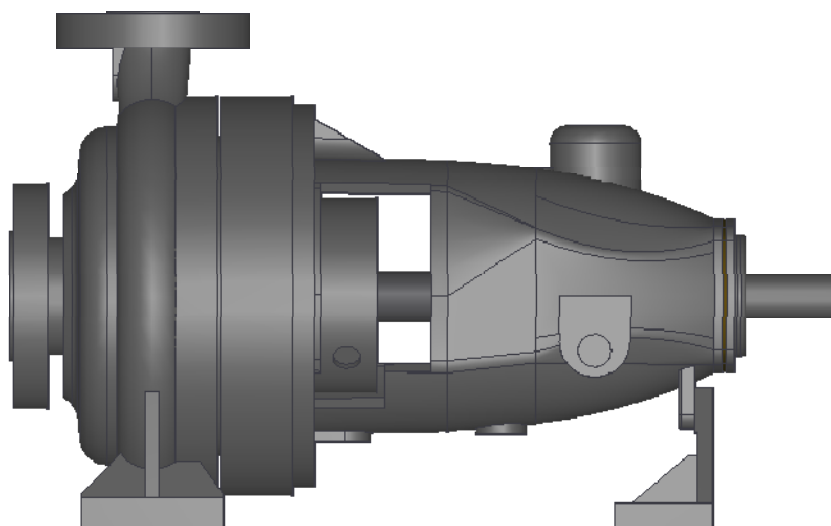


# Operation / Installation Instructions

NCL

Nr. 44.NCL.E7.09/ 17



Original Manual





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# 1. General

This instruction manual describes the proper and safe usage of the pump during all operating phases.

The instruction manual does not consider local regulations. Adherence to those is the responsibility of the owner.

The name tag states pump type and size, the most important operating data as well as the pump serial number. The serial number is a precise description of the pump unit and serves as identification for all following procedures.

In the event of damage, the Customer Service of Dickow Pumpen must immediately be informed in order to maintain guarantee claims.

For installation of supplied interchangeable units, the respective subchapters of "Maintenance, Servicing, Inspection" must be observed.

Applicable documents:

- Pump data sheet
- Dimensional drawing
- Sectional drawing
- Parts lists
- Sub-supplier documentation



## 2. Safety

The manual includes basic instructions for installation, operation and maintenance. Only if these instructions are strictly observed, a safe handling of pump or pump unit is guaranteed and personal injury and material damage is avoided.

All the safety instructions in this manual must be considered.




This manual must be thoroughly reviewed and completely understood by the qualified personnel / operator before attempting assembly and start-up.

The manual must consistently be available on site.



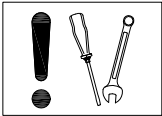

Indications and plates attached to the pump must be followed and kept in legible condition.

### 2.1 Designation of Warning Notices

Signal word	Explanation
<b>DANGER</b>	signifies an imminent danger. If it will not be avoided, death or severe injury are the consequence.
<b>WARNING</b>	signifies a possibly dangerous situation. If it will not be avoided, death or severe injury may be the consequence.
<b>CAUTION</b>	signifies a possibly dangerous situation. If it will not be avoided, slight or minor injury may be the consequence.
<b>ATTENTION</b>	signifies a possibly harmful situation. If it will not be avoided, danger for the pump and its function may be the consequence.

Symbol	Explanation
	General danger sign Together with a signal word, it signifies dangers in connection with death or injury.
	Dangerous voltage Together with a signal word, it signifies dangers in connection with voltage.
	Warning from magnetic field Together with a signal word, it signifies dangers in connection with magnetic fields.



	<b>Hot surface</b> Together with a signal word, it signifies dangers in connection with hot surfaces.
	<b>Explosion protection</b> Gives information on protection from explosion development in hazardous area according to Directive 2014/34/EU.
	<b>Mechanical breakdown</b> Together with the signal word ATTENTION, it signifies dangers for the pump and its function.
	<b>Notice</b> Provides recommendation and useful information for handling the product.

## 2.2 Intended use

The pump / pump unit may only be operated in the application area which is described in the relevant pump data sheet. This applies for instance to pumped liquid, flow, speed, pressure, temperature and motor power. Further points to be observed:

- Operate pump in technically faultless condition only.
- Never operate pump if not completely assembled.
- Never operate pump without liquid.
- Observe pump data sheet / operating manual regarding the minimum flow.
- Observe pump data sheet / operating manual regarding the maximum flow.
- Never throttle pump on suction side.
- Maximum speed is 3500 rpm (+10%).

## 2.3 Avoidance of foreseeable operating errors

- Never open shut-off valves in excess of the allowable range. This would cause exceedance of the maximum flow and possible cavitation damage.
- Never exceed the allowable application limits regarding pressure and temperature which are specified in the pump data sheet.
- Consider and adhere to all safety instructions and other notices mentioned in the operating manual.



### 2.4 Qualification of personnel

The personnel must possess the relevant qualification for assembly, operation, maintenance and inspection of the pump unit.

Responsibility, competence and supervision must be strictly regulated by the owner.

Skill of the personnel shall be improved by training. Training course can be held by the technical staff of Dickow Pumpen.

### 2.5 Additional safety regulations

Besides the safety instructions mentioned in this manual, the following additional regulations apply:

- Accident prevention regulations
- Explosion proof regulations
- Safety regulations for handling hazardous materials
- Applicable standards and laws

### 2.6 Safety instructions for the operator / user

- Protection against contact with hot and cold components must be provided by customer.
- Coupling guard and hand guard on the pump / pump unit must not be removed during operation.
- Pump must always be earth connected / grounded.
- Protective equipment for personnel must be provided and used.
- Toxic liquid leakage must be drained off safely, without endangering individuals and environment. Legal requirements must be observed.
- Danger through electric energy must be excluded.

### 2.7 Safety instructions for maintenance, inspection and assembly

- Alteration works or modifications on the pump are only allowed after consulting Dickow Pumpen.
- Only original parts or parts approved by Dickow shall be used.
- Repairs on the pump / pump unit may only be done during shutdown.
- The pump casing must have cooled down to ambient temperature.
- The pump must be depressurized and drained.
- Consider the procedure for decommissioning according to chapter 6.6.
- Pumps handling products dangerous to health must be decontaminated according to chapter 4.4
- Coupling guard and hand guard must be mounted again after completion of the works.
- Works on the pump unit may be done only with disconnected electricity.
- Secure the pump unit against unintentional switch-on.



### 2.8 Non-observance of the instruction manual

Non-observance of this manual leads to loss of warranty and damage claims. Non-observance will involve the following risks:

- Endangering of individuals through electrical, thermal, mechanical and chemical impacts.
- Danger through explosions.
- Danger through breakdown of essential functions.
- Endangering of environment through leakage of toxic liquids.

### 2.9 Notices on explosion protection

**DANGER**



**Operation in explosive areas requires stringent attention to this chapter.**

- Only pumps with relevant identification are allowed to be used in explosive areas.
- Pumps must be designated for this service in the pump data sheet.
- Intended use must be guaranteed.
- Inadmissible operating conditions must be avoided in any case.
- Special conditions apply for operation in compliance with Explosion Proof Directive. The "Ex"- symbol shown here marks the chapters in this manual which require special attention.

#### 2.9.1 Surface temperature

The highest surface temperatures are to be expected at the pump casing, the atmosphere sided seal ring of the mechanical seal and in the area of antifriction bearings. The surface temperature at the pump casing is equal to the temperature of the pumped liquid.

The surface in the bearing bracket area must be uncovered. Insulation of the bearing bracket is not allowed.

The expected temperature of atmosphere sided seal ring, respectively the allowable temperature of pumped liquid or operating temperature of quench fluid for the DICKOW Metal bellows mechanical seals N6, N9, N10, N11 and N13 can be determined with the formula below.

Temperature class	T <sub>max</sub> Surface [°C]
T1	450 *
T2	300
T3	200
T4	135
T5	100
T6	85

\* max. operating temperature DICKOW-Metal bellows mechanical seal = 350°C

	$\Delta T_{\text{MECH.SEAL}}$ [K]		
Speed [min <sup>-1</sup> ]	Class 1	Class 2	Class 3
1450-1750	20	25	40
2900-3500	35	45	60





## 2. Safety

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Class 1	=	water and watery liquids
Class 2	=	other liquids
Class 3	=	oils

Seal faces – material code	Factor K
SiC / SiC – UU	0,75
SiC / Carbon – UA	1,0

### Temperature at the atmospheric seal component

$$T_{\text{MECH.SEAL}} = T + (K \cdot \Delta T_{\text{MECH.SEAL}})$$

T = Temperature pumped liquid respectively quench fluid

### Allowable temperature of pumped liquid respectively quench fluid

$$T_{\text{allowable}} = T_{\text{max}} - (K \cdot \Delta T_{\text{MECH.SEAL}}) - T_s$$

T<sub>s</sub> = Safety reduction ; T-Classes T6-T3 = 5 °C

T-Classes T2/T1 = 10 °C

#### NOTE



When using mechanical seals of other makes, operating manuals of mechanical seals must be considered.

#### DANGER



**High surface temperatures through gland packings.  
Lack of stable temperature through frictional heat.**

Danger of explosion!

- Gland packings are not suitable for application in hazardous areas.
- For mechanical seals use throttle bushing instead of gland packing.

### 2.9.2 Monitoring devices

The pump may only be operated within the limits given in the pump data sheet and on the name tag. In case the owner cannot maintain the operating limits, monitoring devices are required.

More information about monitoring devices can be inquired at DICKOW Pumpen.

### 2.9.3 Application in explosion group II C

In order to avoid brush discharge from machines of group II G, the coating thickness is limited to maximum 0,2 mm.

For thicker coatings, approved conductive coating systems are used.



# 3. Description

## 3.1 General discription

This pump is used especially for dangerous liquids handled in the chemical, petrochemical, oil and gas industry.

## 3.2 Design code

Example: NCL b h 32/210 A Ge

NCL	pump type
b	special design ; e.g. b = heating jacket
h	material execution ; e.g. h = 1.4408 / 1.4571
32	nominal width discharge flange [mm]
210	nominal impeller diameter [mm]
A	scope of supply ; e.g. A = bare shaft pump
Ge	shaft sealing ; e.g. Ge = standard mechanical seal, balanced

## 3.3 Classification pump size / frame size

Frame size	0	I	II	III	IV	V
Pump sizes	26/170	32/165	32/250	65/320	150/320	250/400
	26/210	32/210	40/250	80/320	150/400	250/500
		40/165	40/320	100/250	150/500	
		40/210	50/250	100/320	200/260	
		50/165	50/330	100/400	200/320	
		50/210	65/165	125/250	200/400	
			65/210	125/320	200/500	
			65/250	125/400	250/320	
			80/165	150/250		
			80/210			
			80/250			
			100/210			



### 3.4 Identification

#### 3.4.1 Name tag

DICKOW PUMPEN Siemensstr. 22 D-84478 WALDKRAIBURG	
Bezeichnung	
Type	
Pos. Nr.	
Fabr. Nr. PB	Baujahr
Q <input type="text"/> m <sup>3</sup> /h	H <input type="text"/> m
n <input type="text"/> min <sup>-1</sup>	ρ <input type="text"/> kg/dm <sup>3</sup>
MAWP@Temp <input type="text"/> bar	@ <input type="text"/> °C
Prüfdruck <input type="text"/> bar	
Ausführung	
➔	
Made in Germany	
CE	

DICKOW PUMPEN Siemensstr. 22 D-84478 WALDKRAIBURG	
Designation	
Type	
Item No.	
Serial No. PB	Year of constr.
Q <input type="text"/> m <sup>3</sup> /h	H <input type="text"/> m
n <input type="text"/> min <sup>-1</sup>	ρ <input type="text"/> kg/dm <sup>3</sup>
MAWP@Temp <input type="text"/> bar	@ <input type="text"/> °C
Test Pressure <input type="text"/> bar	
Design	
➔	
Made in Germany	
CE	

Fig. 1: Name tag German and English

#### 3.4.2 Identification acc. to Explosion Proof Directive

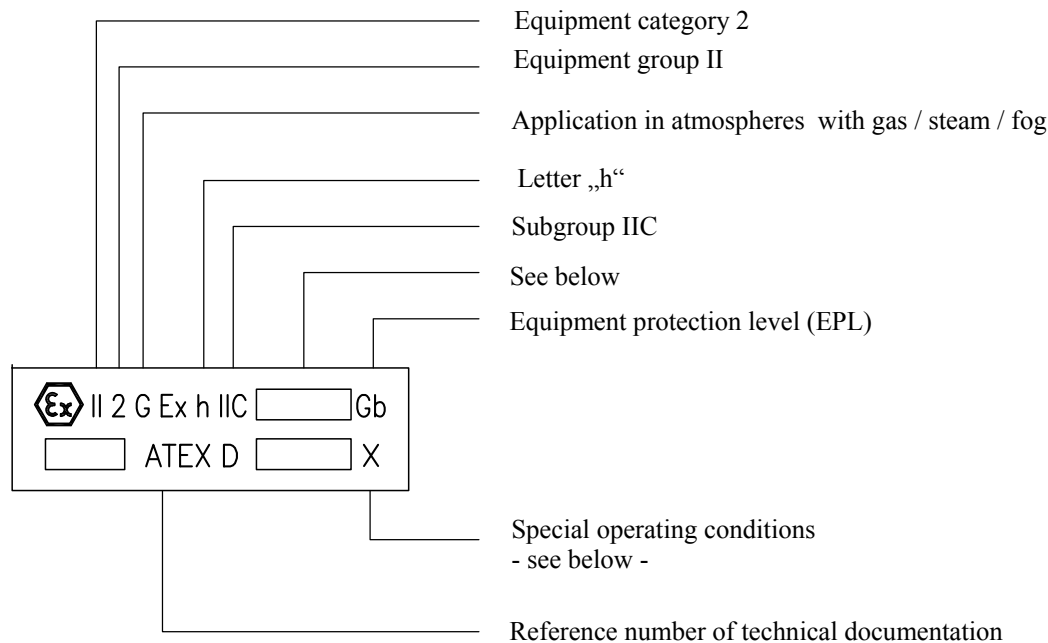


Fig. 3: ATEX- nameplate

The surface temperature does not depend on the ignition source, but on the temperature of the pumped liquid. There is no identification with a temperature class or a temperature. The marking contains an identification of T-area or temperature range as well as the symbol “X” (behind the reference number of technical documentation) for special operating conditions regarding the temperature.

Chapter 2.9.1 refers to the arising surface temperatures.

Space permitting, this Ex-marking is integrated in the name plate as per chapter 3.4.1.



## 3. Description

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### 3.5 Design

#### **Design**

- volute casing pump
- horizontal installation
- single stage
- compliance with requirements of ISO 5199
- dimensions according to ISO 2858

#### **Pump casing**

- single volute / double volute (depending on pump size)
- radially split
- cast-on feet or centerline support

#### **Impeller**

- closed or open
- back vanes, injection slots and/or relief holes for thrust load balance

#### **Bearing**

- motor end: paired angular ball bearing as fixed bearing
- pump end: cylinder roller bearing
- oil lubrication
- optional: grease lubrication with two long-life greased groove ball bearings

#### **Shaft sealing**

- stuffing box
- single and double mechanical seal
- cartridge seal

### 3.6 Scope of supply

Depending on the pump execution, the following items belong to the scope of supply:

- Pump
- Elastic coupling with or without spacer
- Coupling guard
- Casted baseplate respectively welded baseframe of sturdy design
- Drive motor
- Special accessories if required

### 3.7 Dimensions and Weights

Dimensions and weights can be taken from the foundation plan / dimensional drawing.



