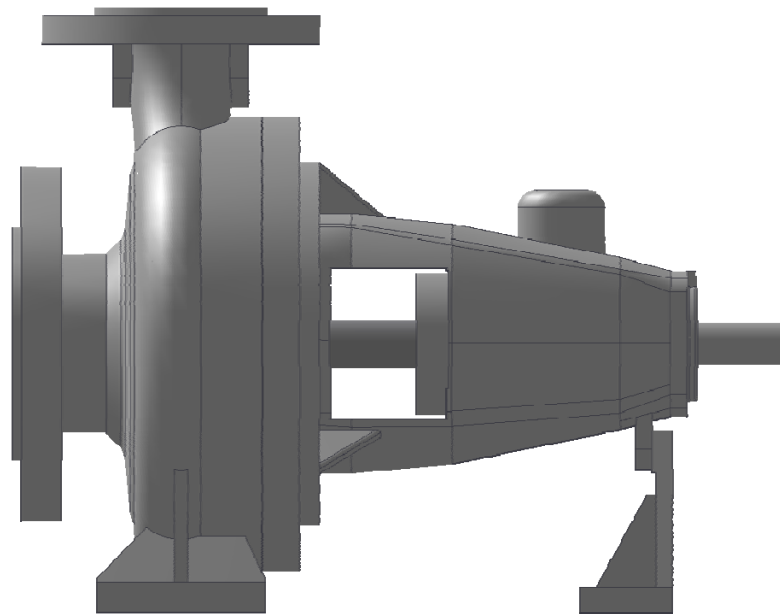


# Operation / Installation Instructions

**NKLs**

**No. 44.NKLs.E2.10/14**



Original Manual



**DICKOW PUMPEN KG**





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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



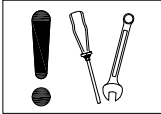

Signal word	Explanation
<b>DANGER</b>	signifies an imminent danger. If it will not be avoided, death or severe injury are the consequence.
<b>WARNING</b>	signifies a possibly dangerous situation. If it will not be avoided, death or severe injury may be the consequence.
<b>CAUTION</b>	signifies a possibly 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.



## 2. Safety

---

	<p>Hot surface Together with a signal word, it signifies dangers in connection with hot surfaces.</p>
	<p>Explosion protection Gives information on protection from explosion development in hazardous area according to EC-Directive 94/9/EG.</p>
	<p>Mechanical breakdown Together with the signal word ATTENTION, it signifies dangers for the pump and its function.</p>
	<p>Notice Provides recommendation and useful information for handling the product.</p>

### 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 “Ex”-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 EC-Directive 94/9/EC (ATEX). The ”Ex”- symbol shown here marks the chapters in this manual which require special attention.

#### 2.9.1 Surface temperatures

The highest surface temperatures are to be expected at the pump casing, the seal end plate 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 of the bearing bracket must be uncovered. Insulation of the bearing bracket is not allowed.

#### 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.





## 3. Description

### 3.1 General description

This pump is used where ever thermal oils are handled in industrial heating applications.

### 3.2 Design code

Example: NKL s 100/320 A N10q

NKL s	pump type
100	nominal width discharge flange [mm]
320	nominal impeller diameter [mm]
A	scope of supply; e.g. A = bare shaft pump
N10q	shaft sealing

### 3.3 Classification pump size / frame size

Frame size	I	II	III
Pump size	32/165	65/250	100/400
	32/210	80/200	125/320
	32/250	80/250	125/400
	40/165	100/200	150/250
	40/210	100/250	150/320
	40/250	100/320	150/400
	50/130	125/250	
	50/210		
	50/250		
	65/130		
	65/210		
	80/165		



### 3.4 Identification

#### 3.4.1 Name tag

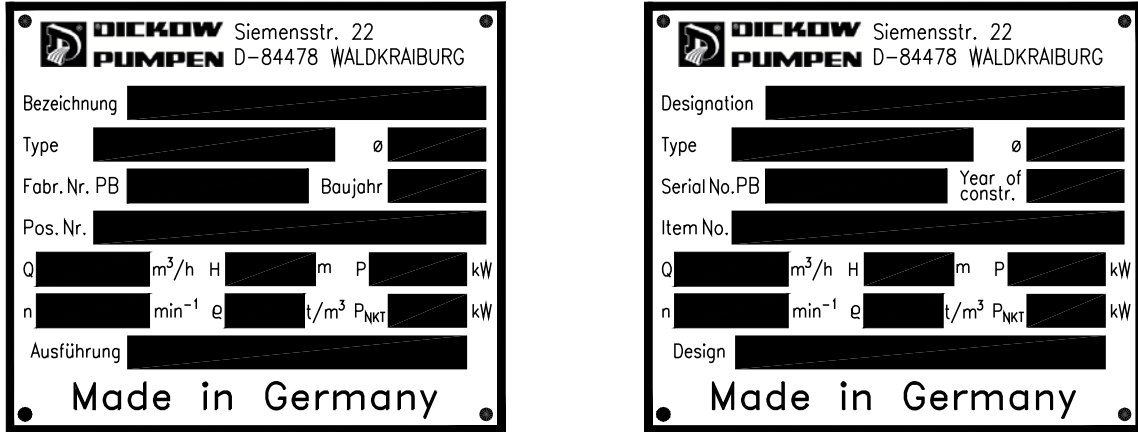


Fig. 1: Name tag German and English

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

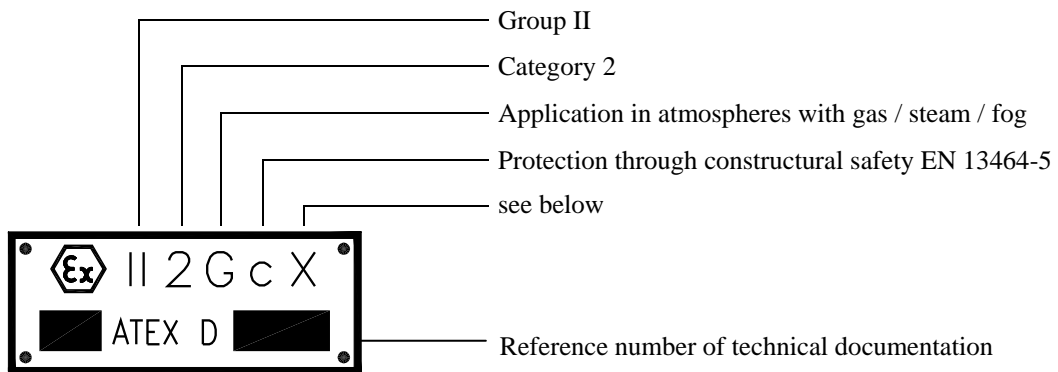


Fig. 2: ATEX-Name tag

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 symbol "X" is integrated in the identification. Chapter 2.9.1 refers to the arising surface temperatures. (Consider the notes on the pump data sheet)



