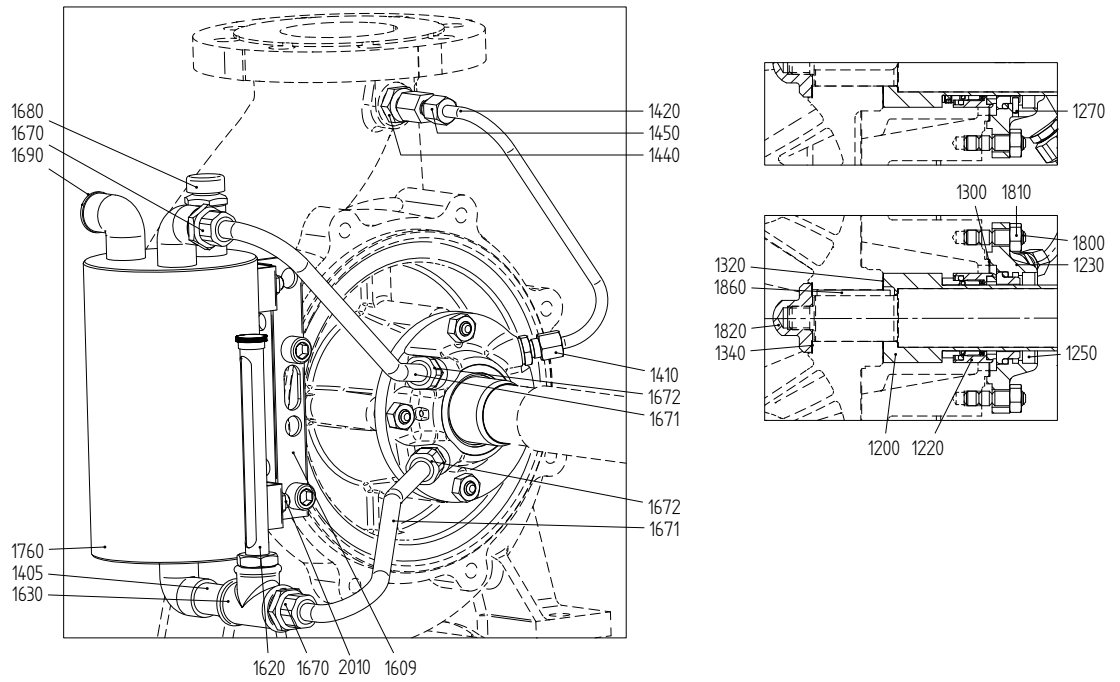


Figure 88: Mechanical seal MQ3 - HJ92N.

9.25.6 Parts list list shaft sealing group MQ3 - HJ92N with tapered bore and plan 11

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel + QPQ
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	-
1320*	1	gasket	-
1340*	1	gasket	-
1405	1	pipe nipple	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
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

9.26 Shaft sealing group MW2

9.26.1 Mechanical seal M7N

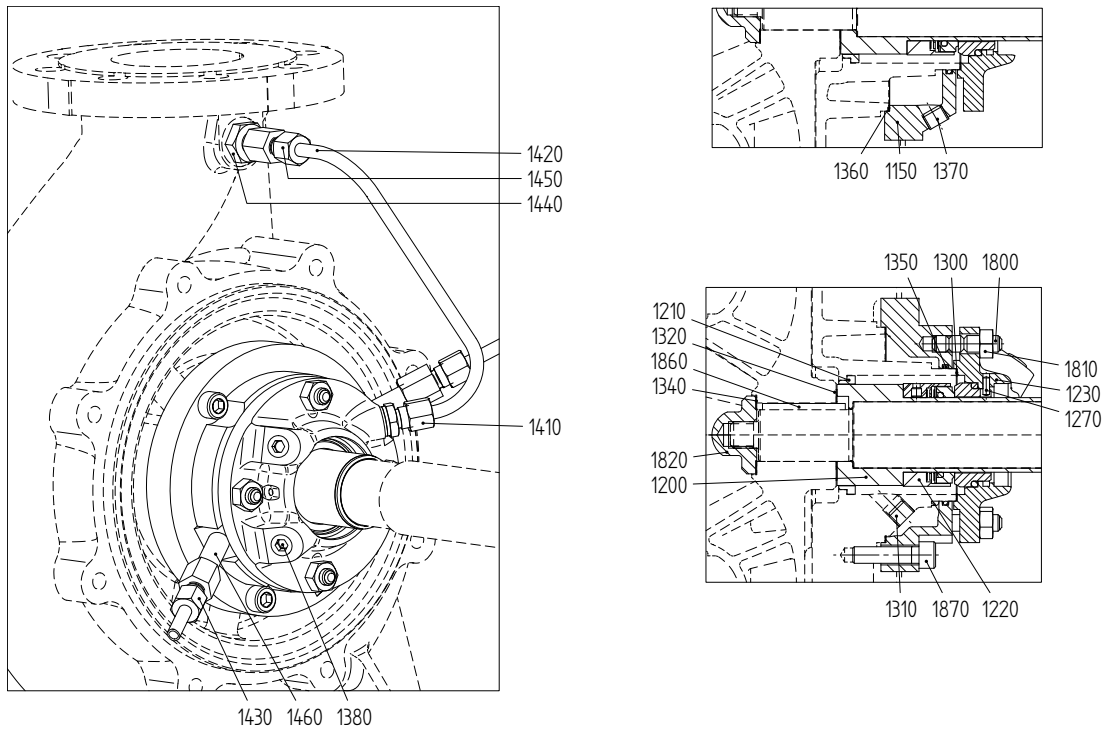


Figure 89: Mechanical seal MW2 - M7N.

9.26.2 Mechanical seal MG12-G60

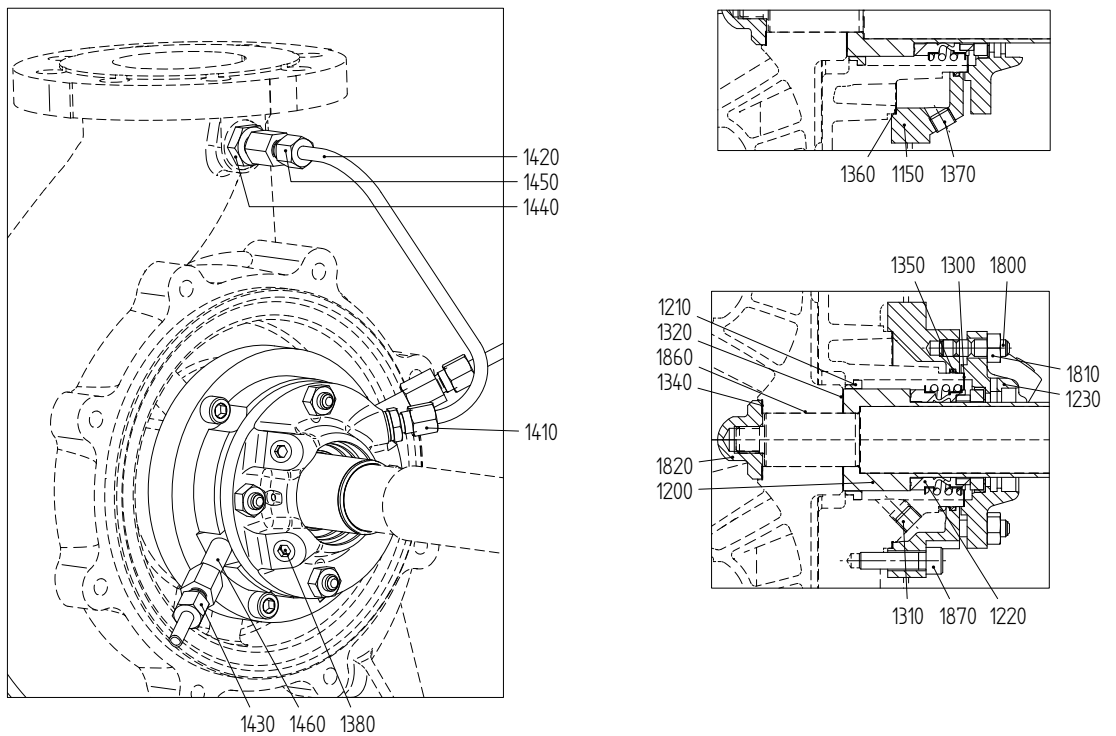


Figure 90: Mechanical seal MW2 - MG12-G60.

9.26.3 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
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	key	stainless steel
1870	3	Allen screw	stainless steel

Item 1270 only for M7N.

9.27 Shaft sealing group MW3

9.27.1 Mechanical seal HJ92N

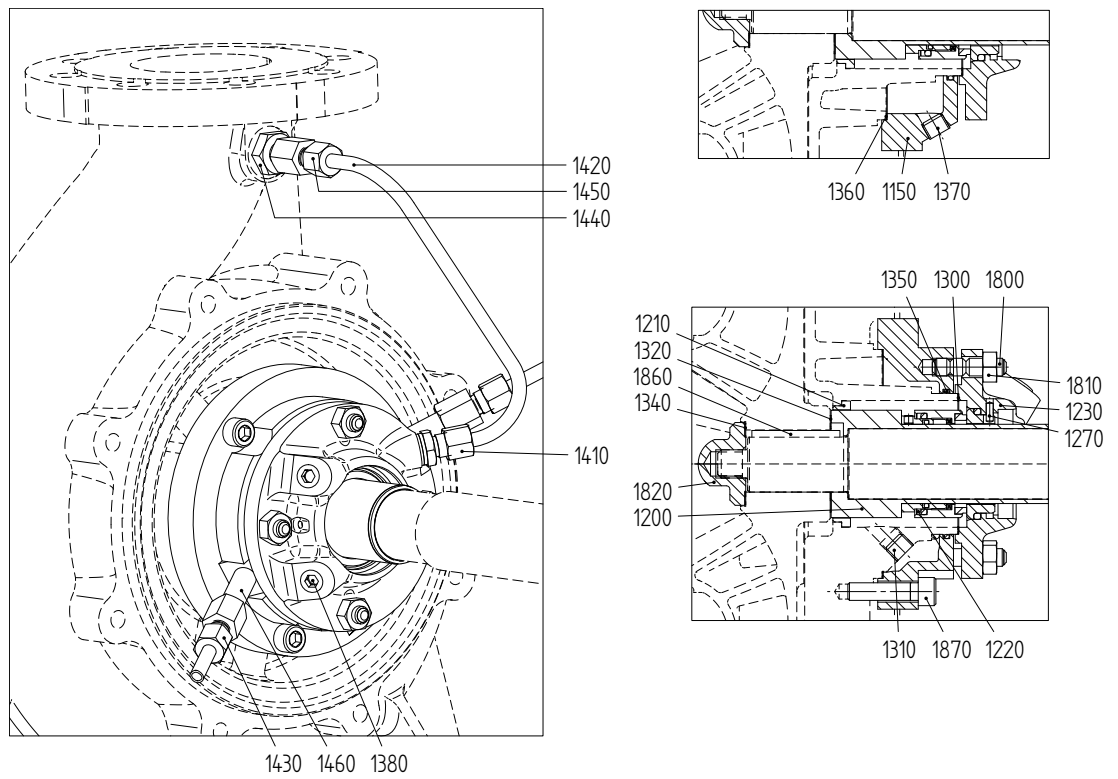


Figure 91: Mechanical seal MW3 - HJ92N.