## 4. Handling / Storage / Disposal

### 4.1 Handling

#### **DANGER**

#### **Slipping of pump / pump unit from its suspension**

Danger of life through components falling down!



- Lift the pump / pump unit only in horizontal position.
- Never hook up the pump on its bare shaft.
- Never hang up the pump unit on the ring screw of the motor.
- Do not stay underneath floating loads.
- Consider weight indications in the dimensional drawing.
- Observe the local accident prevention regulations.
- Use suitable and approved lifting accessories.

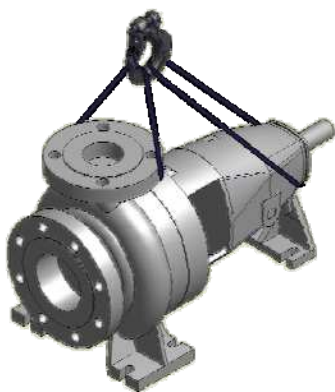


Fig. 3: lifting the pump

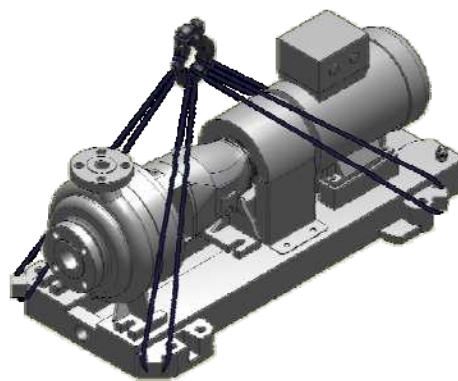


Fig. 4: lifting the complete pump unit

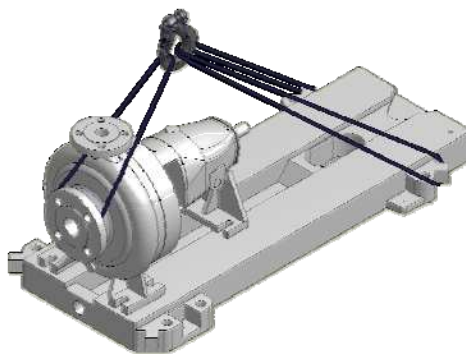


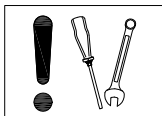
Fig. 5: lifting the pump mounted on base plate



### 4.2 Storage / Preservation

#### ATTENTION

##### **Damage during storage through moisture or dirt.**

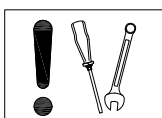


Corrosion and / or contamination of the pump!

- Outside storage requires a watertight cover over pump or over packed pump and accessories.

#### ATTENTION

##### **Wetted, contaminated or damaged openings and joints.**



Leakage or damage of the pump!

- Plugged openings should be uncovered only during installation.

The following measures are recommended for storage of the pump / pump unit:

- Store the pump in a sheltered dry place at normal air humidity of 60%.
- Pump and motor must be decoupled.
- Turn the shaft manually once a month.

New pumps of material GGG (ductile iron) and ferritic cast steel are covered inside with anti-corrosive agent and dewatering-fluid. The maximum inside storage period is 12 months.

If the storage period will be longer than 12 months, Dickow Pumpen must be informed. The pumps need to be treated with a long-term preservation, e.g. nitrogen-preservation.

For storing a pump that has been in operation already, consider chapter 6.6.

### 4.3 Return of pump

- Drain the pump properly considering chapter 7.3.
- Rinse and clean the pump in general, especially when handling dangerous, explosive, hot or other risky liquids.
- A Document of Compliance completely filled in must always be attached to the pump. Refer to chapter 11.2.

#### NOTE



If required, a Document of Compliance can be downloaded under [www.dickow.de](http://www.dickow.de).

<http://www.dickow.de/unbedenk.pdf> (German)

<http://www.dickow.de/unbedenk-en.pdf> (English)



### 4.4 Disposal

#### **WARNING**



#### **Liquids dangerous to health**

Danger for individuals and environment!

- Collect and dispose rinsing water and residual liquid.
- Wear protective clothing and face mask.
- Consider the legal regulations for disposal of liquids dangerous to health.

1. Disassemble pump / pump unit.
2. Collect grease and oil.
3. Separate pump materials
4. Dispose according to the local regulations.



# 5. Installation / Mounting

## 5.1 Safety Instructions

**DANGER**

### Improper installation in explosive area



Danger of explosion!

- Consider the local applicable explosion proof regulations.
- Consider indications on the pump data sheet and on the name tag of pump and motor.

## 5.2 Foundation

**WARNING**

### Installation on weak and unstable foundations



Personal injury and material damage!

- Consider sufficient pressure resistance acc. to class C12/15 in Exposure Class XC1 as per EN 206-1.
- Place the pump unit on hardened foundation only.
- Place the pump unit on level and even surfaces only.
- Consider weight indications of dimensional drawing.

## 5.3 Installation of pump unit

### 5.3.1 Installation on foundation

1. Place the pump unit on the foundation and align it with a water-level.  
Allowable deviation: 0,2 mm/m
2. Insert shims for height compensation. Always insert them both-sided near the foundation bolts between baseplate and foundation.
3. If the space between the foundation bolts is  $> 600$  mm, insert additional shims in the middle between the foundation bolts.
4. All shims must seat solidly.
5. Hook the foundation bolts into the provided bore.
6. Concrete the foundation bolts.
7. Align the base plate after concrete has hardened.
8. Tighten the foundation bolts evenly.
9. Pour the base plate with vibration-free concrete of normal graining with a water-cement-value (W/Z-value)  $\leq 0,5$ . Provide a pourable consistency by using a mobile solvent. Cure of concrete according to DIN 1045.





### 5.3.2 Installation without foundation

Installation without foundation requires a solid and even ground.

1. Place the pump unit on stilts and align it with a water-level.
2. For height compensation, loosen screws and counter nuts of stilts.
3. Adjust the nut until available height differences are compensated.
4. Fasten the counter nuts of the stilts.

## 5.4 Piping

### DANGER



#### Exceedance of the allowable loads at the pump flanges

Danger to life from leaking hot, toxic, caustic or flammable liquids.

- Do not use the pump as an anchor point for piping.
- Support piping before the pump and connect it stress-free.
- Consider allowable flange forces and moments.
- Compensate expansion of the piping in case of high temperatures.

### 5.4.1 Suction pipe

Layout of suction pipe requires special attention. NPSH Available and NPSH Required must be clearly defined. Pay attention to the following:

- Mounting of elbows close to the pump suction must be avoided. Provide a straight pipe of minimum two suction pipe diameters.
- Never connect a larger suction pipe direct to the pump. Flow eddies reduce the free flow area of the pump. Use an eccentric reducer. Installation as shown in the figure below to prevent air cushion formation.

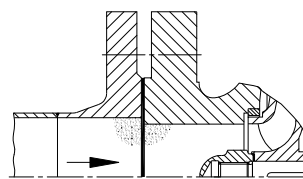


Fig. 6: Flow eddies

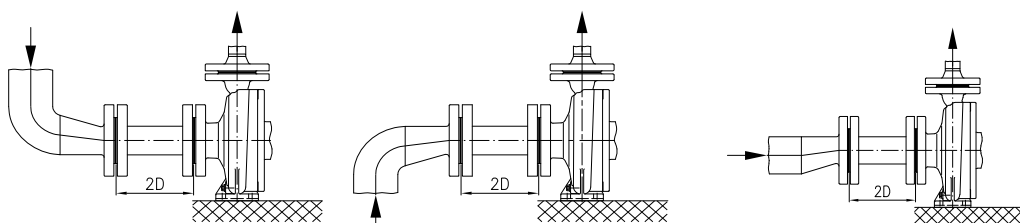


Fig. 7: Reducer connection

- At suction lift conditions, the suction pipe must continuously slope upwards towards pump suction. Avoid air pockets.

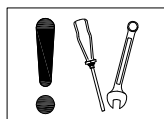


## 5. Installation / Mounting

- At flooded suction conditions, the suction pipe must slope gradually downwards to the suction flange. Avoid air pockets to ensure a complete venting.
- Maximum flow speed of 2 m/s must not be exceeded.

### ATTENTION

#### Welding beads, scale and other impurities in the piping.



Damage of the pump !

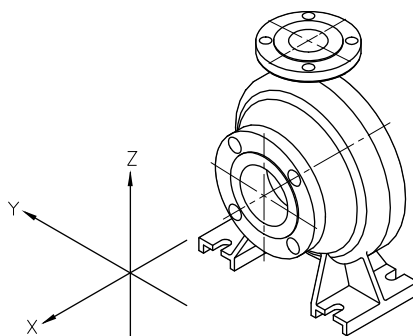
- Piping must be thoroughly cleaned before connecting the pump.
- Remove impurities from the pipes.
- If required, insert a filter.

### NOTE



- Use a filter with a mesh width of 0,5 mm.
- Insert filter with a surface of minimum triple the pipe section.

### 5.4.2 Allowable flange forces and moments



pump size	Suction flange																
	DN	Fx [N]		Fy [N]		Fz [N]		Σ F [N]		Mx [Nm]		My [Nm]		Mz [Nm]		Σ M [Nm]	
		GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS
26/125 - 210	40 1 ½"	556	875	490	770	445	700	860	1360	580	910	400	630	470	735	840	1330
32/165 - 250	50 2"	735	1155	670	1050	600	945	1150	1820	625	1022	445	700	515	805	910	1430
40/125 - 320	65 3"	935	1470	825	1295	760	1190	1460	2310	670	1050	490	770	535	840	970	1540
50/125 - 330	80 3"	1115	1750	1000	1575	915	1435	1750	2760	715	1120	515	805	580	910	1040	1640
65/125 - 320	100 4"	1490	2345	1335	2100	1200	1890	2330	3670	780	1225	560	875	645	1015	1150	1820
80/165 - 320	125 6"	1760	2765	1580	2485	1425	2240	2750	4340	935	1470	670	1050	845	1330	1350	2130
100/210 - 400	125 6"	1760	2765	1580	2485	1425	2240	2750	4340	935	1470	670	1050	845	1330	1350	2130
125/250 - 400	150 6"	2225	3500	2000	3150	1800	2835	3480	5490	1115	1750	780	1225	915	1435	1620	2550
150/250 - 500	200 8"	2980	4690	2670	4200	2400	3780	4640	7310	1445	2275	1025	1610	1180	1855	2130	3360
200/250 - 500	250 10"	4245	5845	3785	5215	3430	4725	6620	9130	2260	3115	1600	2205	1855	2555	3320	4580
250/320 - 500	300 12"	5080	7000	4550	6265	4090	5635	7950	10950	3075	4235	2185	3010	2515	3465	4520	6230



## 5. Installation / Mounting

pump size	Discharge flange																
	DN	Fx [N]		Fy [N]		Fz [N]		Σ F [N]		Mx [Nm]		My [Nm]		Mz [Nm]		Σ M [Nm]	
		GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS
26/125 - 210	25 1"	335	525	315	490	380	595	570	910	400	630	270	420	315	490	570	910
32/165 - 250	32 1 ½"	400	630	380	595	470	735	730	1150	490	770	335	525	380	595	710	1120
40/125 - 320	40 1 ½"	490	770	445	700	560	875	860	1360	580	910	400	630	470	735	840	1330
50/125 - 330	50 2"	670	1050	600	945	735	1155	1150	1820	625	980	445	700	515	805	910	1430
65/125 - 320	65 3"	825	1295	755	1190	935	1470	1460	2310	670	1050	490	770	535	840	970	1540
80/165 - 320	80 3"	1000	1575	915	1435	1111	1750	1750	2760	715	1120	515	805	580	910	1040	1640
100/210 - 400	100 4"	1335	2100	1200	1890	1490	2345	2330	3670	780	1225	560	875	645	1015	1150	1820
125/250 - 400	125 6"	1580	2485	1425	2240	1760	2765	2750	4340	935	1470	670	1050	845	1330	1350	2130
150/250 - 500	150 6"	2000	3150	1800	2835	2225	3500	3480	5490	1115	1750	780	1225	915	1435	1620	2550
200/250 - 500	200 8"	2670	4200	2400	3780	2980	4690	4640	7310	1445	2275	1025	1610	1180	1855	2130	3360
250/320 - 500	250 10"	3790	5215	3430	4725	4245	5845	6620	9130	2260	3115	1600	2205	1855	2555	3320	4580

Forces and moments are based on 20°C. Temperature dependent correction values are given in figure 8.

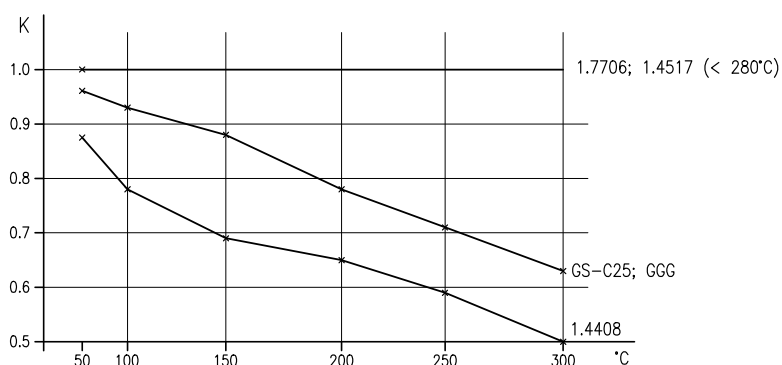


Fig. 8: Temperature correction diagram

In case that not all acting loads reach the maximum allowable values, one of these loads may exceed the limit value under the following provisions.

- Exceedance is limited to 1,4 times the allowable value.
- For the actual forces and moments acting on the flange shall apply:

$$\left( \frac{\Sigma F /_{actual}}{\Sigma F /_{max. allowable}} \right)^2 + \left( \frac{\Sigma M /_{actual}}{\Sigma M /_{max. allowable}} \right)^2 \leq 2$$



### 5.5 Insulation

#### WARNING

**Wetted casing parts adopt the temperature of the pumped liquid.**

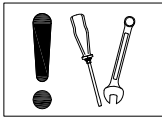


Risk of burns!

- Insulate casing parts
- Attach protective device

#### ATTENTION

**Heat accumulation in the bearing bracket**



Bearing damage!

- Do not insulate the bearing bracket

### 5.6 Coupling alignment

#### DANGER

**Inadmissible temperatures on coupling or antifriction bearings due to misalignment of the coupling**



Danger of explosion!

- Proper alignment of coupling must anytime be ensured.

#### WARNING

**Unintentional switch-on of the pump unit**

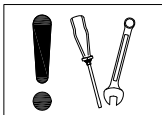


Risk of injury through moving components!

- Works on the pump unit may be done only with disconnected electricity.
- Secure the pump unit against unintentional switch-on.

#### ATTENTION

**Offset of pump shaft and motor shaft**



Damage of pump, motor and coupling!

- Coupling check has always to be performed after pipe connection.
- Coupling check has also to be performed at pump units supplied on common base plate.
- For higher operating temperatures a second alignment at operating temperature is absolutely necessary.