### 3.5 Design

#### Design

- Volute casing pump
- horizontal installation
- single stage
- casing dimensions acc. to EN 733

#### Pump casing

- single volute
- radially split
- cast-on feet

#### Impeller

- closed
- relief holes for thrust load balance

#### Bearing

- motor end: roller bearing as fixed bearing
- pump end: cylinder roller bearing
- oil lubrication

#### Shaft sealing

- single mechanical 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.

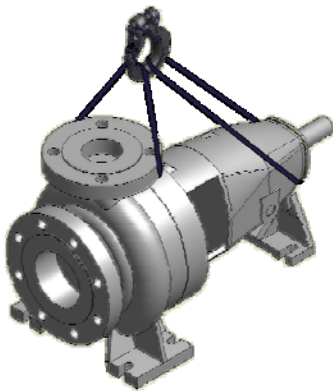


Fig. 3: lifting the pump

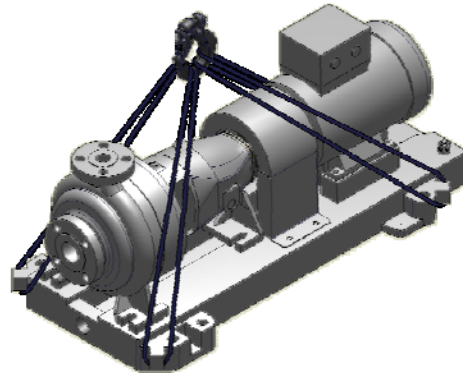


Fig. 4: lifting the complete pump unit

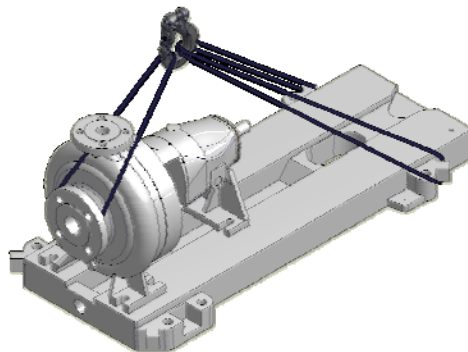


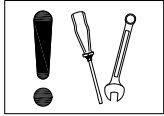
Fig. 5: lifting the pump mounted on base plate



### 4.2 Storage / Preservation

#### ATTENTION

Damage during storage through moisture or dirt.

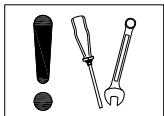


Corrosion and / or contamination of the pump !

- 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 with constant air humidity.
- 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 dry storage period is 12 months.

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-en.pdf>



### 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 concrete strength (minimum class XO) of the foundation acc. to DIN 1045.
- 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. Installation / Mounting

### 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 according to chapter 5.4.2.
- 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, consider the figures below.

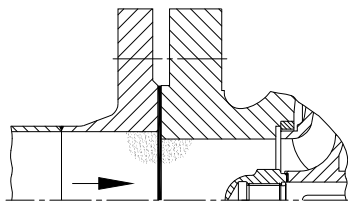


Fig. 6: Flow eddies

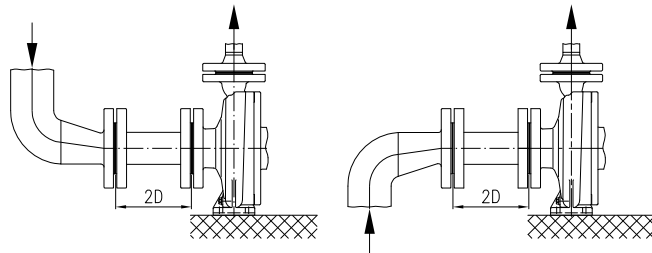
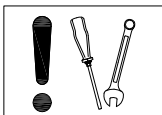


Fig. 7: Reducer connection

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





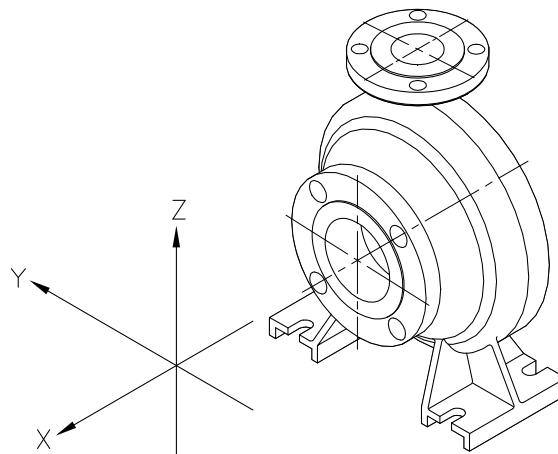
## 5. Installation / Mounting

### 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	F <sub>x</sub> [N]	F <sub>y</sub> [N]	F <sub>z</sub> [N]	Σ F [N]	M <sub>x</sub> [Nm]	M <sub>y</sub> [Nm]	M <sub>z</sub> [Nm]	Σ M [Nm]
32/165 – 250	50 2"	570	520	470	900	480	350	400	700
40/165 – 250	65 3"	730	640	590	1150	500	380	410	750
50/130 – 250	65 3"	730	640	590	1150	500	380	410	750
65/130 – 250	80 3"	870	780	710	1370	550	400	440	810
80/165 – 320	100 4"	1160	1000	940	1800	600	430	480	900
100/200 – 400	125 6"	1370	1200	1050	2000	730	520	650	1050
125/250 - 400	150 6"	1700	1500	1350	2700	870	600	700	1250
150/250 - 400	200 8"	2200	2000	1800	3500	1100	800	900	1600