9.27.2 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
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	key	stainless steel
1870	3	Allen screw	stainless steel

9.28 Shaft sealing group C2

9.28.1 Cartridge seal C2 - UNITEX

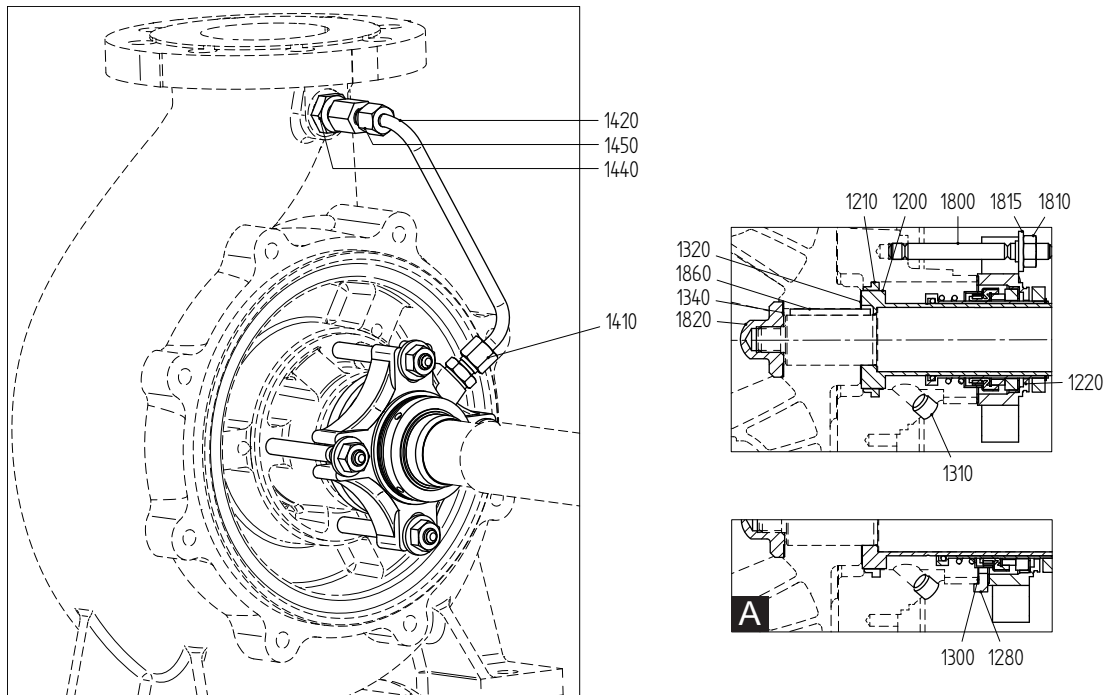


Figure 92: Mechanical seal C2 - UNITEX (A = br.gr 2 and 3).

9.28.2 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	key	stainless steel

9.28.3 Cartridge seal C2 - UNITEX with tapered bore

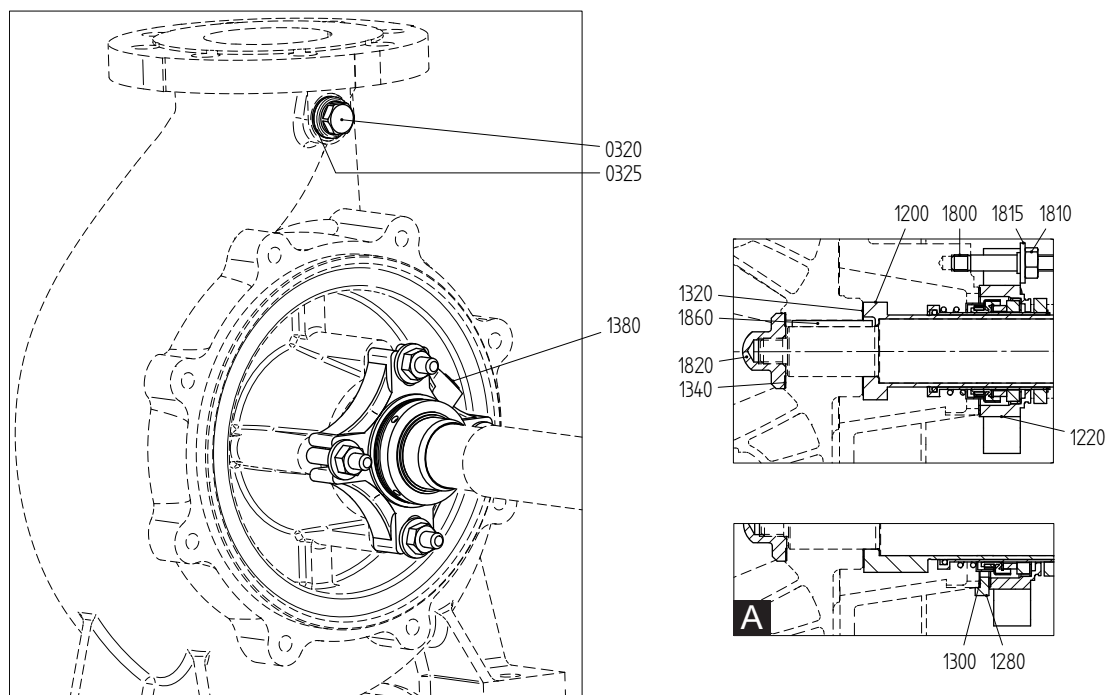


Figure 93: Mechanical seal C2 - UNITEX (A = br.gr 2 and 3).

9.28.4 Parts list shaft sealing group C2 - UNITEX with tapered bore

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	-
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	key	stainless steel

9.28.5 Cartridge seal C2 - UNITEX with tapered bore and plan 11

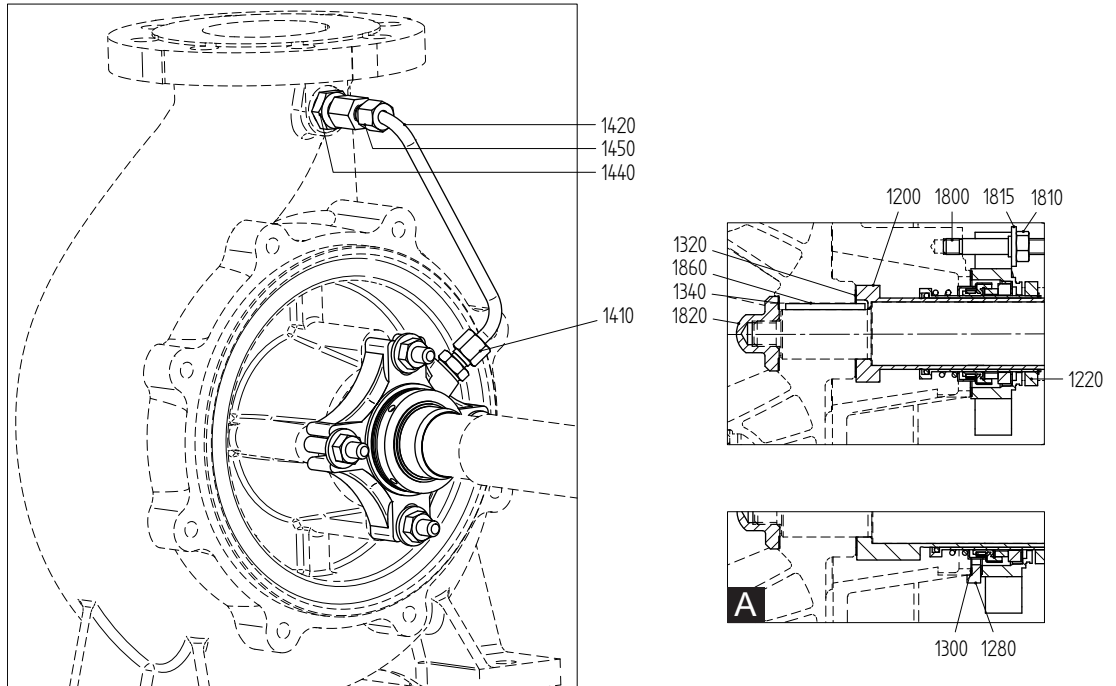


Figure 94: Mechanical seal C2 - UNITEX (A = br.gr 2 and 3).

9.28.6 Parts list shaft sealing group C2 - UNITEX with tapered bore and plan 11

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1220*	1	cartridge seal	-
1280	1	reducing ring	stainless steel
1300*	1	gasket	-
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	key	stainless steel

9.29 Shaft sealing group C3

9.29.1 Cartridge seal C3 - CARTEX SN

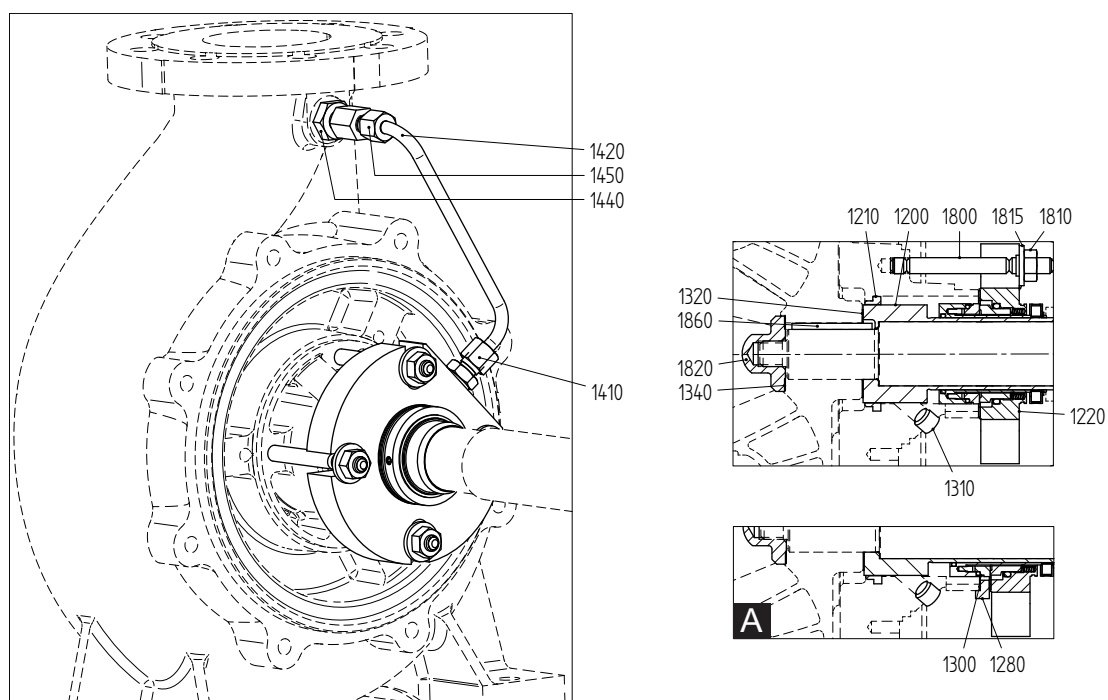


Figure 95: Mechanical seal C3 - CARTEX SN (A = br.gr. 3).

9.29.2 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	key	stainless steel

Item 1280 and 1300 only for bearing group 3.

9.29.3 Cartridge seal C3 - CARTEX SN with tapered bore

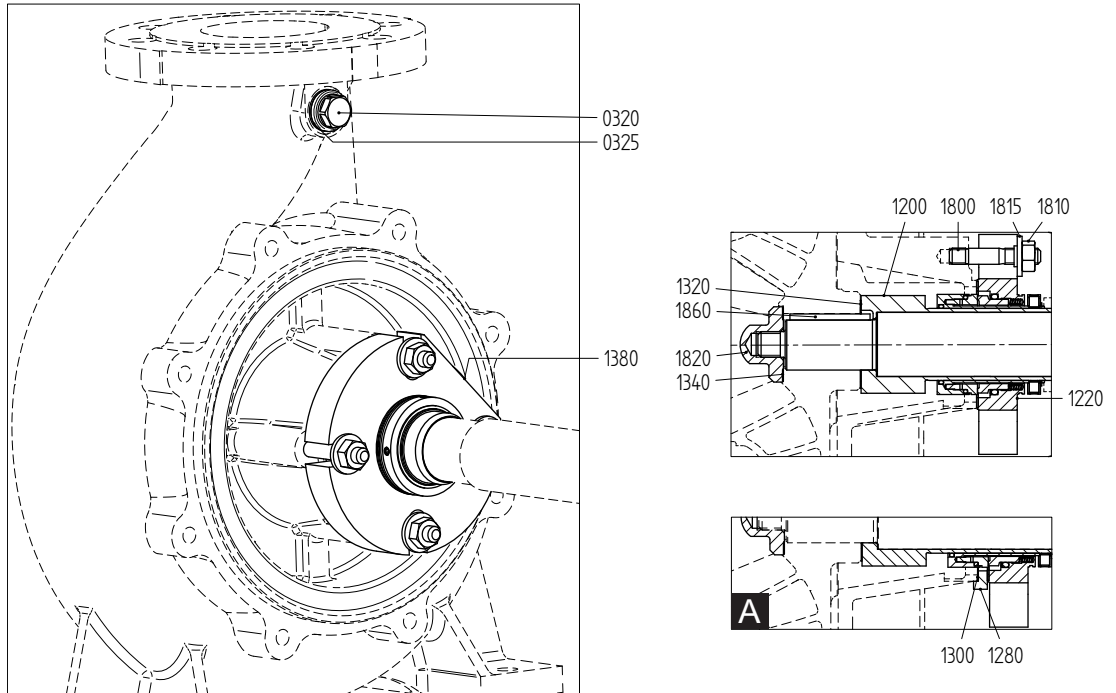


Figure 96: Mechanical seal C3 - CARTEX SN (A = br.gr. 3).

