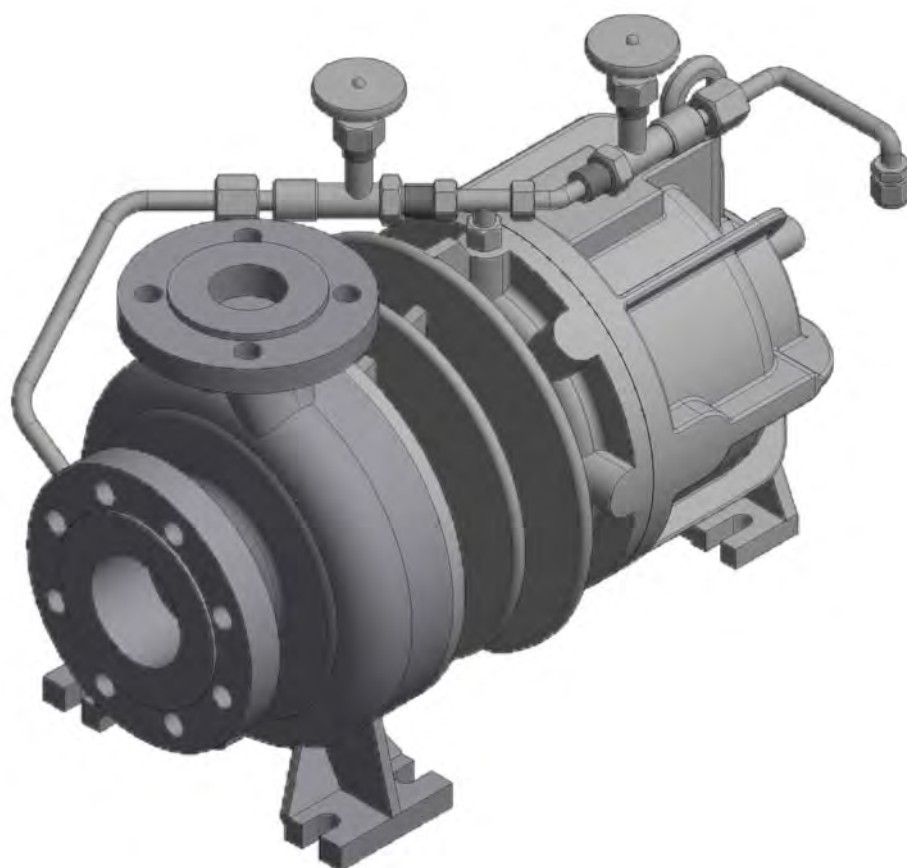


Operation / Installation Instructions

NMW

Nr. 44.NMW.E3.01.18



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.


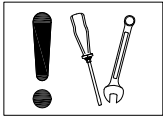

2.1 Designation of Warning Notices

Signal word	Explanation
DANGER	signifies an imminent danger. If it will not be avoided, death or severe injury are the consequence.
WARNING	signifies a possibly dangerous situation. If it will not be avoided, death or severe injury may be the consequence.
CAUTION	signifies a possibly dangerous situation. If it will not be avoided, slight or minor injury may be the consequence.
ATTENTION	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.
	Hot surface Together with a signal word, it signifies dangers in connection with hot surfaces.



2. Safety

	Explosion protection Gives information on protection from explosion development in hazardous area according to Directive 2014/34./EU.
	Mechanical breakdown Together with the signal word ATTENTION, it signifies dangers for the pump and its function.
	Notice 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.
- Pumps must only be operated with heat transfer oil.
- 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 containment shell 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.

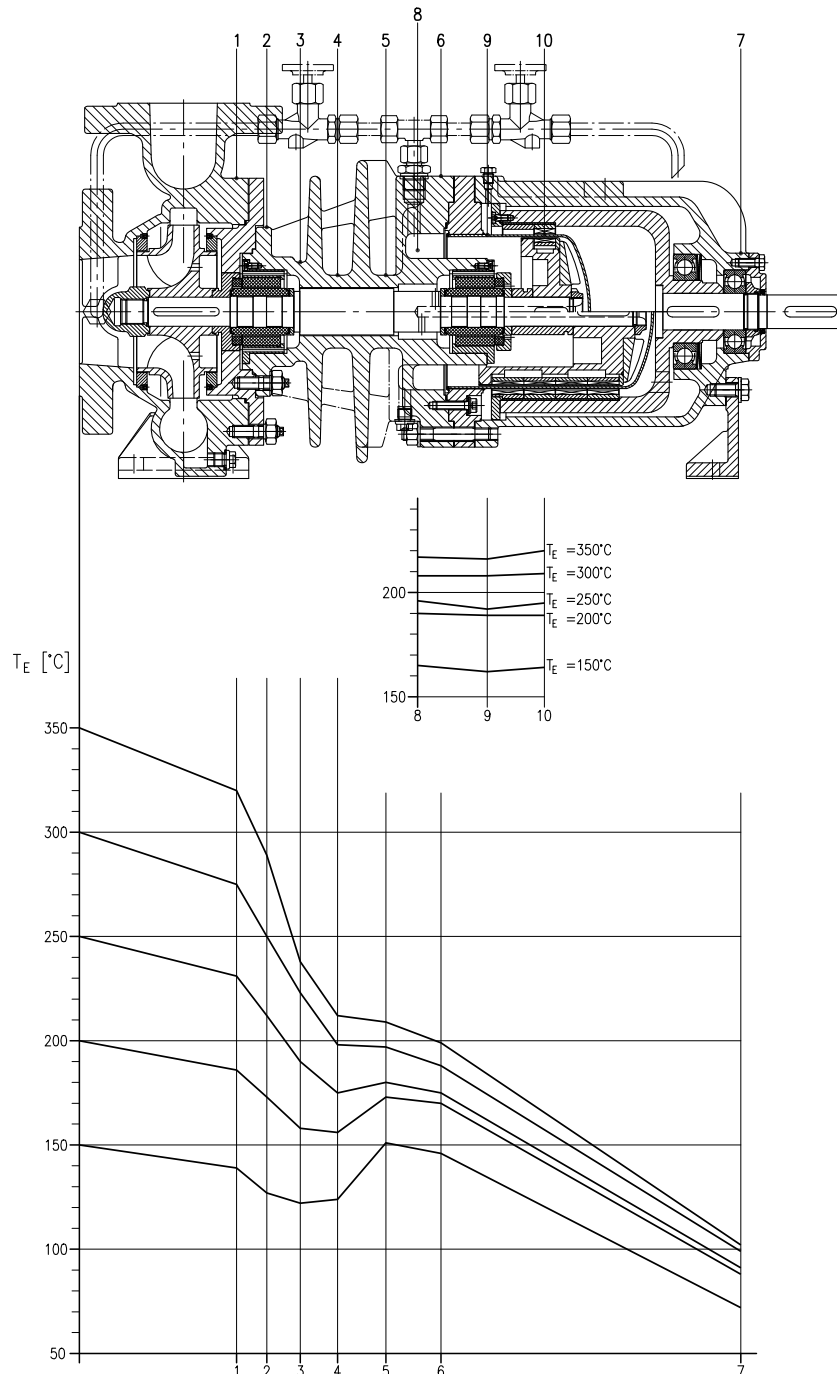


Fig. 1a: Surface temperatures as a function of the inlet temperature T_E without multitube cooler;
Magnet losses $P_V = 0,9$ kw

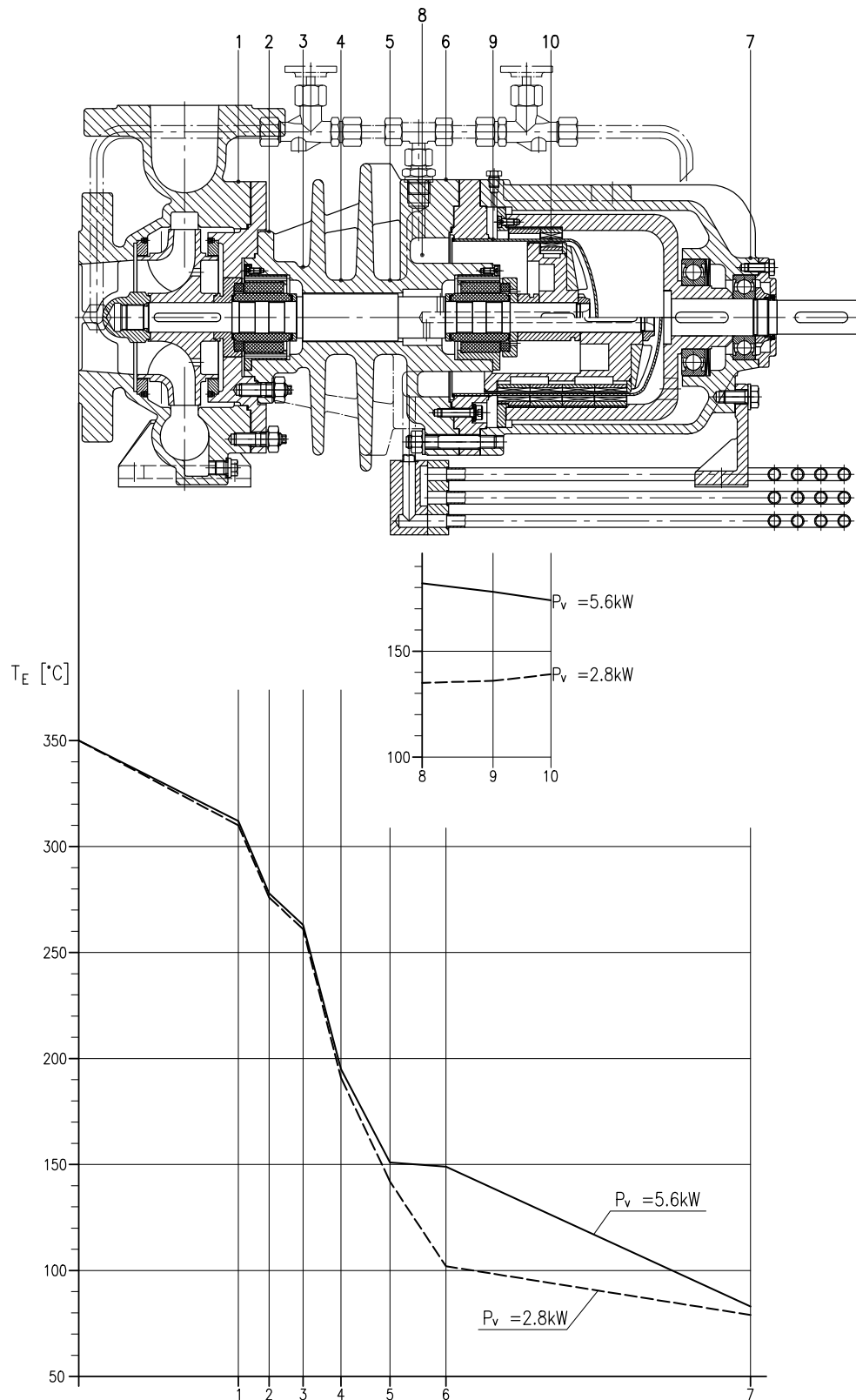


Fig. 1b: Surface temperatures as a function of the inlet temperature T_E with multitube cooler for magnet losses $P_v = 2,8 \text{ kw}$ und $5,6 \text{ kw}$