## 5. Installation / Mounting

Pump size	Discharge flange								
	DN	F <sub>x</sub> [N]	F <sub>y</sub> [N]	F <sub>z</sub> [N]	Σ F [N]	M <sub>x</sub> [Nm]	M <sub>y</sub> [Nm]	M <sub>z</sub> [Nm]	Σ M [Nm]
32/165 – 250	32 1 ½"	310	290	360	570	380	260	290	550
40/165 – 250	40 1 ½"	380	350	430	670	450	310	360	650
50/130 – 250	50 2"	520	470	570	900	480	350	400	700
65/130 – 250	65 3"	640	590	730	1100	520	380	410	750
80/165 – 320	80 3"	780	700	870	1370	550	400	440	820
100/200 – 400	100 4"	1040	930	1150	1800	600	430	480	900
125/250 – 400	125 6"	1230	1100	1300	2100	730	520	650	1050
150/250 – 400	150 6"	1550	1400	1700	2600	870	600	700	1200

Forces and moments are based on 20°C. Temperature dependent correction values are given in the Figure below.

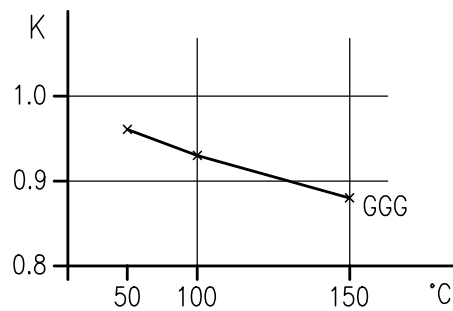


Fig. 8: Temperature correction diagram

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 !

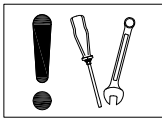
- Insulate casing parts
- Attach protective device



## 5. Installation / Mounting

### 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

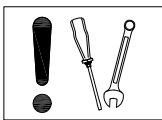


Risk of injury through moving components !

- 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.

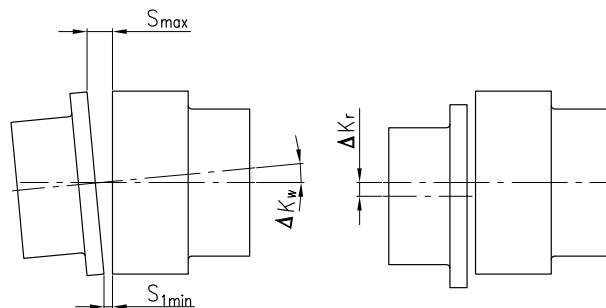


Fig. 9: Angular and radial misalignment of couplings



## 5. Installation / Mounting

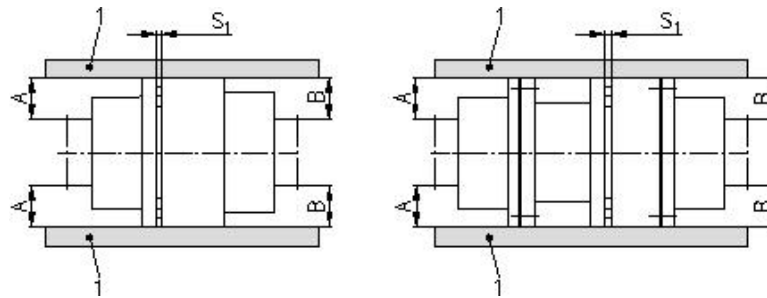


Fig. 10: Coupling alignment

1. Dismantle coupling guard.
2. Loosen support foot.
3. Place a straight edge (1) – see Fig. ... - 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 – see Fig. ...
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 EN 13463-1.

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.



## 5. Installation / Mounting

---

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.

### 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. Installation / Mounting

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### 5.8.1 Checking rotating direction

**DANGER**

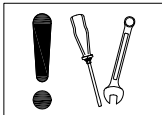


**Temperature rise through parts touching each other**

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

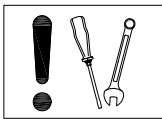
The following points must be checked prior to start-up;

- 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/Service/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**

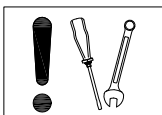


Damage of antifriction bearings !

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

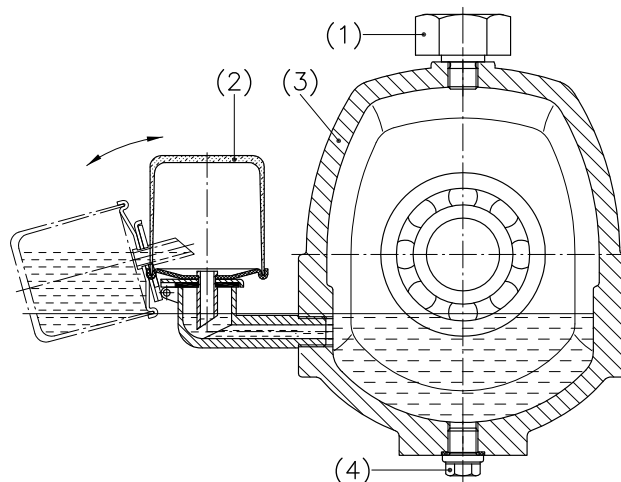
#### **ATTENTION**

#### **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.



## 6. Commissioning / Decommissioning

---

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.

### 6.1.2 Filling and venting the pump

#### DANGER

**Formation of explosive atmosphere inside the pump**



Danger of explosion !

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

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 will be supplied with installed shaft sealing.

### 6.1.4 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.

### **6.1.5 Inspection of shaft sealing**

A mechanical seal is a dynamic 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.

## **6.2 Operating the pump**

### **WARNING**

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

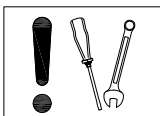


Risk of burns !

- 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.

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.

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 !

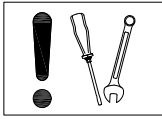
- Check antifriction bearings regularly for running noise.



## 7. Maintenance / Servicing / Inspection

### ATTENTION

#### Wear caused by dry run

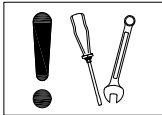


Damage of the pump !

- 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.