9.29.4 Parts list shaft sealing group C3 - CARTEX SN with tapered bore

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	-
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	key	stainless steel

Item 1280 and 1300 only for bearing group 3.

9.29.5 Cartridge seal C3 - CARTEX SN with tapered bore and plan 11

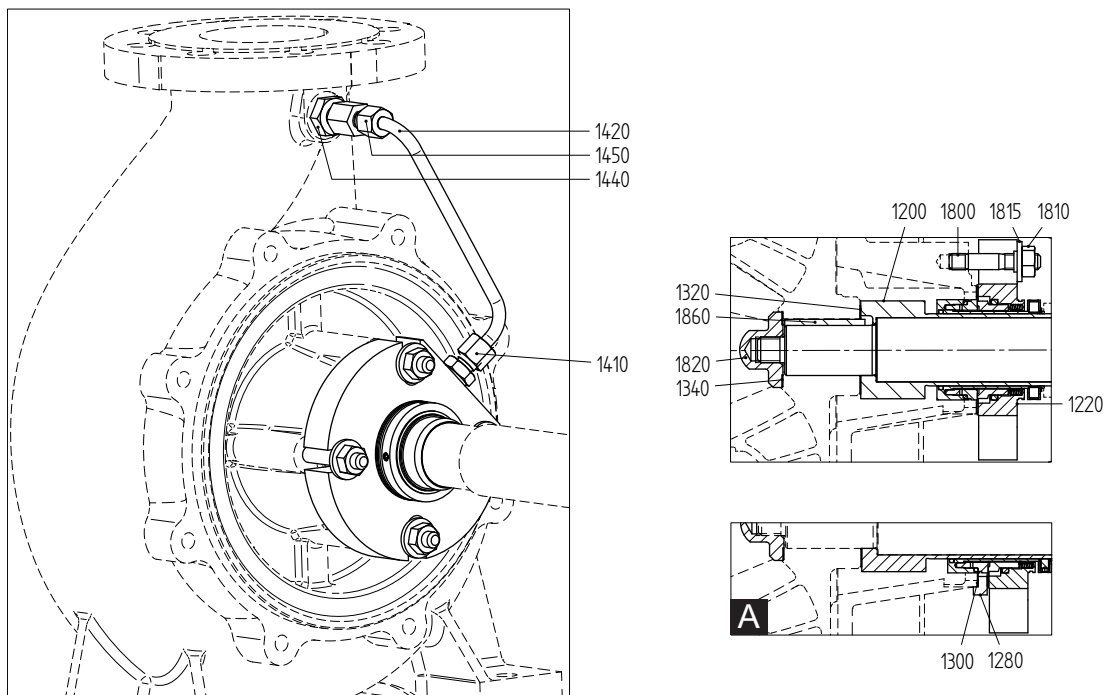


Figure 97: Mechanical seal C3 - CARTEX SN (A = br.gr. 3).

9.29.6 Parts list shaft sealing group C3 - CARTEX SN with tapered bore and plan 11

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1220*	1	cartridge seal	-
1280	1	reducing ring	stainless steel
1300*	1	gasket	-
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	key	stainless steel

Item 1280 and 1300 only for bearing group 3.

9.30 Shaft sealing group CQ3

9.30.1 Cartridge seal CQ3 - CARTEX QN

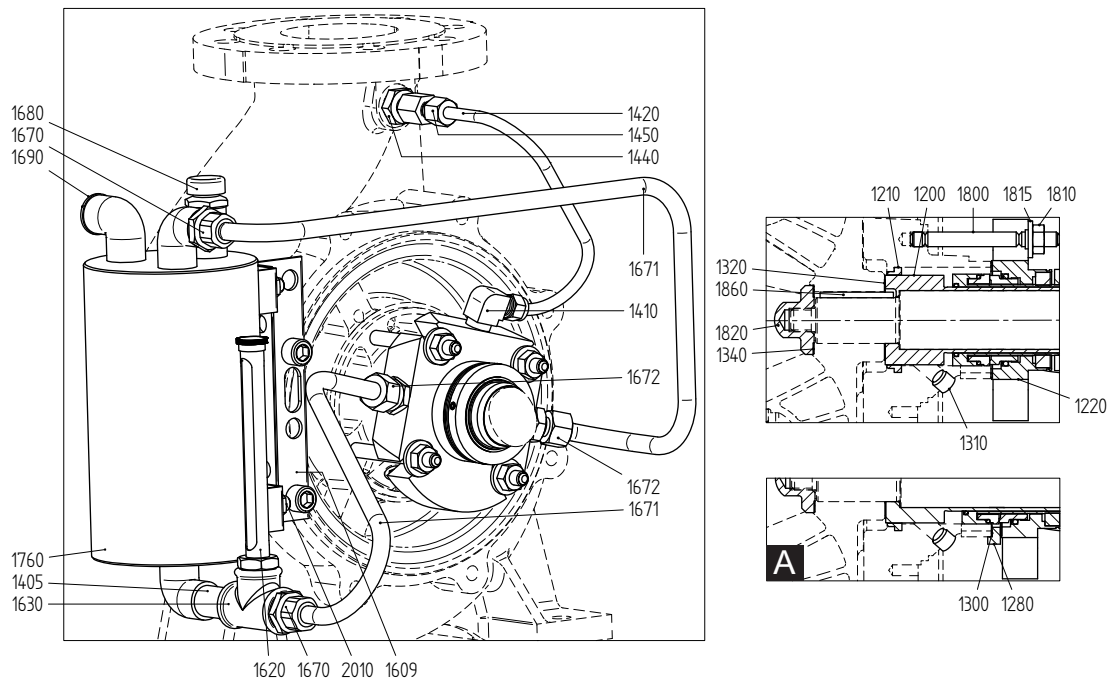


Figure 98: Mechanical seal CQ3 - CARTEX QN (A = br.gr. 3).

9.30.2 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	-
1405	1	pipe nipple	stainless steel
1410	1	elbow	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	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
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.

9.30.3 Cartridge seal CQ3 - CARTEX QN with tapered bore

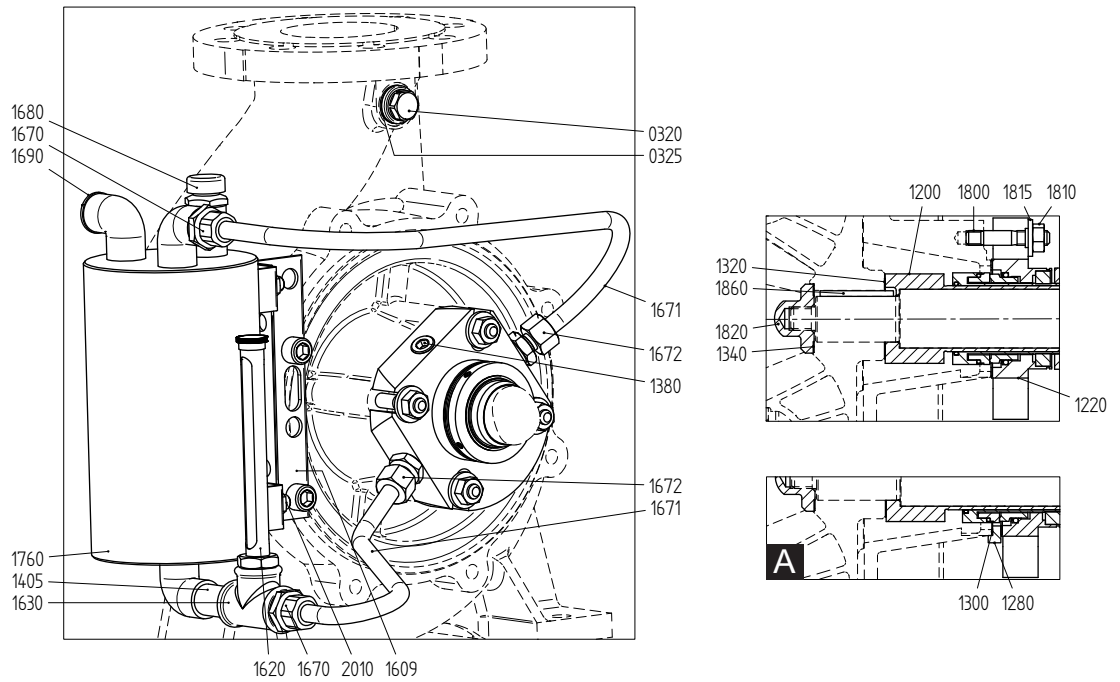


Figure 99: Mechanical seal CQ3 - CARTEX QN (A = br.gr. 3).

9.30.4 Parts list shaft sealing group CQ3 - CARTEX QN with tapered bore

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	-
1320*	1	gasket	-
1340*	1	gasket	-
1405	1	pipe 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
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.

9.30.5 Cartridge seal CQ3 - CARTEX QN with tapered bore and plan 11

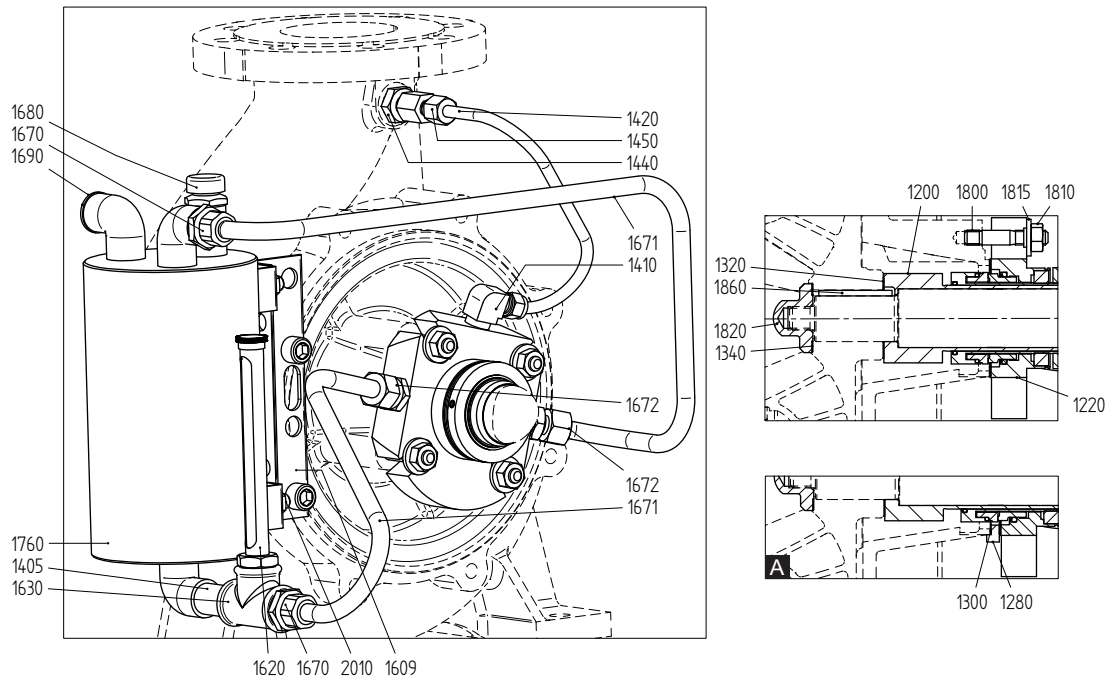


Figure 100: Mechanical seal CQ3 - CARTEX QN (A = br.gr. 3).