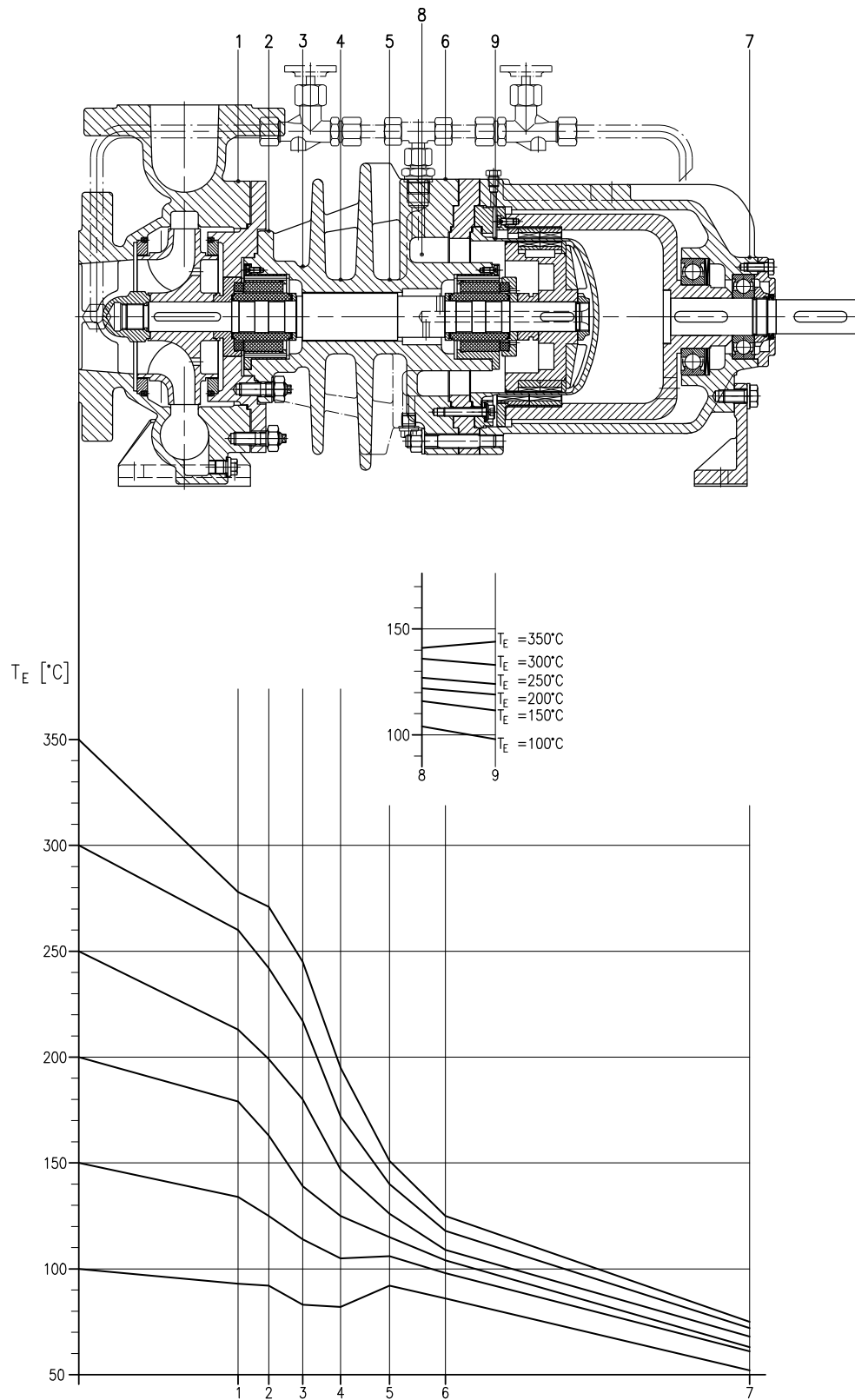


Fig. 1c: Surface temperatures as a function of inlet temperature T_E for **ceramic containment shell**
($P_V = 0$ kW)

**DANGER****High surface temperatures at the containment shell**

Danger of explosion !

- At bearing frame I / II:
Installation of multitube cooler if magnet losses $P_v = \geq 1,9 \text{ kW}$.
- At bearing frame III :
Installation of multitube cooler if magnet losses $P_v = \geq 2,7 \text{ kW}$.

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. The following risks must be considered:

- **Desynchronisation of the magnet coupling**
Overstressing, overheating or non-observance of the design data may result in desynchronisation of the magnet coupling. The generated heat energy may cause temperature rise of the containment shell.
- **Solids between inner magnet and containment shell**
Large solids may become wedged between inner magnet and containment shell and cause inadmissible temperature rise at the containment shell through friction.
- **Product leakage**
If a containment shell is damaged (= rare failure) and leaking product can endanger the environment, a leakage monitor should be provided.
Interaction with adjoining materials must be considered.
- **Operation below the minimum flow**
- **Operation above the maximum flow**

The following monitoring devices can be supplied:

- Level switch to avoid dry running.
- Temperature monitoring of the containment shell for controlling elevated temperatures in the containment shell.
- Monitoring of the inner area of the bearing bracket to detect leakage due to containment shell damage.

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.



2.10 Magnet coupling

DANGER



Strong magnetic field from the area of the magnet coupling or from single magnets.

Danger to life for individuals with pace maker!

Disturbance of magnetic data media, electronic devices, components and instruments!

Uncontrolled attractive force between magnetic components, tools etc.!

- A safe distance of 0,3 m minimum must be maintained.

The safe distance refers to inner and outer magnets which are not yet installed in the pump.

In mounted condition, the magnetic field is completely shielded. There is no danger through magnetic fields from an assembled pump. This refers also to pace makers.



3. Description

3.1 General description

This pump is used especially for hot oil applications in industrial heating plants and where sealless design is required.

3.2 Design code

Example: NMW i hu 32/210 A 21 / 1,0 / 30 / 2 / 1

	Pump code
NMW	pump type
i	special design; e.g. i = inducer
hu	material execution; e.g. hu = 1.0619 – GP240GH
32	nominal width discharge flange [mm]
210	nominal impeller diameter [mm]
A	scope of supply; e.g. A = bare shaft pump
	Magnet code
21	Material; e.g. 2 = containment shell 2.4610; 1 = rotor 1.4571
1,0	wall thickness containment shell [mm]
30	magnet length [mm]
2	circulation; e.g. 2 = no circulation (dead end)
1	sleeve bearing design; e.g. 1 = elastic mounted

3.3 Classification pump size / frame size

Frame size	I	II	III
Pump sizes	32/165	32/250	65/320
	32/210	40/250	80/320
	40/165	40/320	100/250
	40/210	50/250	100/320
	50/165	50/330	100/400
	50/210	65/165	125/250
		65/210	125/320
		65/250	125/400
		80/165	150/250
		80/210	
		80/250	
		100/210	



3. Description

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 ³ /h	H <input type="text"/> m
n <input type="text"/> min ⁻¹	Q <input type="text"/> kg/dm ³
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 ³ /h	H <input type="text"/> m
n <input type="text"/> min ⁻¹	Q <input type="text"/> kg/dm ³
MAWP@Temp <input type="text"/> bar	@ <input type="text"/> °C
Test Pressure <input type="text"/> bar	
Design	
➔	
Made in Germany	
CE	

Fig. 2: Name tag German and English

3.4.2 Identification acc. to Explosion Proof Directive

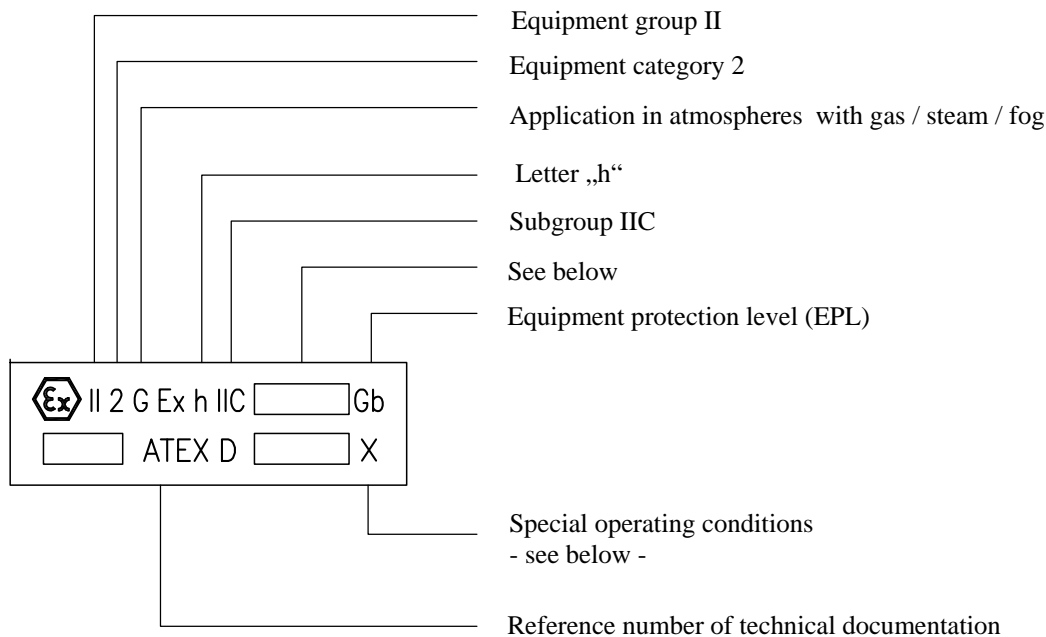


Fig. 3: ATEX- nameplate

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.



3.5 Design

Design

- volute casing pump
- horizontal installation
- single stage
- compliance with requirements of ISO 15783
- 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: two radial ball bearings with permanent grease filling
- pump end: product lubricated sleeve bearings

Shaft sealing

- magnet coupling

3.5.1 Magnet coupling

The drive power is transmitted by the motor - through the magnetic field lines - via the outer magnets to the inner magnet coupling. The inner and outer magnets are tied together through magnetic field lines and are therefore synchronized. No slip exists, the motor speed complies with the coupling speed.

The pump shaft with impeller and driven inner magnet is carried by wetted sleeve bearings. The SiC components have an almost unlimited service life as long as a stable fluid film is available between the sliding surfaces.



3. Description

3.5.2 Multitube cooler

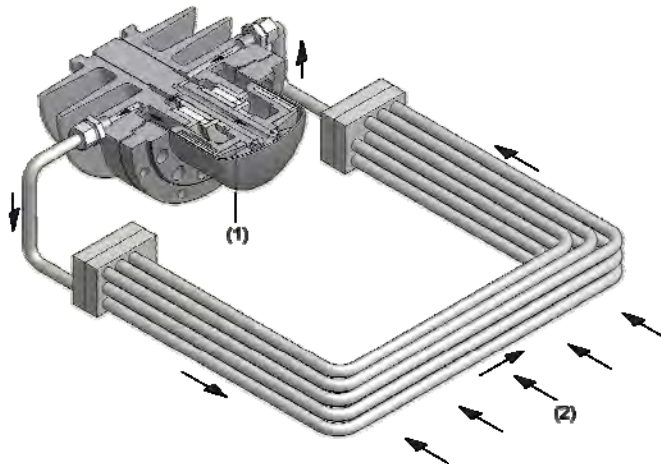


Fig.4: Multitube cooler

An internal circulation flow, led through the multitube cooler, dissipates the heat that is produced through eddy currents in the metallic containment shells. Back vanes (1) generate the required pressure difference to the inner magnet support. The internal circulation flow is cooled by the motor exhaust air (2).

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 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.

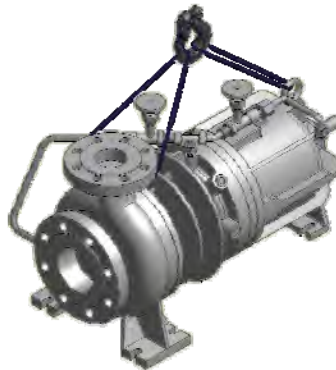
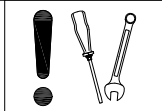


Fig. 5: lifting the pump

ATTENTION



Improper handling of rotating or interchangeable unit!

Damage of sleeve bearings!