## 5. Installation / Mounting

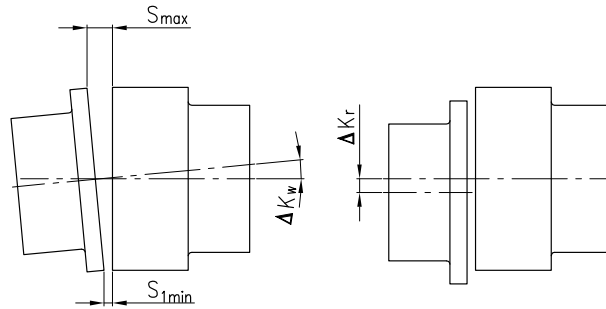


Fig. 9: Angular and radial misalignment of couplings

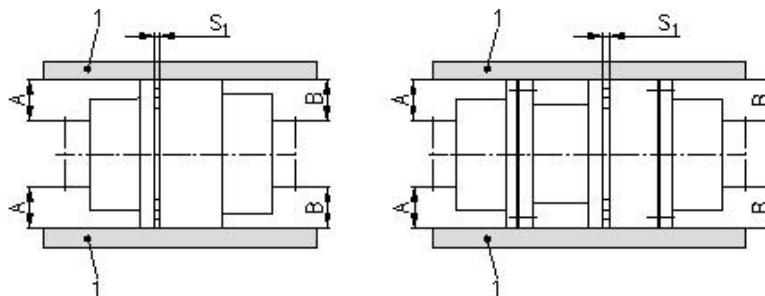


Fig. 10: Coupling alignment

1. Dismantle coupling guard.
2. Loosen support foot.
3. Place a straight edge (1) axially across the coupling half.
4. Possible radial displacement  $\Delta K_r$  becomes visible as a light gap.  
Better: Determine the radial misalignment by measuring the distances A and B at three points staggered by  $120^\circ$ .  
The coupling is aligned correctly if the distance to the shaft is identical at all points.
5. Check the distance  $s_1$  circularly between the coupling halves. The coupling is aligned correctly if the distance is circularly identical.
6. Concerning the allowable deviation  $\Delta s_1$  and  $\Delta K_r$  of both coupling halves, refer to the instruction manual of the coupling manufacturer !
7. Mount the support foot.
8. Mount the coupling guard.

### 5.7 Alignment of pump and motor

#### WARNING



#### Exposed rotating coupling

Risk of injury through rotating shaft!

- Operate the pump unit only with coupling guard.
- Select the coupling guard according to corresponding standards.



### DANGER



#### Ignition hazard through friction sparks

Danger of explosion!

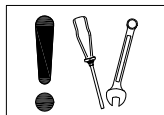
- Use non-sparking material for coupling guard only to exclude flying sparks in case of contact.
- Consider ISO 80079-36.

After the pump unit is installed and piping is connected, check the coupling alignment and realign motor if necessary.

Use shims for height compensation.

1. Dismantle coupling guard.
2. Check coupling alignment. Consider chapter 5.6.
3. Loosen hold down bolts of motor.
4. Place shims under the motor feet for height compensation.
5. Tighten hold down bolts of motor.
6. Check function of coupling / shaft. The coupling must easily be turnable by hand.
7. Mount the coupling guard.
8. Check the space between coupling and coupling guard.

### ATTENTION



#### Offset of pump and motor

Damage of pump, motor and coupling!

- For higher operating temperatures a second alignment at operating temperature is absolutely necessary.

## 5.8 Electrical connection of the pump unit

### DANGER



#### Improper electrical installation

Danger of explosion!

- Electrical installation requires additionally observance of IEC 60079-14.
- Explosion proof motors shall be connected through motor protection switch only

### DANGER



#### Working on the pump unit by unqualified personnel

Danger to life through electric shock!

- Electrical connection must be performed by qualified electrician only.
- Regulations IEC 30364 and IEC 60079 must be considered.



### WARNING



#### Incorrect power connection

Short circuit!

- Adhere to connection conditions of local energy supply companies.

Proceedings:

1. Check for compliance of the available supply voltage with the indications on the motor name tag.
2. Select suitable connection method.
3. Check for identical rotating direction of motor and pump. Consider the rotating direction arrow of the pump !

### NOTE



Observe the instruction manual of the motor !

### 5.8.1 Checking rotating direction

### DANGER

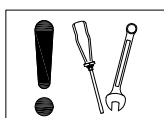


#### Temperature rise through parts touching each other

Danger of explosion!

- Never check rotating direction with dry pump.
- Disconnect the pump for checking rotating direction.

### ATTENTION



#### Wrong rotating direction of motor and pump

Damage of the pump!

- Consider the rotating direction arrow on the pump.

1. Start motor briefly. Note rotating direction of the motor.
2. Rotating direction of the motor must comply with the rotating direction arrow on the pump.
3. In case of wrong rotating direction, change the cables in the motor terminal box.



## 6. Commissioning / Decommissioning

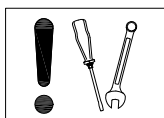
### 6.1 Commissioning

The following points must be checked prior to start-up;

- The pump unit is correctly electronically connected to all relevant protective devices.
- The pump is filled with liquid.
- Rotating direction has been checked.
- All additional connections are connected and fully functional.
- Lubricants are checked.
- After a longer standstill period, the measures mentioned in chapter 7 "Maintenance/Servicing/Inspection" must be considered and performed.

#### 6.1.1 Filling of lubrication oil

##### ATTENTION

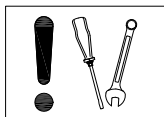


##### Lack of lube oil in the oil reservoir of constant level oiler

Damage of antifriction bearings!

- Check oil level regularly.
- Oil reservoir must always be sufficiently filled.

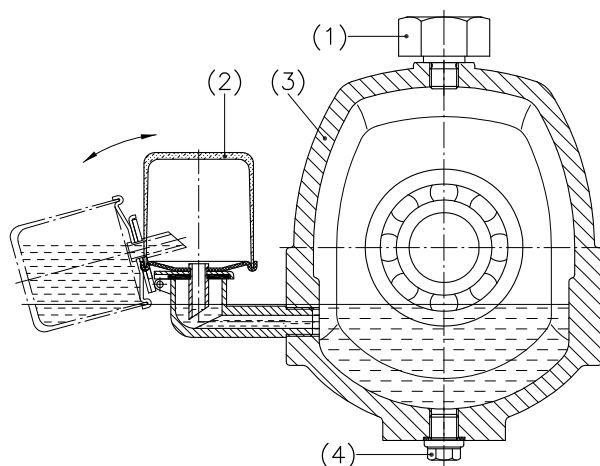
##### ATTENTION



##### Lack of lube oil in the bearing bracket

Damage of antifriction bearings!

- The threaded hole of the constant level oiler must be in horizontal position.



1. Unscrew vent plug (1).
2. Fold down the constant level oiler (2) – away from bearing bracket (3) – and hold it tight.
3. Fill in the oil through the vent plug bore (1) until the filling level reaches the connection pipe of the constant level oiler (2)





4. Fill up the oil reservoir to the maximum.
5. Fold back the constant level oiler (2) to its original position.
6. Screw in the vent plug (1).
7. Check the oil level in the oil reservoir of the constant level oiler (2) after a few minutes. Repeat steps 4 to 6 until oil outflow from the oil reservoir has stopped.

### NOTE



Exceeding oil level causes temperature increase or oil leakage.

For filling quantity and oil quality refer to chapter 7.2.2.

Executions with grease lubrication are not provided with constant level oiler and vent plug. Antifriction bearings are permanent grease lubricated. Relubrication is not required.

### 6.1.2 Filling and venting the pump

#### DANGER

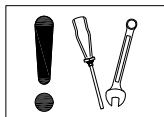
**Formation of explosive atmosphere inside the pump  
Surface temperatures too high**



Danger of explosion!

- The pump must permanently be filled with liquid.
- Appropriate monitoring measures must be provided.

#### ATTENTION



**Operation with empty pump**

Damage of sleeve bearing / mechanical seal!

- Pump must always be filled with liquid.
- Provide appropriate monitoring measures.

1. Vent and fill up pump and suction pipe with liquid.  
Pump is selfventing.
2. Open shut-off valve in suction pipe completely
3. Open all additional connections completely (e.g. external circulation, external flush)

### 6.1.3 Shaft sealing

The pump is supplied with shaft sealing. If a fluid reservoir is foreseen, it must be filled according to the reservoir manual.

If double mechanical seals are provided, a barrier pressure supply must be connected prior to starting the pump, following the instruction manual of reservoir respectively mechanical seal.

In case of external flush, the pump must be flushed with the quantities and pressures as stated in the pump data sheet respectively in the dimensional drawing.



### 6.1.4 Design with heating jacket

Pump casing and intermediate casing with heating jacket.

Permissible heating agent:

- Hot water
- Steam
- Heat transfer oil

Pressure- and temperature limits:

- $t_{\max} = 200^{\circ}\text{C}$
- $p_{\max} = 25 \text{ bar}$

#### ATTENTION

##### Elevated surface temperature

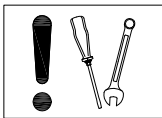


Danger of explosion!

- Consider the allowable temperature class.

#### ATTENTION

##### Lack of heating fluid

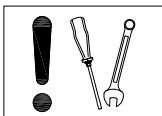


Damage of the pump!

- Provide sufficient amount of heating fluid.

#### ATTENTION

##### Heating period too short

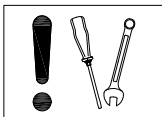


Damage of the pump!

- Consider a sufficient heating period of the pump (approx. 2 hours)
- Check free rotation of the pump shaft.

#### ATTENTION

##### Exceedance of the allowable heating fluid temperature



Leak of pumped liquid or heating agent!

- Consider the application limits for pressure and temperature.

### 6.1.5 Inspection of shaft sealing

A mechanical seal is a dynamical seal and – due to physical and technical reasons – never leakage free. Design, tolerances, operating conditions, smoothness etc. determine the quantity of leakage.

Leakage may increase during normal running-in of the sliding faces but will return to normal value after sufficient running time. If this should not be the case, the mechanical seal must be shut down, dismantled and inspected.



A gland packing must slightly drip during operation.

**DANGER**



### Elevated temperature at gland packings

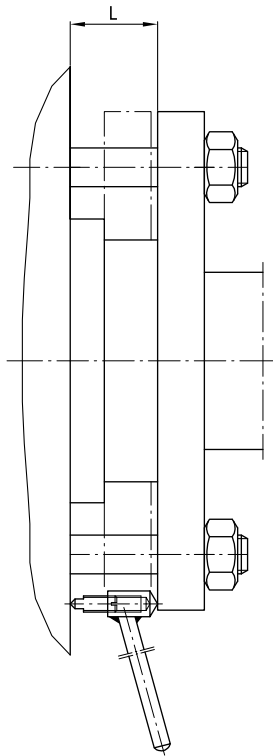
Danger of explosion!

- Gland packings are not suitable for use in explosive areas.

### 6.1.6 Start-up of gland packing

Leakage of the gland packing is adjusted as follows:

1. Tighten the gland nuts only slightly by hand.
2. Check rectangular and centric seat by using a packing gauge.



Bearing frame	L [mm]
I	23
II	34
III	27
IV	41

L = Space between gland 452 and intermediate casing 113

Fig. 11: packing gauge

3. After the pump is filled up, packing must leak.
4. Tighten the gland nuts so far that the appearing leakage is reduced to 60-120 drops per minute.
5. Start the pump.
6. After a running time of 5 minutes, reduce the leakage by fastening the gland nuts with a 1/6 turn.
7. Watch the leakage.

Leakage too high	→	Repeat step 6 and 7.
Leakage too low	→	Loosen the gland nuts slightly.
No leakage	→	Switch off the pump unit immediately! Loosen the gland and repeat the procedure.



### 6.1.7 Starting the pump

#### **DANGER**



#### **Exceedance of allowable pressure- and temperature limits**

Danger of explosion! Leakage of hot or toxic liquid

- Never operate pump with closed shut-off valves in suction and/or discharge pipe.
- Start-up pump unit only against partially opened shut-off valve on discharge side.

#### **DANGER**



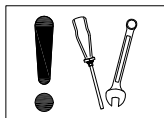
#### **Elevated temperature through dry run**

Danger of explosion!

- Never operate pump in empty condition.
- Always fill up pump properly.
- Operate pump only within the allowable operating range.

1. Open shut-off valve completely in suction pipe
2. Open shut-off valve partially in discharge pipe
3. Switch on the motor.
4. When the pressure gauge indicates pressure, open shut-off valve on discharge side until the duty point is reached.
5. When the operating temperature is reached, check coupling alignment and realign if necessary.

#### **ATTENTION**



#### **Operation without liquid**

Damage of mechanical seal!

- Pump must always be filled with liquid.
- Provide appropriate monitoring measures.

## 6.2 Operating the pump

#### **WARNING**

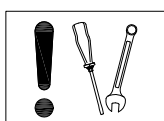


#### **High surface temperatures through hot liquids**

Risk of burns!

- Avoid touching the pump surface.
- Wear protective clothing.

#### **ATTENTION**



#### **Abnormal noises, vibrations, temperatures or leakage**

Damage of the pump!

- Switch off the pump immediately.
- Only restart the pump unit after cause of trouble has been eliminated.



### 6.3 Impeller trimming

The impellers are hydraulically balanced in order to reduce thrust load. Additional to the wear rings, thrust load balance is done individually or in combination with

- Back vanes
- Balancing holes
- Injection slots

Impeller diameter can be trimmed within the range of performance curve.

### 6.4 Operating limits

**DANGER**



#### **Exceedance of operating limits regarding pressure, temperature and speed**

Danger of explosion! Leaking hot or toxic liquid!

- Maintain the allowable service conditions specified in the pump data sheet.
- Avoid operation against closed shut-off valve.
- Never operate pump at a temperature higher than specified in the pump data sheet.

#### 6.4.1 Flow rate

If not stated otherwise in the pump data sheet, the following applies:

$$Q_{\min} = 0,25 \times Q_{\text{BEP}}$$

$$Q_{\max} = 1,2 \times Q_{\text{BEP}}$$

#### 6.4.2 Switching frequencies

**DANGER**



#### **Elevated surface temperature of the motor**

Danger of explosion!

- When using explosion proof motors, consider the information in the motor manual regarding switching frequencies.

The switching frequencies are defined by the maximum temperature rise of the motor and depend on the power reserve of the motor during operation and on the starting conditions.

**NOTE**



Read instruction manual of motor manufacturer!



### 6.4.3 Abrasive liquids or solids

If products containing abrasive solids are handled, increased wear is to be expected. The inspection intervals in this regard must be shorter than the usual ones.

## 6.5 Switching off the pump

1. Keep shut-off valve in suction pipe open.
2. Close shut-off valve in discharge pipe.
3. Switch off the motor and watch for steady run down.

### NOTE



In case a non-return valve is installed in the discharge pipe, the shut-off valve can remain open. A counter pressure must be available.

For a longer standstill period, the following must be observed:

- Liquids which tend to polymerization, crystallization or solidification, must be drained completely.
- If required, rinse the pump with a suitable liquid.
- Close shut-off valve in the suction pipe.
- Flush connections must be closed.

## 6.6 Decommissioning

The pump unit remains in the piping:

- Provide sufficient amount of liquid for the test runs.
- Switch on the pump unit regularly monthly or quarterly.

The pump unit will be dismantled and stored:

- Empty the pump properly.
- Observe the safety instructions acc. to chapter 7.1 / 7.3.
- Spray the inside of the pump casing with preservation agent. Not required for stainless steel pumps.
- Spray preservation agent through suction and discharge flange.
- Plug suction and discharge flanges, e.g. with plastic caps.
- Lubricate all unpainted outside surfaces of the pump with oil and grease free of silicone. Not required for stainless steel pumps.
- Pay attention to additional notes in chapter 4.2.



## 7. Maintenance / Servicing / Inspection

### 7.1 Safety regulations

#### DANGER

##### Improper maintained pump unit



Danger of explosion!