9.30.6 Parts list shaft sealing group CQ3 - CARTEX QN with tapered bore and plan 11

Item	Quantity	Description	Material
1200*	1	shaft sleeve	stainless steel
1220*	1	cartridge seal	-
1280	1	reducing ring	stainless steel
1300*	1	gasket	-
1320*	1	gasket	-
1340*	1	gasket	-
1405	1	pipe nipple	stainless steel
1410	1	elbow	stainless steel
1420	1	pipe	stainless steel
1440	1	extension piece	stainless steel
1450	1	female connector	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
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.

9.31 Shaft sealing group CD3

9.31.1 Cartridge seal CD3 - CARTEX DN

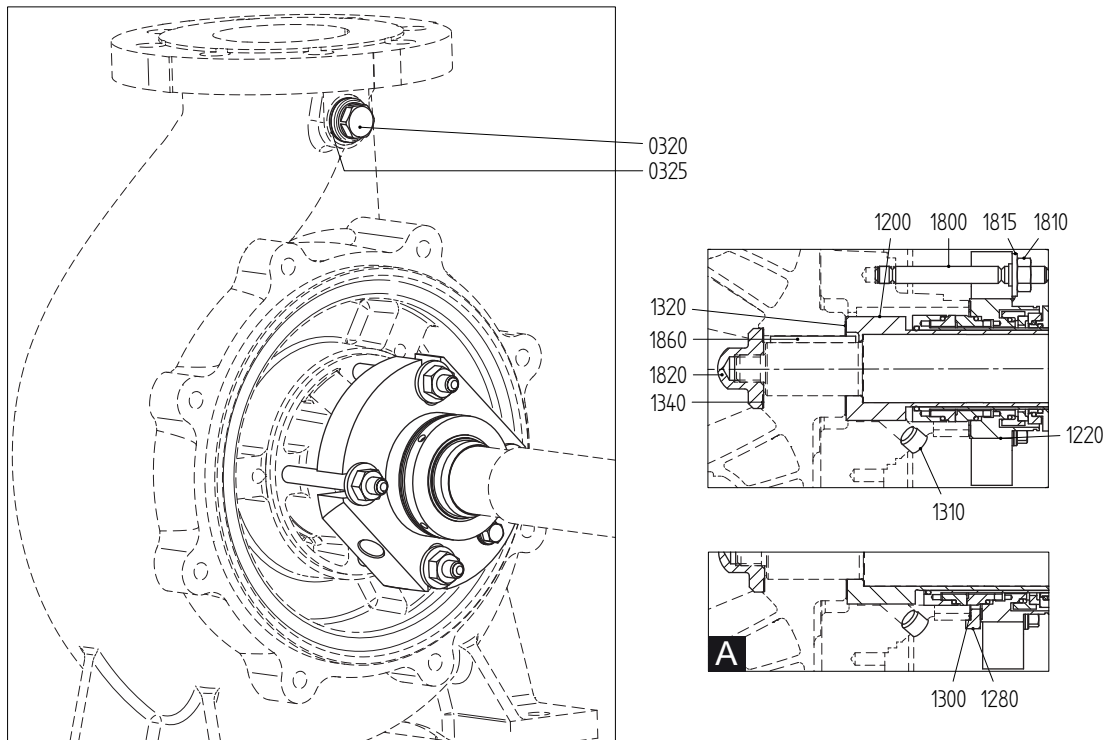


Figure 101: Mechanical seal CD3 - CARTEX DN (A = br.gr. 2 and 3).

9.31.2 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	key	stainless steel

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

9.31.3 Cartridge seal CD3 - CARTEX DN with tapered bore

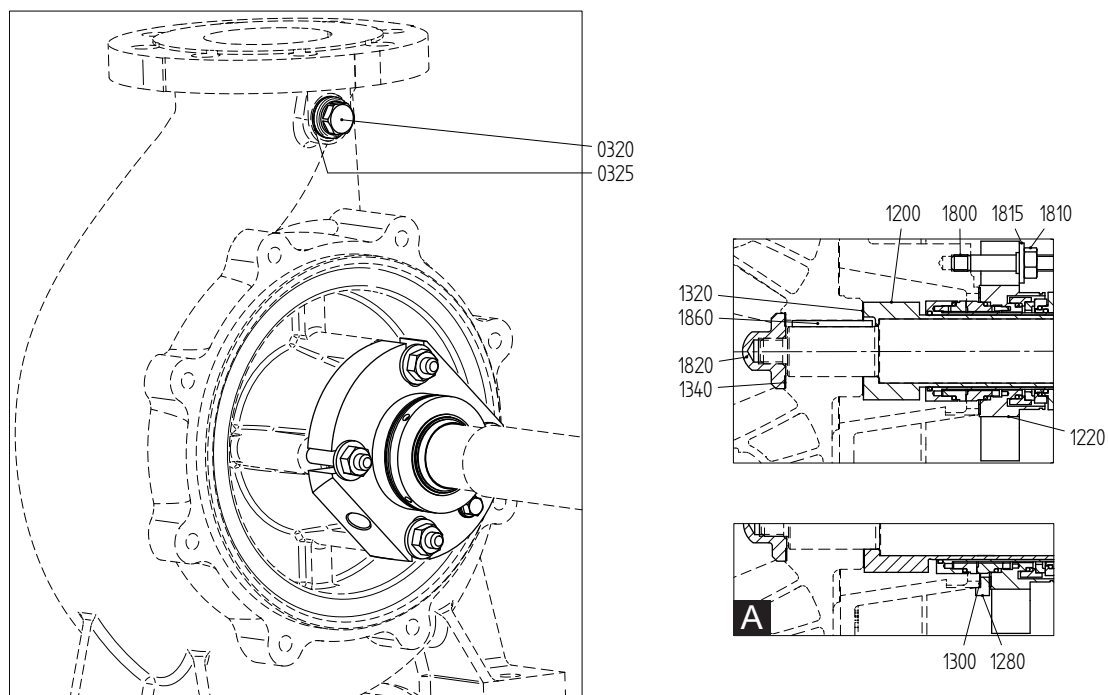


Figure 102: Mechanical seal CD3 - CARTEX DN (A = br.gr. 2 and 3).

9.31.4 Parts list shaft sealing group CD3 - CARTEX DN with tapered bore

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	-
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	key	stainless steel

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

10 Technical data

10.1 Lubricants

10.1.1 Oil

Table 14: Recommended oils according to ISO VG 68 classification for ambient temperatures above 15 °C.

BP	Energol HLP-HM 68
CHEVRON	Rando HDZ 68
CHEVRON	Regal Premium EP 68
EXXONMOBIL	Mobil D.T.E. Oil Heavy Medium
EXXONMOBIL	Teresstic T 68
SHELL	Tellus S2 MX 68
TOTAL	Azolla ZS 68

10.1.2 Oil contents

Table 15: Oil contents.

Bearing group	Oil contents [litres]
0 (25-125)	0,20
0+ (25-160)	0,185
1	0,40
2	0,50
3	0,60
4	1,50

10.1.3 Grease

Table 16: Recommended greases according to NLGI-2 classification.

BP	Energrease LS-EP 2
CHEVRON	Black Pearl Grease EP 2
CHEVRON	MultifaK EP-2
EXXONMOBIL	Beacon EP 2 (Moly)
EXXONMOBIL	Mobilux EP 2 (Moly)
SHELL	Gadus S2 V100 2
SKF	LGMT 2
TOTAL	Total Lical EP 2

10.2 Mounting media

10.2.1 Recommended mounting grease

Recommended greases for greasing stuffing box packing rings:

- Foliac cup grease (graphite grease)
- Molycote BR2 (graphite grease)
- silicon grease

10.2.2 Recommended locking liquids

Table 17: Recommended locking liquids.

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

10.3 Tightening moments

10.3.1 Tightening moments for bolts and nuts

Table 18: 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	325	180

10.3.2 Tightening moments for cap nut

Table 19: Tightening moments for cap nut (1820).

Size	Tightening moment [Nm]
M12 (bearing groups 0 and 1)	43
M16 (bearing group 2)	105
M24 (bearing group 3)	220
M36 (bearing group 4)	510

10.3.3 Tightening moments set screw from coupling

Table 20: Tightening moments set screw from coupling.

Size	Tightening moment [Nm]
M6	4
M8	8
M10	15
M12	25
M16	70

10.4 Maximum allowable working pressures

Table 21: Maximum allowable working pressure [kPa] (according to ISO 7005-2/3)

Materials		Max. temperature [°C]				
		50	120	150	180	200
Cast iron	G1-G2*	600	600	540	500	480
		1000	1000	900	840	800
		1600	1600	1440	1340	1280
Nodular cast iron	NG1-NG2	1000	1000	970	940	920
		1600	1600	1550	1500	1470
Bronze	B2**	600	600	600	600	-
		1000	1000	1000	1000	-
		1300	1300	1300	1300	-
25-125	G	600	600	540	504	480
25-160	G	800	800	720	672	640

100 kPa = 1 bar

* Selection based on value S2/M3 and S4 G1-G2 in Table 23.

** Selection based on value S2/M3 B2 in Table 23.

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

Table 22: Maximum operating conditions of the shaft seals

Shaft sealing groups	Max. admissible working pressure ¹⁾ [kPa]	Max. temperature ²⁾ [°C]
S1	1000	105
S2	1600	105
S3	1000	105
S4	1600	160
M1	1000	110
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
M3 - H7N (bearing group 4)	2500	-50 up to 220
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.

10.5 Maximum working pressure

Table 23: Maximum working pressure.

CN	maximum speed*			Available shaft sealing groups and maximum working pressure [bar] at 50 °C, depending of the material variant.												
				G					NG				B			
	L1 L3	L2 L4	L5 L6	S1 M1	S2 M3 MW3 MQ3	S3 M2 MW2 MQ2 C2	S4	C3 CQ3 CD3	S2 M3 MW3 MQ3	S3 M2 MW2 MQ2 C2	S4	C3 CQ3 CD3	S2 M3 MW3 MQ3	S3 M2 MW2 MQ2 C2	C3 CQ3 CD3	
25-125	-	-	3600	-	6	6	-	-	-	-	-	-	-	-	-	-
25-160	-	-	3600	-	8	8	-	-	-	-	-	-	-	-	-	-
32-125	3600	-	-	10	16	10	-	16	-	-	-	-	13	10	13	
32C-125	3600	-	-	10	16	10	-	16	-	-	-	-	13	10	13	
32-160	3600	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
32A-160	3600	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
32C-160	3600	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
32-200	3600	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
32C-200	3600	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
32-250	3000	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
40C-125	3600	-	-	10	16	10	-	16	-	-	-	-	13	10	13	
40C-160	3600	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
40C-200	3600	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
40-250	3000	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
40A-315	3000	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
50C-125	3600	-	-	10	10	10	-	10	-	-	-	-	10	10	10	
50C-160	3600	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
50C-200	3600	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
50-250	3000	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
50-315	3000	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
65C-125	3600	-	-	10	10	10	-	10	-	-	-	-	10	10	10	
65C-160	3600	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
65C-200	3600	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
65A-250	3000	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
65-315	2400	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
80C-160	2700	3600	-	10	10	10	10	10	16	10	16	16	10	10	10	
80C-200	3600	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
80-250	3300	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
80A-250	3300	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
80-315	2400	-	-	10	10	10	10	10	16	10	16	16	10	10	10	
80-400	2200	2700	-	10	16	10	16	16	16	10	16	16	13	10	13	
100-160	3300	-	-	6	6	6	6	6	10	10	10	10	6	6	6	
100C-200	3000	3000	-	10	16	10	16	16	16	10	16	16	13	10	13	
100C-250	2400	3000	-	10	16	10	16	16	16	10	16	16	13	10	13	
100-315	2400	2400	-	10	16	10	16	16	16	10	16	16	13	10	13	
100-400	2400	-	-	10	16	10	16	16	16	10	16	16	13	10	13	
125-125	2400	2700	-	6	6	6	6	6	10	10	10	10	6	6	6	
125-250	1800	1800	-	10	16	10	16	16	16	10	16	16	13	10	13	

Table 23: Maximum working pressure.