- Pump shaft must be secured against displacement by a suitable transport locking.

NOTE



The ring screw 919 shall be used as lifting device when handling the pump.

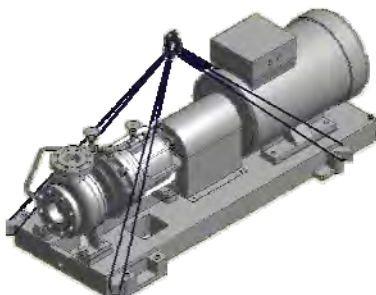


Fig. 6: lifting the complete pump unit

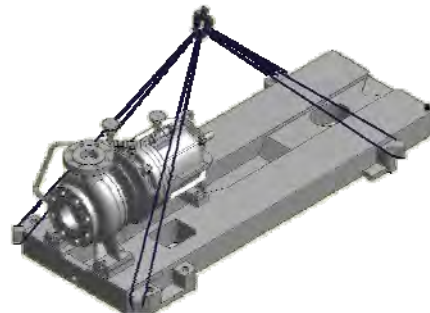


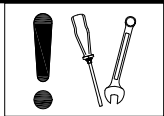
Fig. 7: Lifting the pump mounted on baseplate



4. Handling / Storage / Disposal

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/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.

DANGER



Strong magnetic field from the area of the magnet coupling or from single magnets

Danger to life for individuals with pace maker !

Disturbance on magnetic data media, electronic devices, components and instruments!

Uncontrolled attractive force between magnetic components, tools etc.!

- A safe distance of 0,3 m minimum must be maintained.
- Consider additional notes in chapter 2.10.

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) ≤ 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.
- 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.

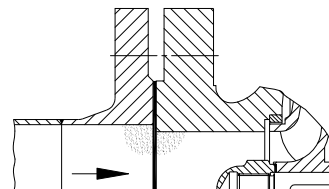


Fig. 8: Flow eddies

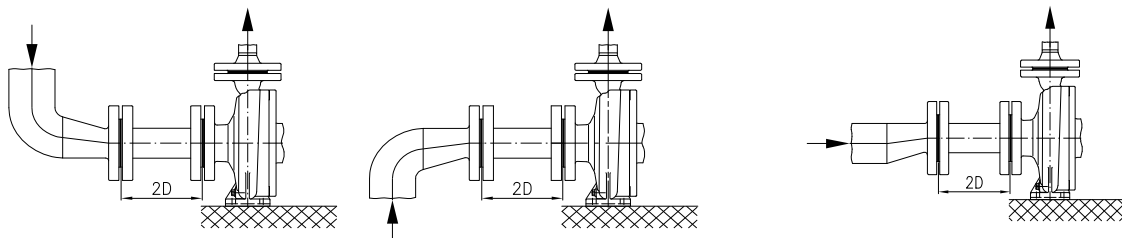
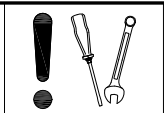


Fig. 9: Reducer connection

- 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.

NOTE

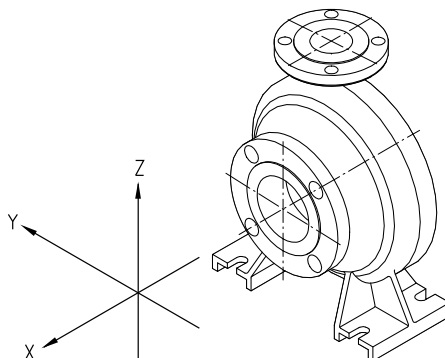


- Use a filter with a mesh width of 0,5 mm.
- Insert filter with a surface of minimum triple the pipe section.



5. Installation / Mounting

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
32/165 - 250	50 2"	735	1155	670	1050	600	945	1150	1820	625	1022	445	700	515	805	910	1430
40/165 - 320	65 3"	935	1470	825	1295	760	1190	1460	2310	670	1050	490	770	535	840	970	1540
50/165 - 330	80 3"	1115	1750	1000	1575	915	1435	1750	2760	715	1120	515	805	580	910	1040	1640
65/165 - 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	200 8"	2980	4690	2670	4200	2400	3780	4640	7310	1445	2275	1025	1610	1180	1855	2130	3360

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
32/165 - 250	32 1 ½"	400	630	380	595	470	735	730	1150	490	770	335	525	380	595	710	1120
40/165 - 320	40 1 ½"	490	770	445	700	560	875	860	1360	580	910	400	630	470	735	840	1330
50/165 - 330	50 2"	670	1050	600	945	735	1155	1150	1820	625	980	445	700	515	805	910	1430
65/165 - 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	150 6"	2000	3150	1800	2835	2225	3500	3480	5490	1115	1750	780	1225	915	1435	1620	2550

The forces and moments are based on 20°C. Temperature dependent correction values are given in the following Figure.



5. Installation / Mounting

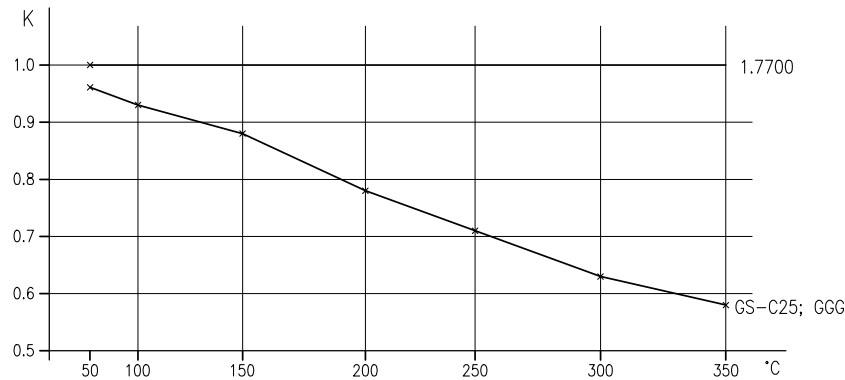


Fig. 10: Temperature correction diagram

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.

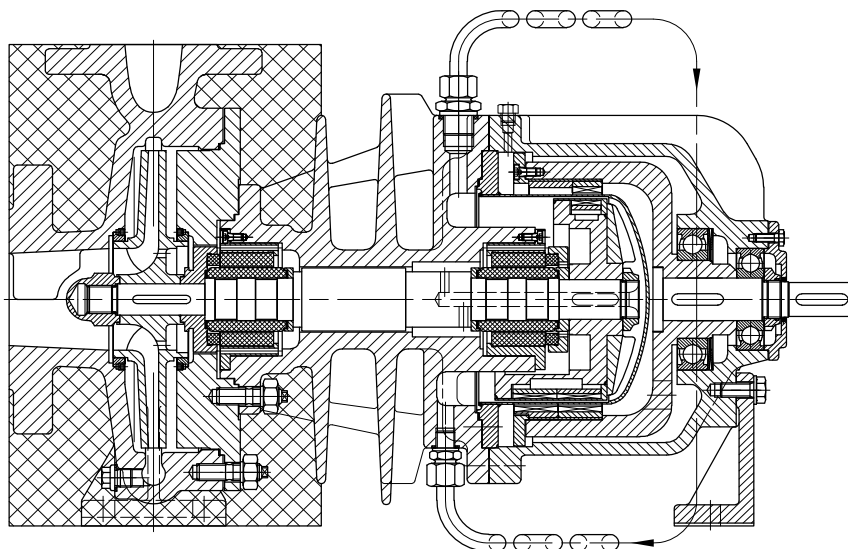
ATTENTION



Heat accumulation in the bearing bracket

Bearing damage!

- Do not insulate the bearing bracket.
- Pump body insulation not beyond limit shown in below picture.





5. Installation / Mounting

Fig.. 11: Insulation limit

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.

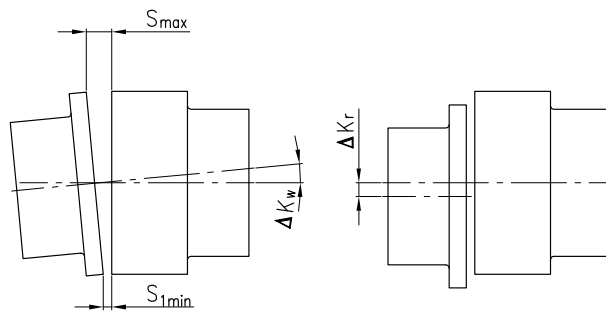


Fig. 12: Angular and radial misalignment of couplings

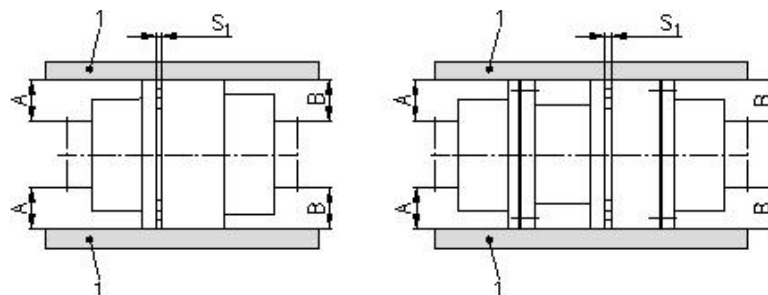


Fig. 13: Coupling alignment

1. Dismantle coupling guard.
2. Loosen support foot.
3. Place a straight edge (1) axially across the coupling half.
4. Possible radial displacement ΔK_r becomes visible as a light gap.

Better: Determine the radial misalignment by measuring the distances A and B at three points staggered



5. Installation / Mounting

by 120°.

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 Δs_1 and ΔK_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 !

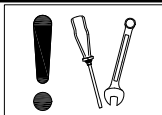
- Use non-sparking material for coupling guard only to exclude flying sparks in case of contact.
- Consider ISO 80079-36.

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 EN 60079-14 or NEC 505.
- Explosion proof motors shall be connected through motor protection switch only



5. Installation / Mounting

DANGER



Static charge

Danger of explosion!

- Use ground connection for earthing.
- Connect pump unit to foundation with suitable earthing-cable.

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 60364 and EN 60079 (Explosion proof) must be considered.

WARNING



Incorrect power connection

Short circuit!

- Adhere to connection conditions of local energy supply companies.

NOTE



Star-Delta starting leads to a high torque increase when switching from star to delta, this can cause decoupling of the magnets. Therefore, star-delta starting is not suitable for magnetic coupled pumps. In order to reduce the starting current, a soft-starter is recommended.

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

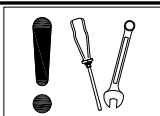


Temperature rise through parts touching each other

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 and venting the pumps

DANGER

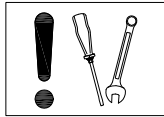
**Formation of explosive atmosphere inside the pump
Surface temperature too high**



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.

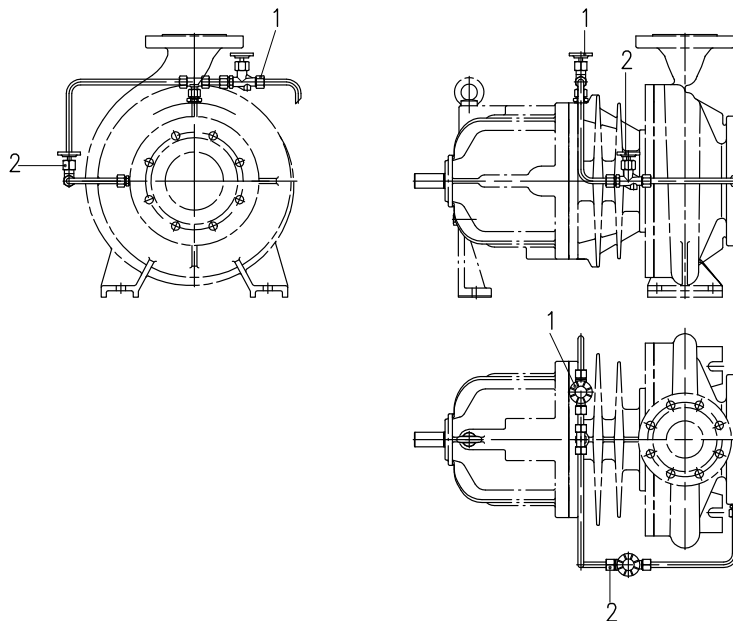


Fig. 14: Vent fittings

1. Open suction and discharge valve. Fill up suction pipe, discharge pipe and pump with liquid.
2. Close vent valve (2), open vent valve (1).
3. Keep vent valve (1) open until pumped liquid flows bubble-free.