- Maintain the pump unit regularly
- Establish a maintenance schedule

#### WARNING

##### Unintentional switching-on of the pump unit



Risk of injury through moving components!

- Works on the pump unit may only be done if electricity is disconnected.
- Secure the pump unit against unintentional switch-on.

#### WARNING

##### Hot liquids



Risk of injury!

- Let the pump unit cool down to ambient temperature.

#### WARNING

##### Liquids dangerous to health



Risk of injury!

- Consider legal requirements.
- Take safety measures for individuals and environment when draining the pumped liquid.
- Decontaminate the pumps.

#### WARNING

##### Lack of stability



Squeezing of hands and feet!

- When assembling or disassembling the pump/pump unit, secure it against tipping and falling.

The user must assure that maintenance, inspection and assembly is performed by qualified personnel. These persons must have studied this operating manual comprehensively.

A maintenance schedule needs a minimum of effort and may avoid expensive repairs.

Any use of force on the pump unit must be avoided.



### 7.2 Operating surveillance

#### **DANGER**

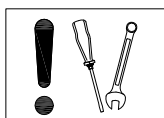


#### **Elevated surface temperature through hot running antifriction bearings**

Danger of explosion! Fire hazard!

- Check antifriction bearings regularly for running noise.
- Check the lubricant level regularly.

#### **ATTENTION**

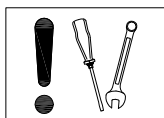


#### **Wear caused by dry run**

Damage of the pump!

- Never operate an empty pump.
- Never close the shut-off valve in suction pipe during operation.

#### **ATTENTION**



#### **Exceedance of the allowable liquid temperature**

Damage of the pump!

- Operation against closed discharge valve is not allowed.
- Consider the temperature indications in the pump data sheet.

The following requires regular checking during operation:

- The pump must always run steady and vibration-free.
- Check antifriction bearings for running noise. Vibrations, noises and increased power consumption are signs of wear.
- Check the elastic elements of the coupling.
- Clean the filter in the suction pipe regularly.

#### 7.2.1 Lubrication / Lifetime of antifriction bearings

#### **DANGER**



#### **Elevated surface temperature through hot running antifriction bearings or defective bearing seals**

Danger of explosion!  
Fire hazard!

- Check lubricant condition regularly.
- Check lubricant level regularly.

Lubrication of antifriction bearings is normally provided by mineral oil of viscosity class ISO VG 46 or 68 with a kinematic viscosity of 46-68 mm<sup>2</sup>/s at 40°C. The following mineral oils can be used:

- BP Energol HL
- Shell Tellus
- Texaco Regal Premium EP
- Castrol Optigear





## 7. Maintenance / Servicing / Inspection

The oil filling shall be renewed the first time after 200 operating hours, then once a year.

Bearing frame	Filling Qty [l]
0 / I	0,75
II	1,0
III	1,25
IV	2,7
V	3,5

### NOTE



If the ambient temperature is  $< -20^{\circ}\text{C}$ , low viscous and temperature suitable mineral oils of viscosity class ISO VG 5 or 10 should be used. Consider the information given on the pump data sheet.

### NOTE



When using oils which are based on synthetic hydrocarbons (Polyalphaolefins = PAO), the oil-change intervals can be raised to 20000 hours. Thereby, the oil temperature should not exceed  $80^{\circ}\text{C}$ .

Particularly suitable are:

- Klübersynth GEM 4-46 N
- BP Enersyn HTX 68
- Shell Tellus S4 ME 46

The calculated lifetime of antifriction bearings is – also under critical service conditions – more than 25000 operating hours, as long as the above mentioned oil changes are regularly performed.

### NOTE



Executions with grease lubrication have permanent grease lubricated antifriction bearings. Relubrication is not required.

### 7.2.2 Oil change

1. Place a suitable bowl for the waste oil underneath the drain plug.
2. Unscrew the drain plug from the bearing bracket and drain the oil.
3. After emptying, screw in the drain plug again.
4. Fill up oil again considering chapter 6.1.1.

### WARNING



#### Lubricating liquids dangerous to health

Danger for individuals and environment!

- Draining requires safety measures for individuals and environment .
- Consider legal requirements concerning disposal of liquids dangerous to health.



### 7.3 Drainage and Disposal

#### **WARNING**



#### **Pumped liquids dangerous to life**

Endangering for individuals and environment !

- Collect flushing liquid and possible residual liquid and dispose it.
- Wear protective clothing and face masks.
- Consider legal requirements concerning disposal of liquids.

Drainage of pumped liquids through the drain plugs at the casing, through a connected shut-off valve or through a flange.

Mode of drainage and position can be taken from the dimensional drawing !

### 7.4 Disassembly of pump unit

#### 7.4.1 General instructions

- Pay attention to safety instructions of chapter 7.1.
- Working on the motor requires observance of the documentation provided by the motor manufacturer.
- Consider the sectional drawings when disassembling.
- In case of damage, our service department can be contacted.

#### **DANGER**



#### **Working on the pump unit without sufficient preparation**

Risk of injury!

- Switch off the pump unit properly.
- Close shut-off valves on suction and discharge side.
- Drain and depressurize the pump.
- Flush connections must be closed.
- Let the pump unit cool down to ambient temperature.

#### **WARNING**



#### **Improper handling and lifting of heavy components**

Personal injury and material damage!

- For handling heavy components use appropriate means of transport, lifting gears and slings.

#### 7.4.2 Removal of driver

1. Disconnect the motor.
2. Remove coupling guard.
3. Remove the hold down bolts of the motor from the baseplate.
4. Decouple pump and motor by displacing the motor.



### WARNING



#### Tilting the motor

Squeezing of hands and feet!

- Secure the motor by lifting or bracing.

### NOTE



If pump units are equipped with spacer type couplings, the motor can remain bolted to the baseplate when disassembling the interchangeable / rotating unit.

### 7.4.3 Disassembly of rotating unit

If spacer type couplings are used, the motor remains bolted to the baseplate. Remove the spacer piece according to the operating instructions of the coupling manufacturer.

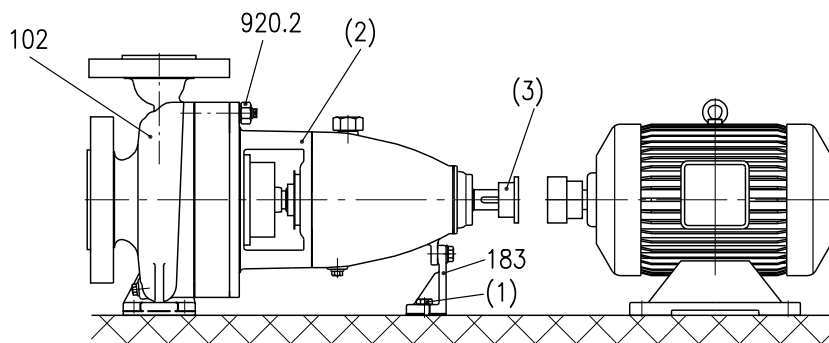


Fig. 12: Disassembly of rotating unit

1. Loosen hexagon nut 920.2.
2. Loosen hexagon head bolt (1) of support foot 183.
3. Press the complete interchangeable unit (2) out off the volute casing 102 by using jack screws.
4. Pull the unit out off the casing and place it beside.
5. Pull off the coupling hub (3) from the shaft end.

### WARNING



#### Tilting the rotating unit

Squeezing of hands and feet!

- Secure the rotating unit by lifting or bracing.



### 7.4.4 Disassembly of impeller

The works according to chapter 7.4.3 are completed.

1. Clamp the complete unit in vertical position in a jaw chuck.
2. Loosen impeller nut 922 respectively inner hexagon cap screw 914.12 (frame size 0) – (right hand thread).
3. Pull off the impeller from pump shaft.
4. Remove the key 940.1.

### 7.4.5 Disassembly of shaft sealing

The works according to chapter 7.4.4 are completed.

#### **Gland packing**

1. Loosen and remove inner hexagon cap screws 914.1.
2. Pull off packing ring 457.
3. Remove hexagon nut 920.5, push back the gland 452 and the follower 454.
4. Remove hexagon nut 920.1.
5. Press the intermediate casing 113 out off the centring.
6. Pull off the shaft sleeve 524 from the pump shaft.
7. Remove gland packings 461 from intermediate casing 113.

#### **DICKOW-Mechanical seal N6 / N10 / N11**

1. Pull off the mechanical seal 433 from pump shaft.
2. Remove the hexagon nut 920.1.
3. Press the intermediate casing 113 out off its centring and place it on the bench.
4. Remove hexagon nut 920.5, pull off the packing ring 457.
5. Slide the seal ring 475 carefully out off the intermediate casing.

#### **DICKOW-Mechanical seal N9 / N13**

1. Pull off the product side mechanical seal 433.1 from the pump shaft.
2. Remove the hexagon nut 920.5.
3. Slide the seal end plate 471, the pressure ring 474 and the stationary seal ring 475.2 towards the shaft step.
4. Remove the hexagon nut 920.1.
5. Press the intermediate casing 113 out off its centring.
6. Pull off the atmospheric seal 433.2 and the distance sleeve 525 from the pump shaft.
7. Take out the seal end plate 471, the pressure ring 474 and the stationary seal ring 475.2 from the bearing bracket.
8. Remove the rotating seal ring 475.1 from the intermediate casing 113.



### **Standard Mechanical seal according to EN 12756**

1. If available, remove the inner hexagon cap screw 914.1 and press the packing ring 457 out off the intermediate casing 113.
2. Pull off the shaft sleeve 524 together with the rotating seal unit from the pump shaft.
3. Remove the hexagon nut 920.1.
4. Press the intermediate casing 113 out off its centring.
5. Remove the hexagon nut 920.5.
6. Remove the seal end plate 471.
7. Dismantle seal ring 475 and O-ring.

### **Tandem-Standard Mechanical seal acc. to EN 12756 (API-Plan 52)**

1. Remove the hexagon nut 920.5.
2. Slide the seal end plate 471 with the stationary seal ring 475.2 towards the shaft step.
3. Remove the hexagon nut 920.1.
4. Press the intermediate casing 113 out off its centring.
5. Pull off the shaft sleeve 524 with mechanical seal 433 and seal ring support 476 from pump shaft.
6. Loosen the grub screws in the mechanical seal 433.2 and pull off the seal from the shaft sleeve.
7. Remove seal ring support 476 with rotating seal ring 475.1.
8. Loosen grub screw in the mechanical seal 433.1 and pull the seal off.
9. Press the rotating seal ring 475.1 together with the O-ring out off the seal ring support 476.
10. Take the seal end plate 471 out off the bearing bracket.
11. Press the stationary seal ring 475.2 together with the O-ring out off the seal end plate.

### **Double Standard Mechanical seal acc. to EN 12756 (API-Plan 53)**

1. Remove inner hexagon cap screw 914.1.
2. Remove seal ring support 476 and seal ring 475.
3. Press the stationary seal ring 475.2 together with the O-ring out off the seal ring support 476.
4. Pull off the shaft sleeve 524 with the mechanical seal 433.1/2 from pump shaft.
5. Remove the hexagon nut 920.1.
6. Press the intermediate casing 113 out off its centring and place it on the bench.
7. Remove the hexagon nut 920.5 and pull off the seal end plate 471.
8. Press the stationary seal ring 475.2 together with the O-ring out off the seal end plate 471.

### **Cartridge-Mechanical seal**

1. If available, remove the inner hexagon cap screw 914.1 and press the packing ring 457 out off the intermediate casing 113.
2. Remove the hexagon nut 920.5.
3. Remove the hexagon nut 920.1.
4. Press the intermediate casing 113 out off its centring.
5. Pull off the intermediate ring 509 from the pump shaft.
6. Attach assembly gauges to the mechanical seal.
7. Loosen the grub screws and pull off the complete seal unit 433 from the pump shaft.



### 7.4.6 Disassembly of antifriction bearings

The works according to chapter 7.4.5 are completed.

1. Loosen grub screw 904.1 and pull off the deflector 507 from pump shaft.
2. Loosen hexagon head bolt 901.2 and pull off bearing cover 360 with radial seal ring 421.2.
3. Press the pump shaft 211 together with angular ball bearing 325 out of the bearing bracket seat. Use a press- or drilling spindle.
4. Remove the inner hexagon cap screws 914.2 and take off the bearing bracket lantern 344.
5. Press the outer ring of the cylinder roller bearing 322 out of the bearing bracket 330.
6. Remove circlip 932.2 und disk 550.3 from pump shaft.
7. Pull off the angular ball bearing 325 from pump shaft.
8. Pull off the disk 550.3 from pump shaft.

The following procedure applies for frame size V:

1. Loosen grub screw 904.1 and pull off the deflector 507 from pump shaft.
2. Loosen inner hexagon cap screw 914.6 and pull off bearing cover 360.2 together with radial seal ring 421.1.
3. Loosen inner hexagon cap screw 914.5 and pull off bearing cover 360.1 together with radial seal ring 421.2.
4. Press the pump shaft 211 together with angular ball bearing 325 out of the bearing bracket seat. Use a press- or drilling spindle.
5. Press the outer ring of the cylinder roller bearing 322 out of the bearing bracket 330.
6. Loosen and remove shaft nut 921.
7. Pull off the angular ball bearing 325 from pump shaft.

The following applies for antifriction bearings with permanent grease lubrication:

1. Loosen grub screw 904.1 and pull off the deflector 507 from pump shaft.
2. Loosen hexagon head bolt 901.2 and pull off bearing cover 360 together with radial seal ring 421.2.
3. Press the pump shaft 211 together with roller bearing 321 out of the bearing bracket seat. Use a press- or drilling spindle.
4. Remove circlip 932.2 and disk 550.3 from pump shaft.
5. Pull off the roller bearing 321 from pump shaft.



### 7.4.7 Replacement of antifriction bearings

Execution with oil lubrication:

Frame size	322	325
0 / I	NU 306	2x 7306 BUA
II	NU 307	2x 7307 BUA
III	NU 409	2x 7311 BUA
IV	NU 411	2x 7313 BUA
V	NU 313	2x 7314 BUA

Execution with permanent grease lubrication:

Frame size	321
0 / I	2x 6306.2RS
II	2x 6307.2RS
III	2x 6409.2RS
IV	2x 6411.2RS

## 7.5 Inspection

### 7.5.1 Impeller / Wear ring

The surfaces in the wear ring area may not have any visible grooves. Diameters of surfaces have to be measured. The total clearance in new condition is  $S = 0,6$  mm. If the clearance exceeds  $S = 0,9$  mm, the wear rings must be replaced.

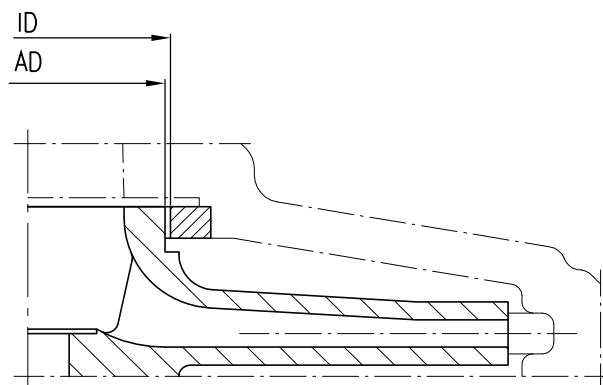


Fig. 13: Wear ring clearance  $S = ID - AD$



### 7.5.2 Bearing bracket

Measure the inner diameter of ball bearing seats. Replace the bearing bracket if following values are exceeded:

Frame size 0 / I	→	max. 72,009 mm
Frame size II	→	max. 80,009 mm
Frame size III	→	max. 120,010 mm
Frame size IV	→	max. 140,012 mm
Frame size V	→	max. 140,026 mm + 150,026 mm

### 7.5.3 DICKOW - Mechanical seal

The metal bellows are stressed when installed, the spring load provides a sufficient closing force on the sliding surfaces.