Lube oil CLP46 or 68 according to DIN 51517 or HD20W/20 with a kinematic viscosity of 46-68 mm<sup>2</sup>/s at 40°C can be used, e.g.:

- OMV lube EPX 46
- Shell Morlina 46-68

The calculated lifetime of antifriction bearings is – also under critical service conditions – more than 25000 operating hours.

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

Bearing frame	Filling Qty [l]
I	0,75
II	1,0
III	1,25



### 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.

#### 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 while dismantling the interchangeable unit.

### 7.4.3 Disassembly of rotating unit

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

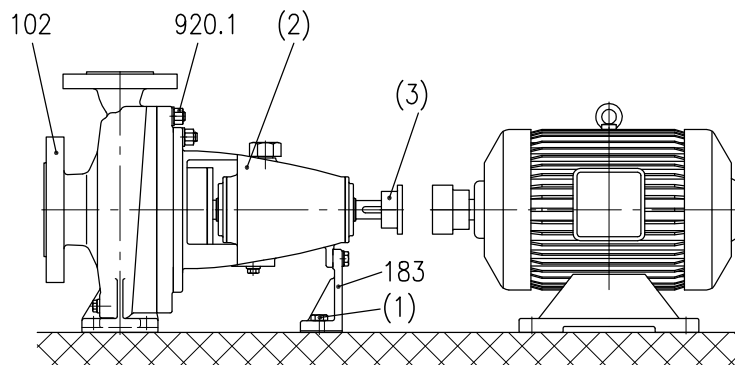


Fig. 11: Disassembly of rotating unit

1. Loosen hexagon nut 920.1.
2. Loosen hexagon head bolt (1) from support foot 183.
3. Press the complete rotating unit (2) out off the volute casing 102 by using jack screws.
4. Pull the rotating 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 the impeller nut 922 (right hand thread).
3. Pull off the impeller from pump shaft.
4. Remove key 940.1.



### 7.4.5 Disassembly of shaft sealing

The works according to chapter 7.4.4 are completed.

#### **DICKOW-Mechanical seal N10g**

1. Pull off mechanical seal 433 from pump shaft.
2. Remove hexagon nut 920.2.
3. Press the intermediate casing 113 out off its centring and place it on a bench.
4. Remove hexagon nut 920.3, pull off pressure ring 474 and seal end plate 471.
5. Pull seal ring 475 carefully out off the intermediate casing.

### 7.4.6 Disassembly of antifriction bearing

The works according to chapter 7.4.5 are completed.

1. Loosen hexagon head bolt 901.2 and pull off bearing cover 360.
2. Press the pump shaft 211 together with antifriction bearing out off the bearing bracket seat by using a press or drilling spindle.
3. Remove circlip 932.1.
4. Frame size I: Pull off radial ball bearing 321 from pump shaft.  
Frame size II + III: Pull off the inner ring of cylinder roller bearing 322 and the radial ball bearing 321 from pump shaft.
5. Remove disk 550.1.
6. Frame size II + III: Press the outer ring of cylinder roller bearing 322 out off the bearing bracket.

### 7.4.7 Replacement of antifriction bearing

Frame size	321	322
I	2x 6306.C3	---
II	6307.C3	NU 307
III	6409	NU 409

## 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 0,6 mm. If the clearance exceeds 0,8 mm, the wear rings must be replaced.





### 7.5.2 Bearing bracket

Measure the inner diameters of the ball bearing seats. Replace the bearing bracket if the following dimensions are exceeded:

frame size I	→	max. 72,009 mm
frame size II	→	max. 80,009 mm
frame size III	→	max. 120,010 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:

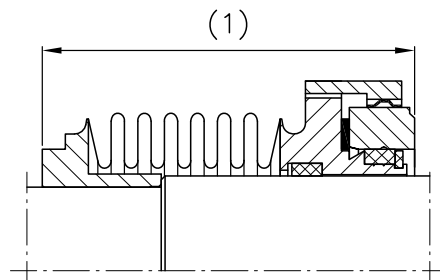


Fig. 12: Length L (1) mechanical seal

Mechanical seal	Code	L [mm] at frame size		
		I	II	III
N10q	U <sub>3</sub>	47,5	58	64

## 7.6 Assembly of pump unit

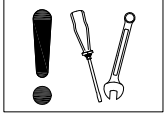
### 7.6.1 General instructions

- 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.



### **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**

#### **Frame size I:**

1. Slide the disks 550.1 onto the pump shaft.
2. Heat up the ball bearing 321 to 80 – 100°C.
3. Slide the first ball bearing onto the pump shaft until limit.
4. Slide disk 550.2 and circlip 932.2 loosely onto the pump shaft.
5. Slide the second ball bearing onto the pump shaft until limit.
6. Press the pump shaft together with both ball bearings through the first bearing bracket seat.
7. Fix circlip 932.2 and disk 550.2.
8. Press the pump shaft with both ball bearings into the final bearing seat.
9. Fit the bearing cover 360 and tighten the hexagon head bolts 901.2.

#### **Frame size II + III:**

1. Slide the disks 550.1 onto the pump shaft.
2. Heat up ball bearing 321 and inner ring of cylinder roller bearing 322 to 80 – 100°C.
3. Slide ball bearing and inner ring onto the pump shaft until limit.
4. Slide on the disk 550.1. Secure ball bearing and inner ring with circlip 932.1.
5. Insert the circlip 932.2 into the bearing bracket.
6. Press the outer ring of cylinder roller bearing 322 into the bearing bracket until limit.
7. Fit the pump sided bearing cover 360 and tighten the hexagon head bolts 901.2.
8. Press the pump shaft 211 with the mounted ball bearing into the bearing bracket.
9. Fit the motor sided bearing cover 360 and tighten the hexagon head bolts 901.2.



## 7. Maintenance / Servicing / Inspection

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### 7.6.3 Assembly of shaft sealing

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.

#### **DICKOW-Mechanical seal N10q**

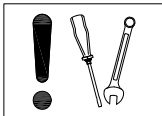
1. Insert seal ring 475 carefully into the intermediate casing.
2. Insert pressure ring 474 and seal end plate 471 and fasten it with hexagon nut 920.3.
3. Press the intermediate casing 113 into the centring and fasten it with hexagon nuts 920.2.
4. Slide the mechanical seal 433 onto the pump shaft.