CN	maximum speed*			Available shaft sealing groups and maximum working pressure [bar] at 50 °C, depending of the material variant.												
				G					NG				B			
	L1 L3	L2 L4	L5 L6	S1 M1	S2 M3 MW3 MQ3	S3 M2 MW2 MQ2 C2	S4	C3 CQ3 CD3	S2 M3 MW3 MQ3	S3 M2 MW2 MQ2 C2	S4	C3 CQ3 CD3	S2 M3 MW3 MQ3	S3 M2 MW2 MQ2 C2	C3 CQ3 CD3	
125-315	2300	2400	-	10	16	10	16	16	16	10	16	16	16	13	10	13
125-400	1800	1800	-	10	16	10	16	16	16	10	16	16	16	13	10	13
125-500	-	1500	-	-	10	10	10	10	16	10	16	16	6	6	6	
150-125	1800	2400	-	6	6	6	6	6	10	10	10	10	6	6	6	
150-160	2400	2500	-	6	6	6	6	6	10	10	10	10	6	6	6	
150-200	2700	2700	-	6	6	6	6	6	10	10	10	10	6	6	6	
150-250	2100	2200	-	6	6	6	6	6	10	10	10	10	6	6	6	
150-315	1480	1480	-	10	10	10	10	10	10	10	10	10	10	10	10	
150-400	1480	-	-	10	10	10	10	10	10	10	10	10	10	10	10	
150B-400	-	1800	-	-	10	10	10	10	16	10	16	16	10	10	10	
150-500	-	1500	-	-	10	10	10	10	16	10	16	16	6	6	6	
200-160	1500	1500	-	6	-	-	-	-	-	-	-	-	-	-	-	
200-200	1780	1800	-	6	6	6	6	6	10	10	10	10	6	6	6	
200-250	-	2400	-	-	10	10	10	10	16	10	16	16	6	6	6	
200-315	-	2400	-	-	10	10	10	10	16	10	16	16	6	6	6	
200-400	-	1700	-	-	10	10	10	10	16	10	16	16	6	6	6	
250-200	1500	1800	-	6	6	6	6	6	10	10	10	10	6	6	6	
250-250	-	1900	-	-	10	10	10	10	16	10	16	16	6	6	6	
250-315	-	2000	-	-	6	6	6	6	16	10	16	16	6	6	6	
300-200	-	1500	-	6	-	-	-	-	-	-	-	-	-	-	-	
300-250	-	1500	-	-	10	10	10	10	16	10	16	16	6	6	6	
300-315	-	1500	-	-	10	10	10	10	16	10	16	16	6	6	6	

* With maximum impeller diameter, see also Table 24 and Table 25.

10.6 Higher maximum speed

10.6.1 Bearings L1-L3

Possible higher maximum speed than mentioned in Table 23, with reduced impeller diameter:

D_{max} = maximum impeller diameter

D_{min} = minimum required impeller diameter

Table 24: Higher maximum speed for bearings L1-L3.

CN		max. speed [min^{-1}] / impeller diameter [mm]															
		1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000
80-400	D_{max}	410							410	405	400	395	385	380			
100-400	D_{max}	410									410	400	390	380			
125-315	D_{max}	324								324	315	305	295	286	275	260	250
125-400	D_{max}	404			404	395	385	375	366	357	352						
	D_{min}							325	337	342	348						
150-160	D_{max}	200									200	190					
150-200	D_{max}	224												224	212		
150-250	D_{max}	273						273	273								
	D_{min}							252	273								
150-315	D_{max}	318	305	295	285	277	270										
150-400	D_{max}	408	395	383	345	340	335	330	325	319	315						
200-160	D_{max}	205	201	195													
200-200	D_{max}	244		244	235	228	222										
250-200	D_{max}	252															

10.6.2 Bearings L2-L4

Table 25: Higher maximum speed for bearings L2-L4.

CN		max. speed [min ⁻¹] / impeller diameter [mm]															
		1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000
80-400	Dmax	410											410				
100-400	Dmax	410									410	400	390	380			
125-315	Dmax	324									324	317	305	290	275	260	250
125-400	Dmax	404			404	395	385	375	366	357	353	345	337	332			
	Dmin												320	325			
125-500	Dmax	530	509	480	455	432	400										
150-160	Dmax	200										200	188	176			
150-200	Dmax	224												224	212		
150-250	Dmax	273							273	254	244						
150-315	Dmax	320	315	295	285	277	270	265	258	250							
150-400	Dmax	408	395	385	372	362	352	345									
150B-400	Dmax	430			430	421	399	380	362								
150-500	Dmax	525	503	475	451												
200-160	Dmax	205	201	195	189	185	181										
200-200	Dmax	244			235	228	222										
200-250	Dmax	310									310						
200-315	Dmax	345									345						
200-400	Dmax	438		438	432	419	408	388	368								
250-200	Dmax	252			252	244	236	230									
250-250	Dmax	310				310											
250-315	Dmax	368					368	366	356	347	339						
300-250	Dmax	345	336	324													
300-315	Dmax	365	330														

10.7 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/m³.

Table 26: Pressure in shaft sealing space for shaft sealing groups M2-MQ2-MW2-M3-MQ3-MW3-C2-C3-CQ3.

CN	n[min^{-1}]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
25-125	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,8	2,2	2,6
25-160	0,3	0,4	0,7	1,0	1,3	1,7	2,2	2,6	3,2	3,8
32-125	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,8	2,2	2,6
32C-125	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,8	2,2	2,6
32-160	0,3	0,4	0,7	1,0	1,3	1,7	2,2	2,6	3,2	3,8
32A-160	0,3	0,4	0,7	1,0	1,3	1,7	2,2	2,6	3,2	3,8
32C-160	0,3	0,4	0,7	1,0	1,3	1,7	2,2	2,6	3,2	3,8
32-200	0,3	0,6	0,9	1,3	1,8	2,4	3,0	3,7	4,5	5,4
32C-200	0,3	0,6	0,9	1,3	1,8	2,4	3,0	3,7	4,5	5,4
32-250	0,5	1,0	1,5	2,1	2,9	3,8	4,8	5,9		
40C-125	0,2	0,3	0,5	0,7	1,0	1,2	1,5	1,9	2,3	2,7
40C-160	0,2	0,4	0,7	0,9	1,3	1,7	2,1	2,6	3,2	3,8
40C-200	0,4	0,7	1,1	1,6	2,2	2,9	3,6	4,5	5,4	6,5
40-250	0,6	1,0	1,6	2,2	3,0	4,0	5,0	6,2		
40A-315	0,8	1,4	2,1	3,1	4,2	5,4				
50C-125	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,8	2,2	2,6
50C-160	0,2	0,4	0,7	1,0	1,3	1,7	2,1	2,7	3,2	3,8
50C-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3	4,1	4,9	5,8
50-250	0,6	1,1	1,7	2,4	3,3	4,3	5,4	6,7		
50-315	0,8	1,4	2,2	3,2	4,3	5,6				
65C-125	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,9	2,3	2,7
65C-160	0,3	0,5	0,7	1,0	1,4	1,8	2,3	2,8	3,4	4,1
65C-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3	4,1	5,0	6,0
65A-250	0,5	0,9	1,5	2,1	2,9	3,7	4,7	5,8		
65-315	0,9	1,6	2,4	3,5	4,7	6,1				
80C-160	0,3	0,5	0,8	1,1	1,5	1,9	2,4	3,0	3,6	4,3
80C-200	0,3	0,6	0,9	1,3	1,8	2,3	2,9	3,5	4,3	5,1
80-250	0,6	1,0	1,6	2,3	3,1	4,1	5,2	6,4	7,7	
80A-250	0,6	1,0	1,6	2,3	3,1	4,1	5,2	6,4	7,7	
80-315	0,8	1,4	2,1	3,1	4,2	5,5				
80-400	1,1	1,9	3,0	4,3	5,9	7,6	9,7			
100-160	0,3	0,5	0,8	1,1	1,5	1,9	2,4	3,0	3,6	4,3
100C-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3	4,1		
100C-250	0,5	1,0	1,5	2,2	3,0	3,9	4,9	6,0		
100-315	0,8	1,4	2,2	3,2	4,4	5,7				
100-400	1,2	2,2	3,4	4,9	6,6	8,6	9,3			
125-125	0,2	0,4	0,6	0,8	1,1	1,5	1,9			

Table 26: Pressure in shaft sealing space for shaft sealing groups M2-MQ2-MW2-M3-MQ3-MW3-C2-C3-CQ3.

CN	n[min^{-1}]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
125-250	0,5	1,0	1,5	2,2	3,0	3,5	4,0	4,4		
125-315	0,8	1,4	2,2	3,1	4,2	5,5	5,6	5,1		
125-400	1,2	2,1	3,2	4,7	5,4	6,3	7,1			
125-500	1,6	2,8	4,4	6,3	7,0	7,2	6,4			
150-125	0,2	0,4	0,7	0,9	1,3	1,7				
150-160	0,3	0,5	0,8	1,2	1,6	2,0	2,0			
150-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3			
150-250	0,5	0,8	1,3	1,9	2,6	3,4				
150-315	0,8	1,4	2,2	3,2	3,0					
150-400	1,3	2,3	3,6	4,2	5,0					
150B-400	1,0	1,8	2,8	4,1	4,8	5,1	5,1			
150-500	1,6	2,9	4,5	5,0						
200-160	0,3	0,5	0,8	1,0						
200-200	0,5	0,8	1,3	1,6						
200-250	0,5	0,8	1,3	1,9	2,5	2,7	3,4	3,4		
200-315	0,6	1,0	1,6	2,3	3,1	4,1	5,2	4,0		
200-400	1,0	1,8	2,8	4,0	4,5	3,7				
250-200	0,5	0,5	1,3	1,8	2,0					
250-250	0,5	0,9	1,4	2,0						
250-315	0,6	1,1	1,7	2,5	3,4	3,7				
300-200	0,5	0,5	1,3							
300-250	0,6	1,0	1,7							
300-315	0,6	1,1	1,8							

10.8 Pressure near the impeller hub for shaft sealing groups S.. and CD3

Pressure near the impeller hub above the inlet pressure, calculated for a specific mass of 1000 kg/m³

Table 27: .Pressure near the impeller hub for shaft sealing groups S1-S2-S3-S4-CD3.

CN	n[min^{-1}]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
25-125	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,3
25-160	0,1	0,2	0,4	0,6	0,8	1,0	1,2	1,5	1,9	2,2
32-125	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,3
32C-125	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,3
32-160	0,1	0,2	0,4	0,6	0,8	1,0	1,2	1,5	1,9	2,2
32A-160	0,1	0,2	0,4	0,6	0,8	1,0	1,2	1,5	1,9	2,2
32C-160	0,1	0,2	0,4	0,6	0,8	1,0	1,2	1,5	1,9	2,2
32-200	0,1	0,2	0,4	0,5	0,7	0,9	1,2	1,4	1,7	2,1
32C-200	0,1	0,2	0,4	0,5	0,7	0,9	1,2	1,4	1,7	2,1
32-250	0,2	0,4	0,6	0,8	1,2	1,5	1,9	2,4		
40C-125	0,1	0,2	0,3	0,4	0,5	0,7	0,8	1,0	1,2	1,5
40C-160	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,3
40C-200	0,2	0,4	0,6	0,9	1,3	1,6	2,1	2,5	3,1	3,7
40-250	0,3	0,4	0,7	1,0	1,4	1,8	2,3	2,8		
40A-315	0,4	0,7	1,1	1,6	2,1	2,8				
50C-125	0,0	0,1	0,1	0,2	0,2	0,3	0,4	0,5	0,5	0,6
50C-160	0,1	0,2	0,2	0,4	0,5	0,6	0,8	1,0	1,2	1,4
50C-200	0,1	0,2	0,3	0,5	0,6	0,8	1,0	1,3	1,5	1,8
50-250	0,3	0,4	0,7	1,0	1,4	1,8	2,3	2,8		
50-315	0,3	0,6	0,9	1,3	1,7	2,2				
65C-125	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1
65C-160	0,0	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,4	0,5
65C-200	0,1	0,2	0,3	0,5	0,6	0,8	1,0	1,3	1,5	1,8
65A-250	0,2	0,3	0,5	0,7	1,0	1,3	1,6	2,0		
65-315	0,4	0,7	1,1	1,6	2,2	2,9				
80C-160	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
80C-200	0,0	0,0	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,4
80-250	0,1	0,3	0,4	0,6	0,8	1,0	1,3	1,6	1,9	
80A-250	0,1	0,3	0,4	0,6	0,8	1,0	1,3	1,6	1,9	
80-315	0,2	0,4	0,6	0,9	1,2	1,6				
80-400	0,4	0,6	1,0	1,4	2,0	2,6	3,3			
100-160	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
100C-200	0,0	0,1	0,1	0,2	0,2	0,3	0,4	0,4		
100C-250	0,1	0,1	0,2	0,3	0,4	0,5	0,7	0,8		
100-315	0,2	0,4	0,7	0,9	1,3	1,7				
100-400	0,6	1,1	1,7	2,5	3,4	4,4	5,6			
125-125	0,0	0,0	0,0	0,0	0,0	0,0	0,0			
125-250	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9		

Table 27: .Pressure near the impeller hub for shaft sealing groups S1-S2-S3-S4-CD3.