Measure the mechanical seal after disassembly and thorough cleaning.

Replace the mechanical seal if the length dimensions are below the following:

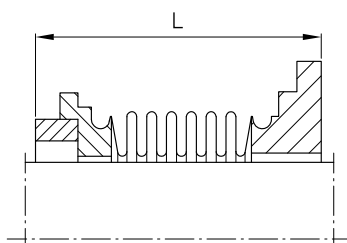


Fig. 14: Seal length

Mechanical seal		Material	L [mm] at frame size			
			0 / I	II	III	IV
N6		A	46	58	58	67
		U <sub>1</sub>	49	58	58	67
		U <sub>3</sub>	54	65	65	77
N10		U <sub>3</sub>	48,5	60,5	56	74
N11		A	86	105	-	-
		U <sub>1</sub>	86	105	113	140
		U <sub>3</sub>	81	-	-	-
N9	product side	U <sub>3</sub>	48,5	60,5	56	74
	atmosphere side	U <sub>2</sub>	45	53	59	79
N13	product side	U <sub>3</sub>	53,5	65,5	65,5	79
	atmosphere side	U <sub>2</sub>	48	58	64	82

Material code:

A = A-Carbon

U<sub>1</sub> = SiC shrink fitted

U<sub>2</sub> = SiC; drive pin

U<sub>3</sub> = SiC elastically beared





### 7.6 Assembly of pump unit

#### 7.6.1 General instructions

- Consider the safety instructions of chapter 7.1.
- Consider sectional drawings for assembly.
- Use new gaskets only.
- Mount gaskets without lubricants.
- Do not use assembling aid when mounting the gaskets. If necessary, use customary contact adhesive. Never use superglue.
- Lubricate fittings and screw joints with graphite or similar lubricant. Lubricants must be compatible with the pumped liquid.
- Tighten all screws properly. Consider chapter 7.7.

#### **WARNING**

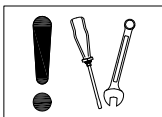


#### **Improper handling and lifting of heavy components**

Personal injury and material damage!

- For handling heavy components, use appropriate means of transport, lifting gears and slings.

#### **ATTENTION**



#### **Unprofessional assembly**

Damage of the pump!

- Assemble pumps / pump units under consideration of the general rules of engineering.
- Only use original spare parts.

The following must be checked prior to assembly:

- All dismantled parts shall be cleaned and checked for wear.
- Damaged or worn out parts must be replaced by original spare parts.
- All sealing surfaces shall be cleaned.

#### 7.6.2 Assembly of antifriction bearings

1. Slide the disk 550.3 onto the pump shaft.
2. Heat up the angular ball bearing 325 to 80-100°C.
3. Push the angular ball bearing 325 onto the pump shaft until limit.
4. Slide disk 550.3 and circlip 932.2 onto the pump shaft.
5. Press the outer ring of the cylinder roller bearing 322 into the bearing bracket 330.
6. Fit the bearing bracket lantern 344 and fasten it with inner hexagon cap screws 914.2.



### NOTE



Install the angular ball bearings in X-arrangement.  
Angular ball bearings installed in pairs must be of the same manufacturer.

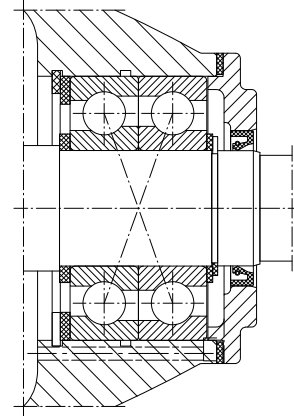


Fig.15: X-arrangement

7. Press the pump shaft 211 together with the angular ball bearing 325 into the bearing bracket seat. Use a press- or drilling spindle.
8. Fit the bearing cover 360 with the new radial seal ring 421.2 and tighten the hexagon cap screws 901.2.
9. Push the deflector 507 onto the pump shaft. Tighten the grub screw 904.1.

### The following procedure applies for frame size V:

1. Heat up the angular ball bearing 325 to 80-100°C.
2. Push the angular ball bearing 325 onto the pump shaft until limit.

### NOTE



Install the angular ball bearings in O-arrangement.  
Angular ball bearings installed in pairs must be of the same manufacturer.

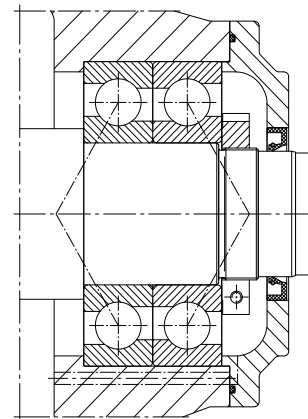


Fig. 16: O-arrangement

3. Screw on the shaft nut 921 and tighten it.
4. Press the outer ring of the cylinder roller bearing 322 into the bearing bracket 330.
5. Fit the bearing cover 360.2 with the new radial seal ring 421.1 and tighten the inner hexagon cap screw 914.6.
6. Press the pump shaft 211 together with the angular ball bearing 325 into the bearing bracket seat. Use a press- or drilling spindle.
7. Fit the bearing cover 360.1 with the new radial seal ring 421.2 and tighten the inner hexagon cap screw 914.5.
8. Push the deflector 507 onto the pump shaft. Tighten the grub screw 904.1.



**The following procedure applies for antifriction bearings with permanent grease lubrication:**

1. Slide disk 550.1 onto the pump shaft.
2. Heat up the pump-sided roller bearing 321 to 80-100°C.
3. Push the roller bearing 321 onto the pump shaft until limit.
4. Slide the distance sleeve 525 on drive side onto the pump shaft.
5. Fit the outer circlip 932.1 and the outer disk to the pump shaft.
6. Heat up the roller bearing 321 on drive side to 80-100°C.
7. Push the roller bearing onto the pump shaft until limit.
8. Slide the disk 550.3 and circlip 932.2 onto the pump shaft.
9. Press the pump-sided roller bearing 321 together with the pump shaft through the bearing bracket seat on drive side. Use a press- or drilling spindle.
10. Push the disk 550.2 into the bearing bracket seat and insert the circlip 932.1.
11. Press the pump shaft 211 together with both roller bearings 321 into the bearing bracket seal. Use a press- or drilling spindle.
12. Fit the bearing bracket lantern 344 and fasten it with inner hexagon cap screws 914.2.
13. Fit the bearing cover 360 with new radial seal ring 421.2 and tighten the hexagon head bolt 901.2.
14. Slide the deflector 507 onto the pump shaft. Tighten the grub screw 904.1.

### **7.6.3 Assembly of mechanical seal**

The works according to chapter 7.6.2 are completed.

Installation requires attention of the following:

- Consider the seal drawing.
- Works must be performed proper and thoroughly.
- Remove protective agent on sliding surfaces completely.
- Never apply lubricants to sliding surfaces.
- Never compress the metal bellows to a block.
- Axial forces must always be applied to the bellows support when pushing on the metal bellows.
- Check parallelism with the casing part after assembly.
- Surface of shaft sleeve must be clean and smooth. The edge has a chamfer.

#### **Gland packing**

1. Slide the gland packings 461 into the intermediate casing 113.  
Number of packing rings can be taken from the table below.
2. Slide the shaft sleeve 524 onto the pump shaft.



## NOTE



- Install only pre-pressed packing rings with dimensions as specified.
- Install the packings in a way that the joints are offset by 180°.
- Easy installation of the follower 454 into the stuffing box chamber must be possible.
- Cut packings of lengths and cross sections as specified in the table can also be used.
- Cross sections and lengths must absolutely be maintained.
- Tapping and pressing of the packings is not allowed.

3. Slide on the follower 454 with new O-ring 412.1 and gland 452.
4. Press the intermediate casing 113 into the centring and fasten it with hexagon nuts 920.1.
5. Slide on the packing ring 457 and fasten it with inner hexagon cap screws 914.1.
6. Push the follower 454 into the intermediate casing 113 and tighten the gland 452 with hexagon nut 920.5 slightly by hand.
7. Observe the start.up instructions as per chapter 6.1.6.

Packing dimensions			
bearing frame	Packing size [mm]	Stretched length [mm]	Cross section [mm]
I	Ø 35 x Ø 51 x 8	135	8 x 8
II	Ø 45 x Ø 65 x 10	173	10 x 10
III	Ø 55 x Ø 75 x 10	204	10 x 10
IV	Ø 70 x Ø 95 x 12,5	259	12,5 x 12,5

### **DICKOW-Mechanical seal N6 / N10 / N11**

1. Insert the seal ring 475 carefully into the intermediate casing.
2. Insert the pressure ring 474 and fasten it with hexagon nut 920.5
3. Press the intermediate casing 113 into the centring and fasten it with hexagon nuts 920.1.
4. Slide the mechanical seal 433 onto the pump shaft.

### **DICKOW-Mechanical seal N9 / N13**

1. Insert the rotating seal ring 475.1 into the intermediate casing 113.
2. Slide the seal end plate 471, pressure ring 474 and stationary seal ring 475.2 onto the pump shaft until it rests on the shaft step.
3. Slide distance sleeve 525 and atmosphere sided seal 433.2 onto the pump shaft.
4. Press the intermediate casing 113 into the centring and fasten it with hexagon nuts 920.1.
5. Fasten the seal end plate by hexagon nuts 920.5.
6. Slide the product sided mechanical seal 433.1 onto the pump shaft.



### **Standard Mechanical seal acc. to EN 12756**

1. Install the seal ring 475 with O-ring in the seal end plate 471.
2. Screw the seal end plate 471 to the intermediate casing 113 by hexagon nuts 920.5.
3. Press the intermediate casing 113 into the centring and fasten it with hexagon nuts 920.1.
4. Slide the shaft sleeve 524 and rotating seal unit onto the pump shaft.
5. If available, press the packing ring 457 into the intermediate casing 113 and fasten it with inner hexagon cap screws 914.1.

### **Tandem-Standard Mechanical seal acc. to EN 12756 (API-Plan 52)**

1. Install the stationary seal ring 475.2 and O-ring in the seal end plate 471.
2. Slide the seal end plate 471 onto the pump shaft until it rests on the shaft step.
3. Install the rotating seal ring 475.1 and O-ring in the seal ring support 476.
4. Slide the mechanical seal 433.1 onto the shaft sleeve and fasten it with grub screw.
5. Slide the seal ring support 476 onto the shaft sleeve.
6. Slide the mechanical seal 433.2 onto the shaft sleeve and tighten the grub screw.
7. Slide the complete unit onto the pump shaft 211.
8. Press the intermediate casing 113 into the centring and fasten it with hexagon nuts 920.1.
9. Screw the seal end plate 471 to the intermediate casing by hexagon nuts 920.5.

### **Double Standard Mechanical seal acc. to EN 12756 (API-Plan 53)**

1. Install the rotating seal ring 475.1 and O-ring in the seal end plate 471 and push it onto the pump shaft.
2. Screw the seal end plate 471 to the intermediate casing by hexagon nuts 920.5.
3. Press the intermediate casing 113 into the centring and fasten it with hexagon nuts 920.1.
4. Slide the shaft sleeve 524 with mechanical seal 433.1/2 onto the pump shaft.
5. Install stationary seal ring 475.2 and O-ring in seal ring support 476.
6. Screw the seal ring support 476 to the intermediate casing 113 by inner hexagon cap screws 914.1.

### **Cartridge-Mechanical seal**

1. Slide the complete seal unit 433 onto the pump shaft.
2. Press the intermediate casing 113 into the centring and fasten it by hexagon nuts 920.1.
3. Screw the seal unit 433 to the intermediate casing 113 by hexagon nuts 920.5.
4. Tighten the grub screws and loosen the assembly gauges.

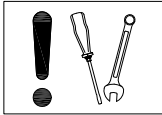


### 7.6.4 Assembly of impeller

1. Slide the impeller onto the pump shaft.
2. Tighten the impeller nut 922 respectively the inner hexagon cap screw 914.12 (frame 0) by torque wrench (right hand thread).

#### ATTENTION

##### Missing Heli-Coil insert



Impeller nut loose!

- Make sure that impeller nut respectively pump shaft (frame 0) are provided with Heli-Coil insert.

### 7.6.5 Assembly of rotating unit

#### WARNING



##### Tilting the rotating unit

Squeezing of hands and feet!

- Secure the rotating unit by lifting or bracing

#### NOTE



Consider chapter 7.4.3

1. Slide the rotating unit into the volute casing.
2. Use new gasket 400.5.
3. Tighten hexagon nut 920.2 by a torque wrench.
4. Mount the support foot 183 with hexagon cap screw 901.1 and washer 554.8.
5. Fasten the support foot with hexagon cap screw to the baseplate.
6. Slide the coupling hub onto the shaft end.

### 7.6.6 Motor assembly

#### NOTE



The first two steps do not apply for pumps with spacer type coupling.

1. Couple pump and motor by displacing the motor.
2. Fix the motor to the baseplate.
3. Align pump and motor. Consider chapter 5.7.
4. Align coupling. Consider chapter 5.6.



## 7.7 Bolt torques

	Bolt torque [Nm]			
	8.8		A4-70	
	standard bolts	expansion bolts	standard bolts	expansion bolts
M5	5	-	4	-
M6	9	-	6	-
M8	22	-	16	-
M10	45	-	30	-
M12	80	55	55	40
M16	195	145	135	100
M20	370	280	260	195

Calculation basis:

- 80% Yield strength utilisation of screw material.
- Friction coefficient  $\mu = 0,14$  ; use screw lubricant for threads and head / nut contact surface.  
Recommended: Klüber-paste HEL 46-450.
- Torque controlled tightening by torque wrench.

### NOTE



Deviating bolt torques are indicated in the pump data sheet.