6. Commissioning / Decommissioning

NOTE



Use a collecting vessel to avoid environmental pollution.

4. Close vent valve (1), open vent valve (2).
5. Keep the pump temperature at 90°C for a longer period in order to remove any water that is possibly remaining in the plant.
6. Keep vent valve (2) open and heat up gradually to an inlet temperature of 200°C – 250°C.
7. Close vent valve (2).
8. Continue heating up until the final inlet temperature is reached.

NOTE



Heating up must be done slowly in order to ensure that no pressure fluctuations, no gases and steams are existing anymore.

Watch the manometer!

If the pump is provided with multitube cooler, check whether the surface of the cooling coils is warm.

DANGER



Hot surface of multitube cooler

Risk of burns!

- Never touch the multitube cooler without adequate hand protection.

WARNING

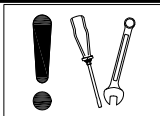


Leakage of hot pumped liquid

Danger for individuals and environment!

- Wear protective clothing.
- Secure vent valve (1) against unauthorized opening.

ATTENTION



Elevated containment shell temperature

Torque reduction of magnet coupling!

- Keep vent valve (2) closed during pump operation.
- Secure vent valve (2) against unauthorized opening.
- Provide temperature monitoring for containment shell and/or magnet chamber.

ATTENTION



Dry run

Damage of sleeve bearings!

- In case of abnormal behaviour of connected manometers or temperature monitoring, consult the factory respectively repeat the venting procedure.
- Repeat the venting procedure after a shut down of the plant.
- Repeat the venting procedure after a gas formation.



6. Commissioning / Decommissioning

6.1.2 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. Pay attention to the synchronicity of pump and motor. Decoupling leads to low differential head and noise in the magnetic coupling.
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.

DANGER



Elevated temperature through decoupling of the magnet coupling

Danger of explosion !

- Switch off pump unit immediately.
- Eliminate cause of malfunction.

ATTENTION



Operation with empty pump

Damage of sleeve bearings!

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

6.2 Operating the pump

WARNING

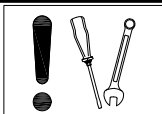


High surface temperatures through hot liquids

Risk of burns!

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

ATTENTION



Abnormal noises, vibrations, temperatures or leakage

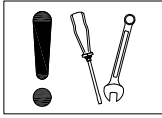
Damage of the pump!

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



6. Commissioning / Decommissioning

ATTENTION



Exceeded containment shell temperature; dry run

Torque devaluation of magnet coupling! Sleeve bearing damage!!

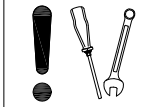
- Observe the thermal decay of the heat transfer fluid.
- Vent the pump again in case of vapour or gas formation.
- Remove low-boilers of the heat transfer fluid regularly. (limit value = 3%)
- Provide temperature monitoring of containment shell and/or magnet chamber.

6.3 Impeller trimming

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

- Back vanes
- Balancing holes
- Injection slots

ATTENTION



Improper impeller trimming

Damage of sleeve bearing through incorrect thrust load balance !

- Impeller trimming shall be done only after consultation with Dickow Pumpen.

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!

6.5 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

DANGER



Strong magnetic field in the area of magnet coupling or single magnets

Danger to life for individuals with cardiac pacemakers!

Disruption of magnetic data medium, electric devices, components and instruments!

Uncontrolled attractive force between magnetic components, tools etc.!

- A safe distance of minimum 0,3 m must be maintained..

WARNING



Unintentional switching-on of the pump unit

Risk of injury through moving components!

- Works on the pump unit may only be done at disconnected electricity.
- 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.

DANGER



High surface temperature in the area of start-up safety (part 160)

Danger of explosion / Fire hazard!

- Check proper condition of antifriction bearing regularly.

DANGER

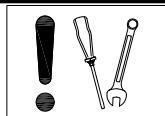


High surface temperature of the containment shell

Danger of explosion / Fire hazard!

- If necessary, monitor the containment shell temperature.

ATTENTION

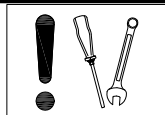


Wear caused by dry run

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

Lubrication of antifriction bearings is not required. Permanent grease-lubricated ball bearings are installed.

	T _{amb} = 25°C				T _{amb} = 40°C			
Speed 1/min	1500	1750	2900	3500	1500	1750	2900	3500
nominal lifetime h	35000	30000	18000	15000	18000	15000	9000	7500

Antifriction bearings should be replaced at the latest when the running time has reached 90% of the lifetime mentioned in this table.



7.2.2 Lubrication of sleeve bearings

Sleeve bearings require a stable liquid film. Checking of wear must be done:

- after dry run or cavitation.
- when vibrations, noises and power consumption are increasing.

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.



7. Maintenance / Servicing / Inspection

WARNING



Tilting the motor

Squeezing of hands and feet!

- Secure the motor by lifting or bracing.

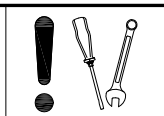
NOTE



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 Tools

ATTENTION



Wrong disassembly and assembly tools

Damage of components!

- Use special tools.

In order to facilitate disassembly and assembly as well as to improve protection of sensitive components, the following special tools shall be used.

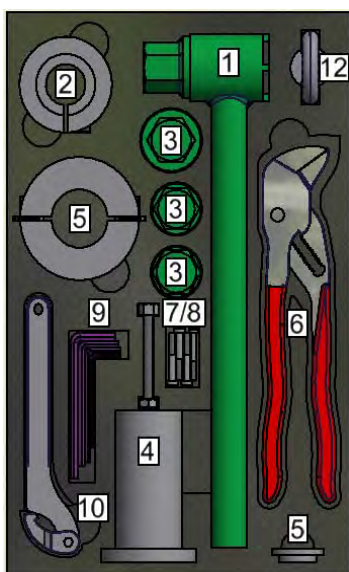


Fig. 15: special tools frame 0/I

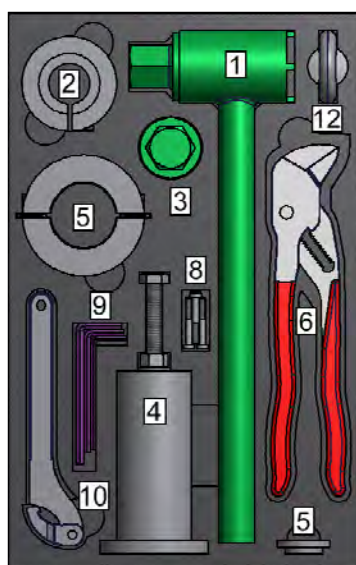


Fig. 16: special tools frame II

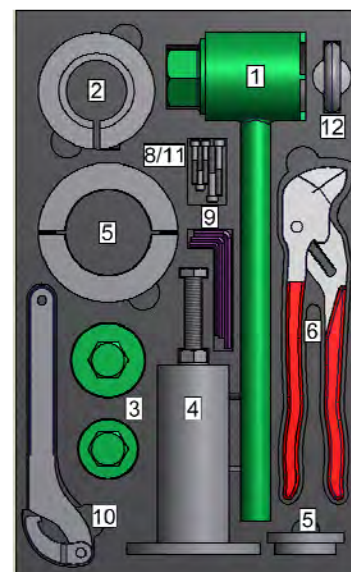


Fig. 17: special tools frame III/IV

	Designation	Dimensions / size / dwg.No.			For part	Notes
		Frame I	Frame II	Frame III		
1.	Socket wrench / adapter unit	60.807	60.808	60.867		
2.	Disassembling sleeve	60.1903	60.1903	60.1904	524	
3.	Socket wrench	(60.863)	60.670	60.671 (fr.III)	921.1	60.863 + 60.2352 only for NM fr.0 60.866 only for fr. IV
		60.670 (fr. I)		(60.866)		
		(60.2352)			(921.3)	
4.	Assembly tool	60.1885	60.1886	60.1887	321/213	
5.	Puller incl. Jack plate	60.2094 / 60.1883	60.2095 / 60.1883	60.2096 (III) / 60.1902 (IV) 60.1884	322	only for type NMWR / PRMW



7. Maintenance / Servicing / Inspection

6.	Knipex-plier wrench	46 mm / 1 3/4 "	46 mm / 1 3/4 "	60 mm / 2 3/8 "	940	
7.	Inner hexagon cap screw	M4 x 35			940.3	
8.	Inner hexagon cap screw	3x M5 x 35	3x M5 x 35	2x M6 x 45	310	
9.	Hex-wrench	size 3, 4, 5, 6	size 4, 5, 6	size 4, 5, 6		
10.	Hook spanner with nib	35 - 60	35 - 60	60 - 90	921.2	
11.	Inner hexagon cap screw			3x M5 x 35	940	
12.	Ring screw	M8	M12	M16	Bearing frame	

7.4.4 Disassembly of rotating unit

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

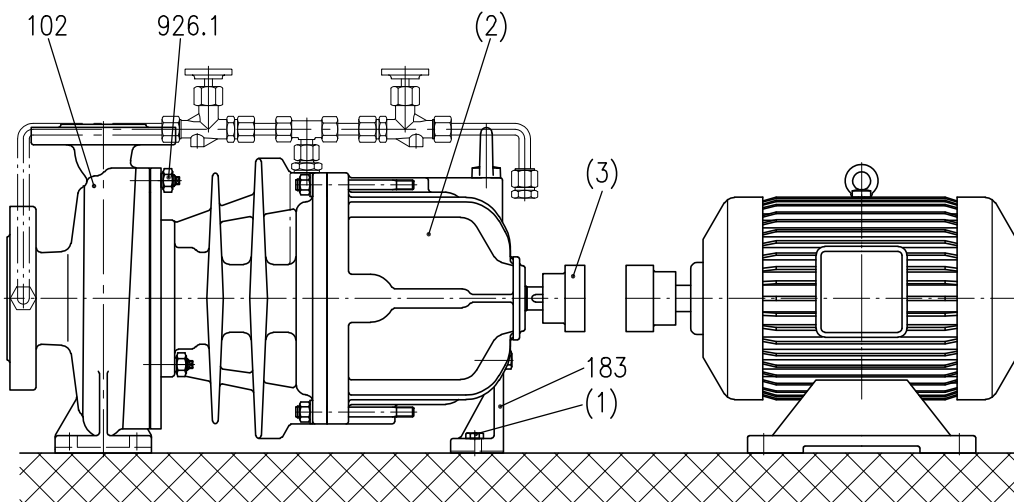


Fig. 18: Disassembly of rotating unit

1. Loosen venting device from suction flange of volute casing 102.
2. Loosen expansion screw nut 926.1.
3. Loosen hexagon head bolt (1) from support foot 183.
4. Press the complete rotating unit (2) out off the volute casing 102 using jack screws.
5. Pull the rotating unit out off the casing and place it beside.
6. Pull off the coupling hub (3) from shaft end.

WARNING



Tilting the rotating unit

Squeezing of hands and feet!

- Secure the rotating unit by lifting or bracing..



