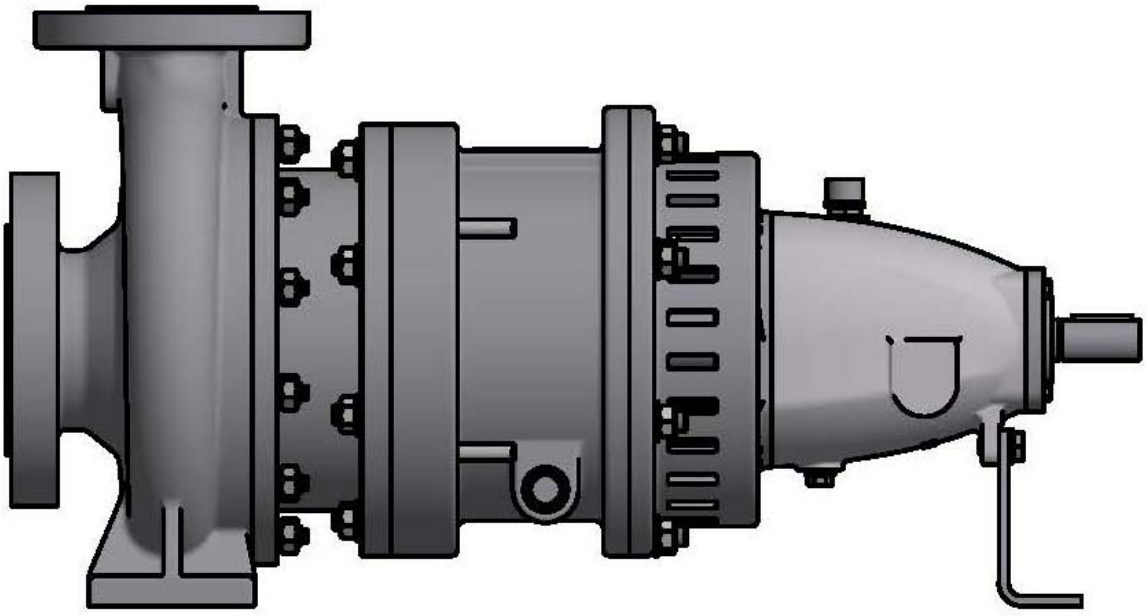
Operating Instructions/Assembly Instructions

NMX

No. 44.NMX.E0.05/21



Original operating instructions

DICKOW PUMPEN

LLOYD'S REGISTER · LRQA
ISO 9001
UKAS MANAGEMENT SYSTEMS
001

Table of contents

1. General information

These operating instructions describe the proper and safe use of the pump during all operating phases.

The operating instructions do not take into account local regulations. The operator of the pump is responsible for compliance with such regulations.

The type plate states the pump type and size, key operating data and the pump serial number. The serial number is a unique identifier for the pump/pump unit and is used as identification for all subsequent procedures.

In the event of damage, the Customer Service department of Dickow Pumpen must be notified immediately to ensure that your entitlement to make a claim under warranty is preserved.

For installation of supplied replacement units, the relevant subsections of "Maintenance, servicing, inspection" must be observed.

Applicable documents:

- Pump data sheet
- Layout plan/dimensional drawing
- Sectional drawing
- Parts lists
- Supplier documentation

NOTE

These operating/assembly instructions apply from pump series number PB12198400.
If previous operating/assembly instructions still apply, observe the information on the pump data sheet!

2. Safety

The operating instructions include general instructions for erection, operation and maintenance. Safe handling of the pump or pump unit and avoidance of personal injury and material damage can only be ensured if the instructions provided in this manual are followed.

All the safety instructions in this manual must be followed.

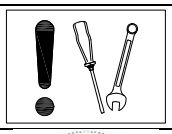
The operating instructions must be thoroughly read and completely understood by the responsible qualified personnel/operator before attempting assembly and commissioning.
The operating instructions must always be available on site.

Notices and signs attached to the pump must be followed and must be maintained in a legible condition.

2.1 Warning notices and their labelling

Signal word	Explanation
DANGER	Signifies an imminent danger. Failure to avert the situation will result in death or serious injuries.
WARNING	Signifies a potentially dangerous situation. Failure to avert the situation may result in death or serious injuries.
CAUTION	Signifies a potentially dangerous situation. Failure to avert the situation may result in minor injuries.
ATTENTION	Signifies a potentially damaging situation. Failure to avert the situation may result in a risk of damage to the pump or may cause it to stop working properly.

Symbol	Explanation
	General danger sign Together with a signal word, it signifies dangers relating to a risk of death or injury.
	Dangerous voltage Together with a signal word, it signifies dangers relating to a risk of electric shock.
	Warning about magnetic fields Together with a signal word, it signifies dangers relating to risks due to magnetic fields.
	Hot surface Together with a signal word, it signifies dangers relating to risks due to hot surfaces.

	Explosion protection Provides information about protection against explosions in areas with a potentially explosive atmosphere in accordance with Directive 2014/34/EU.
	Machine damage Together with the signal word ATTENTION, it signifies risks that could cause damage to the pump or cause it to stop working properly.
	Note Provides recommendations and useful information for working with the product.

2.2 Intended use

The pump/pump unit may only be operated under the conditions described in the applicable pump data sheet. This applies in particular to the liquid being pumped, the flow rate, rotational speed, pressure, temperature and motor power. The following also apply:

- The pump may only be operated if it is technically in perfect condition.
- Never operate the pump if it is not fully assembled.
- Never run the pump without liquid being pumped.
- Observe the information in the pump data sheet/operating instructions regarding the minimum flow.
- Observe the information in the pump data sheet/operating instructions regarding the maximum flow.
- Do not throttle the pump on the suction side.
- The maximum rotational speed is 3,500 rpm $^{-1}$ (+10%).

2.3 Avoidance of foreseeable operating errors

- Never open shut-off valves beyond the permitted range. This would exceed the maximum flow rate and could cause cavitation damage.
- Never exceed the permitted pressure and temperature limits that are specified in the pump data sheet.
- Observe and comply with all the safety instructions and other information in the operating instructions.

2.4 Personnel qualifications

All personnel must have the relevant qualifications for assembly, operation, maintenance and inspection of the pump/pump unit.
The operator must carefully define the areas of responsibility, competence and supervision.
Training must be provided to close any gaps in knowledge. Training can be provided by technical staff from Dickow Pumpen.

2.5 Additional safety regulations

In addition to the safety instructions mentioned in these operating instructions, the following regulations also apply:

- Accident prevention regulations
- Explosion protection 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 the customer.
- The coupling guard and hand guard on the pump/pump unit may not be removed during operation.
- The earth connection of the pump unit must always be connected.
- Protective equipment for personnel must be provided and used.
- Any leakages of dangerous pumped liquids must be drained off safely, without endangering people or the environment. Legal requirements must be observed.
- Steps must be taken to rule out risks of electric shock.

2.7 Safety instructions for maintenance, inspection and assembly work

- Alterations or modifications to the pump are only permitted after consultation with Dickow Pumpen.
- Only original parts from Dickow Pumpen may be used.
- Work on the pump/pump unit may only be performed when the equipment is shut down.
- The pump casing must be allowed to cool down to ambient temperature first.
- The pump must be depressurised and drained.
- The decommissioning procedure set out in section 6.6 must be followed.
- Pumps that process hazardous materials must be decontaminated. Follow the instructions in section 4.4.
- The coupling guard and hand guard must be mounted again after completion of the work.
- Work on the pump unit may only be performed with all electrical connections disconnected.
- Secure the pump unit so that it cannot be switched on accidentally.

2.8 Non-compliance with the operating instructions

Non-compliance with these operating instructions will result in loss of warranty rights and will rule out any claims for
damages. The following risks are associated with non-compliance:

- Endangering of individuals through electrical, thermal, mechanical or chemical effects.
- Danger due to risk of explosion.
- Danger due to failure of important functions.
- Potential harm to the environment due to leakage of hazardous materials.

2.9 Notes on explosion protection

DANGER

It is extremely important that the information in this section is carefully followed when working in areas with a potentially explosive atmosphere.

- Only pumps with “Ex” identification are allowed to be used in explosive areas.
- Pumps must be designated for this purpose in the pump data sheet.
- Proper use of the pumps must be ensured.
- Avoid any form of use that is not permitted.
- Special conditions apply for operation in accordance with the Explosion Protection Directive. The “Ex” symbol shown here marks the sections in these operating instructions that require special attention.

2.9.1 Surface temperature

The highest surface temperatures are to be expected on the pump housing, on the containment shell and in the area of the rolling bearings. The surface temperature at the pump casing corresponds to the temperature of the pumping medium.
In the area of the bearing support, there must be free contact between the surface and the surroundings. Insulation of the bearing support is not permitted. The containment shell temperature is determined as shown in Fig. 1 and using the following formula.

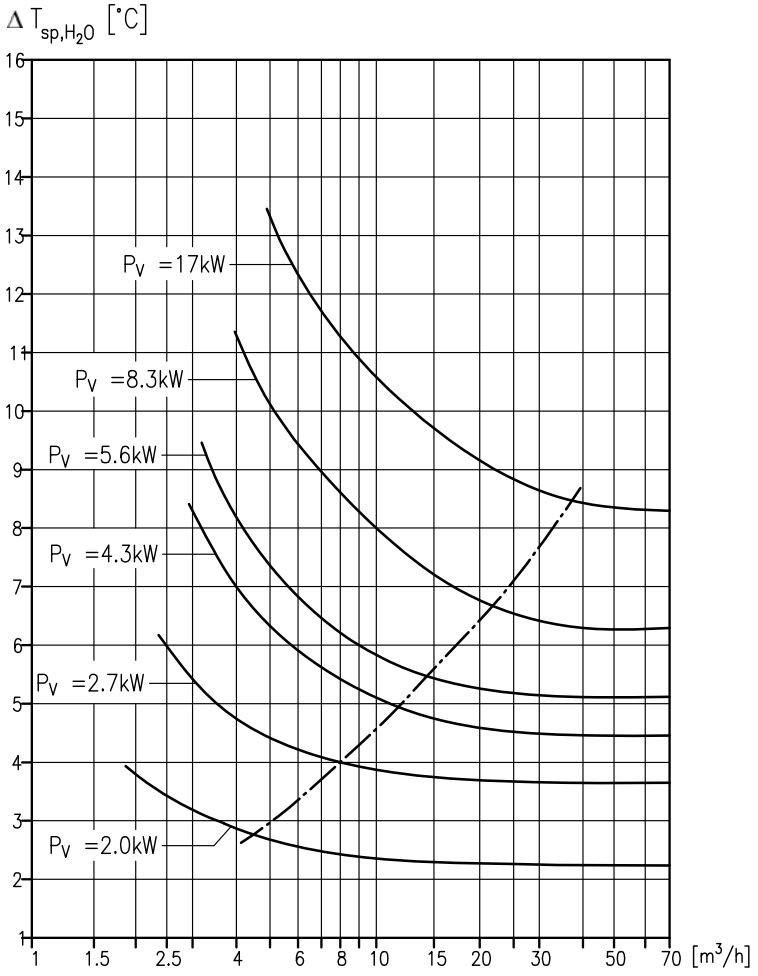


Fig. 1: The containment shell temperature subject to the magnetic loss P_v when using water.

$$T_{sp,medium} = T_E + \Delta T_{sp,H_2O} \; x \; \frac{c_{H_2O}}{c_{medium}} \; x \; \frac{\rho_{H_2O}}{\rho_{medium}}$$

T_E	=	Inlet temperature of pumped liquid in the suction connection
$\Delta T_{sp,H_2O}$	=	See Fig. 1
$c_{H\,O}$	=	Specific heat capacity of water = 4.187 kJ / kgK
c_{medium}	=	Specific heat capacity of pumping medium [kJ / kgK]
ρ_{H_2O}	=	Density of water = 1 kg / dm^3
ρ_{medium}	=	Density of pumping medium [kg / dm^3]

NOTE

Pumps with ceramic containment shells do not have magnet loss P_v.
The surface temperature at the containment shell corresponds to the temperature of the pumping medium.