Bolt torque for screwed plugs (independent of material):

- G 1/4 = 25 Nm
- G 3/8 = 45 Nm
- G 1/2 = 75 Nm

Bolt torque for impeller nut 922 respectively inner hexagon cap screw 914.12 and shaft nut 921 (independent of material)

Frame size	922 resp. 914.12		921 – Bolt torque [Nm]
	Bolt torque [Nm]	Wrench size	
0	30	19	---
I	100	32	---
II	120	41	---
III	140	50	---
IV	140	65	---
V	140	65	160



## 8. Troubleshooting

Failure	Number
Pump delivers no or not enough liquid	1
Motor is overloaded	2
Bearing temperature too high	3
Pump is leaking	4
Increased noises and vibrations	5
Inadmissible temperature increase	6
Shaft seal leakage	7

Failure number							Problem	Elimination
1	2	3	4	5	6	7		
X				X	X		Pump or piping not completely vented or filled	Venting respectively filling
X							Shut-off valve in suction line not completely opened	Open shut-off valve
X							Air pockets in piping system	Correct piping layout Install vent valve
X							Wrong rotating direction	Exchange 2 phases of power supply
X	X						Counter pressure of the pump is higher than specified	Readjust the duty point by discharge valve Increase speed Install a larger impeller
X	X				X		Viscosity of pumped liquid is higher than specified	Consult the factory
X				X			Counter pressure of the pump is lower than specified	Trim the impeller Readjust the duty point by discharge valve
X				X	X	X	NPSHA too low	Check liquid level in suction tank Improve NPSHR with inducer Reduce resistances in suction line Open shut-off valve in suction line completely
	X						Wrong speed	Check speed
		X		X		X	Pump unit is not aligned correctly	Check coupling alignment and correct if necessary
		X		X			Pump stressed by piping	Check piping connections and pump mounting
		X		X			Ball bearing damage	Renew antifriction bearings





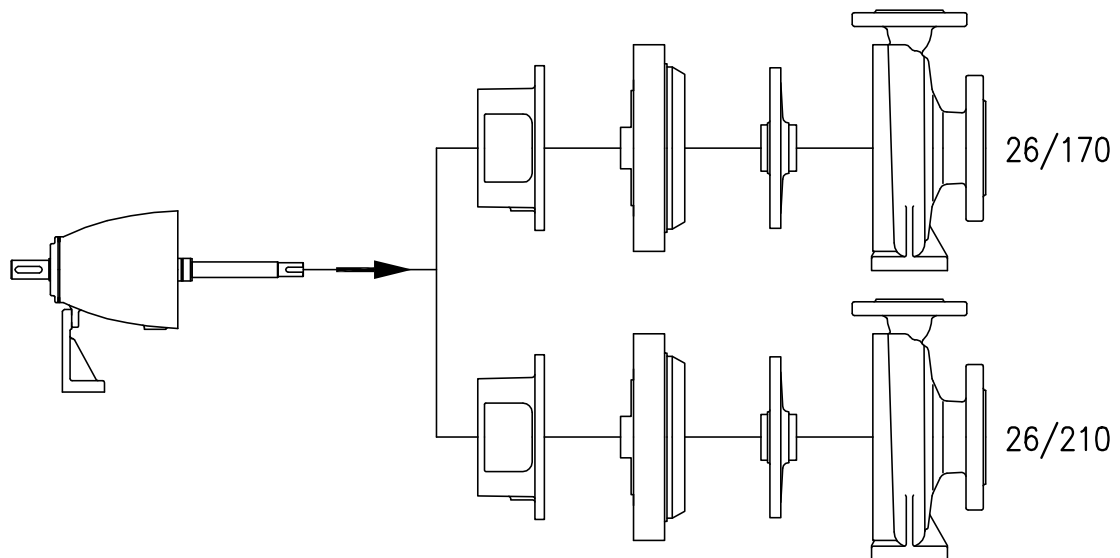
## 8. Trouble shooting

Failure number							Problem	Elimination
1	2	3	4	5	6	7		
				X		X	Unbalance of rotating parts, e.g. impeller	Balance the parts
			X				Casing screws and screwed plugs loose	Tighten the screws and plugs Renew gaskets
		X					Coupling gap not correct	Correct coupling gap
		X					No cooling flow available from motor to antifriction bearing	Check the installation Install a cooling fan
	X				X	X	Gland tightened too strong or bevelled	Correct it
						X	Shaft sealing worn out	Renew shaft sealing Check flushing/barrier fluid
						X	Shaft sleeve grooved or rough	Renew shaft sleeve
						X	Failure in circulation pipe	Enlarge the cross section
						X	Damaged elastomeres on mechanical seal	Replace elastomeres
						X	Boiling point of pumped liquid at atmospheric pressure is below the operating temperature	Use double mechanical seal Use seal with steam quench
						X	Abrasive solids	Install wear resistant seal faces Change seal flush (plan 31/32) Install double mechanical seal (plan 53)