CN	n[min^{-1}]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
125-315	0,2	0,4	0,6	0,8	1,1	1,4	1,8	2,2		
125-400	0,4	0,7	1,1	1,6	2,2	2,8	3,6			
125-500	0,9	1,5	2,4	3,4	3,4	2,8	1,3			
150-125	0,0	0,0	0,0	0,0	0,0	0,0				
150-160	0,0	0,0	0,0	0,0	0,1	0,1	0,1			
150-200	0,0	0,0	0,0	0,0	0,0	0,0	0,0			
150-250	0,0	0,0	0,0	0,0	0,0	0,0				
150-315	0,1	0,2	0,4	0,5	0,7					
150-400	0,4	0,6	1,0	1,4	1,9					
150B-400	0,4	0,7	1,1	1,6	1,6	1,1	0,2			
150-500	0,8	1,5	2,3	2,0						
200-160	0,0	0,0	0,1	0,1						
200-200	0,0	0,0	0,0	0,1						
200-250	0,1	0,2	0,4	0,5	0,7	0,4	0,5	0,0		
200-315	0,2	0,3	0,5	0,6	0,9	1,2	1,5	0,0		
200-400	0,4	0,7	1,0	1,5	1,2	0,0				
250-200	0,0	0,1	0,1	0,1	0,2					
250-250	0,1	0,2	0,4	0,5						
250-315	0,1	0,2	0,4	0,5	0,7	0,3				
300-200	0,1	0,2	0,2							
300-250	0,1	0,2	0,3							
300-315	0,1	0,1	0,2							

10.9 Permissible forces and moments on the flanges

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

The maximum allowable forces and moments on the flanges should be based on the following maximum values for the lateral displacement of the shaft end, relative to the fixed point in space:

- pumps of bearing group 0(+) and 1: 0,15 mm,
- pumps of bearing group 2: 0,20 mm,
- pumps of bearing group 3: 0,25 mm,
- pumps of bearing group 4: 0,40 mm.

The values can be applied simultaneously in all directions with positive or negative signs, or separately on each flange (suction and discharge).

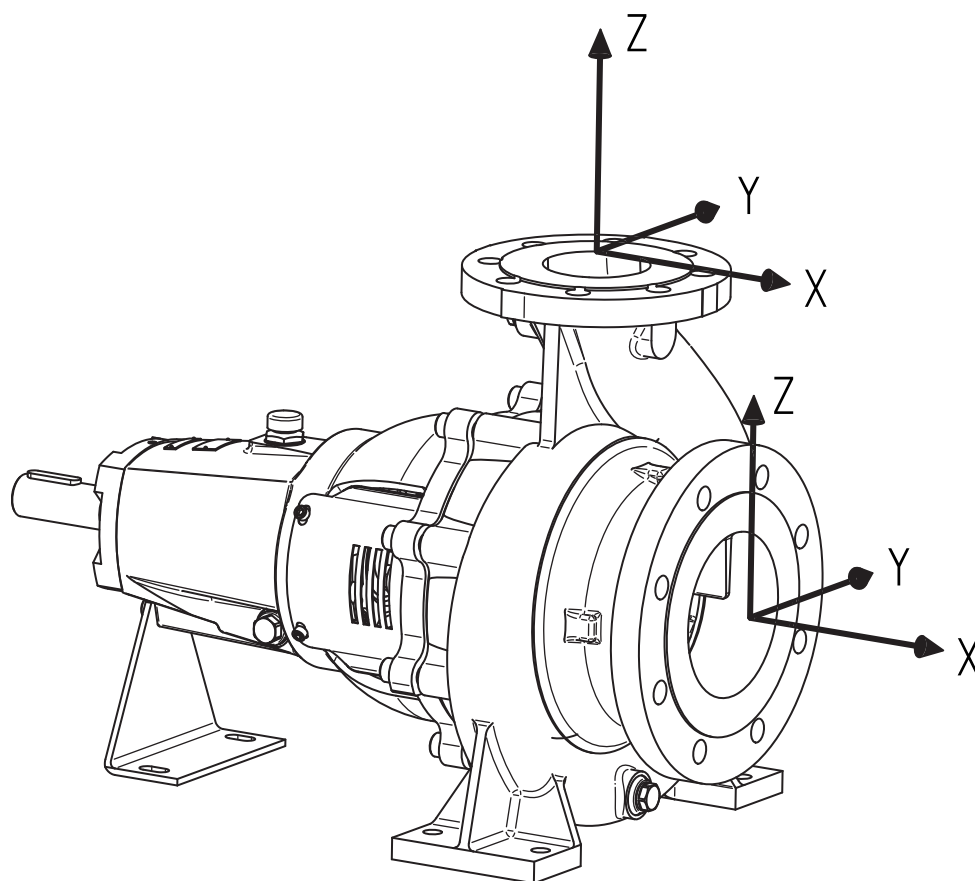


Figure 103: Coordinate system.

Table 28: Permissible forces and moments on the flanges, based on EN-ISO 5199

CN	Pump unit with a non-grouted base plate															
	Horizontal Pump, End branch, x-Axis								Horizontal Pump, Top branch, z-Axis							
	Force [N]				Moment [Nm]				Force [N]				Moment [Nm]			
	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
25-125	315	298	368	578	263	298	385	560	245	298	263	455	210	245	315	455
25-160	263	245	298	455	210	245	315	455	245	298	263	455	210	245	315	455
32-125	525	473	578	910	350	403	490	718	298	368	315	578	263	298	385	560
32C-125	525	473	578	910	350	403	490	718	298	368	315	578	263	298	385	560
32-160	525	473	578	910	350	403	490	718	298	368	315	578	263	298	385	560
32A-160	525	473	578	910	350	403	490	718	298	368	315	578	263	298	385	560
32C-160	525	473	578	910	350	403	490	718	298	368	315	578	263	298	385	560
32-200	525	473	578	910	350	403	490	718	298	368	315	578	263	298	385	560
32C-200	525	473	578	910	350	403	490	718	298	368	315	578	263	298	385	560
32-250	525	473	578	910	350	403	490	718	298	368	315	578	263	298	385	560
40C-125	648	595	735	1155	385	420	525	770	350	438	385	683	315	368	455	665
40C-160	648	595	735	1155	385	420	525	770	350	438	385	683	315	368	455	665
40C-200	648	595	735	1155	385	420	525	770	350	438	385	683	315	368	455	665
40-250	648	595	735	1155	385	420	525	770	350	438	385	683	315	368	455	665
40A-315	648	595	735	1155	385	420	525	770	350	438	385	683	315	368	455	665
50C-125	648	595	735	1155	385	420	525	770	473	578	525	910	350	403	490	718
50C-160	648	595	735	1155	385	420	525	770	473	578	525	910	350	403	490	718
50C-200	648	595	735	1155	385	420	525	770	473	578	525	910	350	403	490	718
50-250	648	595	735	1155	385	420	525	770	473	578	525	910	350	403	490	718
50-315	648	595	735	1155	385	420	525	770	473	578	525	910	350	403	490	718
65C-125	788	718	875	1383	403	455	560	823	595	735	648	1155	385	420	525	770
65C-160	788	718	875	1383	403	455	560	823	595	735	648	1155	385	420	525	770
65C-200	788	718	875	1383	403	455	560	823	595	735	648	1155	385	420	525	770
65A-250	788	718	875	1383	403	455	560	823	595	735	648	1155	385	420	525	770
65-315	788	718	875	1383	403	455	560	823	595	735	648	1155	385	420	525	770
80C-160	1050	945	1173	1838	438	508	613	910	718	875	788	1383	403	455	560	823
80C-200	1050	945	1173	1838	438	508	613	910	718	875	788	1383	403	455	560	823
80-250	1050	945	1173	1838	438	508	613	910	718	875	788	1383	403	455	560	823
80A-250	1050	945	1173	1838	438	508	613	910	718	875	788	1383	403	455	560	823
80-315	1050	945	1173	1838	438	508	613	910	718	875	788	1383	403	455	560	823
80-400	1243	1120	1383	2170	525	665	735	1068	718	875	788	1383	403	455	560	823
100-160	1243	1120	1383	2170	525	665	735	1068	945	1173	1050	1838	438	508	613	910
100C-200	1243	1120	1383	2170	525	665	735	1068	945	1173	1050	1838	438	508	613	910
100C-250	1243	1120	1383	2170	525	665	735	1068	945	1173	1050	1838	438	508	613	910
100-315	1243	1120	1383	2170	525	665	735	1068	945	1173	1050	1838	438	508	613	910
100-400	1243	1120	1383	2170	525	665	735	1068	945	1173	1050	1838	438	508	613	910
125-125	1243	1120	1383	2170	525	665	735	1068	1120	1383	1243	2170	525	665	735	1068
125-250	1575	1418	1750	2748	613	718	875	1278	1120	1383	1243	2170	525	665	735	1068
125-315	1575	1418	1750	2748	613	718	875	1278	1120	1383	1243	2170	525	665	735	1068
125-400	1575	1418	1750	2748	613	718	875	1278	1120	1383	1243	2170	525	665	735	1068
125-500	2100	1890	2345	3658	805	928	1138	1680	1120	1383	1243	2170	525	665	735	1068
150-125	1575	1418	1750	2748	613	718	875	1278	1418	1750	1575	2748	613	718	875	1278
150-160	1575	1418	1750	2748	613	718	875	1278	1418	1750	1575	2748	613	718	875	1278
150-200	1575	1418	1750	2748	613	718	875	1278	1418	1750	1575	2748	613	718	875	1278

Table 28: Permissible forces and moments on the flanges, based on EN-ISO 5199

CN	Pump unit with a non-grouted base plate															
	Horizontal Pump, End branch, x-Axis								Horizontal Pump, Top branch, z-Axis							
	Force [N]				Moment [Nm]				Force [N]				Moment [Nm]			
	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
150-250	2100	1890	2345	3658	805	928	1138	1680	1418	1750	1575	2748	613	718	875	1278
150-315	2100	1890	2345	3658	805	928	1138	1680	1418	1750	1575	2748	613	718	875	1278
150-400	2100	1890	2345	3658	805	928	1138	1680	1418	1750	1575	2748	613	718	875	1278
150B-400	2980	2700	3340	5220	1260	1460	1780	2620	1418	1750	1575	2748	613	718	875	1278
150-500	2980	2700	3340	5220	1260	1460	1780	2620	1418	1750	1575	2748	613	718	875	1278
200-160	2100	1890	2345	3658	805	928	1138	1680	1890	2345	2100	3658	805	928	1138	1680
200-200	2100	1890	2345	3658	805	928	1138	1680	1890	2345	2100	3658	805	928	1138	1680
200-250	2980	2700	3340	5220	1260	1460	1780	2620	1890	2345	2100	3658	805	928	1138	1680
200-315	2980	2700	3340	5220	1260	1460	1780	2620	1890	2345	2100	3658	805	928	1138	1680
200-400	3580	3220	4000	6260	1720	1980	2420	3560	1890	2345	2100	3658	805	928	1138	1680
250-200	2980	2700	3340	5220	1260	1460	1780	2620	2700	3340	2980	5220	1260	1460	1780	2620
250-250	3580	3220	4000	6260	1720	1980	2420	3560	2700	3340	2980	5220	1260	1460	1780	2620
250-315	3580	3220	4000	6260	1720	1980	2420	3560	2700	3340	2980	5220	1260	1460	1780	2620
300-200	3580	3220	4000	6260	1720	1980	2420	3560	3220	4000	3580	6260	1720	1980	2420	3560
300-250	3580	3220	4000	6260	1720	1980	2420	3560	3220	4000	3580	6260	1720	1980	2420	3560
300-315	3580	3220	4000	6260	1720	1980	2420	3560	3220	4000	3580	6260	1720	1980	2420	3560