7.4.5 Disassembly of bearing bracket

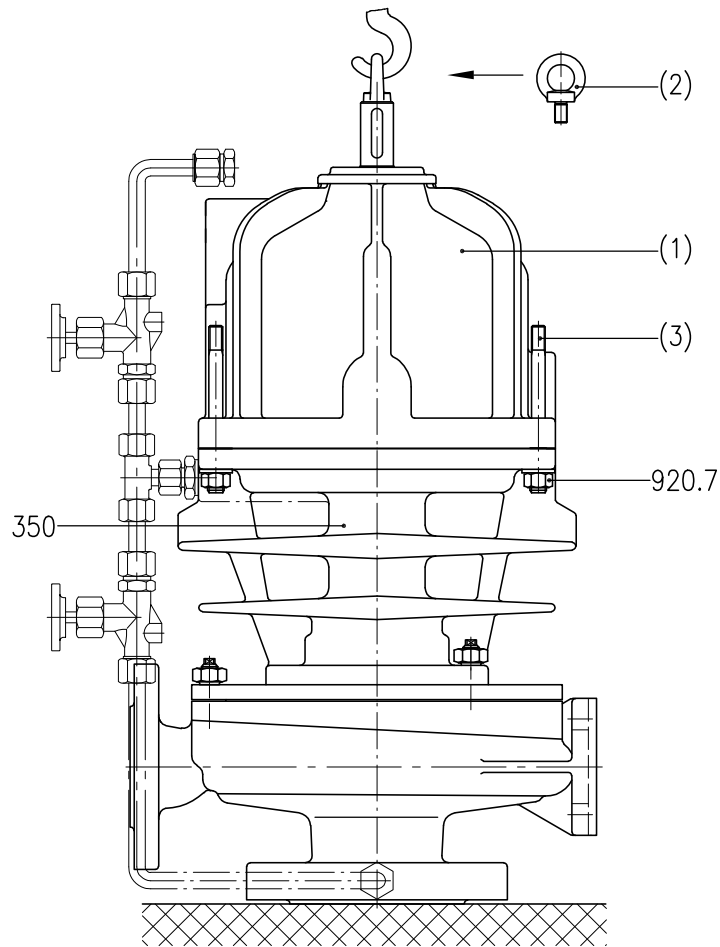


Fig. 19 : Disassembly of bearing bracket

1. Remove the motor, consider chapter 7.4.2.
2. Disconnect the pump from piping.
3. Place the pump in vertical position on a clean and even bench.
4. Remove hexagon nut 920.7 from bearing housing 350.
5. Pull off the complete drive unit (1) by crane. Use of a ring screw (2) – see chapter 7.4.3 - is recommended.
6. Place the drive unit in vertical position on a clean and even bench.

WARNING

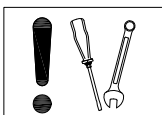


Tilting the pump

Squeezing of hands and feet!

- Secure the pump by lifting or bracing.

ATTENTION



Outer magnet is touching the containment shell

Damage of containment shell or outer magnet!

- Use guide rods (3).
- Pull off the bearing bracket slowly and carefully.



7.4.6 Disassembly of interchangeable unit

The works according to chapter 7.4.3 are completed..

1. Loosen venting device from suction flange of volute casing 102.
2. Loosen expansion screw nut 926.1.
3. Press the complete interchangeable unit (= from impeller to containment shell) out of the volute casing 102 by using jack screws.
4. Pull the unit out off the casing and place it beside.

7.4.7 Disassembly of antifriction bearing

The works according to chapter 7.4.5 are completed.

1. Fix the drive unit to the bench and secure it against twisting.
2. Remove ring screw and key.
3. Loosen hexagon head bolt 901.2 and remove it together with bearing cover 360 and radial seal ring 421.
4. Reinsert the key 940.2 and press it in by a Knipex-plier wrench – see chapter 7.4.3.

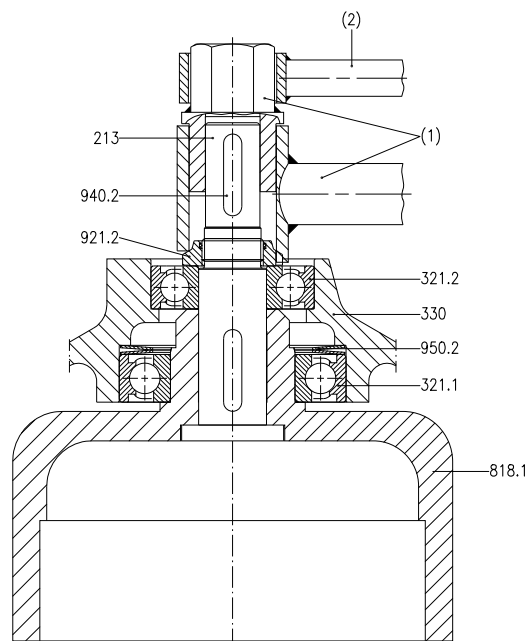


Fig. 20: Disassembly of shaft nut

5. Fit the socket wrench / adapter unit (1) – see chapter 7.4.3 – to the shaft nut 921.2 and loosen it by a ring spanner (2) (left hand thread).
6. Remove key 940.2.
7. Press the drive shaft 213 with a press- or drilling spindle down and out off the bearing 321.2.
8. Remove the bearing 321.2 from the bearing bracket 330 using a puller.
9. Take care of the cap springs 950.2.
10. Pull off the bearing 321.1 from drive rotor 818.1 using a puller.



7. Maintenance / Servicing / Inspection

7.4.8 Replacement of antifriction bearings

Frame size	321.2	321.1
I	6306.2ZR.C3	6211.ZZ.C3.S1.J11.L77
II	6307.2ZR.C3	6212.ZZ.C3.S1.J11.L77
III	6311.2ZR.C3	6217.ZZ.C3.S1.J11.L77

7.4.9 Disassembly of impeller

The works according to chapter 7.4.4 are completed.

1. Clamp the impeller.
2. Loosen impeller nut 922 (right hand thread)
3. Pull off the impeller from pump shaft.

7.4.10 Disassembly of rotor and sleeve bearing

The works according to chapter 7.4.5 are completed.

WARNING



Possibly available residues of pumped liquid

Danger for individuals and environment!

- Wear protective clothing.

1. Loosen and remove inner hexagon cap screws 914.7.
2. Loosen containment shell by jack screws.
3. Loosen expansion screw nut 926.1.
4. Detach volute casing 102 from intermediate flange 981.1 by jack screws.
5. Disassemble impeller 233 according to chapter 7.4.9.
6. Remove key 940.1 and pull off start-up ring 500.5.
7. Pull the pump shaft unit out off the bearing housing unit.
8. Reinsert key 940.1 and press it in by Knipex-plier wrench.

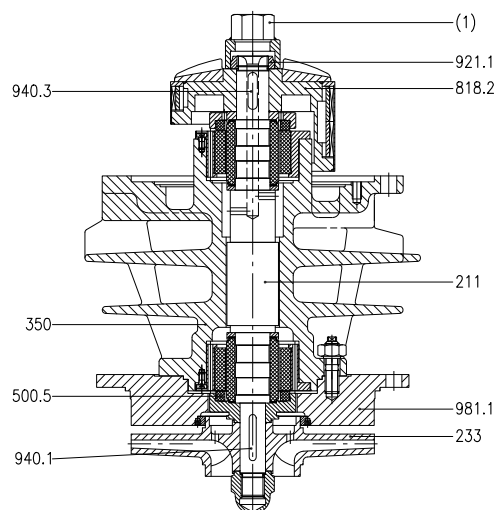


Fig. 21: Bearing bracket I - III

9. Clamp the pump shaft unit in a jaw chuck.
10. Loosen the shaft nut 921.1 by socket wrench (1) – see chapter 7.4.3 - (left hand thread).
11. Pull off the rotor 818.2.



WARNING



Axial magnetic forces

Danger of squeezing fingers and hands!

- Use non-magnetic tools only.
- Never place the rotor 818.2 near magnetic components.

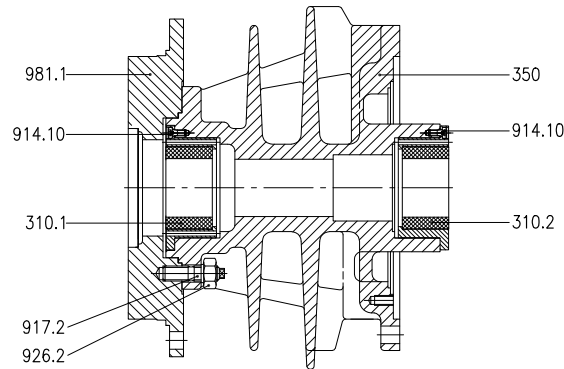


Fig. 22: Bearing housing unit

12. Loosen expansion screw nut 926.2 and remove intermediate flange 981.1.
13. Loosen inner hexagon cap screws 914.10.
14. Remove stationary sleeve bearings 310.1/2.

7.4.11 Disassembly of shaft sleeve

The works according to chapter 7.4.10 are completed.

WARNING



Possibly available residues of pumped liquid

Danger for individuals and environment!

- Wear protective clothing

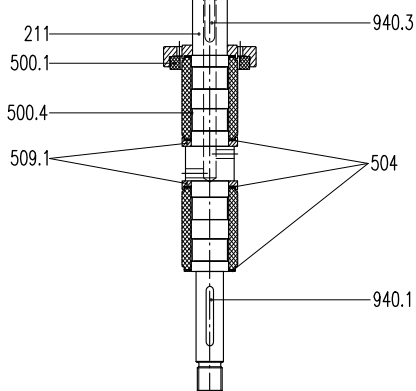


Fig. 23: Pump shaft unit

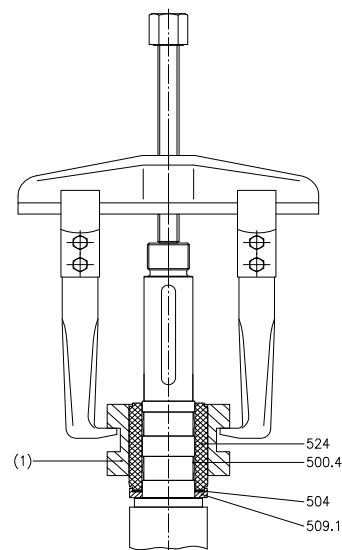


Fig. 24: Disassembling sleeve

1. Clamp the pump shaft unit at the key 940.1 in a jaw chuck.



7. Maintenance / Servicing / Inspection

2. Remove key 940.3 with inner hexagon cap screw by a hex-wrench – see chapter 7.4.3..
3. Pull off the start-up ring 500.1.
4. Fit the disassembling sleeve (1) – see chapter 7.4.3 – to the shaft sleeve 524 and fasten it.
5. Fit the puller and remove the shaft sleeve.
6. Remove tolerance ring 500.4 and intermediate ring 509.1.

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 Magnet assembly

Driven rotor 818.2

Surface must be free of cracks and bulges. Check parallelism by a bevelled steel edge.

Drive rotor 818.1

Replace outer magnets if mechanical or chemical damage is visible.

Ball bearing seats must be measured, the rotor must be replaced if values fall below the following:

Frame size I	→	55,002 mm
Frame size II	→	60,002 mm
Frame size III	→	85,002 mm

Torque capacity

Torques of new magnets are stated in the table below. Magnet length according to pump data sheet or name tag. For magnets that have been in operation, a reduction of 15% is allowed. Larger reduction requires exchange of magnet coupling,

Frame size.	Magnet length [mm]	Torque [Nm]
I / II	20	41
	30	63
	40	90
	50	115
	60	138
II	70	165
	80	190
	90	210
	100	235
	110	260
	120	280
III	31	92
	62	184
	93	276
	124	368

7.5.3 SiC-Sleeve bearing / Shaft sleeves

Measure the diameters of the sliding surfaces. The total clearance in new condition is as follows:



7. Maintenance / Servicing / Inspection

Frame size I / II = 0,194 mm

Frame size III = 0,176 mm

Replace sleeve bearings if the mentioned clearances are exceeded.
The axial clearance between the start-up rings is 1,0 – 1,6 mm.