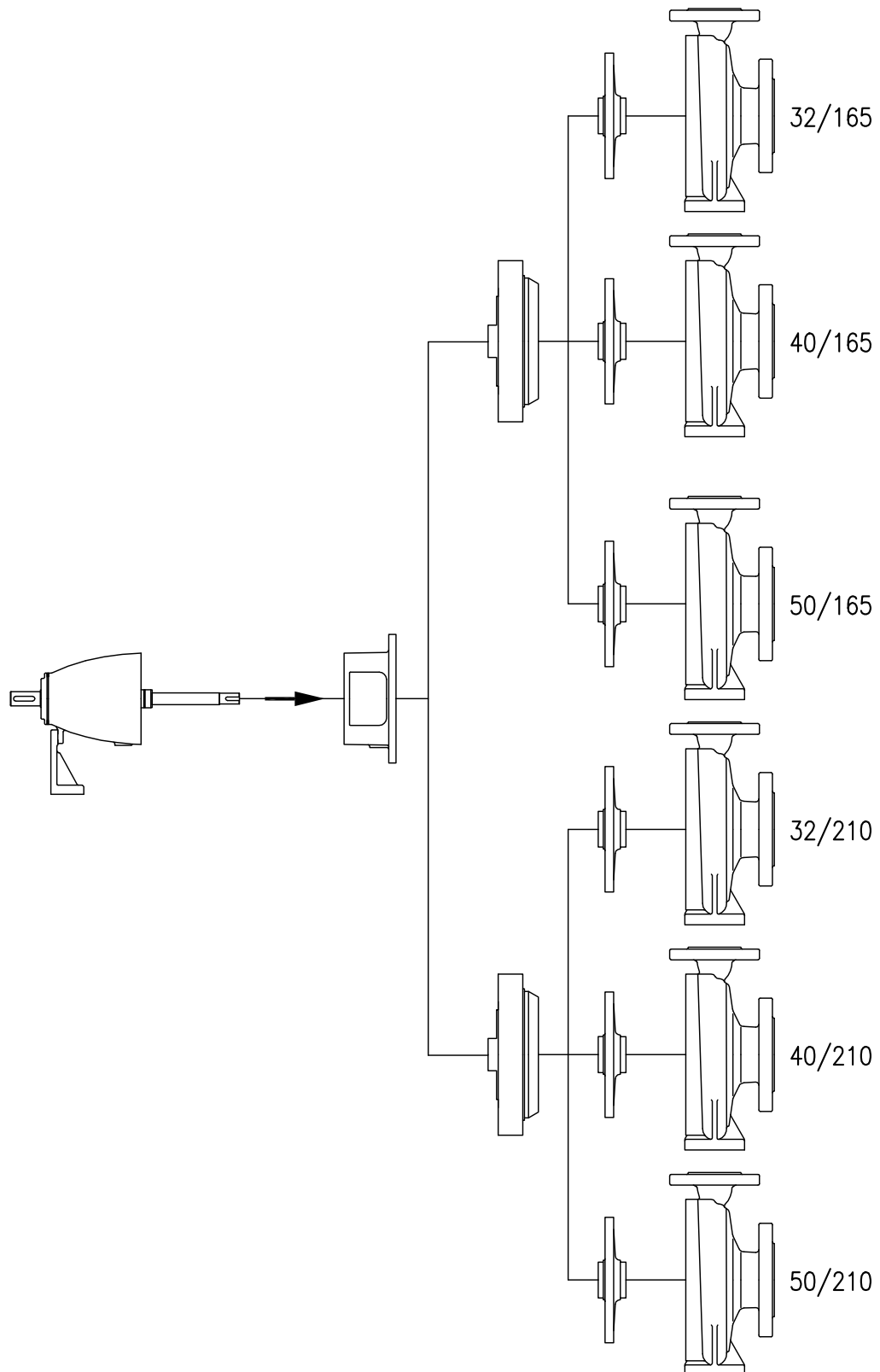
## 9. Interchangeability

### 9.1 Frame size 0



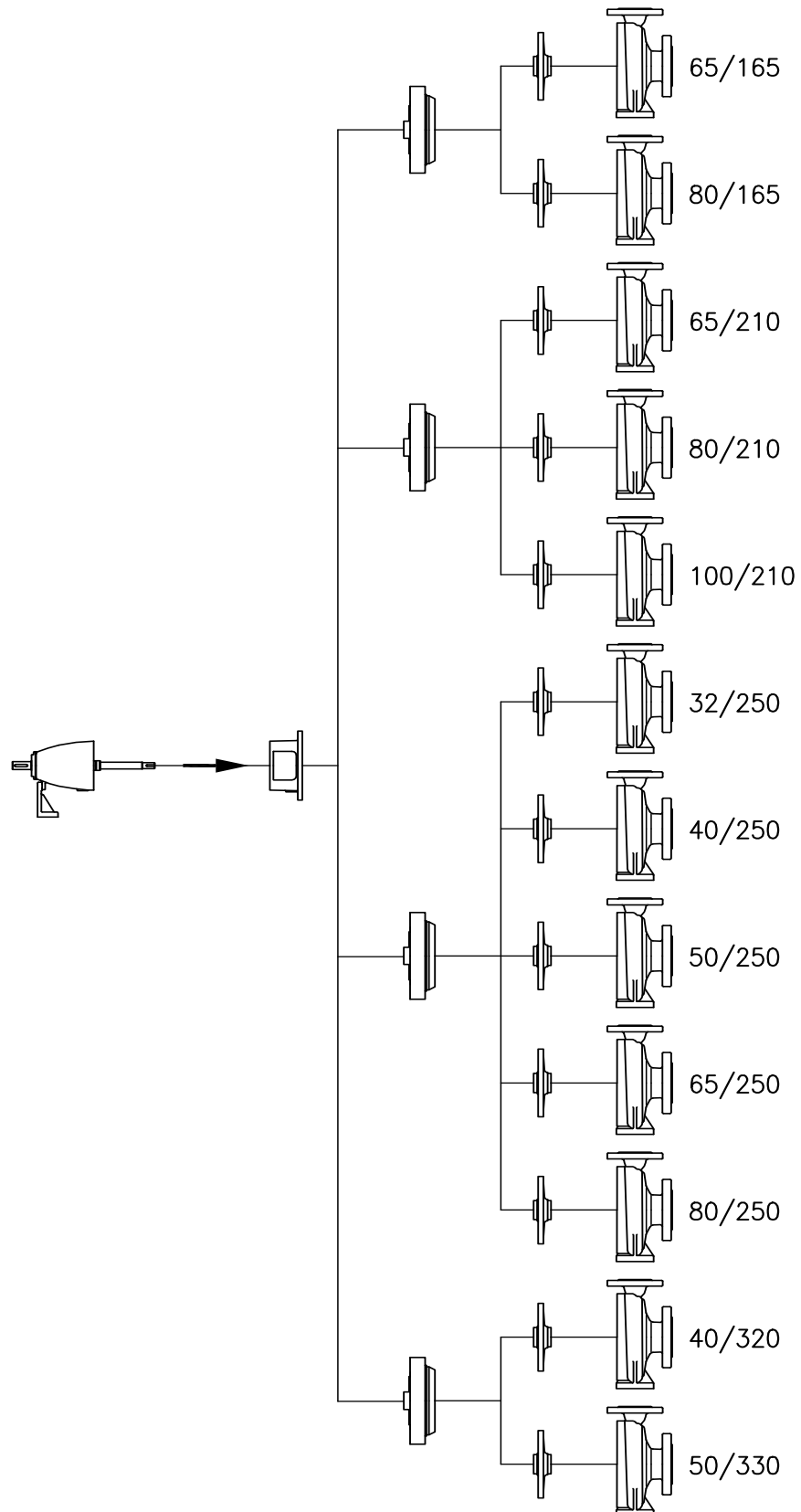


## 9.2 Frame size I



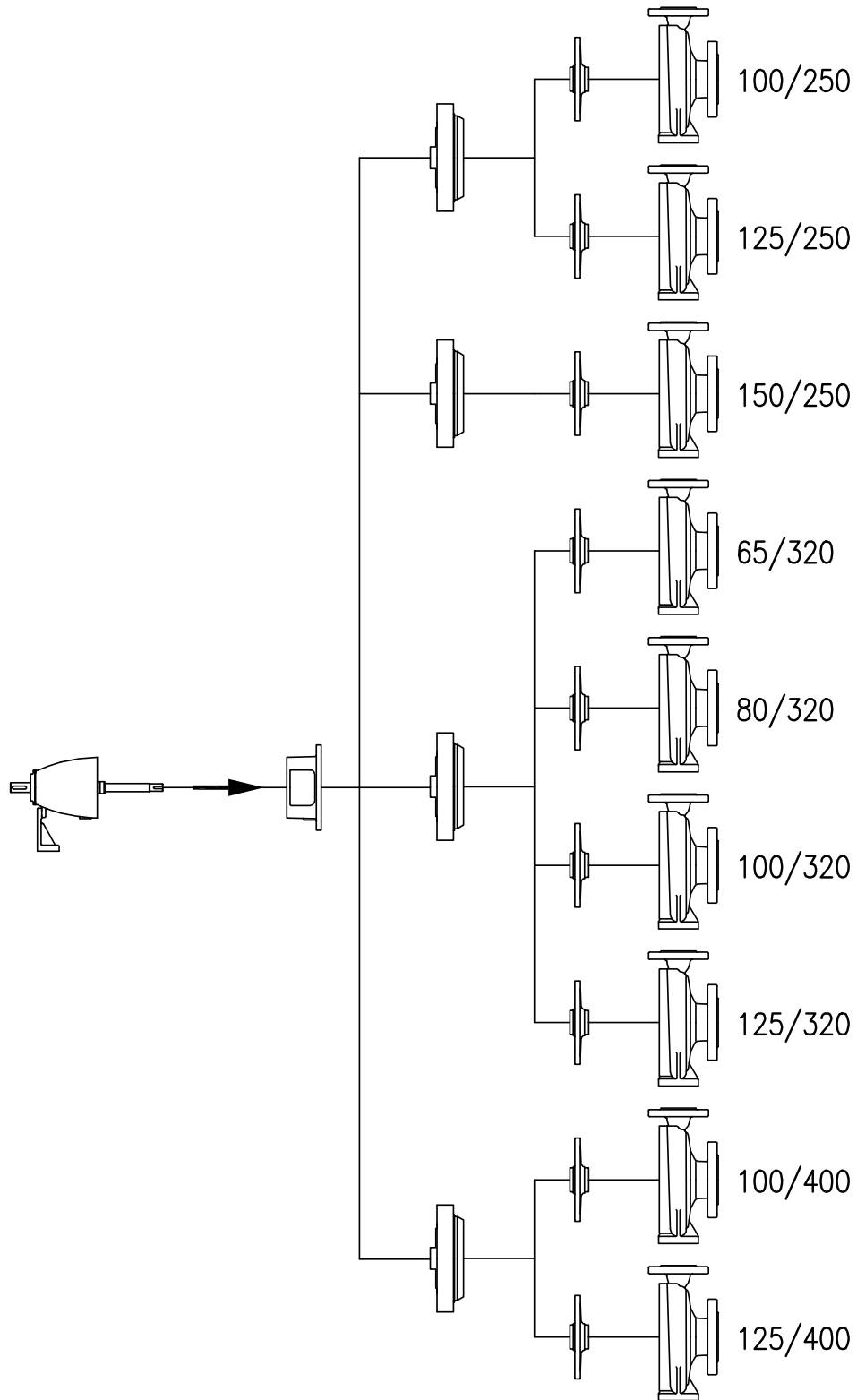


### 9.3 Frame size II



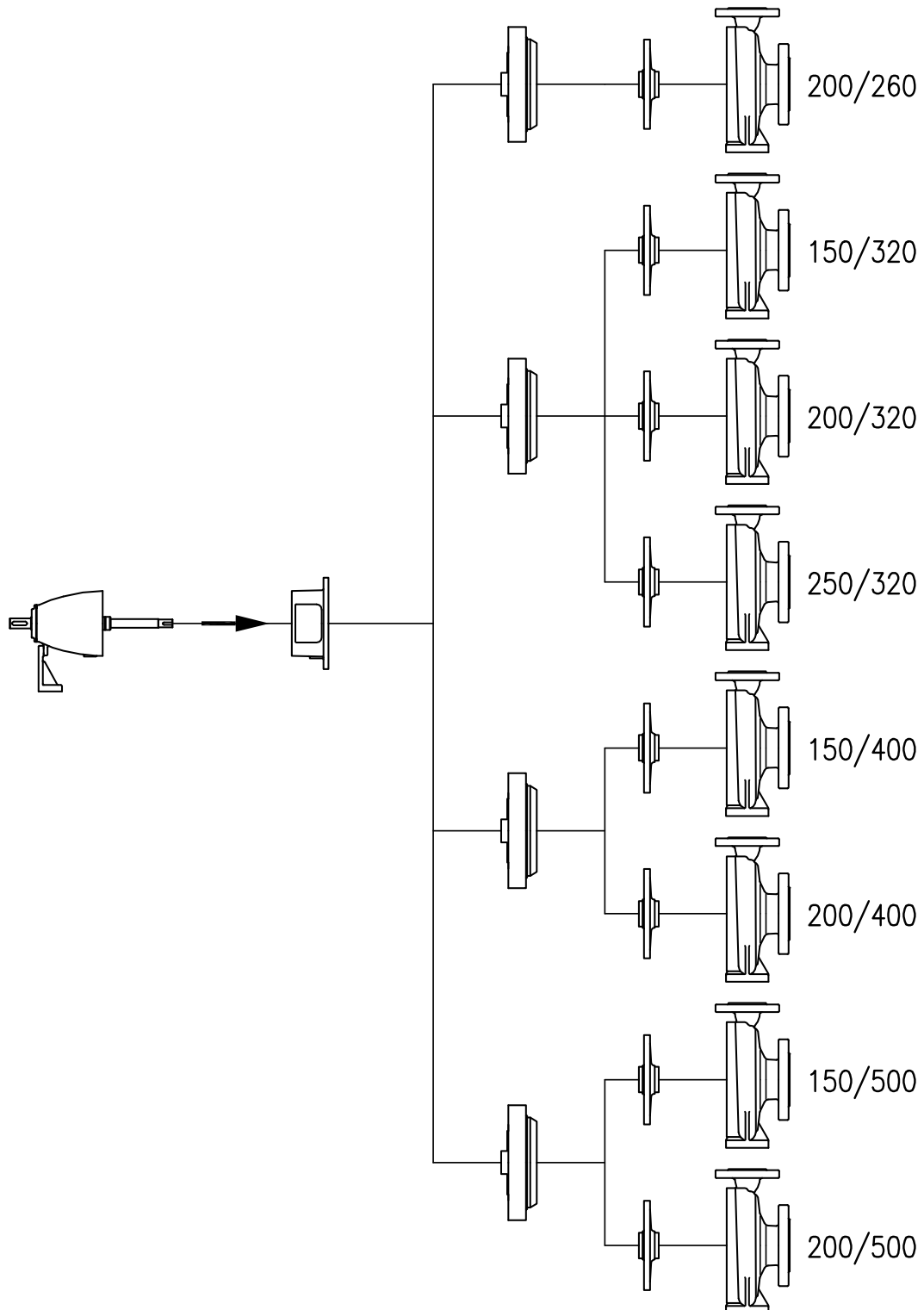


## 9.4 Frame size III



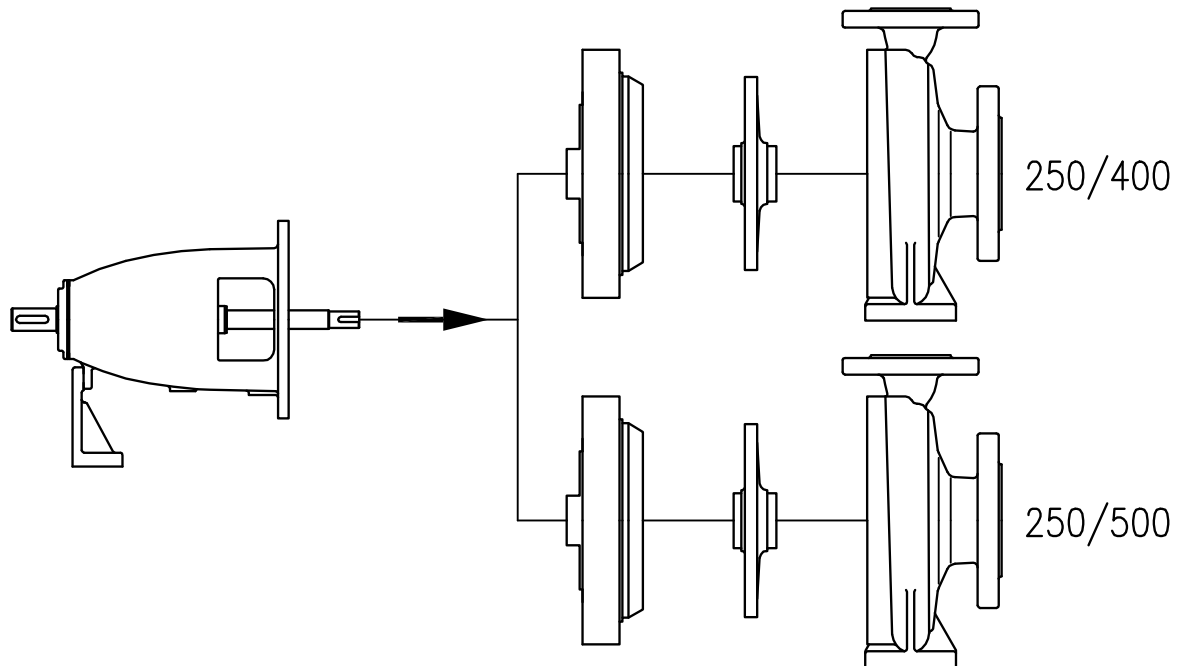


## 9.5 Frame size IV





## 9.6 Frame size V





## 10. Sectional drawings

### 10.1 Pump

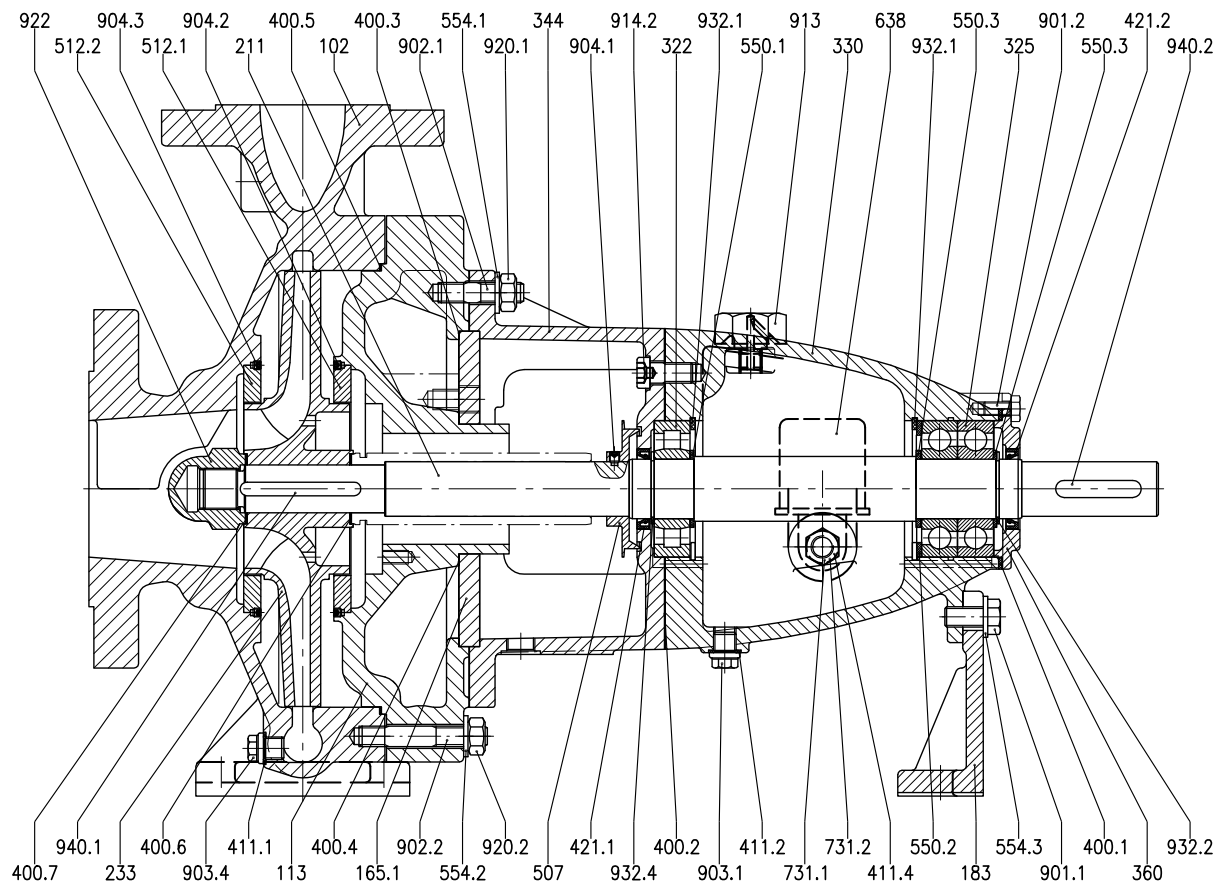


Fig. 17 : Sectional drawing Standard design NCL

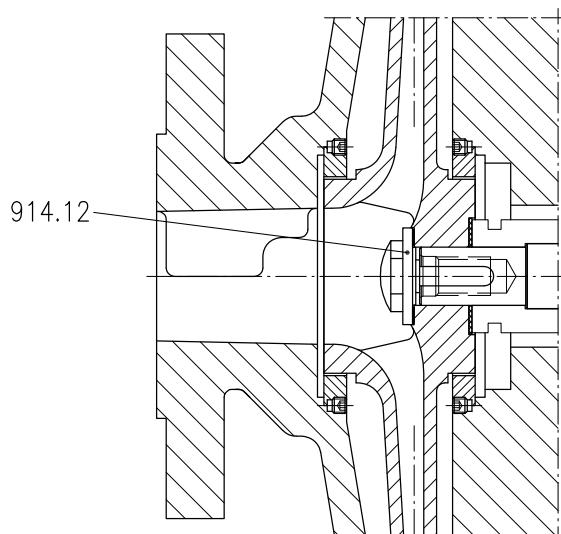


Fig. 18 : Impeller bolting, frame size 0

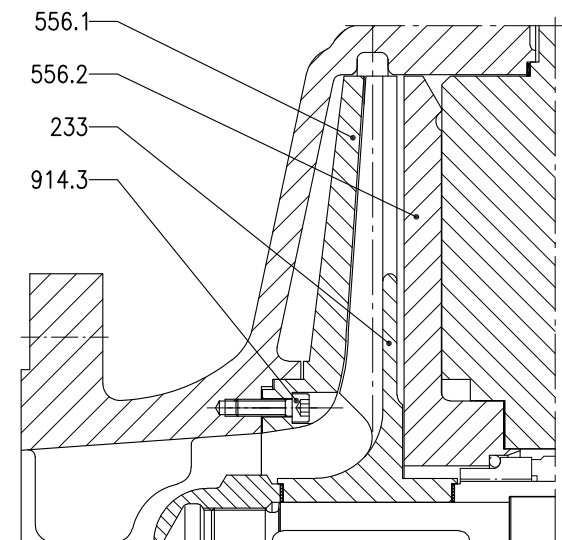


Fig. 19: Open impeller





## 10. Sectional drawings

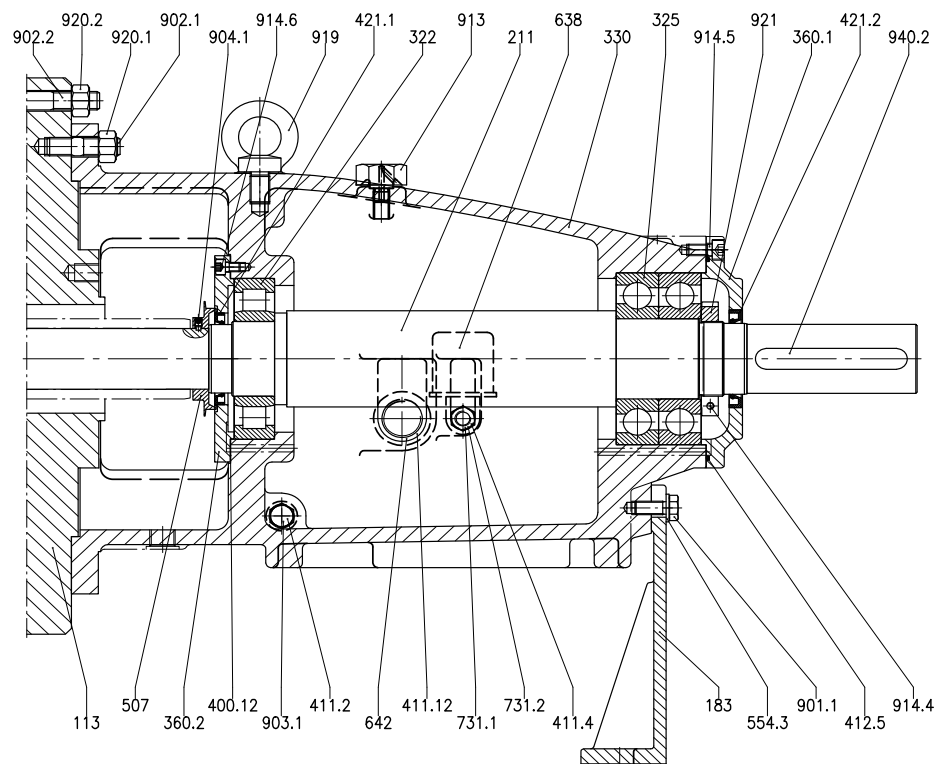


Fig. 20: Bearing bracket, frame size V

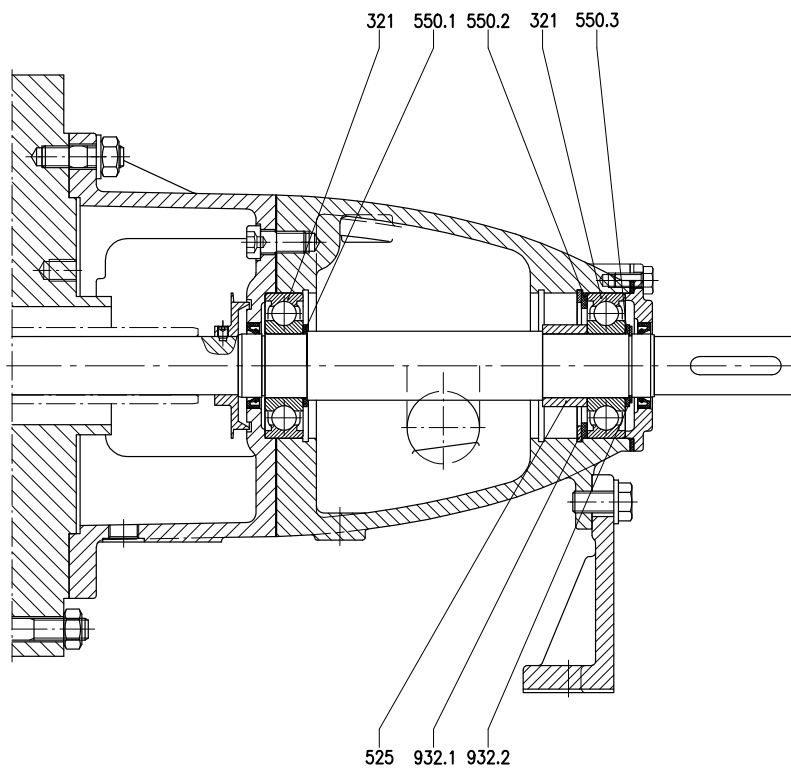


Fig. 21: Execution with permanent lubricated antifriction bearings

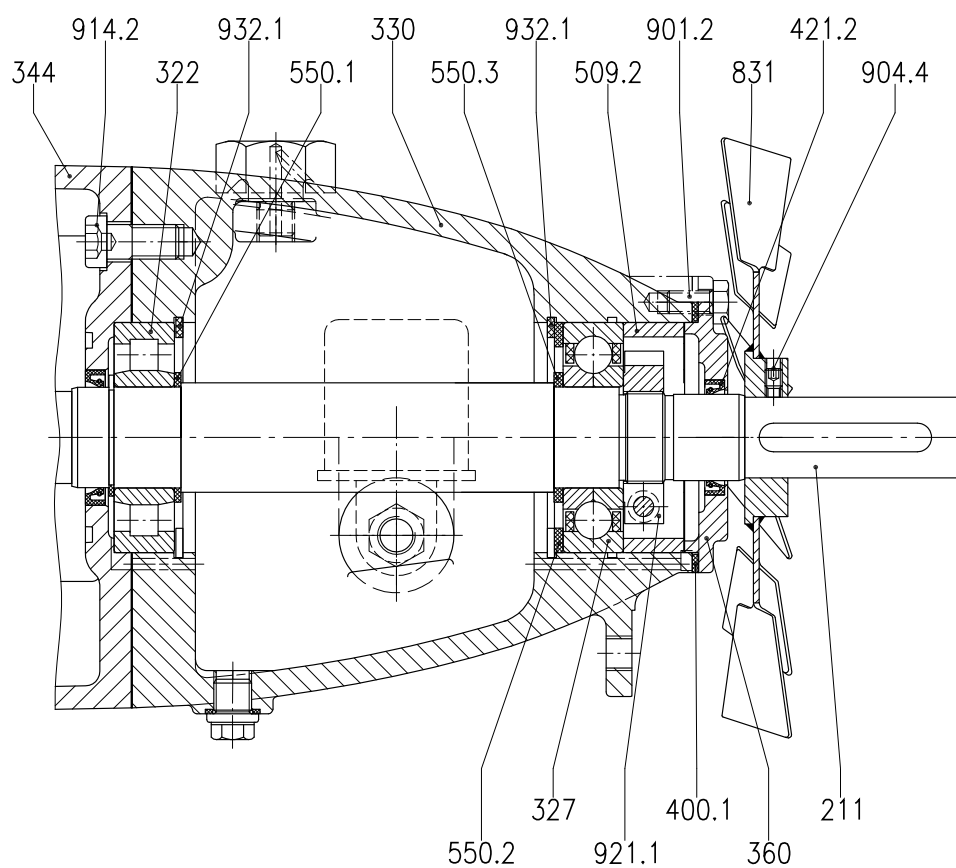


Fig. 22: Execution bearing frame III, speed  $3500 \text{ min}^{-1}$

## 10.2 Mechanical seals

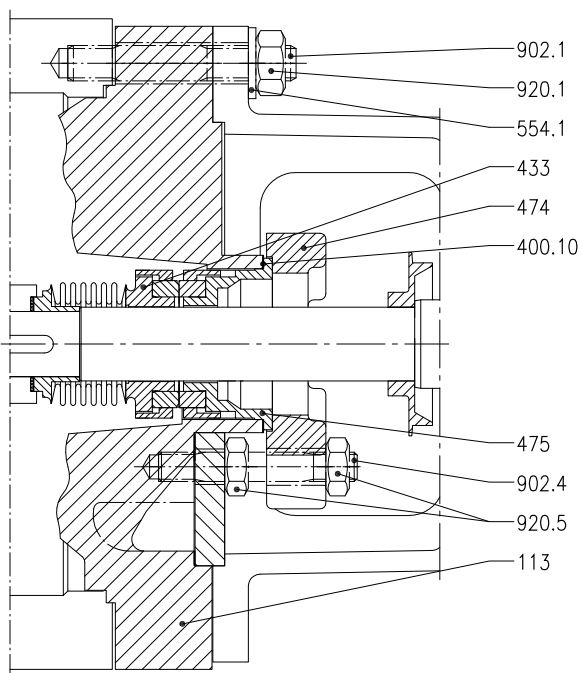


Fig. 23: single acting DICKOW-Mechanical seal

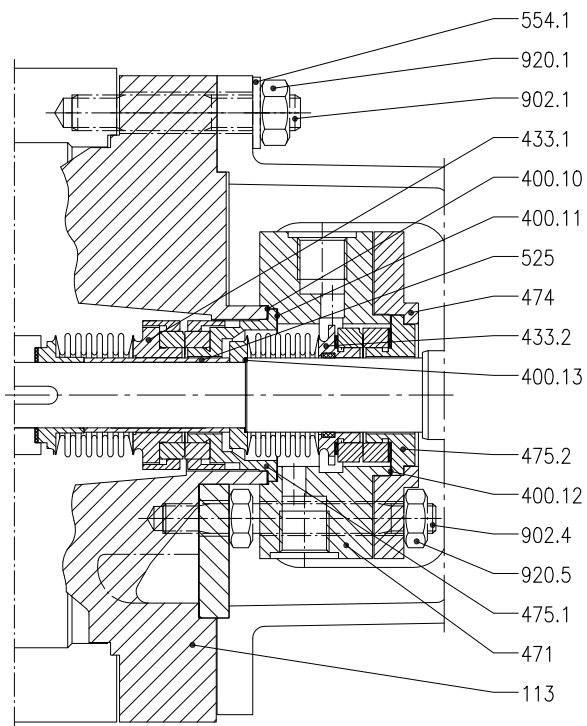


Fig. 24: Tandem DICKOW-Mechanical seal

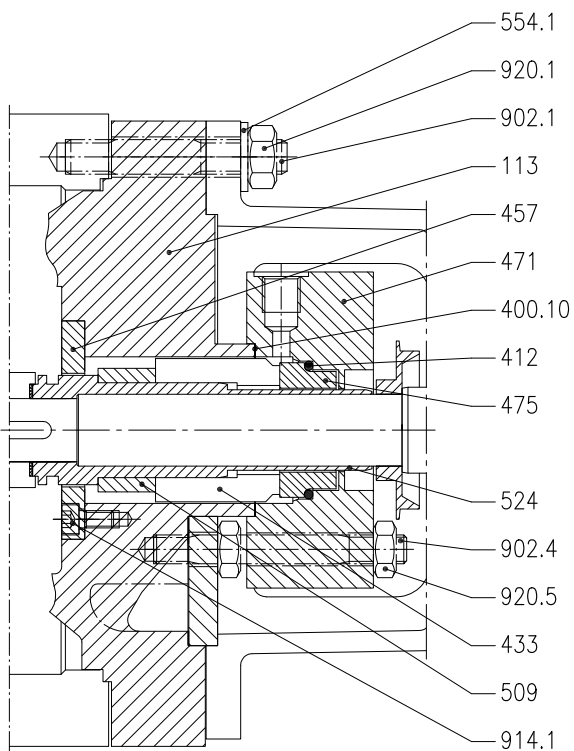


Fig. 25: single acting DIN Standard-Mechanical seal

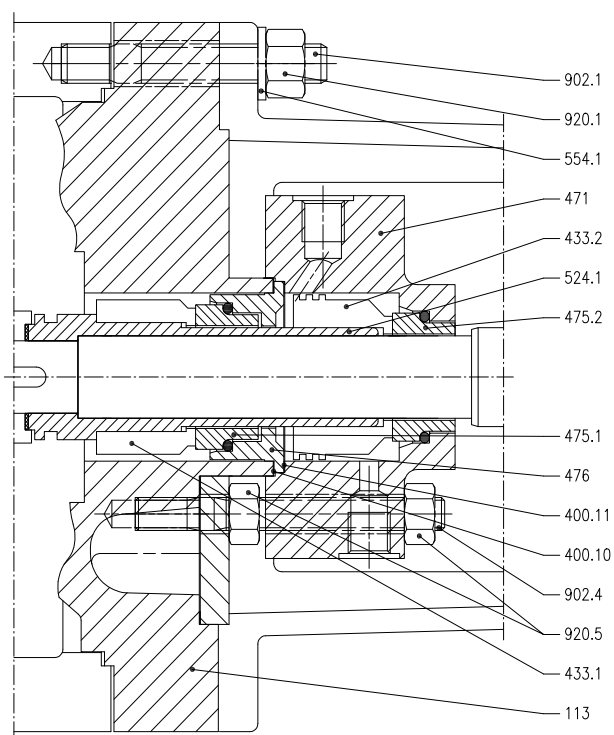


Fig. 26: Tandem DIN Standard Mechanical seal



## 10. Sectional drawings

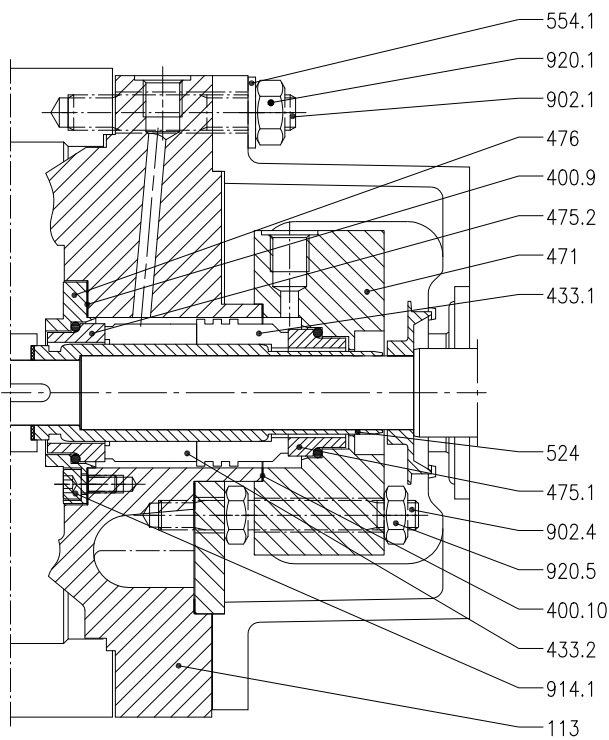


Fig. 27: double acting DIN Standard-Mechanical seal

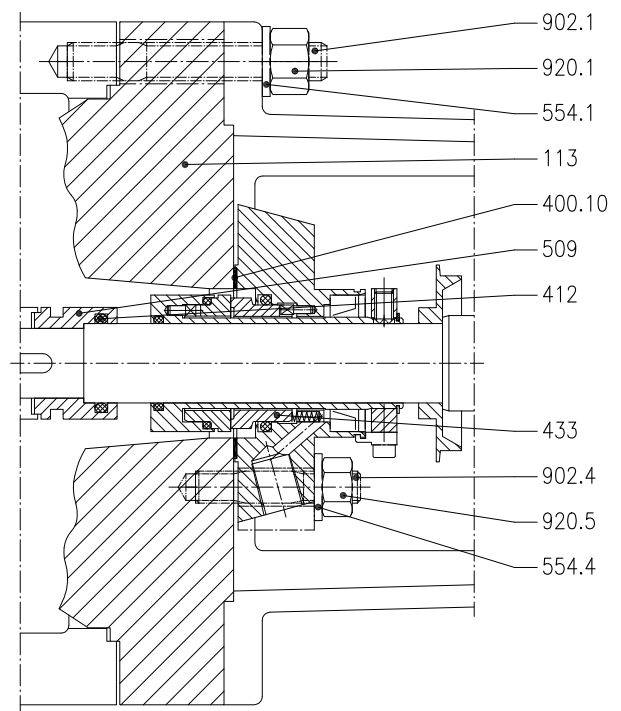


Fig. 28: Cartridge-Mechanical seal

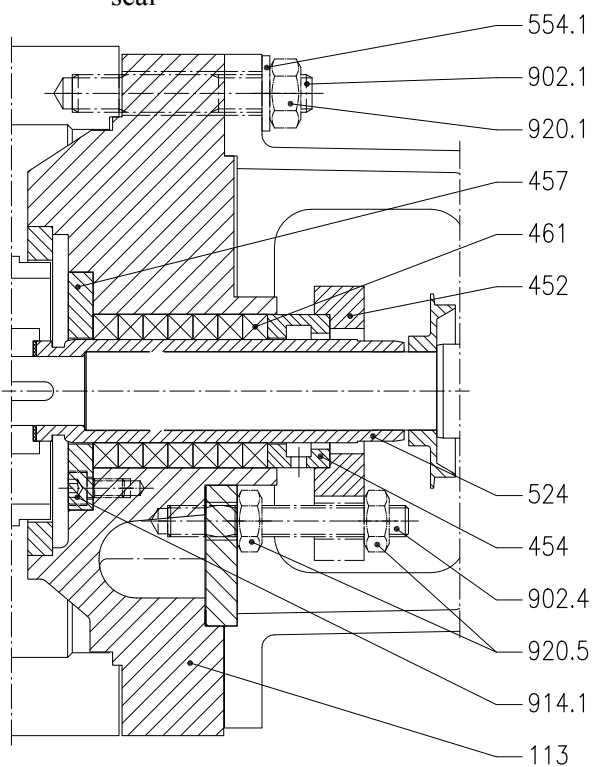


Fig. 29: Gland packing



# 11. Certificates

## 11.1 EC-Declaration of Conformity

### EC-Declaration of Conformity

according to EC-Machinery Directive 2006/42/EG, Annex II, No. 1A