The basic values mentioned in the table above should be multiplied with the following coefficients in relation to the relevant pump casing materials:

Cast iron or bronze	1
Nodular cast iron (DN ≤ 200)	1,6
Nodular cast iron (200 < DN ≤ 500)	1,4

10.10 Hydraulic performance

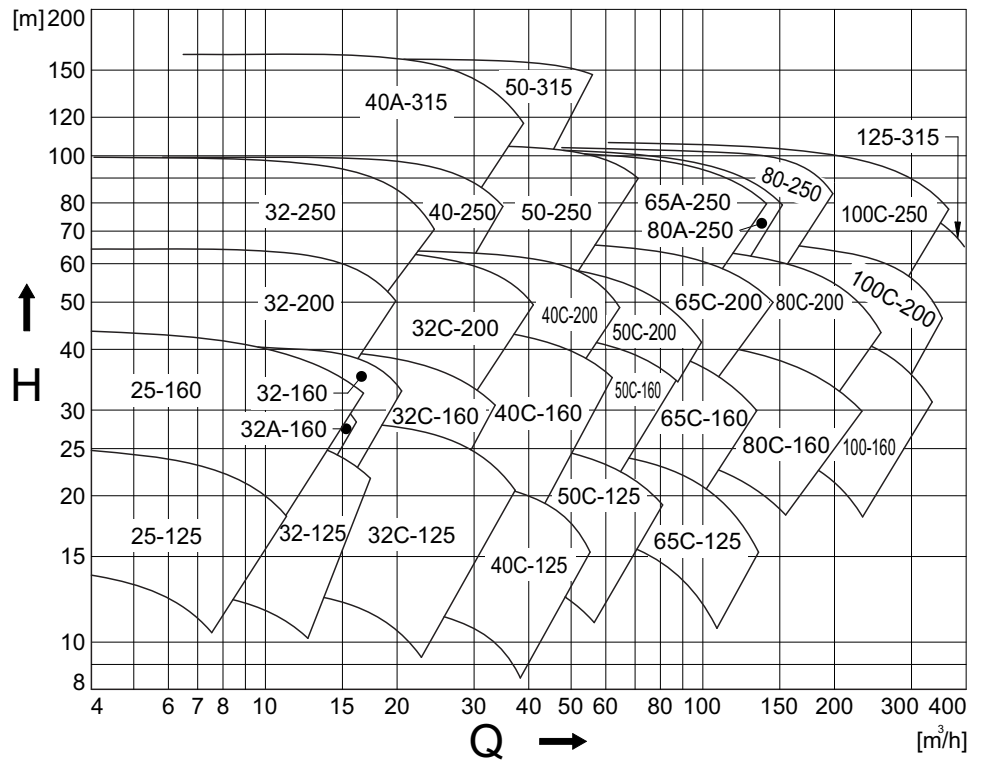


Figure 104: Performance overview 3000 min⁻¹.

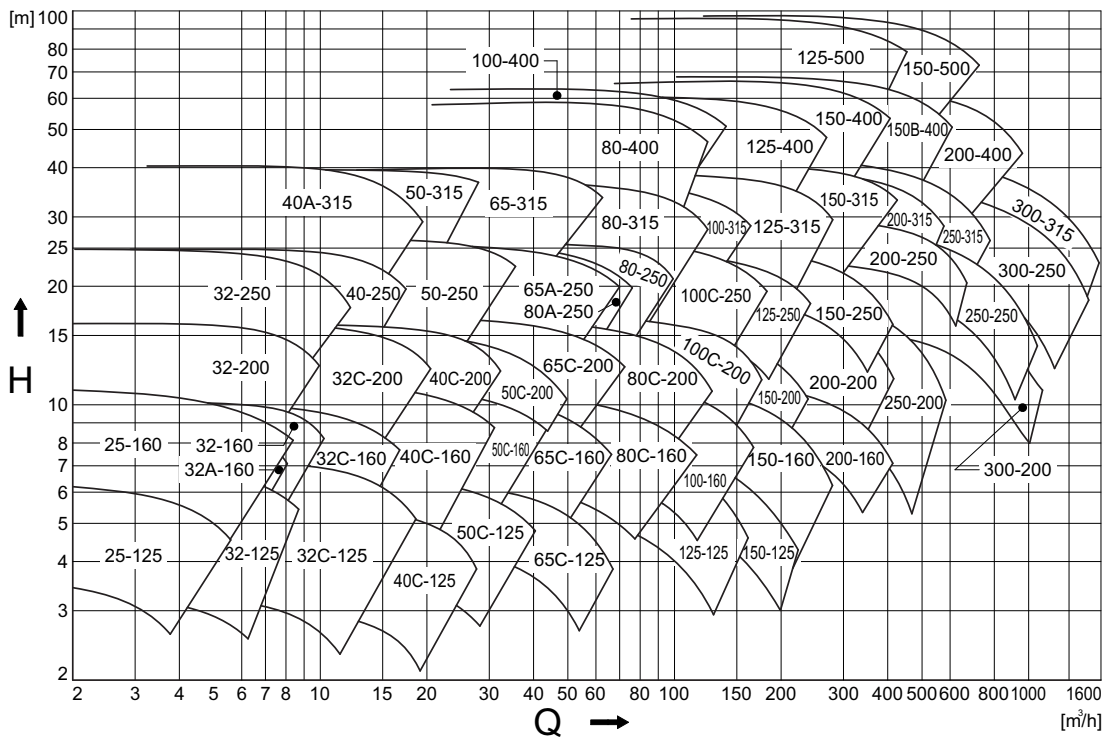


Figure 105: Performance overview 1500 min⁻¹.

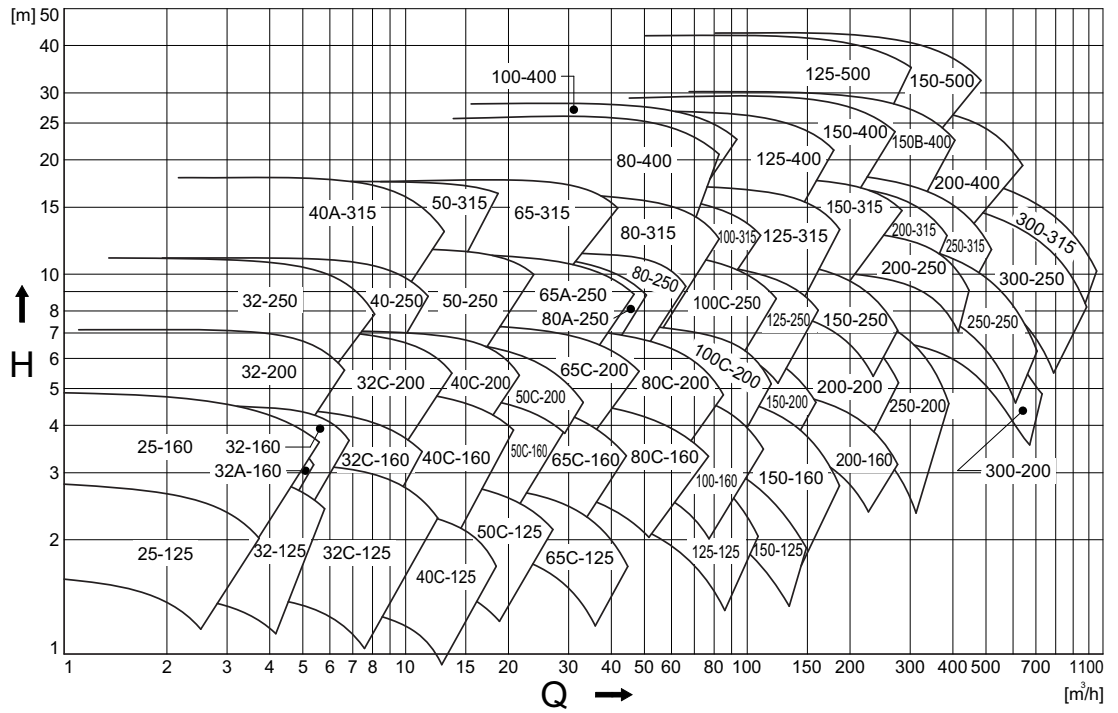


Figure 106: Performance overview 1000 min⁻¹.

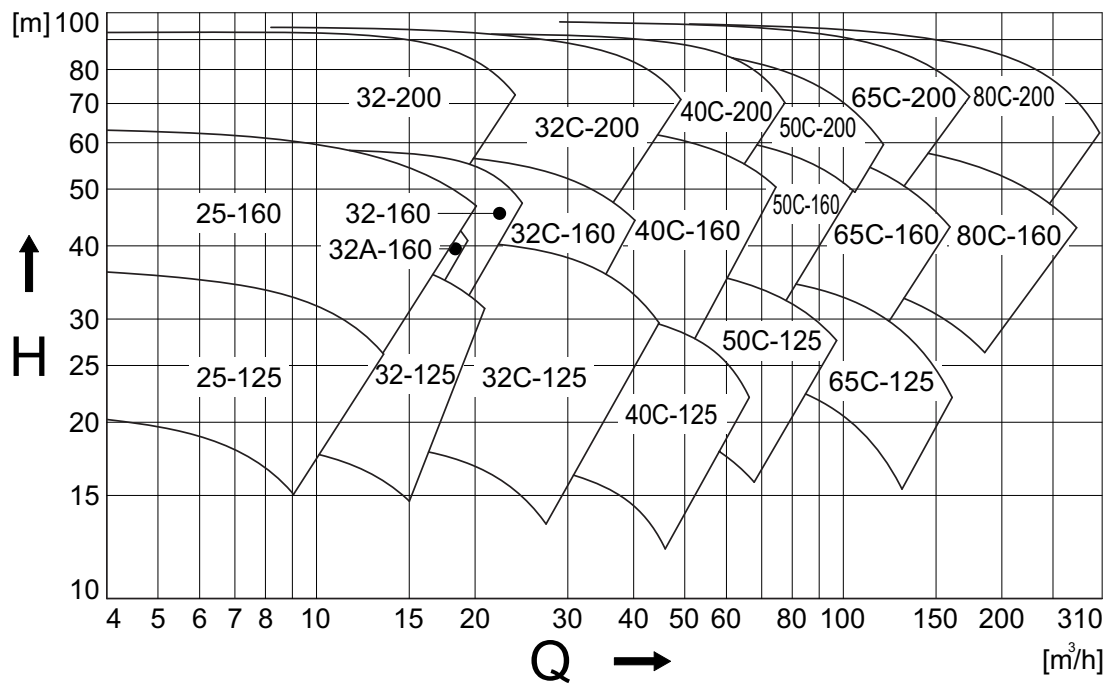


Figure 107: Performance overview 3600 min⁻¹.