2.9.2 Monitoring device

The pump must only be operated within the limits stated in the pump data sheet and on the type plate.
If the operator cannot ensure that the operational limits are complied with then monitoring devices must be provided. In so doing, observe the following risks:

- **Blockages in internal circulation channels**
  The inner, pumping medium-filled area of the magnet coupling is cooled by an internal circulation system. Interruption of this internal circulation through certain properties of the pumping medium can cause an unacceptable temperature rise.

- **Decoupling of the magnet coupling**
  Overloading, overheating or non-observance of the design data may result in decoupling of the magnet coupling. The heat energy generated may cause a rise in temperature at the containment shell.

- **Solids between inner magnet and containment shell**
  Large solids may become wedged between the inner magnet and containment shell, thereby causing an unacceptable rise in temperature at the containment shell through friction.

- **Escape of pumping medium**
  If containment shell damage (= rare fault) causes pumping medium to escape and this presents a risk to the environment, then leakage monitoring must be planned.
  The interaction with the surrounding materials must be observed.

- **Minimum flow rate undershot**

- **Maximum flow rate exceeded**

- **Completely dry operation**
  A pump unit is switched on while it is in a non-filled pipe and the pump itself is also dry. No fluid is pumped, and as a result there is no cooling/lubrication of the plain bearing. Within a very short period of time, extreme localised temperature increases will occur as a result of friction or eddy current losses.

- **Semi-dry operation**
  A pump unit is filled with fluid, but it is taken into operation with the supply line shut off or the flow is interrupted during operation, e.g. in "slurping mode" during emptying of a tank in which a certain proportion of the medium being pumped remains in the pump housing and provides cooling and lubrication, if only for a certain period of time. The time it takes until the temperature reaches a critical level in this "operating mode" depends on many influencing factors: Design and size of the pump, type and temperature of the fluid or the pipe design. The power input in "slurping mode" is low. Fault free operation, depending on lubricating capacity, evaporation enthalpy of the fluid, start-up and boiling temperature of the fluid, and the retention capacity of the connected pipe, can continue for a considerable period of time. More accurate time data can be specified after consultation with DICKOW.

The following devices can be supplied on request for monitoring purposes:

- Level check, in order to prevent dry running.

- Temperature monitor to be fitted on the containment shell, to monitor rises in temperature in the containment shell.

- Power monitor, to monitor the minimum flow rate and/or maximum flow rate and to detect dry running and desynchronisation of the magnet coupling.

- Monitoring of the interior of the bearing support, in order to detect a leakage due to damage to the containment shell.

2.9.3 Use in explosion group II C

To prevent brush discharge from group II C devices, the coating thickness is limited to a maximum of 0.2 mm.

Approved conductive coating systems are used on thicker coatings.

2.10 Magnet coupling

DANGER **Strong magnetic field in the vicinity of the magnetic coupling or individual magnets**

Danger to lives of people with pacemakers!
Interference of magnetic data media, electronic devices, components and instruments!
Uncontrolled force of attraction between magnetic components, tools etc.!

- Keep a safe distance of at least 0.3 m.

The safe distance relates to equipped interior and exterior magnets, which have not yet been installed in the pump.

When installed, the magnetic field is completely shielded. No magnetic field risk is presented by an assembled pump. This also relates to heart pacemakers.

3. Description

3.1 General description

This pump is suitable for use wherever heat transfer oils are conveyed in industrial systems and where no leakage is permitted.

3.2 Designation

Example:
Type: NMX-p-hu-32/210
Design: A-25-2-0-002-1-A
Code magnetic coupling: 21/1.0/30t/1/1/1

	Pump code
NMX	Pump type
p	Special design; e.g. p = with center-axle suspension
hu	Material design; e.g. hu = GP240GH
32	Nominal diameter of pressure joint [mm]
210	Nominal diameter of impeller [mm]
A	Scope of supply; E.g. A = free shaft end
25	Flange rating; e.g. 25 = PN25 RF
2	Sealing material; e.g. 2 = graphite
0	Secondary seal; e.g. 0 = standard
002	Safety feature; e.g. 002 = containment shell monitoring PT100
1	Emptying; e.g. 1 = standard, plug
A	Structural design status
	Magnet code
21	Material ; e.g. 2 = containment shell 2.4610, 1 = rotor 1.4571
1.0	Wall thickness containment shell [mm]
30t	Magnet design
1	Circulation ; e.g. 1 = internal
1	Sliding bearing design ; e.g. 1 = elastic
1	Relief; e.g. 1 = without

3.3 Pump size/bearing support assignment

Bearing support	0	I	II	III	IV
Construction size	26/125	32/165	32/250	65/320	150/320
	26/170	32/210	40/250	80/320	150/400
	26/210	40/165	40/320	100/250	150/500
	40/125	40/210	50/250	100/320	200/260
	50/125	50/165	50/330	100/400	200/320
	65/125	50/210	65/165	125/250	200/400
			65/210	125/320	200/500
			65/250	125/400	250/320
			80/165	150/250	
			80/210		
			80/250		
			100/210		

3.4 Designation

3.4.1 Type plate

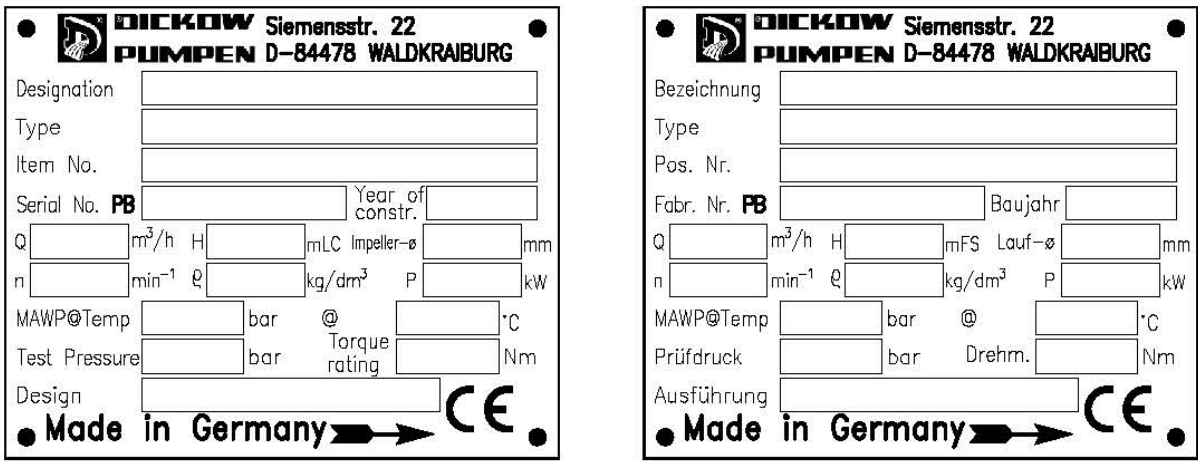


Fig. 2: Typeplate English and German

3.4.2 Labelling in accordance with the Explosion Protection Directive

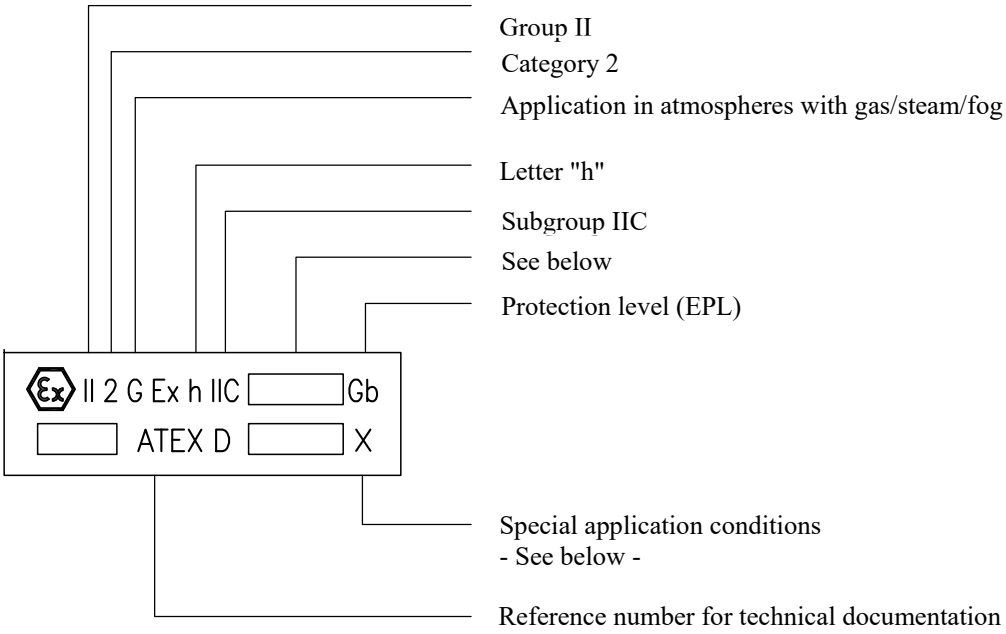


Fig. 3: ATEX type plate

The surface temperature does not depend on the ignition source, but on the temperature of the pumped liquid. There is no specific temperature class or temperature in the ID. The identification contains a T-area or temperature area ID plus the symbol "X" behind the reference number for the technical documentation for special application conditions relating to the temperature.
Chapter 2.9.1 refers to the arising surface temperature.

If there is room, this Ex identification will be integrated on the type plate, in accordance with 3.4.1.

3.5 Structural design and layout

Design
- Volute casing pump
- Horizontal setup
- Single-stage
- Compliance with requirements in accordance with ISO 15783
- Dimensions in accordance with ISO 2858

Pump casing
- Single volute/double volute (depending on pump size)
- Radially split
- Cast-on feet or support brackets

Impeller
- Closed or open
- Back vanes, injector bores and/or relief holes relieve axial thrust

Bearings
- Motor-side cylinder roller bearing as a loose bearing and grooved ball bearing as a fixed bearing
- Oil lubrication
- Pump-side plain bearing lubricated by the pumping medium

Shaft seal
- Magnetic coupling

3.5.1 Magnetic coupling

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

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

The heat in the metallic containment shells, generated through eddy currents, is dissipated through an internal circulation flow. The internal circulation is an additional safety feature against exceeding the boiling point in the magnet chamber and serves as a lubrication of the plain bearings.

3.6 Dry operation

3.6.1 Completely dry operation

The pump unit is switched on while it is in a non-filled pipe and the pump itself is also dry. No fluid is pumped, and as a result there is no cooling/lubrication of the plain bearing. Within the shortest time, local extreme temperature increases occur on account of the friction / slide ring seal.