### 7.6.4 Assembly of impeller

1. Slide the impeller onto the pump shaft.
2. Tighten impeller nut 922 with torque wrench (right hand thread).

#### **ATTENTION**

##### **Missing Heli-Coil insert**



Impeller nut loose !

- Make sure that impeller nut is provided with Heli-Coil insert.

### 7.6.5 Assembly of rotating unit

#### **WARNING**

##### **Tilting the rotating unit**



Squeezing of hands and feet!

- Secure 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 400.1.
3. Tighten hexagon nut 920.1 by torque wrench.
4. Mount support foot 183 with hexagon head bolt 901.1 and washer 554.8.
5. Fasten the support foot with hexagon head bolt 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 Standard bolt
M5	5
M6	9
M8	22
M10	45
M12	80
M16	195
M20	370

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:

frame size	922	
	bolt torque [Nm]	wrench size
I	100	32
II	120	41
III	140	50



## 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 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
				X		X	Unbalance of rotating parts, e.g. impeller	Balance the parts



## 8. Trouble shooting

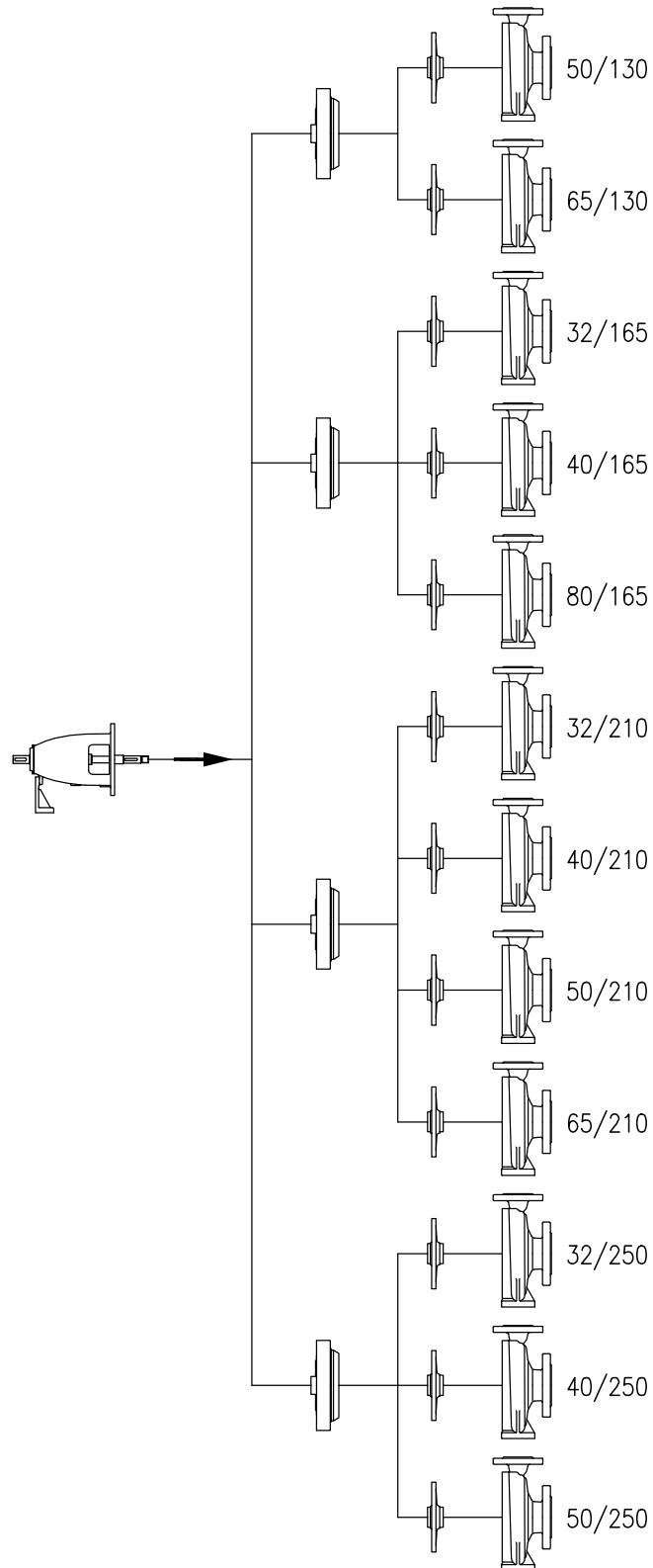
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Failure number							Problem	Elimination
1	2	3	4	5	6	7		
			X				Casing screws and screwed plugs loose	Tighten the screws and plugs Renew gaskets
		X					Coupling gap not correct	Correct coupling gap
		X					No cooling flow available from motor to antifriction bearing	Check the installation Install a cooling fan
						X	Shaft sealing worn out	Renew shaft sealing