7.5.4 Bearing bracket

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

Frame size I → 100,022 mm + 72,018 mm

Frame size II → 110,022 mm + 80,018 mm

Frame size III → 150,026 mm + 120,022 mm

7.6 Assembly of pump unit

7.6.1 General instructions

- Consider the safety instructions of chapter 7.1.
- Consider the 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.
- When mounting the shaft sleeve, use new tolerance rings only.

WARNING

Hitting of rotor against containment shell or of containment shell against coupling half through magnetic forces



Damage of magnets and bearing! Risk of injury!

- Strictly follow the assembling instructions.

WARNING

Improper handling and lifting of heavy components

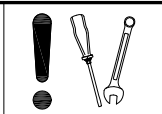


Personal injury and material damage !

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

ATTENTION

Unprofessional assembly



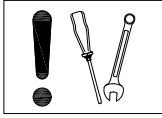
Damage of the pump!

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



7. Maintenance / Servicing / Inspection

ATTENTION



Improper mounting

Damage of outer magnet coupling!

- Use guide rods.

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 shaft sleeve

1. Slide the intermediate ring 509.1 and a new distance ring 504 up to the shaft collar.
2. Insert new tolerance rings 500.4 into the keyways.
3. Fit the disassembling sleeve – see chapter 7.4.3 – to the shaft sleeve and fasten it.
4. Spray the pump shaft in the area of the tolerance rings with graphite.
5. Press the pump shaft with a press- or drilling spindle into the shaft sleeve
6. Slide on the start-up ring 500.1 and a new distance ring 504.
7. Insert key 940.3 and press it in by using Knipex-plier wrench.

7.6.3 Assembly of rotor and sleeve bearing

The works according to chapter 7.6.2 are completed.

1. Fasten the stationary sleeve bearings 310.1/2 with inner hexagon cap screws 914.10 to the bearing housing 350.
2. Fasten the intermediate flange 981.1 with expansion screw nut 926.6 to the bearing housing 350.
3. Insert the key 940.1 into the pump shaft and press it in by using a Knipex-plier wrench.
4. Clamp the pump shaft unit in a jaw chuck.
5. Slide on the rotor 818.2
6. Tighten the shaft nut 921.1 by a socket wrench – see chapter 7.4.3 – (left hand thread).
7. Unclamp the pump shaft unit and remove again the key 940.1.
8. Push the pump shaft unit into the bearing housing unit.

WARNING



Axial magnetic force

Danger of squeezing fingers and hands!

- Use non-magnetic tools.
- Never place the rotor 818.2 near magnetic components.

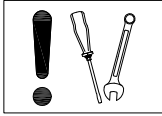
9. Slide on start-up ring 500.5 and new distance ring 504.
10. Reinsert and press the key 940.1 into the pump shaft.
11. Mount the impeller according to chapter 7.6.4.
12. Insert the bearing housing unit into the volute casing 102. Use a new gasket 400.5.
13. Tighten the expansion screw nut 926.1 by torque wrench.
14. Fit the containment shell, use a new gasket 400.13.
15. Tighten the inner hexagon cap screws 914.7 of the containment shell by torque wrench.



7.6.4 Assembly of impeller

1. Slide the impeller onto the pump shaft
2. Tighten the impeller nut 922 by 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 antifriction bearings

1. Heat up the antifriction bearing 321.1 to 80-100°C.
2. Push the bearing onto the drive rotor 818.1 until limit.
3. Press the bearing 321.2 into the bearing bracket 330, using assembling tool (1) – see chapter 7.4.3 – and a press or drilling spindle.

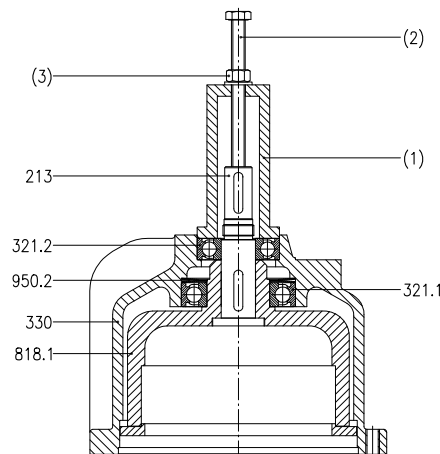


Fig. 25: Mounting antifriction bearings

4. Clamp the assembling tool (1) in a jaw chuck and fit the bearing bracket 330 with the bearing 321.2.
5. Insert the cap springs 950.2 (X-arrangement)
6. Press the drive rotor 818.1 into the bearing bracket 330.
7. Insert the drive shaft 213 into the drive rotor 818.1.
8. Screw the spindle (2) into the drive shaft.
9. Place the bearing bracket unit on the bench.
10. Draw the drive shaft into the hub of the drive rotor by turning the hexagon nut (3).
11. Insert the key 940.2 and press it in by using a Knipex-plier wrench.
12. Fit the shaft nut 921.2 and tighten it by socket wrench / adapter unit – (left hand thread).
13. Remove key 940.2.
14. Fit the bearing cover 360 with a new radial seal ring 421 and tighten it by hexagon cap screw 901.2
15. Reinsert the key 940.2 and press it in by using a Knipex-plier wrench.

7.6.6 Assembly of interchangeable unit

Perform the working steps according to chapter 7.6.7 and 7.6.8.



7. Maintenance / Servicing / Inspection

7.6.7 Assembly of bearing bracket

WARNING



Tilting the pump

Squeezing of hands and feet !

- Secure the pump by lifting or bracing.

ATTENTION



Outer magnet is touching the containment shell

Damage of containment shell or outer magnets !

- Use guide rods.
- Lower the bearing bracket slowly and careful.

NOTE



Consider chapter 7.4.5

1. Screw the ring screw into the thread of the drive shaft 213.
2. Lift the bearing bracket by crane.
3. Insert new gasket 400.15.
4. Lower the bearing bracket via the guide rods to the bearing housing 350.
5. Tighten the hexagon nut 920.7 by torque wrench.

7.6.8 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 7.4.4!

1. Slide the rotating unit into the volute casing.
2. Use new gasket 400.5.
3. Tighten expansion screw nut 926.1 by a torque wrench.
4. Connect the venting device to the suction flange of volute casing 102.
5. Mount the support foot 183 with hexagon head bolt 901.1 and washer 554.8.
6. Fasten the support foot with hexagon cap screw to the baseplate.
7. Slide the coupling hub onto the shaft end.



7. Maintenance / Servicing / Inspection

7.6.9 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		1.7218 (25CrMo4)
	Standard bolts	Expansion bolts	Standard bolts	Expansion bolts	Expansion bolts
M5	5	-	4	-	-
M6	9	-	6	-	-
M8	22	-	16	-	-
M10	45	-	30	-	-
M12	80	55	55	40	40
M16	195	145	135	100	100
M20	370	280	260	195	190

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 containment shell screws 914.7 = 40 Nm

Bolt torque for impeller nut 922 and shaft nut 921, independent of material.

Frame size	922		921 – Bolt torque [Nm]		
	Bolt torque [Nm]	Wrench size	M27 x 1,5	M35 x 1,5	M50 x 1,5
I	100	32	90	---	---
II	120	41	90	120	---
III	140	50	---	120	150



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
Sleeve bearing damage	7
Magnet chamber is insufficiently vented	8

Failure number								Problem	Elimination
1	2	3	4	5	6	7	8		
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 line Improve NPSHR by inducer Reduce resistances in suction line Open shut-off valve in suction line completely
	X							Wrong speed	Check speed
		X		X				Pump is not correctly aligned	Check coupling alignment and correct if necessary
		X		X				Pump stressed by piping	Check piping connections and pump mounting



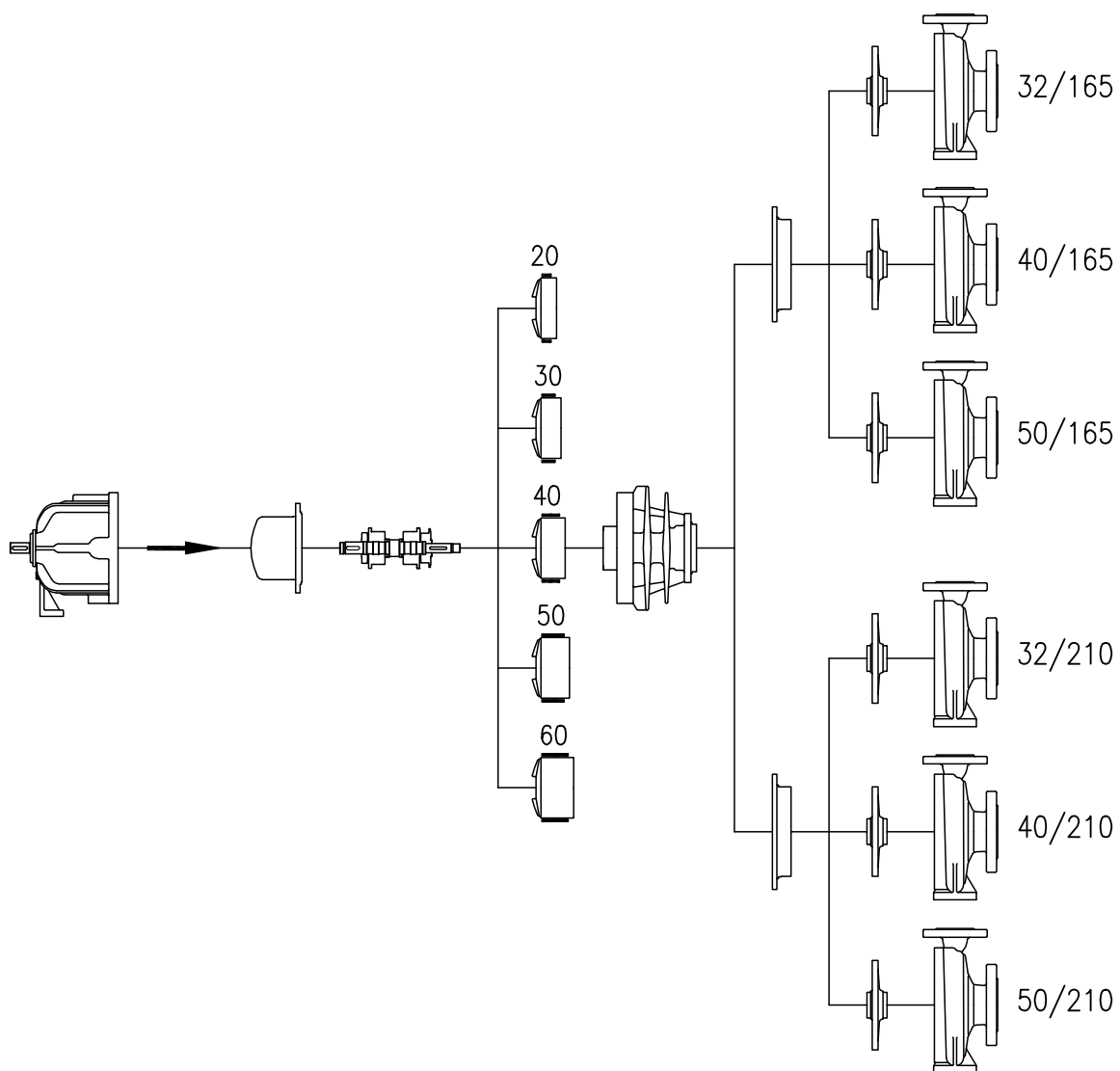
8. Troubleshooting

Failure number								Problem	Elimination
1	2	3	4	5	6	7	8		
		X		X				Ball bearing damage	Renew antifriction bearings
				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 plant Install a cooling fan
X								Motor is bigger than nominal capacity of magnet coupling	Install smaller motor Consult the factory
X								Star delta starting	Consult the factory
X					X	X		Torque of magnet coupling devalued	Check torque
				X	X	X		Rated flow too low	Increase rated flow
X				X	X			Magnet coupling decoupled	Shut down the motor and restart Check start-up safety Consult the factory
				X		X	X	Increased thrust load	Check wear ring clearance Vent the magnet chamber Consult the factory
					X	X	X	Boiling point exceedance in containment shell area	Temperature monitor on containment shell Increase pressure in containment shell Vent the magnet chamber Install a multitube cooler