DANGER

Localised high surface temperatures

Risk of explosion!a

- The unit is not intended to be run in completely dry operation.
- Completely dry operation is not permitted.

3.6.2 Semi-dry operation

The pump unit is filled with fluid, but it is taken into operation with the supply line shut off or the flow is interrupted during operation, e.g. in "slurping mode" during emptying of a tank in which a certain proportion of the medium being pumped remains in the pump housing and provides cooling and lubrication, if only for a certain period of time. The time it takes until the temperature reaches a critical level in this "operating mode" depends on many influencing factors: Design and size of the pump, type and temperature of the fluid or the pipe design. The power input in "slurping mode" is low. Fault free operation, depending on lubricating capacity, evaporation enthalpy of the fluid, start-up and boiling temperature of the fluid, and the retention capacity of the connected pipe, can continue for a considerable period of time.

DANGER

Operation with the supply line shut off
Slurping operation during tank wagon emptying
Risk of explosion!a

- Consult DICKOW Pumpen.
- Provide a monitoring device, e.g. flow monitor and/or a Liquiphant.

3.7 Scope of supply

Depending on the specific design, the following items may be included in the scope of supply:

- Pump
- Elastic coupling with or without spacer
- Coupling protection
- Cast base plate or welded frame in a warp-resistant design
- Drive motor
- Other special accessories if applicable

3.8 Dimensions and weights

Information about dimensions and weights can be found in the erection plan/dimensional drawing.

4. Transport/intermediate storage/disposal

4.1 Transport

DANGER

Risk of the pump/pump unit slipping out from the suspension

Risk of death due to falling components.

- Only transport the pump / pump unit in a horizontal position.
- Never attach the pump at the free shaft end.
- Never attach the pump unit to the eyelet on the motor.
- Never step underneath a suspended load.
- Note the weight specifications on the layout plan.
- Observe the local accident prevention regulations.
- Use suitable and approved lifting accessories.

Fig. 4: Transporting the pump

ATTENTION

Improper transportation of rotating unit or interchangeable unit!

Damage to the slide bearings!

- Secure the pump shaft with suitable transportation locks to prevent movement.

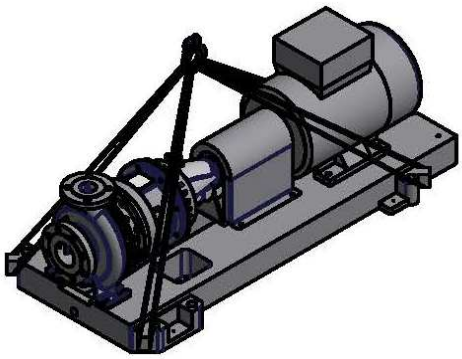


Fig. 5: Transporting the complete pump unit

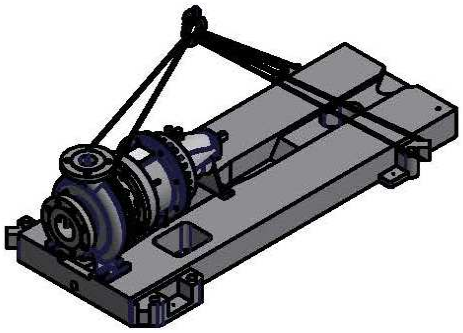
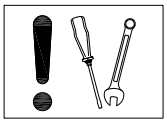


Fig. 6: Transporting the pump on the base plate

4.2 Storage/preservation

ATTENTION

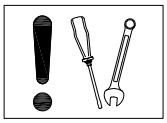


Damage due to moisture or dirt during storage

Corrosion and/or soiling of the pump

- For outside storage, the pump or packaged pump and accessories must be covered with a waterproof covering.

ATTENTION



Damp, dirty or damaged openings and connection points

Leakage or damage to the pump

- Do not expose sealed openings before the erection process.

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

- The pump must be stored in a dry, protected room at normal humidity of 60%.
- The pump and motor should be uncoupled from each other.
- Turn the shaft once a month by hand.

New pumps made of the materials GGG and ferritic cast steel are pre-treated inside with an anti-corrosion agent and dewatering fluid. The maximum storage period for indoor storage is 12 months.

If the storage duration will exceed 12 months then Dickow Pumpen should be informed. In this case, the pumps will need to be treated with long-term preservatives, e.g. nitrogen preservation.

If a pump is to be put into storage that has already been in use, please refer to section 6.6.

4.3 Returning the pump

- Empty the pump properly. Refer to Chapter 7.3.
- Thoroughly rinse and clean the pump, especially if it has been used to pump harmful, explosive, hot or other risky liquids.
- A fully filled-in Document of Compliance must always be enclosed with the pump. See Chapter 11.2.

NOTE

If required, a Document of Compliance can be downloaded from www.dickow.de.

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

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

4.4 Disposal

WARNING

Harmful pumping media

Dangerous for people and the environment!

- Collect and dispose of all the rinsing water and any remaining liquid.
- Wear protective clothing and a face mask.
- Follow the legal requirements for the disposal of harmful liquids.

1. Disassemble the pump/pump unit.
2. Collect grease and oil.
3. Sort and separate the different pump materials.
4. Dispose of them in accordance with your local regulations.

5. Setup/installation

5.1 Safety instructions

DANGER

Incorrect setup in areas with a potentially explosive atmosphere

Risk of explosion!

- Comply with the locally applicable explosion protection regulations.
- Observe the information on the pump data sheet and the pump/motor type plate.

DANGER

Strong magnetic field in the vicinity of the magnetic coupling or individual magnets

Danger to lives of people with pacemakers!
Interference of magnetic data media, electronic devices, components and instruments! Uncontrolled force of attraction between magnetic components, tools etc.!

- Keep a safe distance of at least 0.3 m.
- Observe the additional information in Chapter 2.10.

5.2 Foundations

WARNING

Setup on unsurfaced and non-load-bearing foundations

Risk of personal injury and material damage!

- Ensure that the load bearing capacity complies with class C12/15 for exposure class XC1 in accordance with EN 206-1.
- Only set up the pump unit on set foundations.
- Always set up the pump unit on a horizontal and level surface.
- Observe the weights specified in the layout plan.

5.3 Setting up the pump unit

5.3.1 Setup on foundations

1. Place the pump unit on the foundations and align it with a spirit level. Permissible positioning deviation: 0.2 mm/m.
2. Insert bearing plates to compensate any height differences. Always insert them on both sides in the immediate vicinity of the foundation bolts between the base frame and the foundations.
3. If the distance between the foundation bolts exceeds 600 mm then you must also insert bearing plates in the middle between the foundation bolts.
4. All bearing plates must lie flat.
5. Only insert the foundation bolts in the designated bores.
6. Embed the foundation bolts in concrete.
7. After the concrete has set, align the base frame.
8. Tighten the foundation bolts uniformly and securely.
9. Embed the base frame in vibration-resistant, standard grade concrete with a water/cement value of (W/C value) ≤ 0.5. Use a plasticiser to establish a flowable consistency. Carry out after treatment of the concrete in accordance with DIN 1045.

5.4 Piping

DANGER

Permitted loads exceeded at the pump connecting pieces

Risk of death due to escaping hot, toxic, caustic or flammable liquids at leaks!

- Do not use the pump as an fixed point for piping.
- Support the piping immediately before the pump and connect it free of stress.
- Observe the permitted forces and torques at the connecting pieces.
- Thermal expansion of the piping during temperature increases needs to be compensated for.

5.4.1 Suction line

The routing of the suction line must be carried out with particular care. The NPSH values of the pump and system must be clearly defined. The following should be noted:

- Do not connect a pipe elbow directly to the suction flange. Provide a straight inlet piece. The length must be at least 2x the suction line diameter.
- Never connect a suction line with a larger nominal diameter directly to the pump. Turbulence in the airflow will reduce the free inlet cross-section. Use an eccentric transition piece. Install in accordance with the diagram to avoid air pocket formation

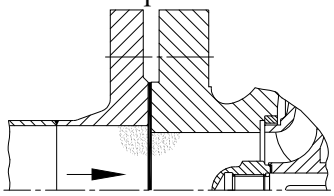


Fig. 7: Flow eddy

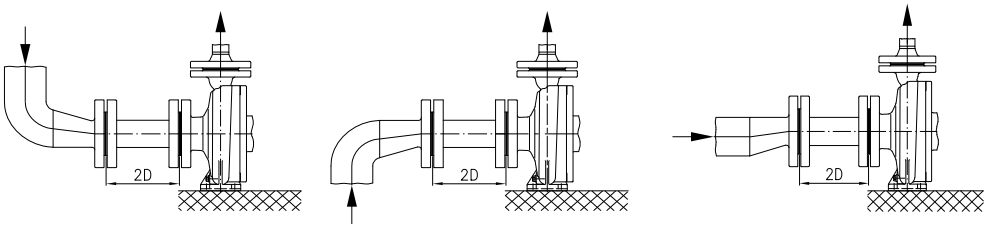
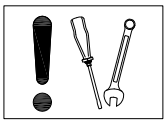


Fig.8 Connection of eccentrics

- In suction operation, run the suction line to the suction nozzle so that it is continuously rising. Avoid air pockets.
- In inflow operation, run the suction line to the suction nozzle so that it is continuously falling. Avoid complete deaeration of the air bags.
- A maximum flow rate of 2 m/s must not be exceeded.

ATTENTION



Weld beads, cinders and other impurities in the pipeline

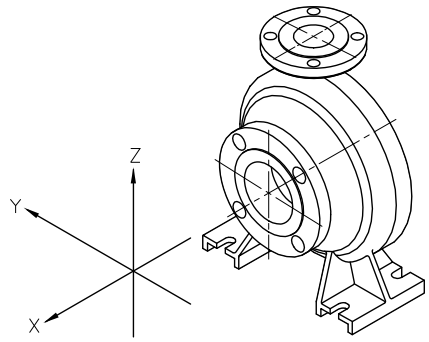
Damage to the pump!

- Thoroughly clean the pipe before connecting the pump.
- Remove any impurities from the lines.
- Use a filter if necessary.

NOTE

- Use a filter with a mesh size of 0.5 mm.
- Use a filter with three times the cross section of the pipe.

5.4.2 Permissible forces and torques at connections



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

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

The forces and torques apply at 20°C. Refer to the diagram for temperature-dependent correction values.