DICKOW PUMPEN KG  
Siemensstraße 22  
D-84478 Waldkraiburg

Herewith we declare that the pump unit described in the data sheet

**Designation** : Centrifugal pump  
**Type:** NCL  
**Size** :  
**Design:**  
**Serial No.:**

is in compliance with all relevant provisions of the EC-Machinery Directive 2006/42/EG.

Applied harmonized standards:

EN 809:1998+A1:2009+AC:2010	EN ISO 12732-1:2008
EN ISO 12100:2010	EN ISO 12732-3:2008
EN 12162:2001+A1:2009	EN ISO 20361:2009
EN 953:1997+A1:2009	

Additionally applied standards and technical specifications:

EN ISO 5199:2002	VDMA 24276:2001
EN ISO 9906:2012	
EN ISO 2858:2010	


Waldkraiburg,

(Jürgen Konrad, Head of Technical Dept. at DICKOW)

Jürgen Konrad is authorized to compile the technical documentation



### 11.2 Document of Compliance

	<b>DICKOW PUMPEN</b>	<b>Document of Compliance</b>
<p>Please fill in this statement for health innocuousness completely and attach it to the pump to be returned to the factory.</p>		
<b><u>Pump data</u></b>		
Type:	Serial No.: PB	
<b><u>Reason for shipment</u></b>		
<b><u>Contamination of the pump</u></b>		
<input type="checkbox"/> Hazardous liquids were <b>not</b> handled		
<input type="checkbox"/> Hazardous liquids were handled		
Pumped liquid:		
The pump has been		
<input type="checkbox"/> cleaned	<input type="checkbox"/> flushed	<input type="checkbox"/> breamed
The following safety measures must be taken before opening/repairing the pump:		
<b><u>Customer data</u></b>		
Company:	Phone:	
	Fax:	
Address:	E-Mail:	
Name: (Block Letters)	Position:	
This is to certify that the above mentioned pump has been proper cleaned/flushed/breamed and repair can be performed without risk.		
Date:	Signature:	