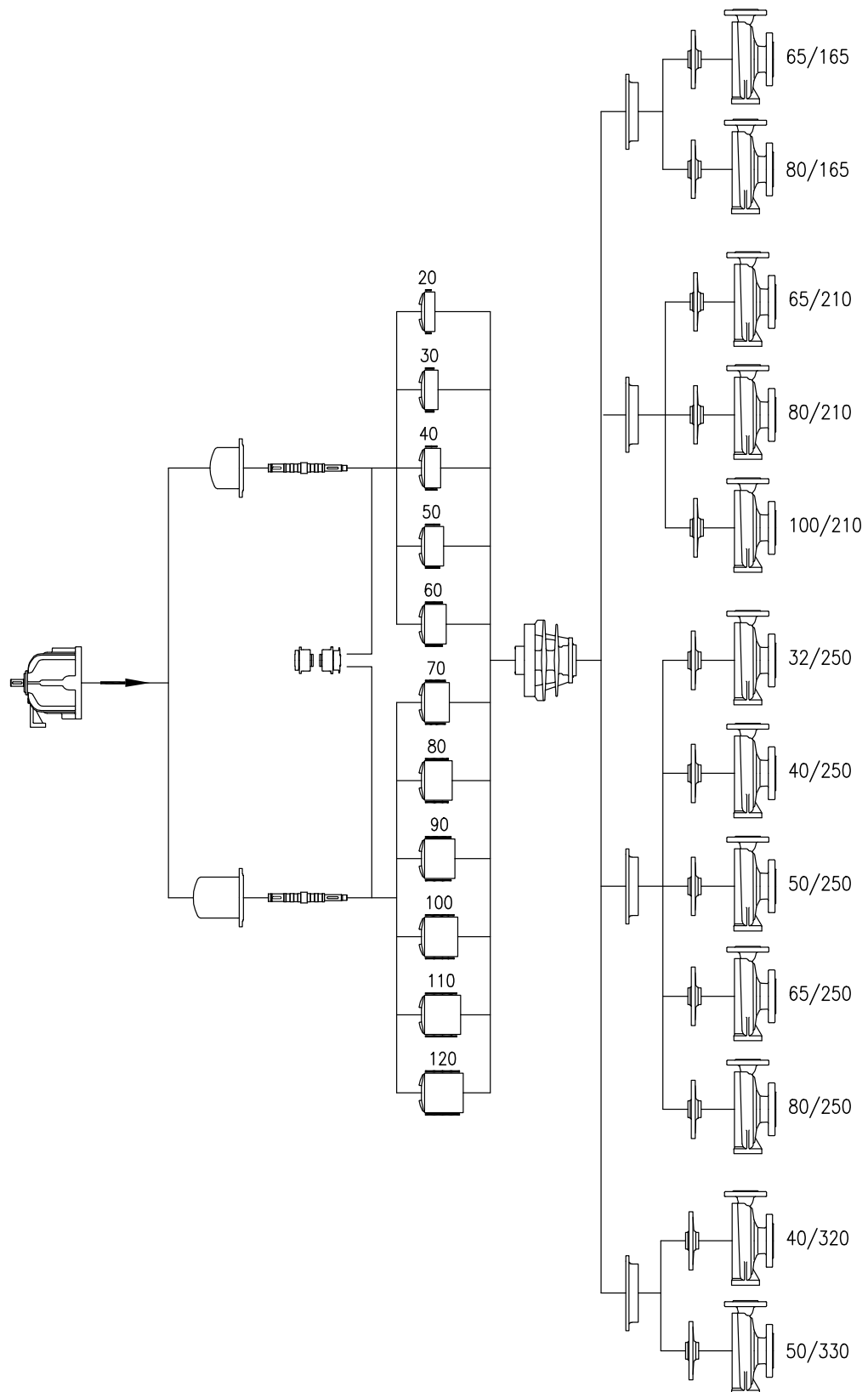
9. Interchangeability

9.1 Frame size I



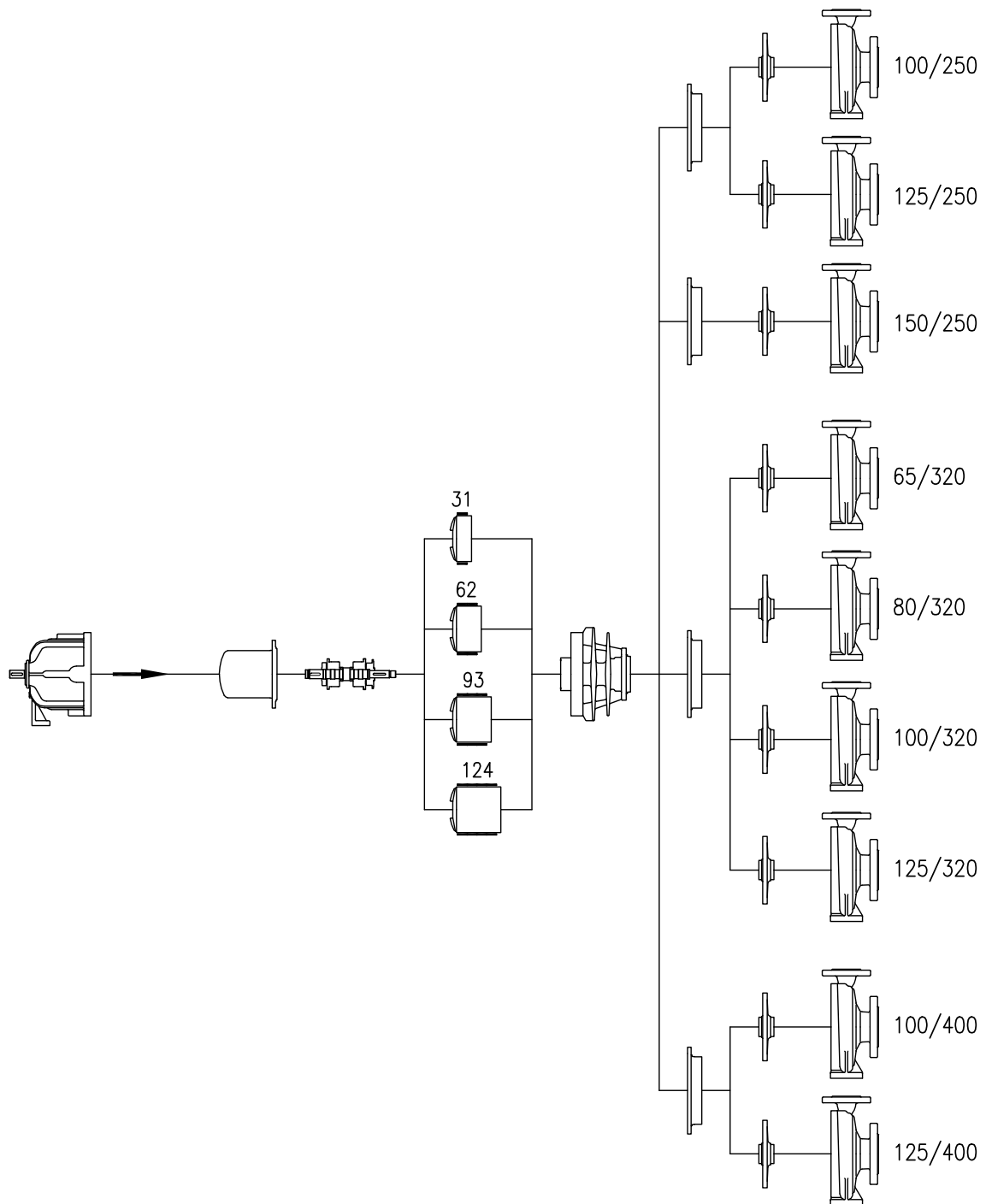


9.2 Frame size II





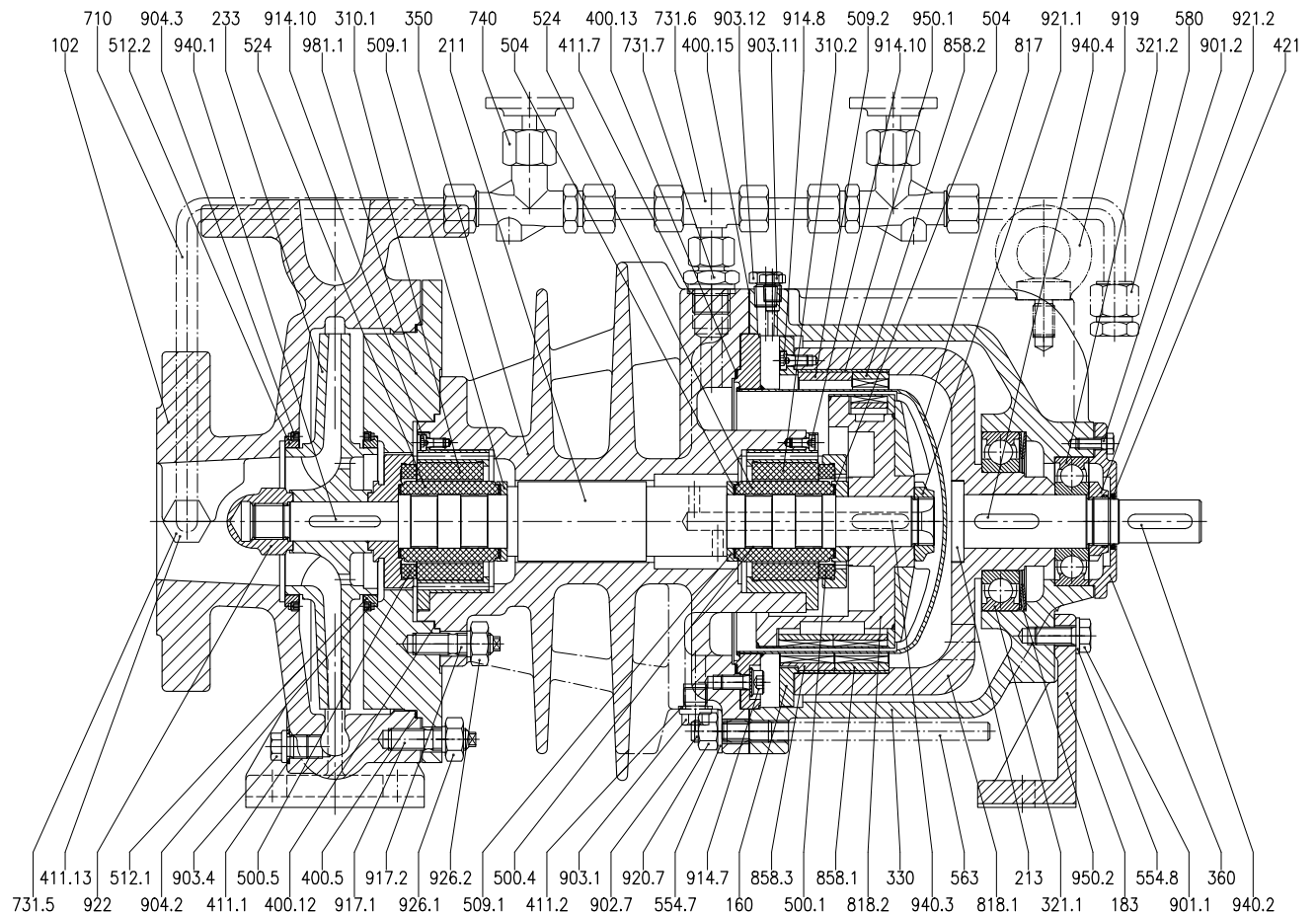
9.3 Frame size III





10. Sectional drawings

10.1 Frame size I

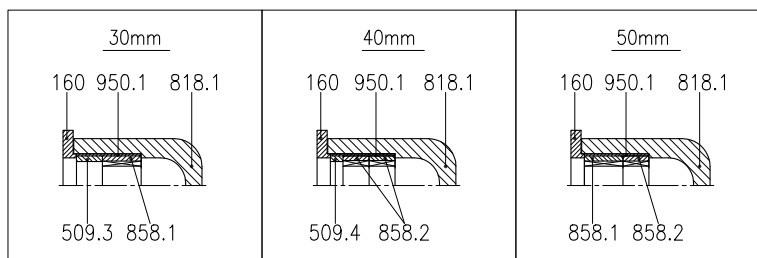


Sectional drawing NMW – Frame size I

Top magnet coupling = 20 mm magnet length

Bottom magnet coupling = 60 mm magnet length

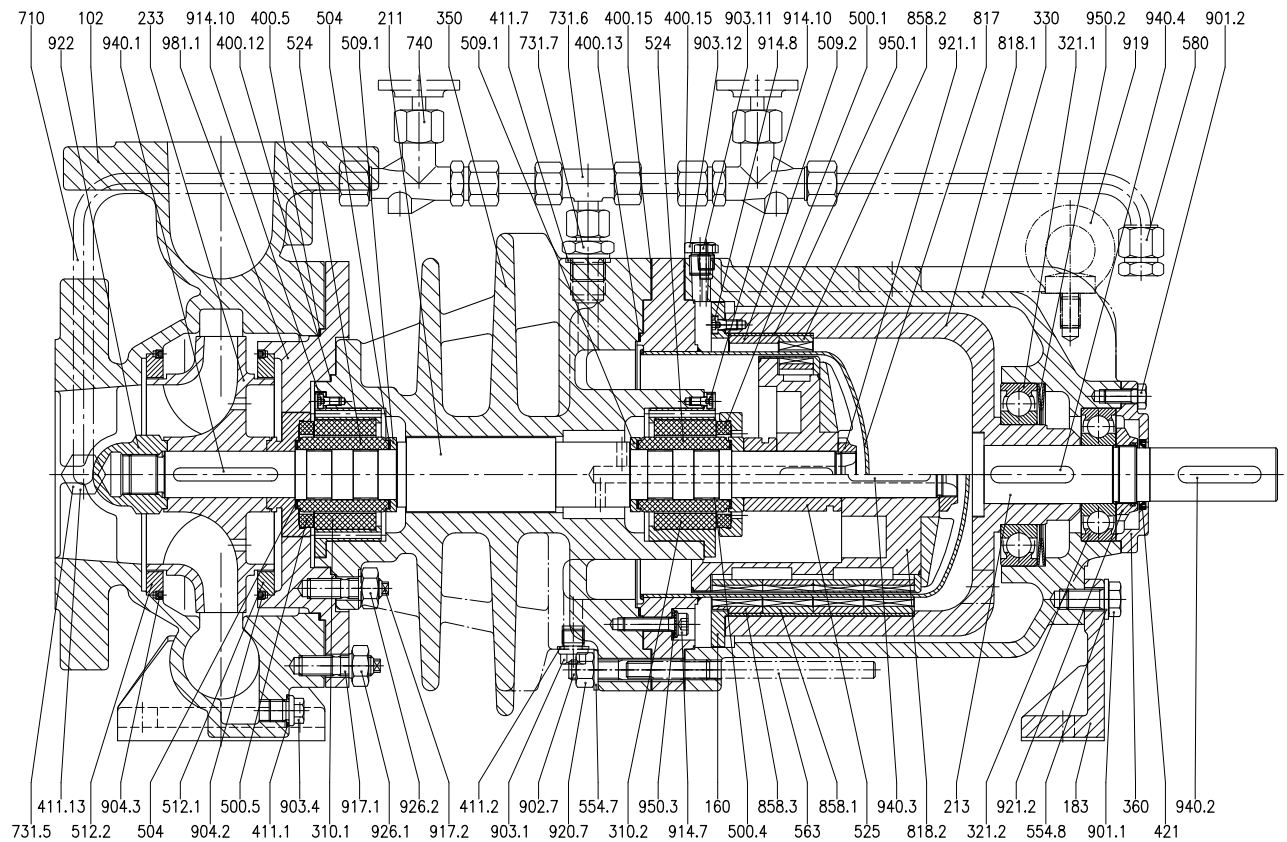
Further possible magnet arrangements:





10. Sectional drawings

10.2 Frame size II

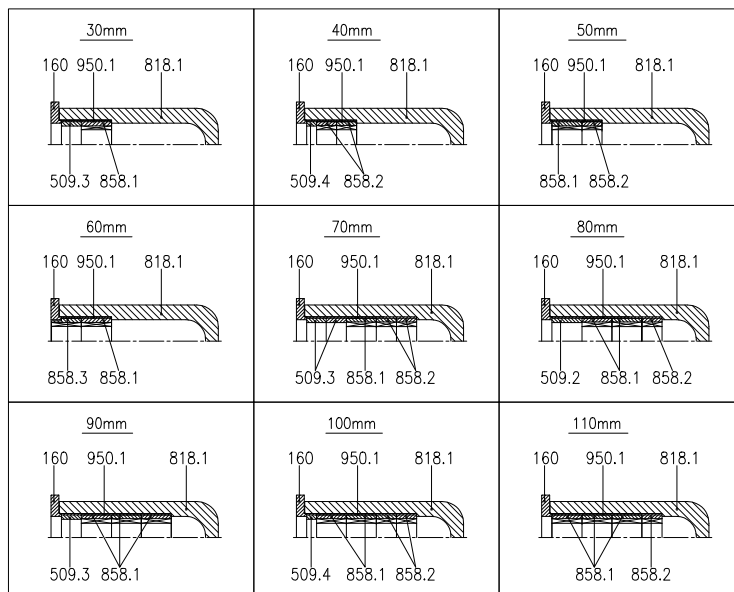


Sectional drawing NMW Frame size II

Top magnet coupling = 20 mm magnet length

Bottom magnet coupling = 120 mm magnet length

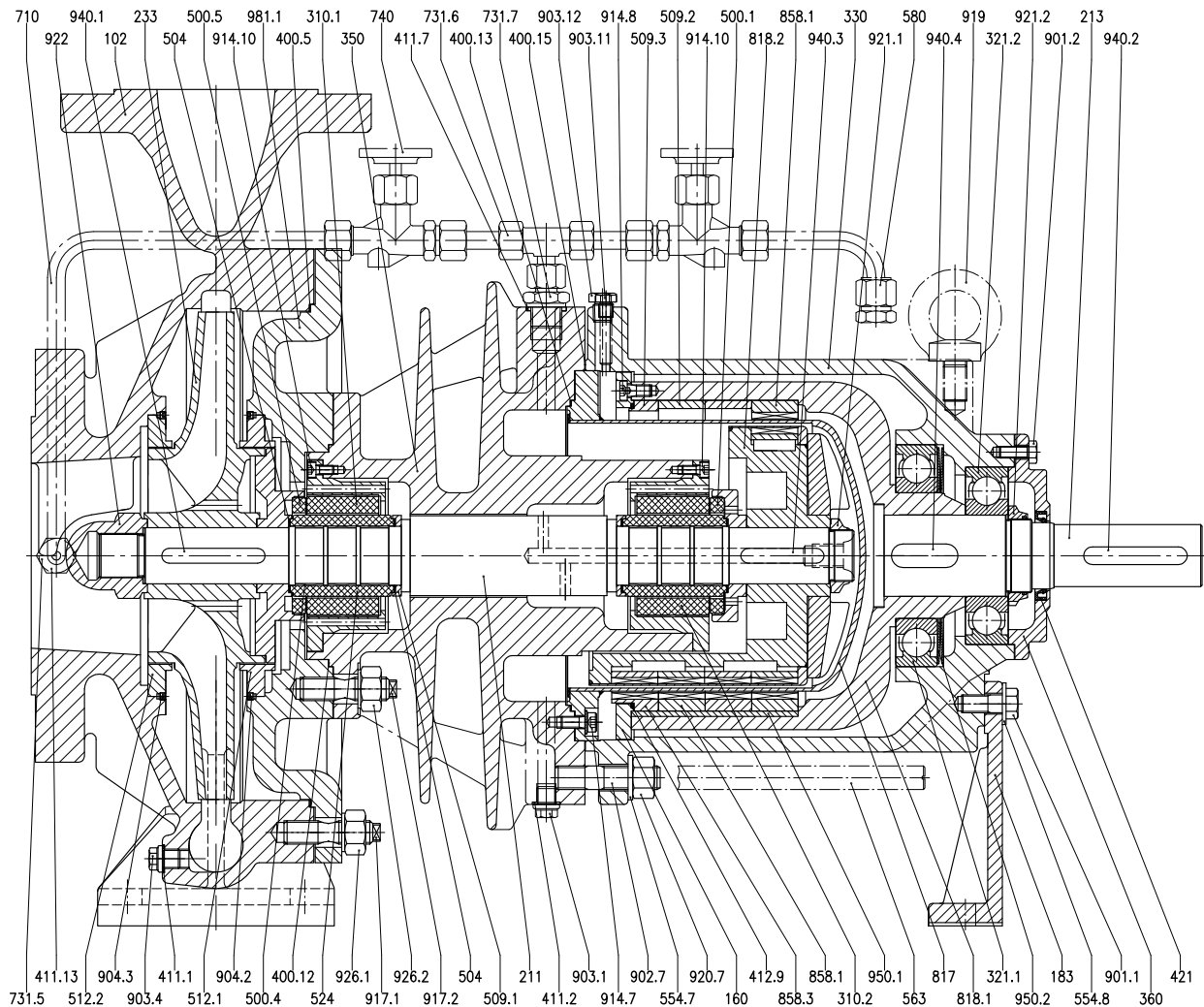
Further possible magnet arrangements:





10. Sectional drawings

10.3 Frame size III

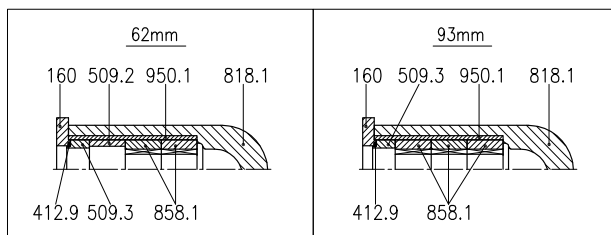


Sectional drawing NMW Frame size III

Top magnet coupling = 31 mm magnet length

Bottom magnet coupling = 124 mm magnet length

Further possible magnet arrangements:





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 GmbH & Co. KG
Siemensstraße 22
D-84478 Waldkraiburg

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

Designation: Volute casing pump
Type: NMW
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 15783:2003+A1:2008	EN ISO 15783:2003+A1:2008
EN ISO 9906:2012	EN ISO 9906:2012
EN ISO 2858:2010	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

	DICKOW PUMPEN	Document of Compliance
<p>Please fill in this statement for health innocuousness completely and attach it to the pump to be returned to the factory.</p>		
<u>Pump data</u>		
Type:	Serial No.: PB	
<u>Reason for shipment</u>		
<u>Contamination of the pump</u>		
<input type="checkbox"/> Hazardous liquids were not 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:		
<u>Customer data</u>		
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:	