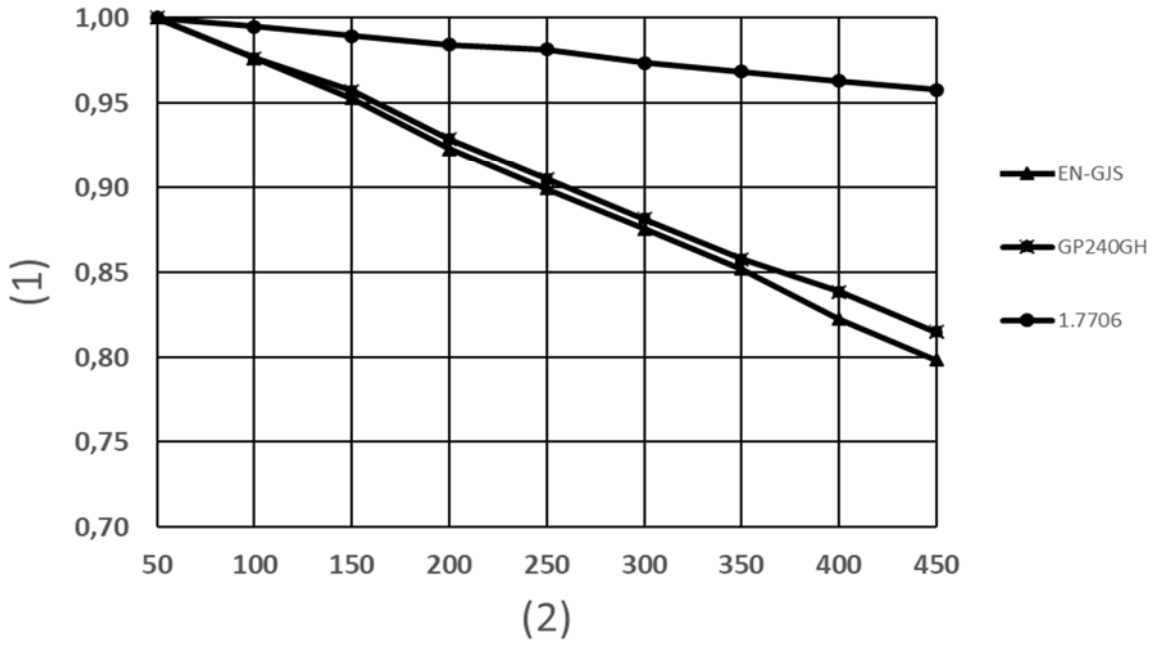


Fig. 9: Temperature correction diagram.(1) = correction factor (2) = temperature [°C]

If not all the acting loads reach the maximum permitted values then one of these loads is permitted to exceed the limit provided the following conditions are met:

- The maximum permitted value is not exceeded by more than a factor of 1.4.
- The following applies to the actual forces and torques acting on each flange:

$$\left(\frac{\Sigma F_{actual}}{\Sigma F_{max.\ allowable}}\right)^2 + \left(\frac{\Sigma M_{actual}}{\Sigma M_{max.\ allowable}}\right)^2 \leq 2$$

5.5 Insulation

WARNING

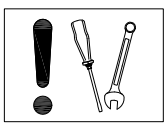
Parts of the housing that come into contact with product will adopt the temperature of the medium being pumped.

Risk of burns!

- Insulate the housing parts.
- Attach protective devices.

ATTENTION

Heat build-up in the bearing support



Bearing damage!

- Do not insulate the bearing support.

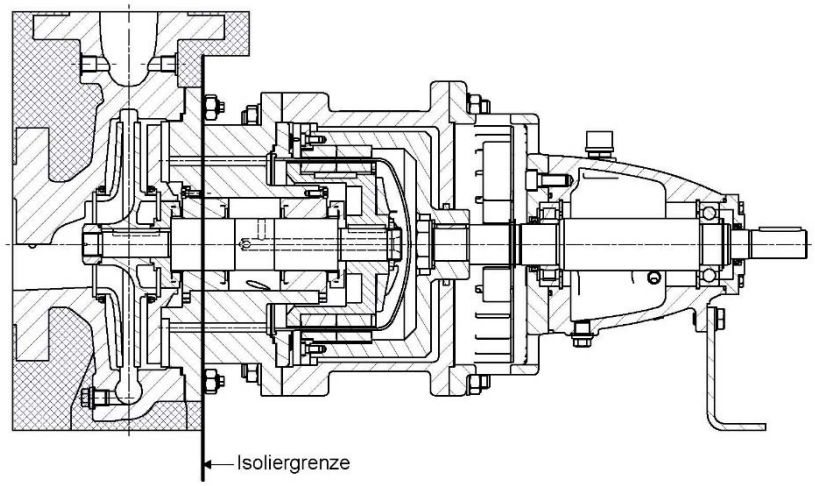


Fig. 10: Insulation limit

5.6 Coupling alignment

DANGER

Impermissible temperatures at the coupling or roller bearing due to incorrect alignment of the coupling

Risk of explosion!

- Make sure that the coupling is correctly aligned at all times.

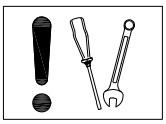
WARNING

Accidental switching-on of the pump unit

Risk of injury due to moving parts!

- Work on the pump unit may only be performed with all electrical connections disconnected.
- Secure the pump unit so that it cannot be switched on accidentally.

ATTENTION



Shaft misalignment between pump and motor

Damage to pump, motor and coupling!

- Always check the coupling after connecting the pipe.
- Also, perform a check of the coupling on pump units that have been supplied on a shared base plate.
- At higher temperatures, the alignment must always be performed when the components are hot.

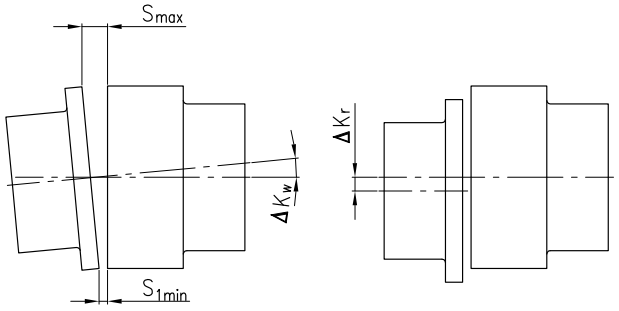


Fig. 11: Angular/radial coupling misalignment

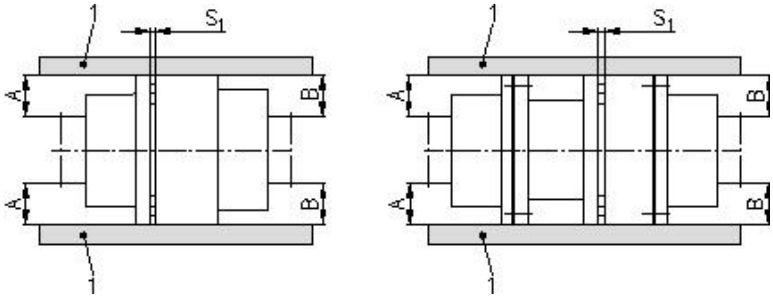


Fig. 12: Coupling alignment

1. Remove the coupling protection.
2. Loosen the support foot.
3. Place a straight edge (1) axially over the coupling half.
4. Any radial offset ΔKr will be evident as a light gap.
   Better: Determine the radial offset by measuring the distances A and B in three different locations offset by 120°.
   The coupling is correctly aligned if the distance to the shaft is the same in all positions.
5. Check the distance s_1 between the coupling halves all around the circumference. The coupling is correctly aligned if the same distance is present all around the circumference.
6 For the permissible deviation Δs_1 and ΔKr for the two coupling halves, refer to the information provided in the operating instructions of the coupling manufacturer.
7. Screw on the support foot.
8. Assemble the coupling protection.

5.7 Alignment of pump and motor

WARNING

Exposed rotating coupling

Risk of injury due to rotating shaft!

- Only run the pump unit with the coupling protection in place.
- Select an appropriate coupling protection in accordance with applicable guidelines and safety legislation.

DANGER

Risk of ignition due to friction sparks

Risk of explosion!

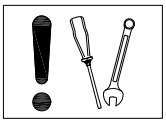
- Select the material for the coupling protection so that no flying sparks are generated during contact.
- Refer to ISO 80079-36.

After setup of the pump unit and connection of the pipe, check the alignment of the coupling and realign with the motor if necessary.
Use bearing plates to compensate for any height differences.

1. Remove the coupling protection.
2. Check the alignment of the coupling. Refer to the procedure in section 5.6.
3. Loosen the hexagon nuts on the motor feet.
4. Place bearing plates under the motor feet until the height difference is compensated for.
5. Tighten the hexagon bolts on the motor feet.
6 Check the operation of the coupling / shaft. It must be possible to turn the coupling easily by hand.

7. Assemble the coupling protection.
8. Check the distance between the coupling and the coupling protection.

ATTENTION **Shaft misalignment between pump and motor**



Damage to pump, motor and coupling!

- At higher temperatures, the alignment must always be performed when the components are hot.

5.8 Electrical connection of the pump unit

DANGER **Incorrect electrical installation**

Risk of explosion!

- The requirements set out in EN 60079-14 or NEC 505 must also be followed during the electrical installation.
- Explosion-proof motors must always be connected via a motor protection switch.

DANGER **Static charge**

Risk of explosion!

- Connect equipotential bonding at the prescribed ground connection point.
- Install equipotential bonding between the pump unit and the foundation.

DANGER **Work carried out by unqualified personnel on the pump unit**

Risk of death due to electric shock!

- All electrical connection work may only be performed by a qualified electrician.
- Observe the IEC 60364 and EN 60079 (explosion protection) regulations.

WARNING **Incorrect connection to the power supply**

Short circuit

- Observe the connection conditions of your local energy supply company.

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, we recommend using a softstarter device.

Procedure:

1. Check the available supply voltage against the ratings on the motor type plate.
2. Select a suitable connection layout.
3. Compare the direction of rotation of the motor with the direction of rotation of the pump. Note the arrow on the pump that indicates the direction of rotation.

NOTE

Refer to the supplied operating instructions for the motor.

5.8.1 Checking the direction of rotation

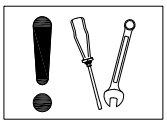
DANGER

Increase in temperature due to touching parts

Risk of explosion!

- Never check the direction of rotation if the pump is dry.
- Uncouple the pump before checking the direction of rotation.

ATTENTION



Incorrect rotational direction for motor and pump

Damage to the pump!

- Note the arrow on the pump that indicates the direction of rotation.

1. Start up the motor briefly. Note the direction of rotation of the motor.
2. The direction of rotation of the motor must match the arrow on the pump.
3. If the direction of rotation is incorrect, swap the connections of the mains supply cable in the motor terminal box.

6. Commissioning/decommissioning

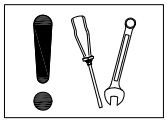
6.1 Commissioning

Check the following points prior to commissioning:

- The pump unit is correctly connected electronically to all protective devices.
- The pump is filled with pumping medium.
- The direction of rotation has been checked.
- All additional connections are connected and fully functional.
- Lubricants have been checked.
- After an extended standstill period, the measures set out in section 7 "Maintenance/servicing/inspection" must be followed and performed.

6.1.1 Filling lubricants

ATTENTION



Not enough lubricating oil; oil level lower than the middle of the oil sight glass

Damage to the rolling bearings!

- Regularly check the oil level. Oil level.
- The threaded hole of the level indicator must be horizontal.

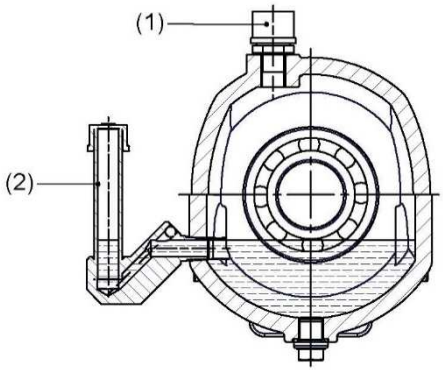


Fig. 13: Filling the bearing support

1. Unscrew the venting screw (1).
2. Keep filling oil through the hole for the venting screw (1) until the oil enters the level indicator (2).
3. The required oil level is shown on the level indicator.
4. Screw in the venting screw (1).

NOTE

An oil level that is too high leads to a temperature increase, untightness or oil leakages.