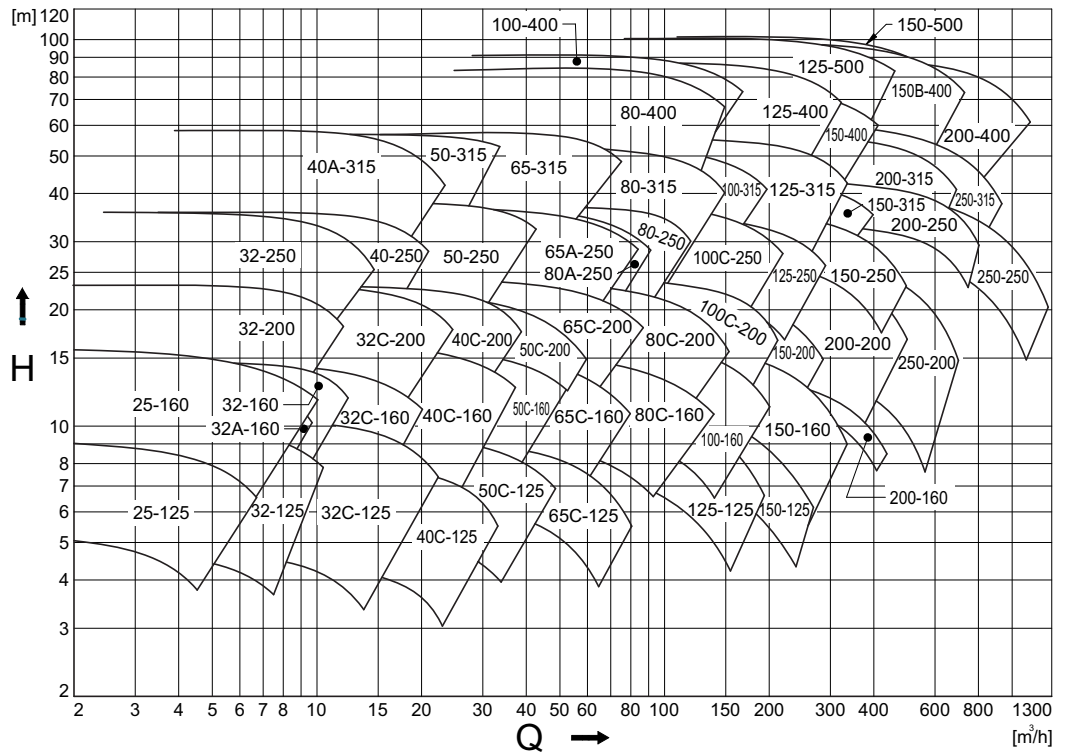


Figure 108: Performance overview 1800 min⁻¹.

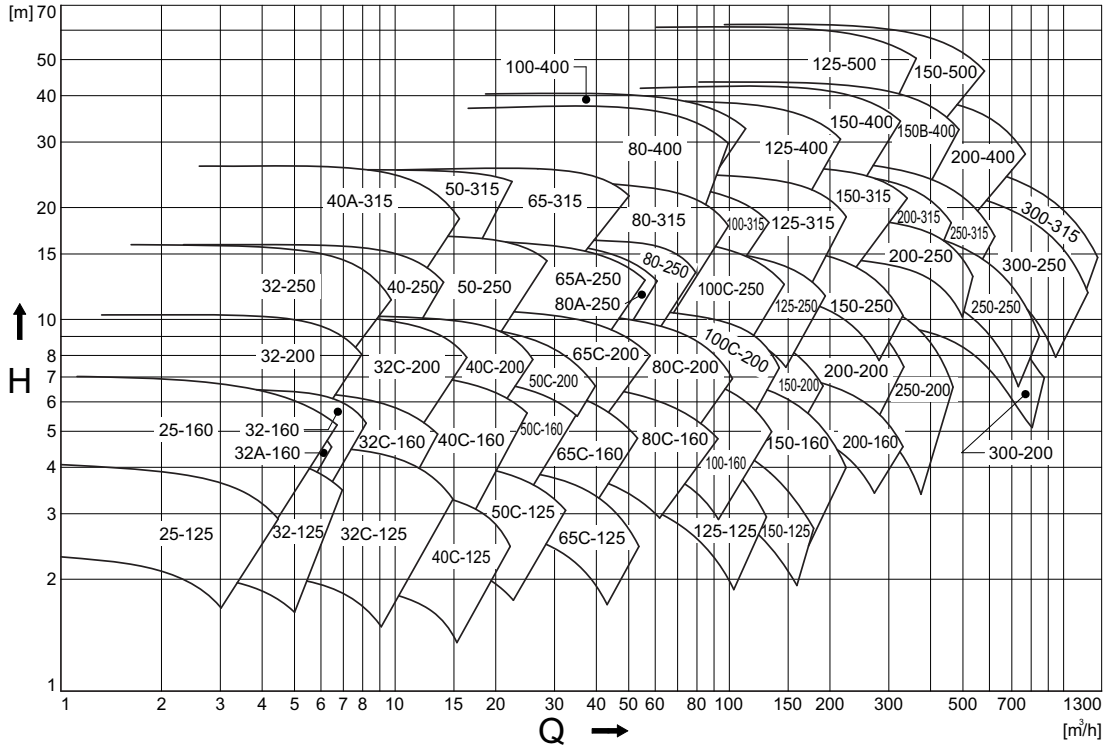


Figure 109: Performance overview 1200 min⁻¹.

10.11 Noise data

10.11.1 Pump noise as a function of pump power

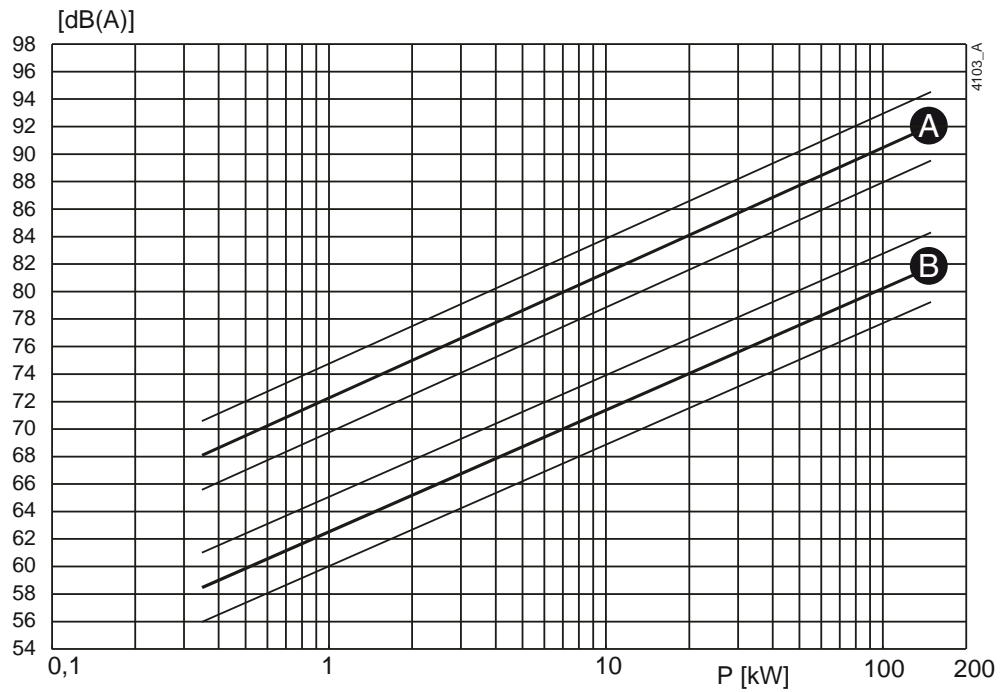


Figure 110: Noise level as function of pump power [kW] at 1450 min^{-1}
A = sound power level, B = sound pressure level.

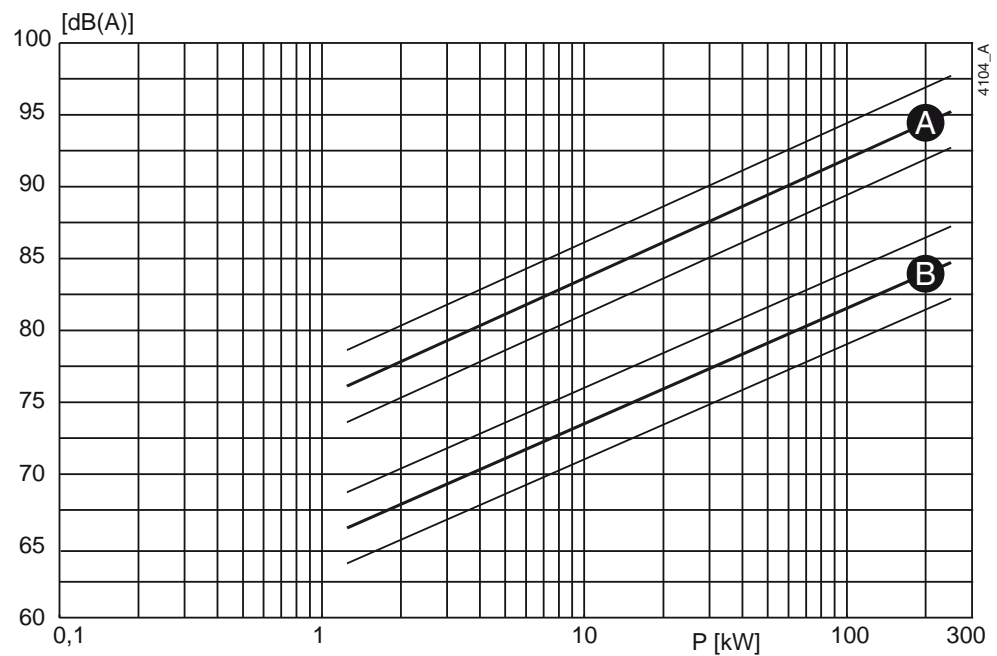


Figure 111: Noise level as function of pump power [kW] at 2900 min^{-1}
A = sound power level, B = sound pressure level.

10.11.2 Noise level of entire pump unit

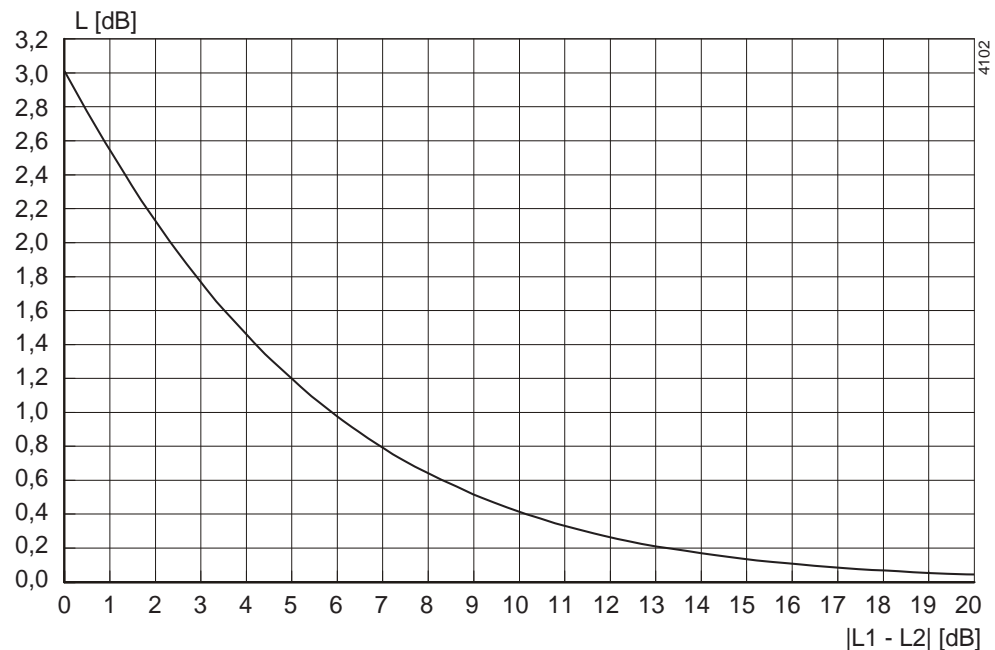


Figure 112: Noise level of entire pump unit.

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 (L_1) of the pump, see figure 110 or figure 111.
- 2 Determine the noise level (L_2) of the motor, see documentation of the motor.
- 3 Determine the difference between both levels $|L_1 - L_2|$.
- 4 Find the differential value on the $|L_1 - L_2|$ -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 (L_1 or L_2).

Example:

- 1 Pump 75 dB; motor 78 dB.
- 2 $|75-78| = 3$ dB.
- 3 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.

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CombiNorm

Horizontal centrifugal pump according to
EN 733 (DIN 24255)

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