# 9. Interchangeability

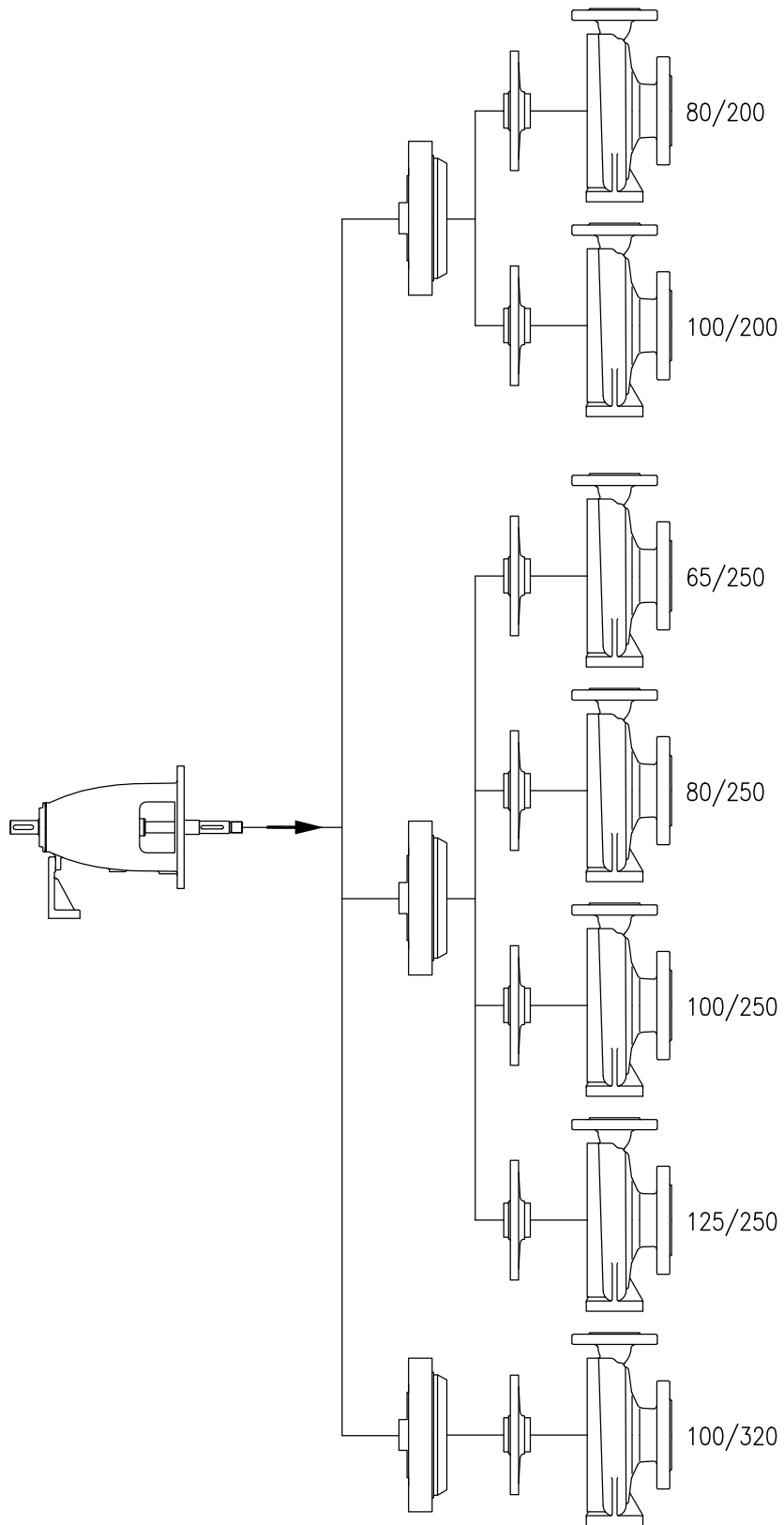
## 9.1 Frame size I





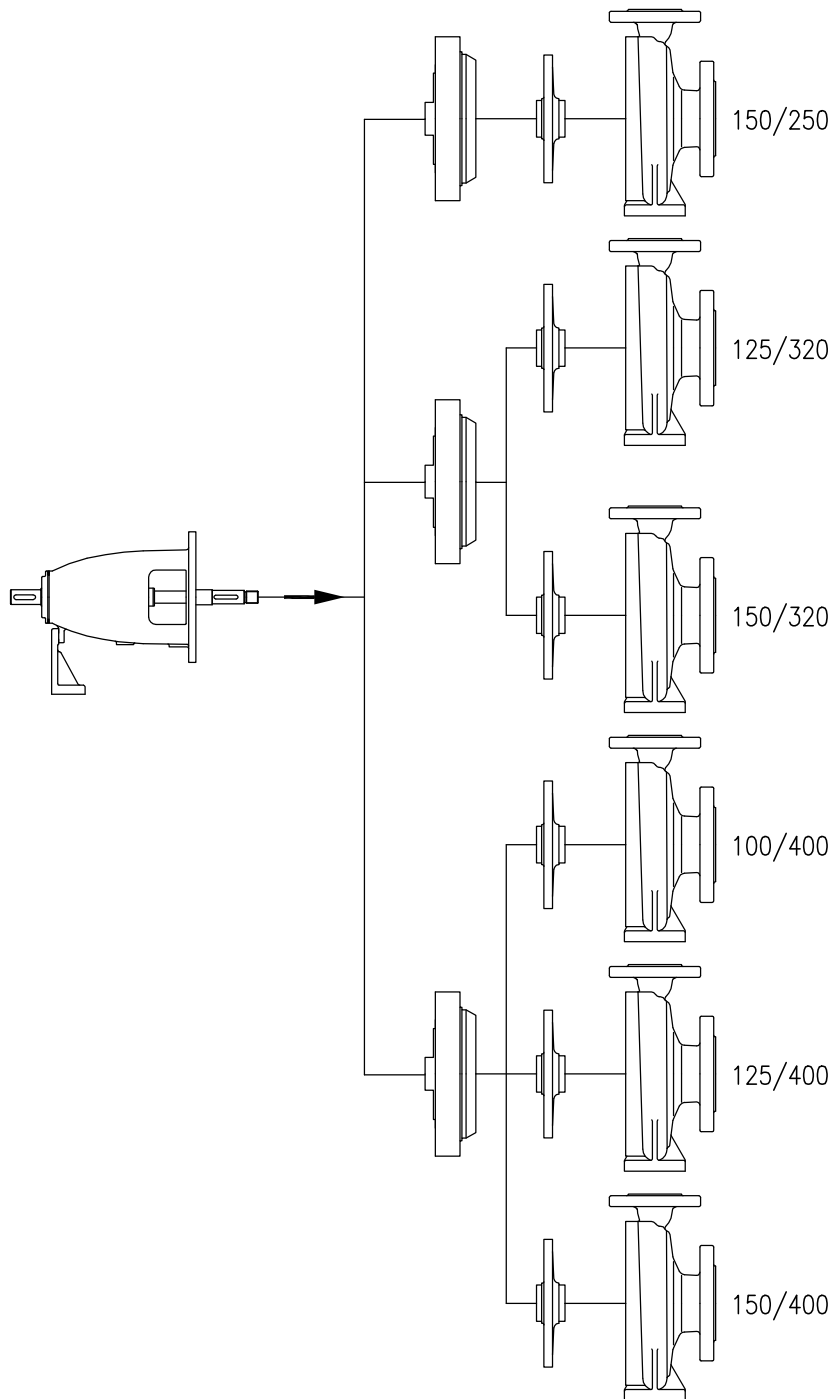


## 9.2 Frame size II





### 9.3 Frame size III





# 10. Sectional drawings

## 10.1 Frame size I

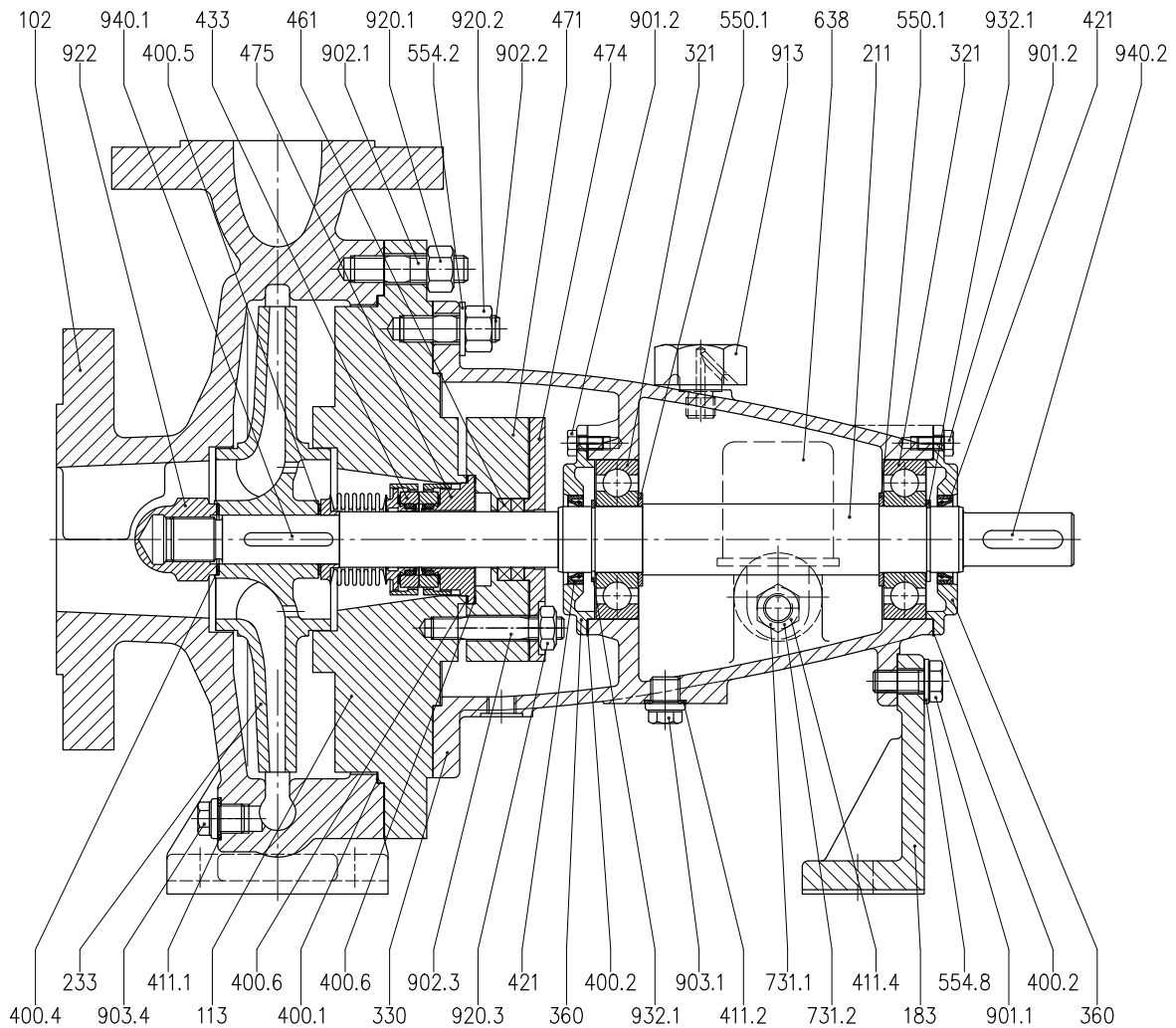


Fig. 13: Section drawing NKLs, standard design – frame size I