Refer to section 7.2.2 for information about the filling quantity and oil quality.

6.1.2 Filling up and venting the pump

DANGER

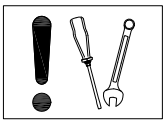
Generation of a potentially explosive atmosphere inside the pump
Excessively high surface temperatures

Risk of explosion!

- The pump must always be filled with pumping medium.
- Corresponding monitoring measures must be provided.

ATTENTION

Operation without pumping medium



Damage to the slide bearing/mechanical seal!

- The pump must always be filled with pumping medium.
- Corresponding monitoring measures must be provided.

1. Vent the pump and suction line and fill with pumped liquid.
   The pump is self-venting.
2. Fully open the shut-off valve in the suction line.
3. Fully open all additional connections (e.g. external circulation, external infeed).

6.1.3 Switching the pump on

DANGER

Exceeding the permitted pressure and temperature limits

Risk of explosion! Escaping hot or toxic liquids.

- Never operate the pump with closed shut-off valves in the suction line and/or pressure line.
- Only start up the pump unit against a partially opened shut-off valve on the pressure side.

DANGER

Overtemperature due to dry running

Risk of explosion!

- Never operate the pump when it is not filled.
- Always fill the pump correctly.
- Only operate the pump within the permitted operating range.

1. Fully open the shut-off valve in the supply line / suction line.
2. Partially open the shut-off valve in the pressure line.
3. Switch on the motor. Pay attention to the synchronisation of pump and motor. Decoupling can be recognised by low delivery head and noise in the drive system.
4. When the pressure gauge indicates pressure, open the shut-off valve on the pressure side until the operating point is reached.
5. When the operating temperature has been reached, check the alignment of the coupling and realign if required.

DANGER

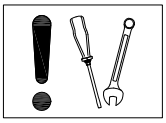
Overtemperature through decoupling of the magnet coupling

Risk of explosion!

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

ATTENTION

Operation without pumping medium



Damage to the plain bearing!

- The pump must always be filled with pumping medium.
- Corresponding monitoring measures must be provided.

6.2 Operating the pump

WARNING

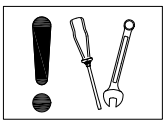
High surface temperatures due to hot pumping media

Risk of burns!

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

ATTENTION

Abnormal noises, vibrations, temperatures or leakage



Damage to the pump!

- Switch off the pump unit immediately.
- Do not restart the pump unit until the cause of trouble has been remedied.

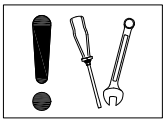
6.3 Impeller trimming

The impellers are hydraulically balanced in order to balance axial thrust. In addition to the wear rings, the compensation is performed individually or in combination with:

- Back vanes
- Relief holes
- Injector bores

ATTENTION

Improper, independent impeller correction



Damage of sliding bearing due to incorrect axle thrust compensation!

- Only perform impeller correction after contacting Dickow Pumpen for advice.

6.4 Operating limits

DANGER

Exceeding operating limits for pressure, temperature and rotational speed

Risk of explosion! Escaping hot or toxic liquids.

- Make sure that the operating limits stated in the characteristic curve sheet are not exceeded.
- Avoid operation against a closed shut-off valve.
- Never operate the pump at a higher temperature than specified in the pump data sheet.

6.4.1 Flow rate

The minimum flow rate (% of Q_{opt}) must be observed, in accordance with the following table:

Pump size	Frame size	Speed [min^{-1}]			
		1450	1750	2900	3500
26/125	0	15	15	15	15
26/170					
26/210					
32/165	I	15	15	15	15
32/210					
32/250	II	30	30	30	30
40/125	0	15	15	15	15
40/165	I	15	15	15	15
40/210					
40/250	II	30	30	30	30
40/320					
50/125	0	15	15	15	15
50/165	I	15	15	15	15
50/210					
50/250	II	30	30	30	30
50/330					
65/125	0	15	15	15	15
65/165	II	30	30	30	30
65/210					
65/250					
65/320	III	30	30	30	30
80/165	II	30	30	30	30
80/210					
80/250					
80/320	III	30	30	30	30
100/210	II	30	30	50	50
100/250	III	30	30	50	50
100/320				50	50
100/400				-	-
125/250				50	50
125/320				-	-
125/400				-	-
150/250				50	50
150/320	IV	30	30	-	-
150/400				-	-
150/500				-	-
200/260				-	-
200/320				-	-
200/400				-	-
200/500				-	-
250/320				-	-
250/400	**V**	30	30	-	-
250/500				-	-

6.4.2 Switching frequency

DANGER

Surface temperature of motor too high

Risk of explosion!

- With explosion-proof motors, refer to the information about switching frequency in the operating instructions of the motor.

The switching frequency is defined by the maximum temperature increase of the motor and depends on the power reserves of the motor during operation as well as on the starting conditions.

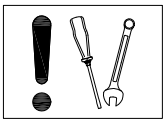
NOTE

Refer to the operating instructions provided by the motor manufacturer.

6.4.3 Abrasive liquids or solids

Increased wear is to be expected if liquids with abrasive components or solids are handled by the pump. In this case, the inspection intervals must be shortened in comparison to the normal times.

ATTENTION **Magnetic components in the pumped liquid**



Damage to the magnetic coupling!

- Use suitable measures to keep magnetic components away from the containment shell area.
- When using a magnetic filter, provide differential pressure measurement.

6.5 Switching off the pump

1. The shut-off valve in the suction line remains open.
2. Close the shut-off valve in the pressure line.
3. Switch off the motor and watch that it coasts steadily to a standstill.

NOTE

If a non-return valve is installed in the pressure line, the shut-off valve can remain open. Counter pressure must be present.

The following must be observed if the pump is to be switched off for an extended period of time:

- Fully drain all media that tend to polymerisation, crystallisation or solidification.
- Rinse the pump with a suitable fluid if necessary.
- Close the shut-off valve in the suction line.
- Close the additional connections.

6.6 Decommissioning

Pump unit to remain installed in the piping:

- Provide sufficient liquid for the test run.
- Regularly switch on the pump unit every one to three months.

Pump unit to be dismantled and placed in storage:

- Empty the pump properly.
- Observe the safety instructions in section 7.1 / 7.3.
- Spray the inside of the pump casing with preservation agent. This is not required on stainless steel pumps.
- Spray preservation agent through the suction and discharge connections.
- Close off the suction and pressure flanges.
- Coat all unpainted external surfaces of the pump with silicone-free oil and grease.
- Observe the additional information in Chapter 4.2.

7. Maintenance/servicing/inspection

7.1 Safety regulations

DANGER

Incorrectly maintained pump unit

Risk of explosion!

- Regularly maintain the pump unit.
- Draw up a maintenance schedule.

DANGER

Strong magnetic field in the vicinity of the magnetic coupling or individual magnets

Danger to lives of people with pacemakers!
Interference of magnetic data media, electronic devices, components and instruments!
Uncontrolled force of attraction between magnetic components, tools etc.!

- Keep a safe distance of at least 0.3 m.

WARNING

Accidental switching-on of the pump unit

Risk of injury due to moving parts!

- Work on the pump unit may only be performed with all electrical connections disconnected.
- Secure the pump unit so that it cannot be switched on accidentally.

WARNING

Hot liquids

Risk of injury!

- Let the pump unit cool down to ambient temperature.

WARNING

Harmful pumping media

Risk of injury!

- Comply with the legal regulations.
- When draining the pumping medium, take appropriate measures to protect people and the environment.
- Decontaminate the pumps.

WARNING

Insufficient stability

Danger of crushing hands or feet!

- When installing and removing the pump or pump unit, secure it to prevent tilting or falling over.

The operator must ensure that all maintenance, inspection and assembly work is performed by qualified specialist personnel. Such personnel must have read the operating instructions in sufficient detail.

A maintenance schedule helps to avoid expensive repairs with a minimum of effort.

Never use excessive force on the pump unit.

7.2 Monitoring during operation

DANGER

High surface temperatures due to roller bearings running hot

Risk of explosion! Risk of fire!

- Regularly check the roller bearings for running noise.
- Regularly check the lubricant level.

DANGER

High surface temperature in the area of the start-up protection (Part 160)

Risk of explosion! Risk of fire!

- Check the roller bearing regularly to ensure its proper condition.

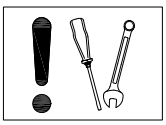
DANGER

High surface temperature at the containment shell

Risk of explosion! Risk of fire!

- If necessary, monitor the temperature at the containment shell.

ATTENTION

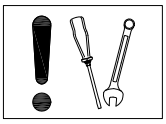


Wear due to the pump running dry

Damage to the pump!

- Never run the pump if it is not filled.
- Never close the shut-off valve in the suction line while the pump is running.

ATTENTION



Exceeding the maximum liquid temperature

Damage to the pump!

- Operation against a closed shut-off valve on the pressure side is not permitted.
- Refer to the temperature information in the pump data sheet.

The following must be checked regularly during operation:

- The pump must always run smoothly and without vibrations.
- Check the roller bearings for running noise. Vibrations, noises and increased current draw are all signs of wear.
- Check the elastic elements of the coupling.
- Regularly clean the filter in the suction line.

7.2.1 Lubrication / service life of roller bearings

DANGER

High surface temperatures due to roller bearings running hot or due to defective bearing seals

Risk of explosion! Risk of fire!

- Regularly check the condition of the lubricant.
- Regularly check the lubricant level.

The roller bearings are normally lubricated with mineral oil in viscosity class ISO VG 46 or 68 with a kinematic viscosity of 46-68 mm^2/s at 40°C. Suitable mineral oils include e.g.:

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

The first oil change needs to be performed after 200 operating hours. Then, the oil fill needs to be replaced once a year.

Bearing support	Fill quantity [l]
0/I	0.75
II	1.0
III	1.25
IV	2.7

NOTE

When using oils on the basis of synthetic hydrocarbons (polyalphaolefines – PAO), the oil changing intervals can be increased to 20,000 hours. The oil temperature should not exceed 80°C.

Particularly suitable are:

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

NOTE

At ambient temperatures below -20°C, low-viscosity mineral oils that are suitable for use in low temperatures and meet the requirements for viscosity class ISO VG 5 or 10 must be used.

Observe the note on the pump data sheet!

The calculated lifetime of the rolling bearings is more than 25,000 operating hours, even under disadvantageous operating conditions.

7.2.2 Changing the oil

1. Place a suitable container for used oil underneath the screw plug.
2. Unscrew the screw plug on the bearing support and drain the oil.
3. After it has run dry, screw the screw plug back in again.
4. Fill up with oil again. Refer to section 6.1.1.

WARNING

Potentially harmful lubricating fluids

Dangerous for people and the environment

- Make sure that safety measures are in place to protect people and the environment during draining.
- Follow the legal regulations for the disposal of harmful fluids.

7.2.3 Lubrication of plain bearings

The plain bearings require a stable liquid film. Check them for signs of wear:

- After dry run or cavitation.
- When vibrations, noises and power consumption increase.

7.3 Emptying and disposal

WARNING

Harmful pumping media

Dangerous for people and the environment!

- Collect and dispose of all the rinsing liquid and any remaining liquid.
- Wear protective clothing and a face mask.
- Comply with the legal regulations regarding the disposal of the liquid.

Emptying of the pumping medium is performed via the drain screw on the housing, via a connected shut-off valve or via a flange connection.
Refer to the layout plan for the method and location of emptying.

7.4 Disassembly of the pump unit

7.4.1 General information

- Refer to the safety information in section 7.1.
- When working on the motor, observe the documentation provided by the relevant motor manufacturer.
- Refer to the sectional drawings during disassembly.
- Our Service department is available to help in cases of damage.

DANGER

Working on the pump unit without sufficient preparations

Risk of injury!

- Switch off the pump unit properly.
- Close the shut-off valves on the suction side and pressure side.
- Empty the pump and depressurise it.
- Close any additional connections that are present.
- Let the pump unit cool down to ambient temperature.

WARNING

Incorrect lifting and moving of heavy assemblies

Risk of personal injury and material damage!

- Always use appropriate transport aids, lifting gear and lifting tackle when moving heavy assemblies.

7.4.2 Removal of the motor

1. Disconnect the motor.
2. Remove the coupling protection.
3. Loosen the fastening screws of the motor on the base plate.
4. Move the motor to uncouple the pump and motor.

WARNING

Motor tilting over

Danger of crushing hands or feet!

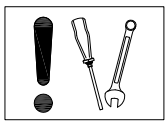
- Secure the motor by suspending or supporting it.

NOTE

On pump units with a spacer-type coupling the motor can remain screwed/bolted on the base plate during removal of the rotating unit/interchangeable unit.

7.4.3 Tools

ATTENTION



Incorrect disassembly or assembly tools

Damage to components!

- Use special tool.

For easier disassembly/assembly and for better protection of sensitive components, use the following special tools.

	Designation	Dimensions / size / D. No.			For component
		Bearing support size 0 / I	Bearing support size II	Bearing support size III / IV	
1.	Disassembling sleeve	60.1903	60.1903	60.1904	524
2.	Socket wrench	60.863 (bs. 0)	60.670	60.671 (bs. III)	921.1
		60.670 (bs. I)		60.866 (bs. IV)	
3.	Knipex pliers wrench	46 mm / 1 ¾ "	46 mm / 1 ¾ "	60 mm / 2 ⅜ "	940
4.	Allen key	Size 3, 4, 5, 6	Size 4, 5, 6	Size 4, 5, 6	
5.	Hexagon socket head screw			3x M5 x 35	940
6	Ring bolt	M8	M12	M16	Bearing support

7.4.4 Removing the rotating unit

On pump units with a spacer-type coupling the motor can remain screwed/bolted on the base plate.Remove the spacer in accordance with the manufacturer's operating instructions.

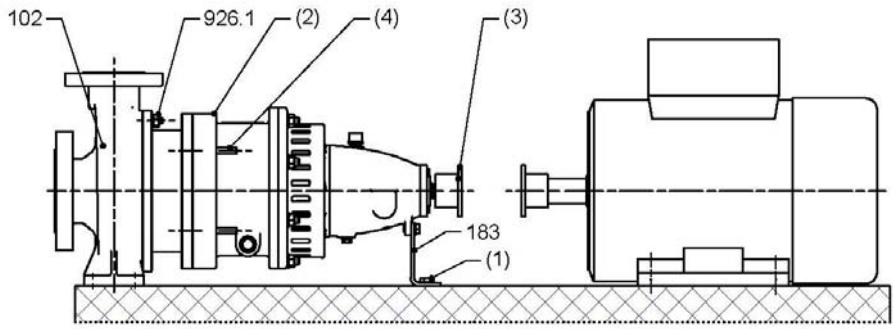


Fig. 14: Dismantle the rotating unit

1. Loosen the expansion bolt nut 926.1.
2. Loosen the hexagonal screw (1) on the support leg 183
3. Use jackscrews to press the entire rotating unit (2) out of the spiral housing 102.
4. Pull the rotating unit out of the housing and place it down.
5. Pull the coupling hub (3) off the end of the shaft.

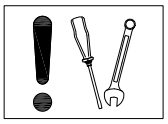
WARNING

Tilting the rotating unit

Danger of crushing hands or feet!

- Secure the rotating unit by suspending or supporting it.

ATTENTION



Knocks to the outer magnet on the containment shell

Damage to containment shell or outer magnet

- Use guide pins (4).
- Remove the rotating unit slowly and in a controlled manner.

7.4.5 Removing the bearing support unit

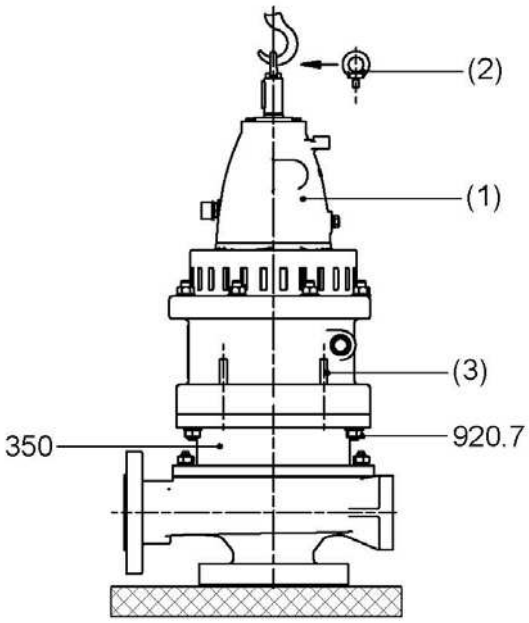


Fig. 15: Dismantle the bearing support

1. Remove the motor. Refer to Chapter 7.4.2.
2. Remove the pumps from the pipeline.
3. Place the pump vertically onto a clean and flat assembly location.
4. Remove the hexagonal nut 920.7 from the bearing housing 350.
5. Using a crane, remove the entire drive section (1). The use of a ring screw (2) - see Chapter 7.4.3 - is recommended.
6 Place the bearing support unit vertically onto a clean and flat assembly location.

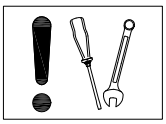
WARNING

Tilting of pump

Danger of crushing hands or feet!

- Secure the pump by suspending or supporting it.

ATTENTION



Knocks to the outer magnet on the containment shell

Damage to containment shell or outer magnet!

- Use guide pins (3).
- Remove the bearing support unit slowly and in a controlled manner.

7.4.6 Removing the interchangeable unit

The work described in section 7.4.5 has been completed.

1. Loosen the expansion bolt nuts 926.1.
2. Use the jackscrews to press the entire interchangeable unit (= from the impeller to the containment shell) out of the spiral housing 102.
3. Pull the interchangeable unit out of the housing and place it down.

7.4.7 Removing the roller bearing

The work described in section 7.4.5 has been completed.

1. Clamp the bearing support unit in the chuck / vice using drive shaft 213. Use protective jaws!
2. Wrench size 36 - place the wrench end fitting onto the retaining screw 900.
3. Remove the retaining screw 900 (right-hand thread).
4. Pull the driving rotor unit out of the bearing support unit and place it onto a clean and flat assembly location.

WARNING

Tipping over of the driving rotor and bearing support unit

Danger of crushing hands or feet!

- Secure the rotor or bearing support unit by suspending or supporting it.

5. Loosen the hexagonal nut 920.9.
6. Pull off the drive lantern 341.
7. Remove the circlips 932.1 and pull the fan propeller 831 off the drive shaft.
8. Remove the key 940.2.
9. Loosen the hexagonal screw 901.2 and pull off the bearing cover 360 with radial seal ring 421.2.
10. Press the drive shaft 213 and deep groove ball bearing 321 out of the bearing support together. Use a drill or press spindle for this.
11. Loosen the hexagon socket-head screw 914.2 and remove the bearing bracket lantern 344.
12. Push the outer ring of the cylinder roller bearing 322 out of the bearing support 330.
13. Remove the circlip 932.2 and support plate 550.2 from the drive shaft.
14. Pull the deep groove ball bearing 321 off the drive shaft.

7.4.8 Replacing the roller bearing

Bearing support	321	322
0 / I	6207	NU 207
II	6207	NU 207
III		
IV		

7.4.9 Removal of the impeller

The work described in section 7.4.4 has been completed.

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

7.4.10 Removing the rotor and sliding bearing

The work described in section 7.4.5 has been completed.

WARNING **Possible pumping medium residues**

Dangerous for people and the environment!

- Wear protective clothing.

1. Loosen and remove the containment shell screws 914.7.
2. Loosen the containment shell with set screws.
3. Loosen the expansion bolt nut 926.1.
4. Use jackscrews to separate the spiral housing 102 and bearing housing 350.
5. Remove the impeller 233 as specified in chapter 7.4.9.
6. Pull off the key 940.1 and thrust ring 500.5.
7. Pull the pump shaft unit out of the bearing housing unit.
8. Reinsert the key 940.1 and push in with the Knipex pliers wrench.
9. Clamp the pump shaft unit in the jaw chuck.
10. Loosen the shaft nut 921.1 with the socket wrench – see Chapter 7.4.3 – (left-hand thread).
11. Pull off the rotor 818.2.

WARNING **Axial magnetic forces**

Danger of crushing fingers or hands!

- Use non-magnetic tools.
- Never place the rotor 818.2 down in the vicinity of magnetic components.

12. Loosen the hexagonal socket-head screws 914.1 and remove the housing cover 161 (only bearing support I – III).
13. Loosen the Allen screws 914.10.
14. Remove the stationary slide bearing 310.

7.4.11 Removing the shaft sleeve

The work described in section 7.4.10 has been completed.
Only the version with elastic slide bearing (medium temperature ≤ 380°C) has replaceable shaft protection sleeves.

WARNING **Possible pumping medium residues**

Dangerous for people and the environment!

- Wear protective clothing.

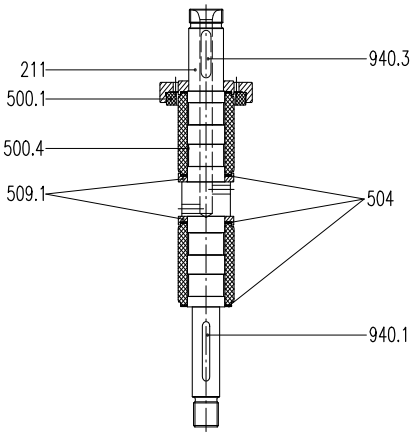


Fig. 16: Pump shaft unit

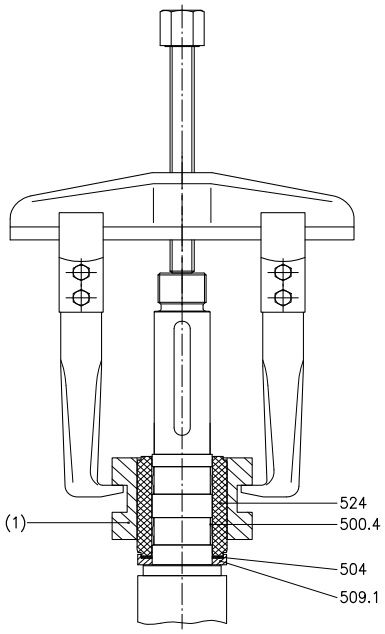


Fig. 17: Disassembling sleeve

1. Clamp the pump shaft unit to the key 940.1 in the jaw chuck.
2. Remove the key 940.3 using a hexagonal socket-head screw and Allen key - see chapter 7.4.3.
3. Pull off the thrust ring 500.1.
4. Fit disassembling sleeve (1) – see chapter 7.4.3 – on shaft sleeve 524 and fasten into place.
5. Fit the puller and take off the shaft sleeve.
6 Remove the tolerance ring 500.4 and intermediate ring 509.1.