## 10.2 Frame size II

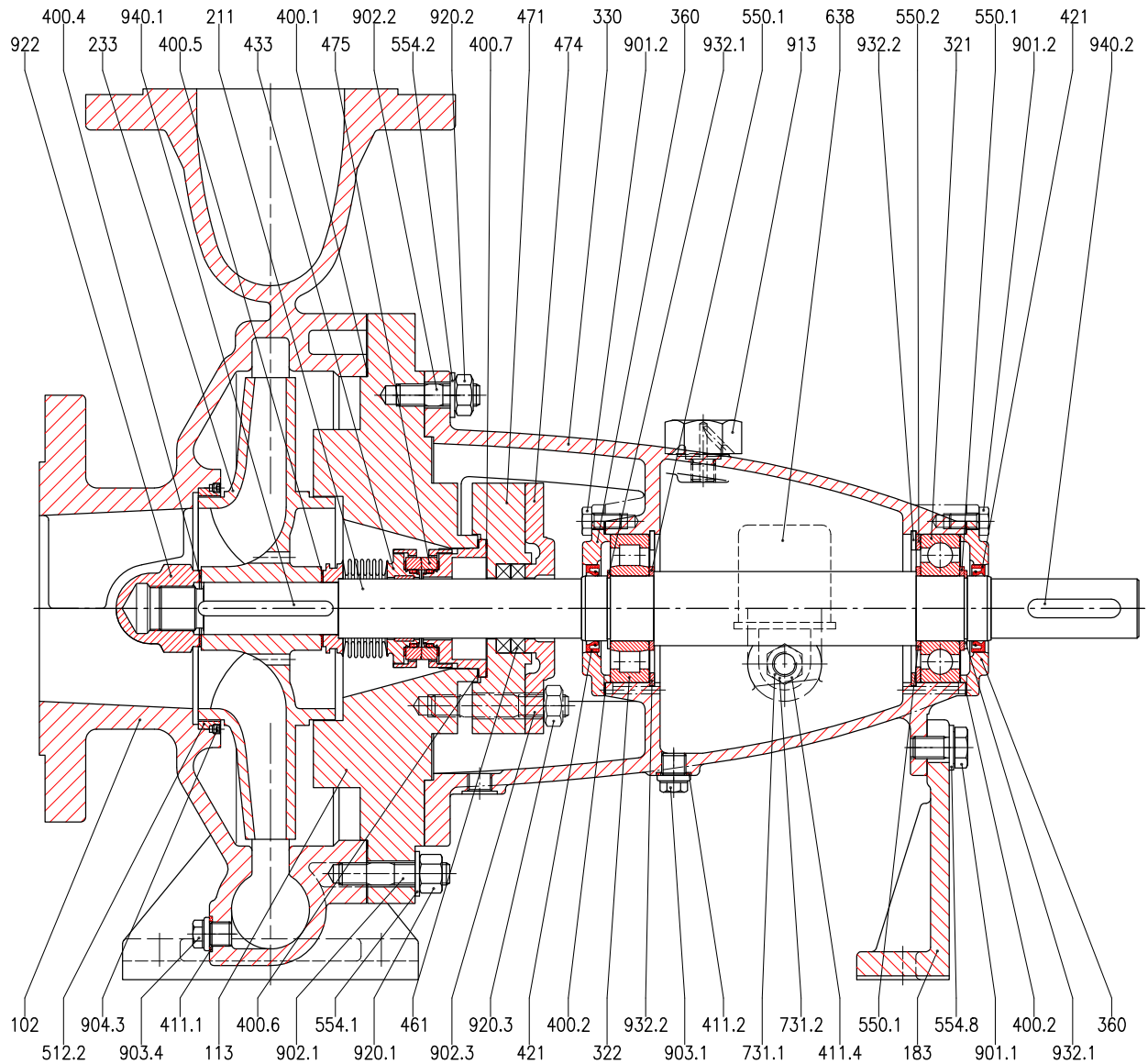


Fig. 14 : Sectional drawing NKs, standard design – frame size II



10.3 Frame size III

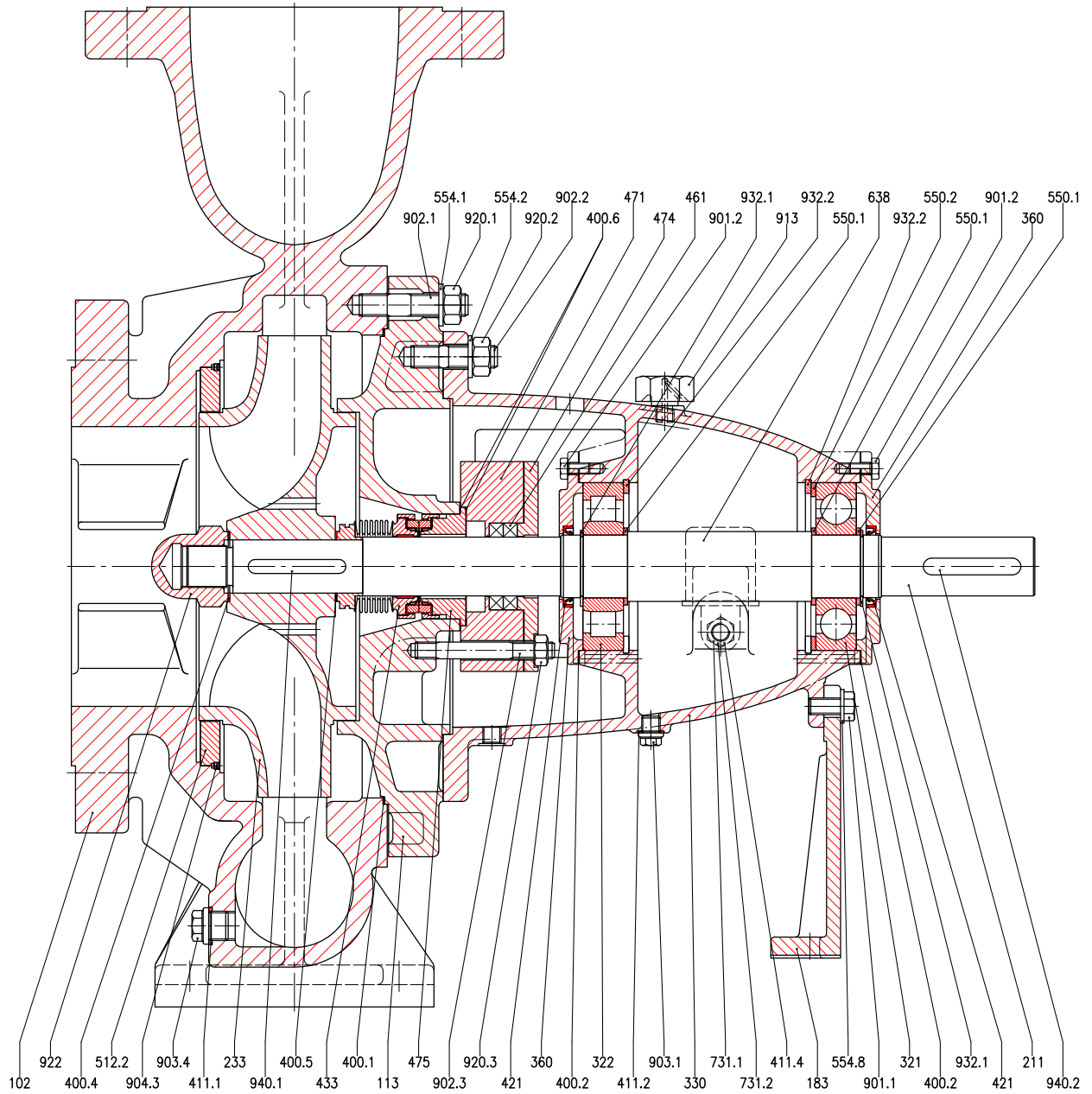


Fig. 15: Sectional drawing NKLS, standard design – frame size III



# 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:** NKLS  
**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

Additionally applied standards and technical specifications:

EN ISO 5199:2002	VDMA 24276:2001
EN ISO 9906:1999	
EN 12723:2000	
EN 733:1995	

Waldkraiburg,

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

Jürgen Konrad is authorized to compile the technical documentation