7.5 Component inspection

7.5.1 Impeller / wear ring

The running surfaces in the wear ring area must not display any visible lead-in grooves. Measure the diameter of the running surfaces. When new, the total play is 0.6 mm. Replace the wear rings when the play exceeds 0.8 mm.

7.5.2 Magnetic coupling

Driven rotor 818.2
The surface must be free of cracks or bulges. Check the parallelism with a straight edge.

Driving rotor 818.1
Replace outer magnets if mechanical or chemical damage is visible.

Torque
Torques of new magnets are as stated in the table below. The magnet length according to pump data sheet or type plate. A reduction in capacity of 10% is permissible for magnets which are already in use. If the reduction exceeds this, replace the magnetic coupling.

Bearing support size	Magnet design	Torque [Nm]
I / II	20t	37
	30t	56
	40t	81
	50t	103
	60t	124
II	70t	148
	80t	171
	90t	189
	100t	211
	110t	234
	120t	252
III	31t	82
	62t	162
	93t	248
	124t	331
IV	33t	132
	64t	288
	95t	459
	126t	621
	157t	774
	188t	945

7.5.3 SiC plain bearing/shaft protection sleeves

Measure the diameter of the running surfaces. The total play in new condition is as follows:

Bearing support size I / II = 0.194 mm

Bearing support size III = 0.176 mm

Bearing support size IV = 0.176 mm

Replace the plain bearings as soon as the specified play is exceeded.
The axial play between the two thrust rings is 1.0 - 1.6 mm.

7.5.4 Bearing support

Measure the internal diameters of the ball bearing seats. Replace the bearing supports when the following dimensions are exceeded:

Bearing support size I	→	72,009 mm
Bearing support size II	→	80.009 mm
Bearing support size III	→	120.010 mm
Bearing support size IV	→	125,012 mm

7.6 Installation of the pump unit

7.6.1 General information

- Refer to the safety information in section 7.1.
- Refer to the sectional drawings during assembly.
- Always use new flat seals.
- Mount the flat seals without lubricants.
- Do not use mounting aids during the assembly of flat seals. If necessary, use standard commercially available contact adhesive. Never use super glue.
- Lubricate fittings and screw joints with graphite or similar lubricant. Lubricants must be compatible with the pumping medium.
- Tighten all screws to the required torque. Refer to section 7.7.
- When mounting the shaft protection sleeves, always use new tolerance rings.

WARNING

Magnetic forces may cause rotor and containment shell or containment shell and coupling part to hit one another

Magnet and bearing damage! Risk of injury!

- Observe the assembly instructions closely.

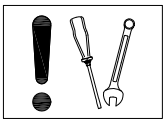
WARNING

Incorrect lifting and moving of heavy assemblies

Risk of personal injury and material damage!

- Always use appropriate transport aids, lifting gear and lifting tackle when moving heavy assemblies.

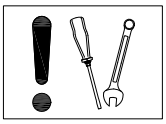
ATTENTION **Incorrect assembly**



Damage to the pump!

- When assembling the pumps/pump assembly, always follow the general rules of engineering.
- Always use original spare parts.

ATTENTION **Incorrect assembly**



Damage to outer magnetic coupling!

- Use guide pins.

The following must be checked prior to assembly:

- All removed parts must be cleaned and checked for wear.
- Damaged or worn parts must be replaced with original spare parts.
- All sealing surfaces must be cleaned.

1. Slide on the intermediate ring 509.1 and a new spacer ring 504 up to the shoulder of the shaft.
2. Insert the new tolerance rings 500.4 into the shaft grooves.
3. Fit the disassembling sleeve – see Chapter 7.4.3 – on the shaft sleeve and fasten in place.
4. Coat the pump shaft with graphite spray around the vicinity of the tolerance rings.
5. Press the pump shaft into the shaft protection sleeve using a drilling spindle or press.
6 Slide on the thrust ring 500.1 and a new spacer ring 504.
7. Insert the key 940.3 and push in with the Knipex pliers wrench.

7.6.3 Assembling the rotor and plain bearing

The work described in Chapter 7.6.2 has been completed.

1. Fasten the stationary slide bearing 310 with hexagon socket-head screws 914.10 to the bearing housing 350.
2. Fasten the housing cover 161 to the bearing housing 350 using hexagon socket-head screws 914.1 (only bearing support I-III).
3. Insert the key 940.1 into the pump shaft and push in with the Knipex pliers wrench.
4. Clamp the pump shaft unit in the jaw chuck.
5. Fit the rotor 818.2.
6 Tighten the shaft nut 921.1 with the socket wrench – see Chapter 7.4.3 – (left-hand thread).
7. Unclamp the pump shaft unit and remove the key 940.1 again.
8. Insert the pump shaft unit into the bearing housing unit.

WARNING **Axial magnetic forces**

Danger of crushing fingers or hands!

- Use non-magnetic tools.
- Never place the rotor 818.2 down in the vicinity of magnetic components.

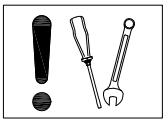
9. Slide on the thrust ring 500.5 and a new spacer ring 504.
10. Insert the key 940.1 into the pump shaft again and press in.
11. Fit the impeller in accordance with chapter 7.6.4.
12. Insert the bearing housing unit into the spiral housing 102. Use a new flat seal 400.5.
13. Tighten the expansion screw nuts 926.1 with a torque wrench.
14. Attach the containment shell. Use a new flat seal 400.13.
15. Tighten the containment shell screws 914.7 with a torque wrench.

7.6.4 Fitting the impeller

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

ATTENTION

Missing heli-coil insert



Impeller bolt loose!

- Make sure that the impeller bolt is fitted with a heli-coil insert.

7.6.5 Installation of the rolling bearings

1. Heat the deep groove ball bearing 321 to 80 - 100°C.
2. Push the deep groove ball bearing onto the drive shaft 213.
3. Slide on the support plate 550.2 and circlip 932.2.
4. Push the outer ring of the cylinder roller bearing 322 into the bearing support 330 up to the stop.
5. Attach the bearing bracket lantern 344 and fix into place with the hexagonal socket-head screw 914.2.
6 Press the drive shaft 213 and deep groove ball bearing 321 into the bearing support seat together. Use a drill or press spindle for this.
7. Fit the bearing cover 360 with the new radial seal ring 421.2 and fix into place with the hexagonal screws 901.2.
8. Fit the fan propeller with the corresponding circlips 932.1 onto the drive shaft.
9. Fit the drive lantern 341.
10. Tighten the hexagon nuts 920.9.

7.6.6 Fitting the interchangeable unit

Follow the steps specified in chapter 7.6.7 and 7.6.8.

7.6.7 Fitting the bearing support

WARNING

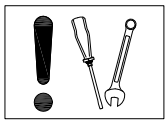
Tilting of pump

Danger of crushing hands or feet!

- Secure the pump by suspending or supporting it.

ATTENTION

Knocking of the outer magnets on the containment shell



Damage to containment shell or outer magnet!

- Always use guide bolts.

NOTE

Observe the image in Chapter 7.4.5!

1. Screw the ring screw into the thread of the drive shaft 213.
2. Lift the bearing support with a crane.
3. Use a new flat seal 400.15.
4. Lower the bearing support onto the bearing housing 350 using the guide bolts.
5. Tighten the hexagonal nut 920.7 with a torque wrench.

7.6.8 Fitting the rotating unit

WARNING

Tilting the rotating unit

Danger of crushing hands or feet!

- Secure the rotating unit by suspending or supporting it.

NOTE

Observe chapter 7.4.4!

1. Insert the rotating unit into the spiral housing.
2. Use a new flat seal 400.5.
3. Tighten the expansion screw nuts 926.1 with a torque wrench.
4. Fit the support leg 183 with a hexagonal screw 901.1 and disc plate 554.8.
5. Fasten the support leg to the base plate using a hexagonal screw.
6 Pull the coupling hub onto the end of the shaft.

7.6.9 Motor assembly

NOTE

The first two steps are not performed on versions with a removal coupling.

1. Move the motor to couple the pump and motor.
2. Fasten the motor on the base plate.
3. Align the pump and motor. Refer to Chapter 5.7.
4. Align the coupling. Refer to Chapter 5.6.

7.7 Tightening torques

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

Basis for calculation:

- 80% yield strength utilisation of bolt material.
- Friction coefficient μ = 0.14; use bolt lubricant for thread and head/nut contact area. Recommendation: Klüberpaste HEL 46-450.
- Torque controlled tightening via a torque wrench.

NOTE

Deviating screw tightening torques are stated on the pump data sheet.

Tightening torque for screw plugs (regardless of material):

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

Tightening torque for containment shell screws 914.7 (material 1.7225) = 30 Nm

Tightening torque for impeller nuts 922, retaining screw 900 and shaft nuts 921 (irrespective of material).

Bearing support	922		921 - Tightening torque [Nm]					900
	Tightening torque [Nm]	Wrench size	M27 x 1.5	M35 x 1.5	M38 x 1.5	M45 x 1.5	M65 x 1.5	Tightening torque [Nm]
I	100	30	90	---	---	---	---	40
II	120	41	90	120	---	---	---	
III	140	50	90	---	130	---	---	
IV	140	65	---	---	---	140	200	100

8. Troubleshooting

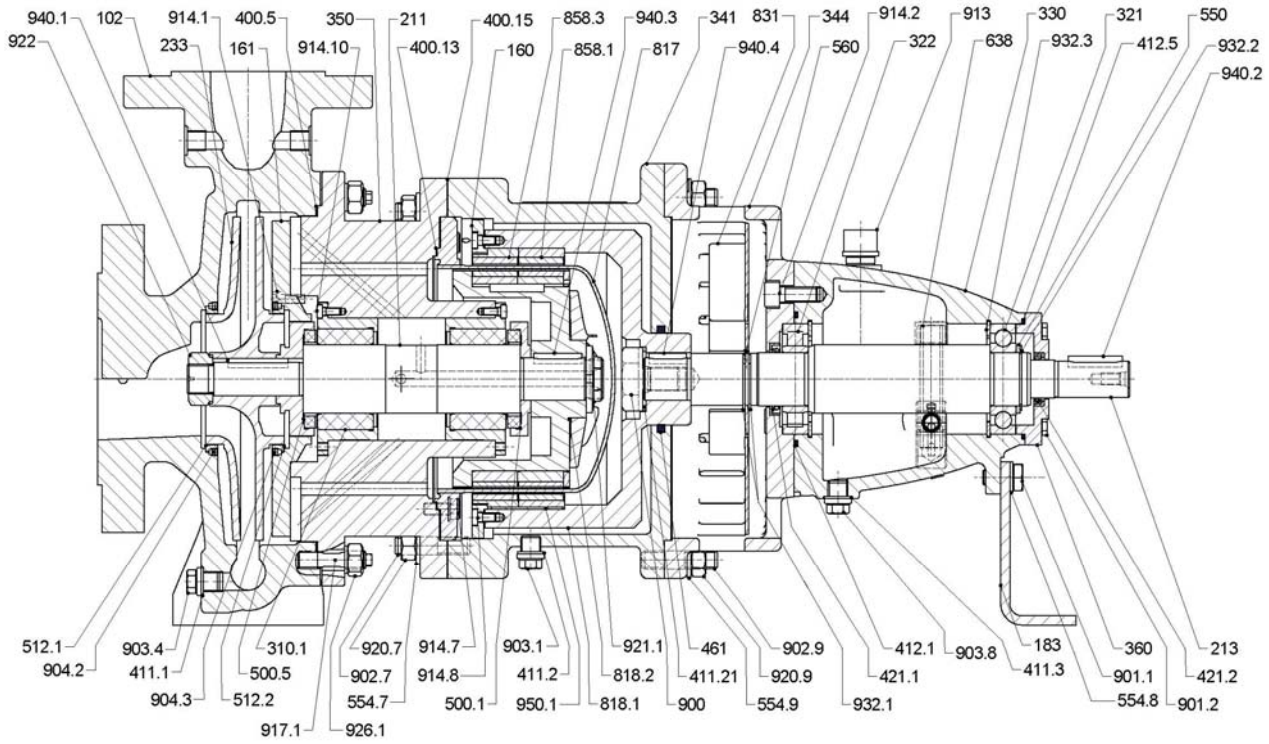
Fault	Number
Pump delivering not enough liquid or no liquid at all	1
Motor overloaded	2
Roller bearing temperature too high	3
Leakage on the pump	4
Increased noises and vibrations	5
Prohibited temperature increase	6
Plain bearing damage	7

Fault number							Cause	Remedy
1	2	3	4	5	6	7		
X				X	X		Pump or pipeline not fully vented or filled	Vent or fill
X							Shut-off valve in the infeed line not fully opened	Open the shut-off valve
X							Air cushion formation in the pipe	Change the routing of the pipe, install a venting valve
X							Incorrect direction of rotation	Swap the 2 phases of the power supply
X	X						Counter-pressure of pump is higher than specified	Re-adjust the duty point, increase the rotational speed Install a larger impeller
X	X				X		Viscosity of pumping medium is higher than specified	Consult the factory
X				X			Counter-pressure of pump is lower than specified	Trim the impeller Re-adjust the duty point
X				X	X	X	NPSHA too low	Check the fluid level Improve NPSHR with inducer Reduce resistances in the infeed line Open the shut-off valve in the infeed line fully
	X						Incorrect rotational speed	Check the rotational speed
		X		X			Pump unit is poorly aligned	Check the alignment of the coupling and realign it if necessary
		X		X			Pump strained in pipeline	Check the piping connections and pump fastenings
		X		X			Roller bearing damage	Replace the roller bearing
				X		X	Imbalance of rotating components, e.g. impeller	Rebalance components

Fault number							Cause	Remedy
1	2	3	4	5	6	7		
			X				Housing bolts and screw plugs loose	Tighten screws Install a new flat seal
		X					Coupling gap not correct	Correct the gap
		X					Cooling flow from motor to roller bearing missing	Check the system Install the impeller
X							Motor is bigger than nominal capacity of magnetic coupling	Use smaller motor Consult the factory
X							Star delta starting	Consult the factory
X					X	X	Magnetic coupling torque reduced	Check the torque
				X	X	X	Flow rate too low	Increase flow rate
X				X	X		Magnetic coupling decoupled	Shut off the motor and restart Check start-up safety Consult the factory
				X		X	Increased axial thrust	Check the wear ring play Consult the factory
					X	X	Boiling point exceeded in containment shell area	Temperature monitor on containment shell Increase pressure in containment shell Increase minimum capacity
					X	X	Internal circulation interrupted	Repairs required
		X					Insufficient, excess or inappropriate lubricant	Add, reduce or replace lubricant

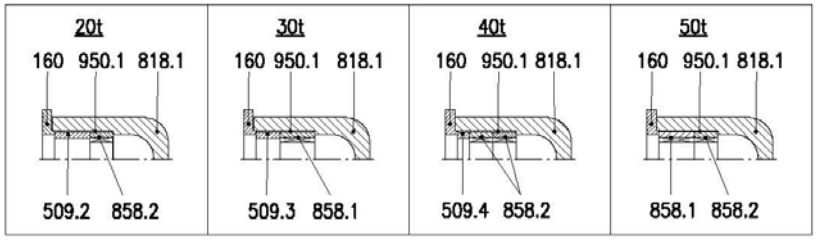
9. Sectional drawings

9.1 Bearing support I

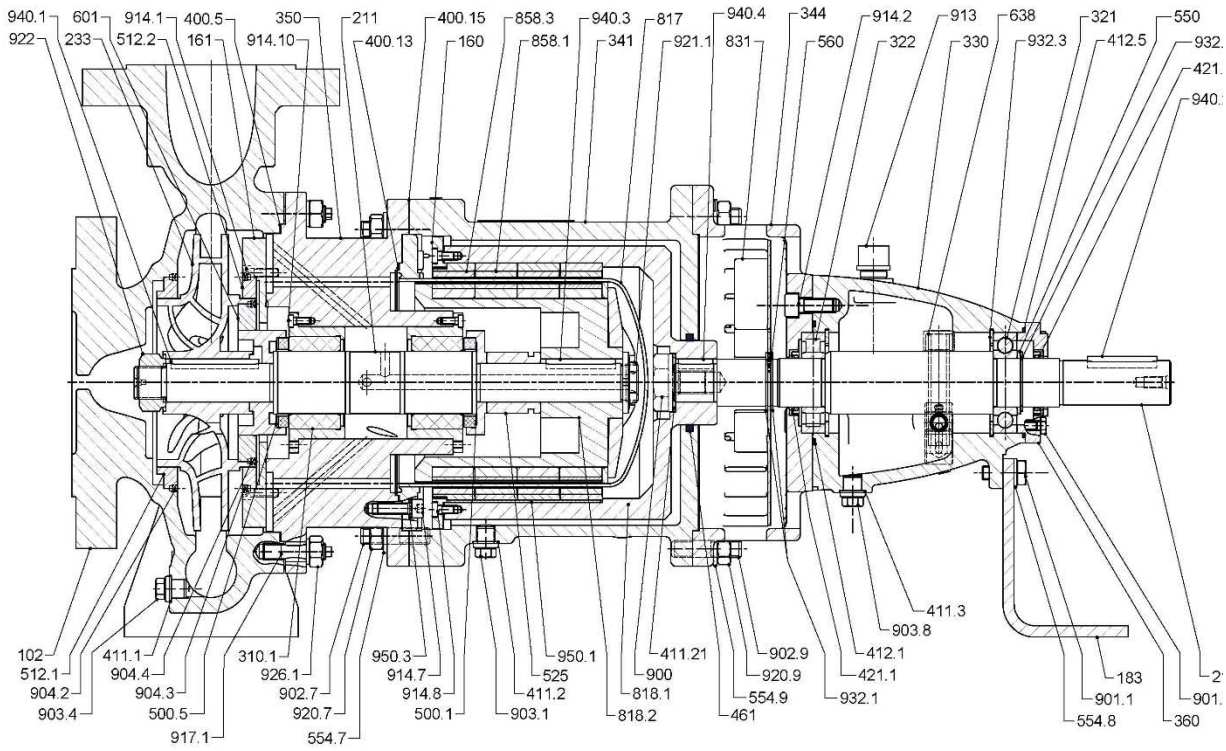


Overall diagram NMX bearing support I
Magnetic coupling = 60t

Other magnet arrangements:

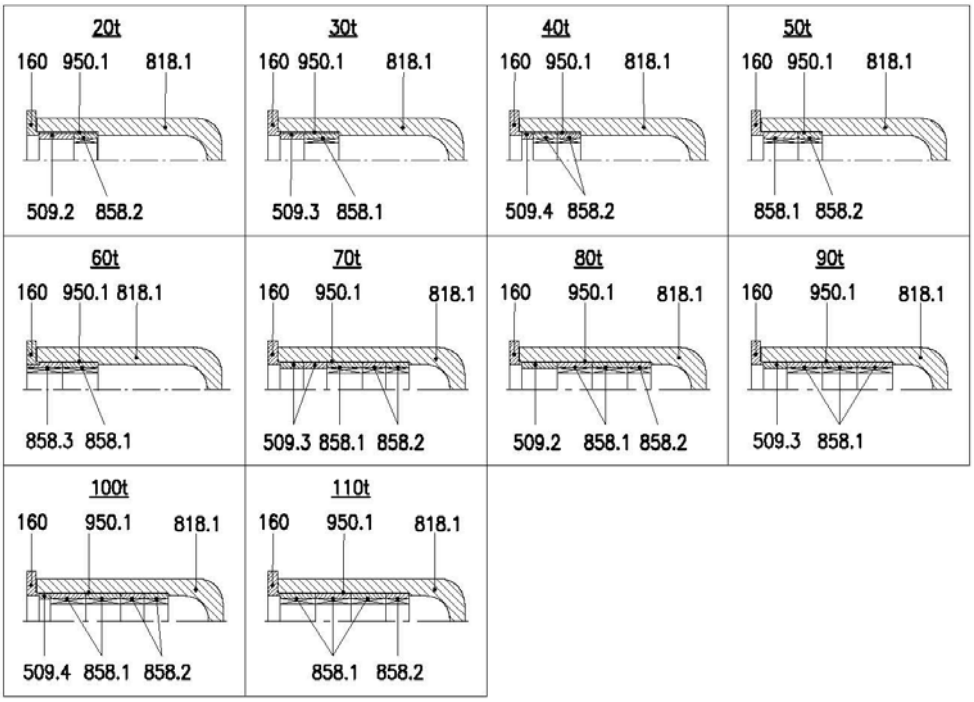


9.2 Bearing support II



Overall diagram NMX bearing support II
Magnetic coupling = 120t

Other magnet arrangements:



10. Certificates

10.1 EC Declaration of Conformity

EC Declaration of Conformity

as defined by EC-Machinery Directive 2006/42/EG, Annex II, No. 1A

DICKOW PUMPEN KG
Siemensstrasse 22
D-84478 Waldkraiburg, Germany

We hereby declare that the pump unit described in the data sheet

Designation	Centrifugal pump
Type:	NMX
Size:	
Execution:	
Serial no.:	

fulfills all the relevant provisions of the EC-Machinery Directive 2006/42/EC

Applied harmonized European standards in particular

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	

Furthermore the following standards and technical Specifications have been applied

EN ISO 15783:2003+A1:2008	VDMA 24276:2001
EN ISO 9906:2012	
EN ISO 2858:2010	

Waldkraiburg, _____

(Jürgen Konrad, Head of technical department DICKOW)

Mr. Konrad is empowered to draw up the declaration

10.2 Document of Compliance

DICKOW PUMPEN	Document of Compliance

Please complete this declaration to certify that the pump you wish to send in to us is safe from a health & safety point of view and enclose it with the pump.

Pump data

Type: Serial no.: PB

Reason for return

Contamination of the pump

☐ Potentially harmful liquids were **not** handled.

☐ Potentially harmful liquids were handled.

Pumped medium:

The pump has been

☐ cleaned ☐ flushed ☐ flamed

The following safety precautions must be taken before opening/repairing the pump:

Customer data

Company: Phone:
Fax:
Address: E-mail:

Name: Position:
(Block letters)

We hereby confirm that the above pump has been properly cleaned/flushed/flamed and that it can be safely repaired without risks to the person carrying out the work.

Date: Signature: