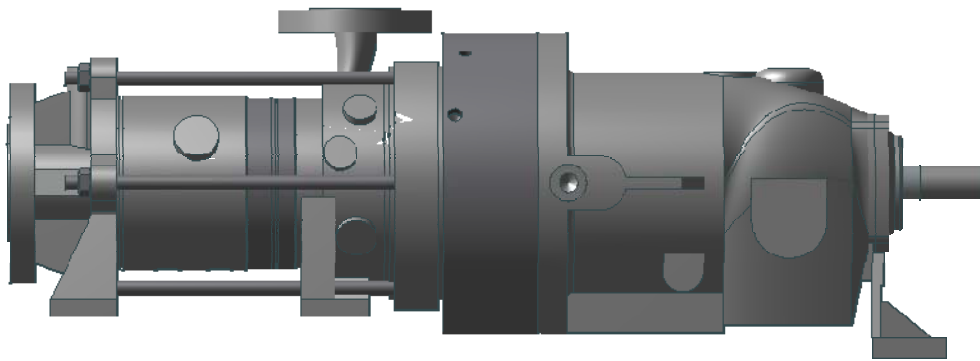


Operating / Installation Instructions

SCMR

No. 44.SCMR.E4.04/18



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
	signifies an imminent danger. If it will not be avoided, death or severe injury are the consequence.
	signifies a possibly dangerous situation. If it will not be avoided, death or severe injury may be the consequence.
	signifies a possibly dangerous situation. If it will not be avoided, slight or minor injury may be the consequence.
	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 the pump data sheet / operating manual regarding the minimum flow.
- Observe the pump data sheet / operating manual regarding the maximum flow.
- Never throttle pump on suction side.
- Maximum speed is 1450 rpm (+10%) at 50 cycles and 1750 rpm (+10%) at 60 cycles. Consider deviations mentioned in the pump data sheet

2.3 Avoidance of foreseeable operating errors

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

2.4 Qualification of personnel

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

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

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



2.5 Additional safety regulations

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

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

2.6 Safety instructions for the operator / user

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

2.7 Safety instructions for maintenance, inspection and assembly

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

2.8 Non-observance of the instruction manual

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

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



2.9 Notices on explosion protection

DANGER



Operation in explosive areas requires stringent attention to this chapter.

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

2.9.1 Surface temperature

The highest surface temperatures are to be expected at the pump casing, the 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. The containment shell temperature can be determined with Figure 1 and the following formula.

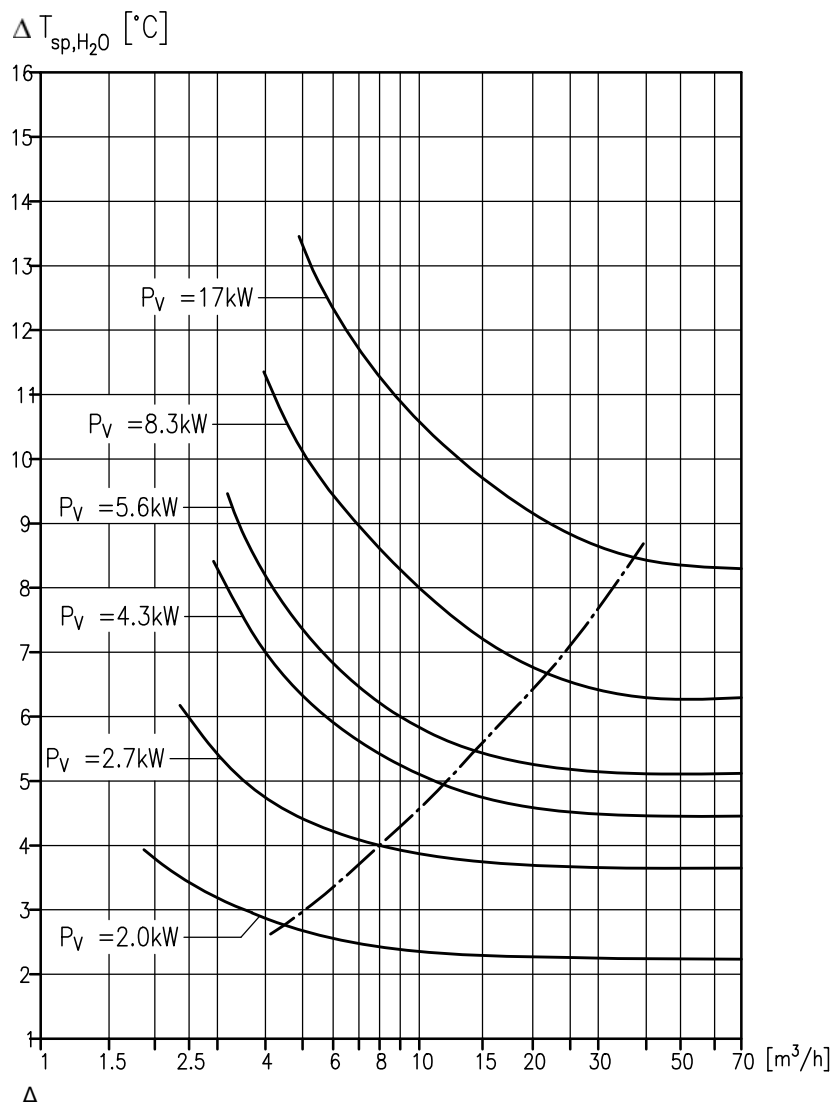


Fig. 1: Containment shell temperature as a function of magnet losses P_V based on water



2. Safety

$$T_{sp,liquid} = T_E + \Delta T_{sp,H_2O} \times \frac{C_{H_2O}}{C_{liquid}} \times \frac{\rho_{H_2O}}{\rho_{liquid}}$$

T_E = inlet temperature of product at suction flange

$\Delta T_{sp,H_2O}$ = refer to Figure 1

C_{H_2O} = specific heat capacity of water = 4,187 kJ / kgK

C_{liquid} = specific heat capacity of handled liquid [kJ / kgK]

ρ_{H_2O} = density of water = 1 kg / dm³

ρ_{liquid} = density of handled liquid [kg / dm³]

NOTE



If pumps are equipped with ceramic or PEEK containment shell, no magnet losses P_v will occur.

The surface temperature of the containment shell is almost equal to the temperature of the handled liquid.

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:

- **Plugging of internal circulation channels**
The wetted area of the magnet coupling is cooled by an internal circulation. Interruption of this internal circulation through certain properties of the liquid handled can cause an inadmissible temperature rise.
- **Desynchronisation of the magnet coupling**
Overstressing, overheating or non-observance of the design data may result in desynchronisation of the magnet coupling. The generated magnet losses may cause temperature rise of the containment shell.
- **Product leakage**
If a containment shell is damaged (= rare failure) and leaking liquid 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**
- **Dry run**
A temporary dry run can already lead to inadmissible surface temperatures and wear due to the small clearance between side channel impellers and stage disks.



2. Safety

The following monitoring devices can be supplied:

- Liquid level limit switch to avoid dry running.
- Temperature monitoring of the containment shell to controlling elevated temperatures of the containment shell.
- Power monitor for controlling minimum flow and/or maximum flow and detection of dry run and desynchronisation of the magnet coupling.
- 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 where ever sealless design and selfpriming ability is required. This applies for instance to dangerous, explosive, toxic and other harmful but clean or gaseous liquids without solids which are handled in the chemical, petrochemical and general industry.

3.2 Design code

Example: SCMR h 3562 A 21 / 1,0 / 36 / 1 / 2

	Pump code
SCMR	pump type
h	material execution; e.g. h = 1.4408 / 1.4571
35	nominal width discharge flange = 32 mm
6	design; e.g. 6 = end suction flange
2	number of stages
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]
36	magnet length [mm]
1	circulation; e.g. 1 = internal
2	sleeve bearing design; e.g. 2 = shrink fitted

3.3 Pump sizes

Pump size	Magnet length [mm]
25	18 / 36 / 54 / 72 / 90 / 108
35	
40	
45	20 / 30 / 40 / 50 / 60 70 / 80 / 90 / 100 / 110 / 120
50	
65	



3.4 Identification

3.4.1 Name tag

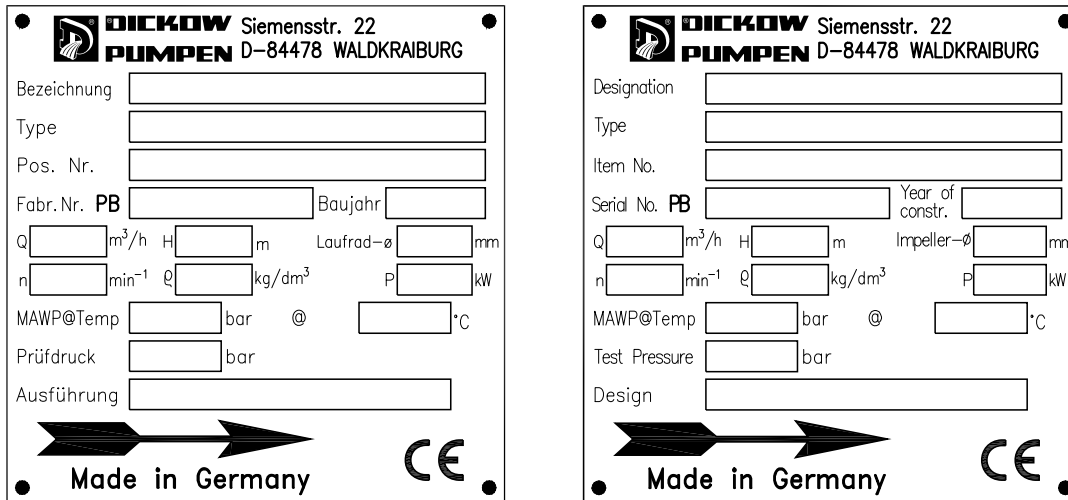


Fig. 2: Name tag German and English

3.4.2 Identification acc. to Explosion Proof Directive

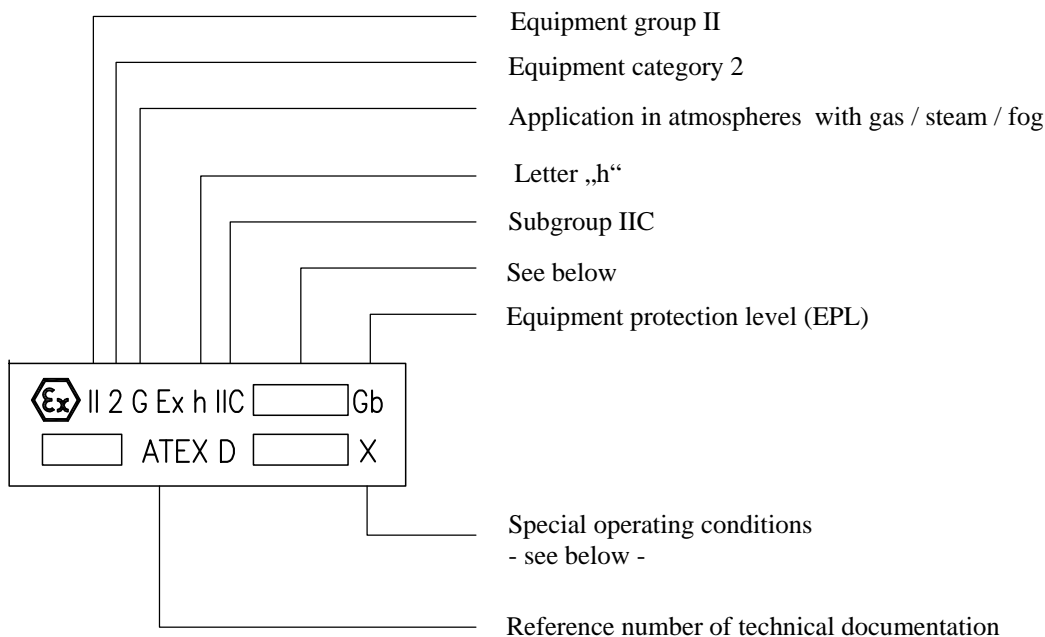


Fig. 3: ATEX- nameplate

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

- side channel pump
- horizontal installation
- multistage
- selfpriming

Pump casing

- end suction flange (vertical suction flange on request)
- vertical discharge flange
- cast-on feet

Impeller

- suction impeller
- star-shaped side channel impellers

Bearing

- motor end: cylinder roller bearing as loose bearing and grooved ball bearing as fixed bearing
- oil lubrication
- 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.

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 against exceedance of boiling point in the magnet chamber and serves as a lubrication of the sleeve bearings.

3.5.2 Operating temperature > 180°C

Above an operating temperature of 180°C to max. 240°C, the basic design will be modified in order to relieve the tension caused by thermal expansion. The modification includes:

- casing screws with cup springs (1)
- mounting the suction casing with set-screw (2) to the base frame (3)



3. Description

- wear resistant design with SiC-rings
- elastic mounted sleeve bearings (4)
- compensators must be provided on suction side (5)

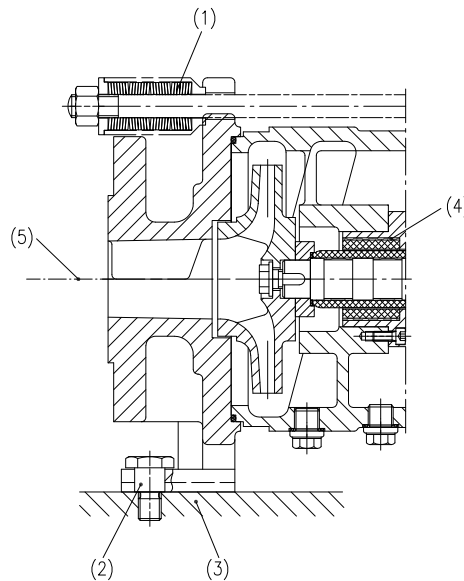


Fig. 4: Modifications for operating temperature $> 180^{\circ}\text{C}$

3.6 Scope of supply

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

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

3.7 Dimensions and Weights

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



4. Handling / Storage / Disposal

4.1 Handling

DANGER

Slipping of pump / pump unit from its suspension

Danger of life through components falling down!



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

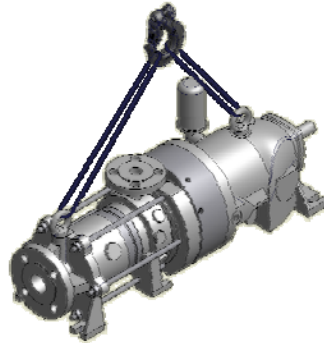


Fig. 5: lifting the pump

NOTE

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

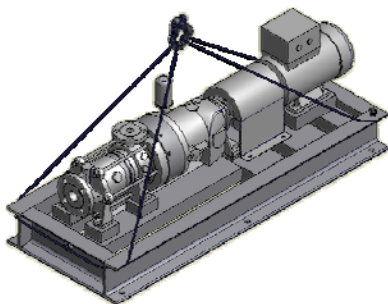


Fig. 6: lifting the complete pump unit

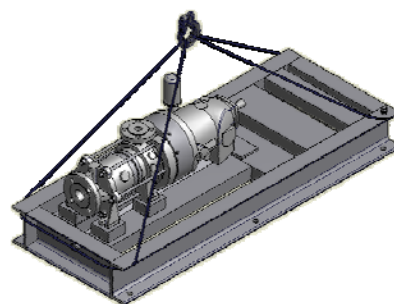
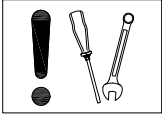


Fig. 7: lifting the pump mounted on base plate



4.2 Storage / Preservation

ATTENTION

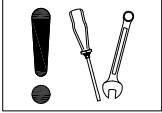


Damage during storage through moisture or dirt.

Corrosion and / or contamination of the pump!

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

ATTENTION



Wetted, contaminated or damaged openings and joints.

Leakage or damage of the pump!

- Plugged openings should be uncovered only during installation.

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

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

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

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

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

4.3 Return of pump

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

NOTE



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

<http://www.dickow.de/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) $\leq 0,5$. Provide a pourable consistency by using a mobile solvent. Cure of concrete according to DIN 1045.



5. Installation / Mounting

5.3.2 Installation without foundation

Installation without foundation requires a solid and even ground.

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

5.4 Piping

DANGER



Exceedance of the allowable loads at the pump flanges

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

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

5.4.1 Suction pipe

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

- Mounting of elbows close to the pump suction must be avoided. Provide a straight pipe of minimum two suction pipe diameters
- Never connect a larger suction pipe direct to the pump. Flow eddies reduce the free flow area of the pump. Use an eccentric reducer. Consider the figures below.

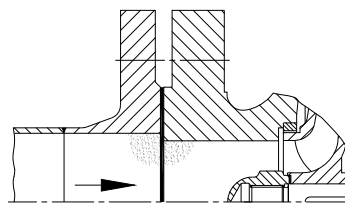


Fig. 8: flow eddies

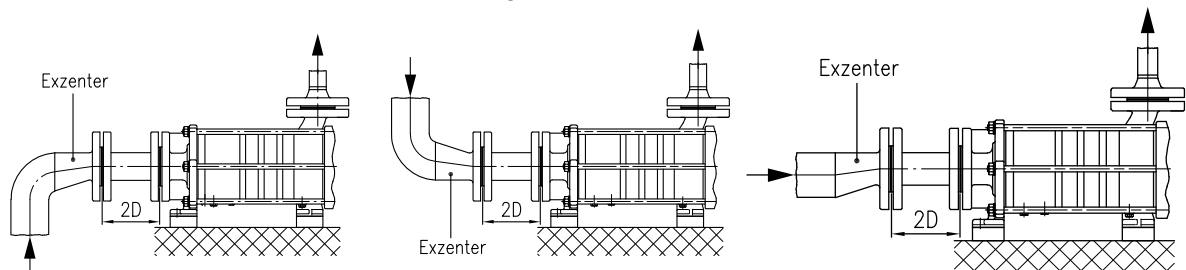


Fig. 9: reducer connection

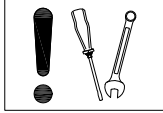
- At suction lift conditions, the suction pipe must continuously slope upwards towards pump suction. Avoid air pockets.



5. Installation / Mounting

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

ATTENTION



Welding beads, scale and other impurities in the piping.

Damage of the pump!

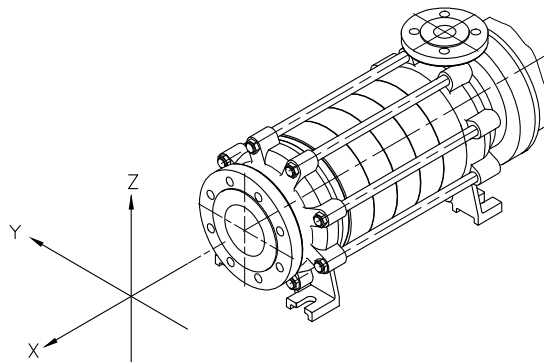
- Piping must be thoroughly cleaned before connecting the pump.
- Remove impurities from the pipes.
- If required, insert a filter.

NOTE



- Use a filter with a mesh width of 0,2 mm.
- Insert filter with a surface of minimum triple the pipe section.

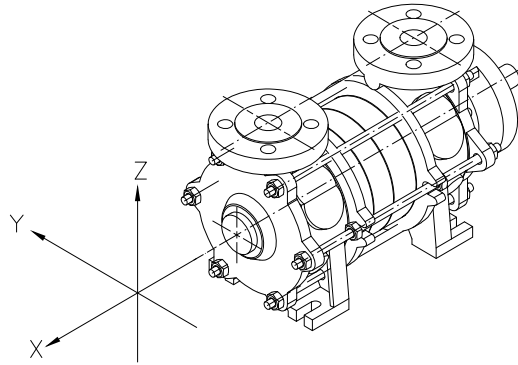
5.4.2 Allowable flange forces and moments



Pump size	Suction flange										Discharge flange											
	DN	F _x [N]		F _y [N]		F _z [N]		Σ F [N]		Σ M [Nm]		DN	F _x [N]		F _y [N]		F _z [N]		Σ F [N]		Σ M [Nm]	
		GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS		GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS
25	40	375	750	330	660	300	600	585	1170	490	980	25	225	450	210	420	255	510	390	780	280	560
35	40	375	750	330	660	300	600	585	1170	490	980	32	270	540	255	510	315	630	495	990	385	770
40	40	375	750	330	660	300	600	585	1170	490	980	32	270	540	255	510	315	630	495	990	385	770
45	65	630	1260	555	1110	510	1020	990	1980	595	1190	50	450	900	405	810	495	990	780	1560	543	1085
50	65	630	1260	555	1110	510	1020	990	1980	595	1190	50	450	900	405	810	495	990	780	1560	543	1085
65	80	750	1500	675	1350	615	1230	1185	2370	648	1295	65	555	1110	510	1020	630	1260	990	1980	595	1190

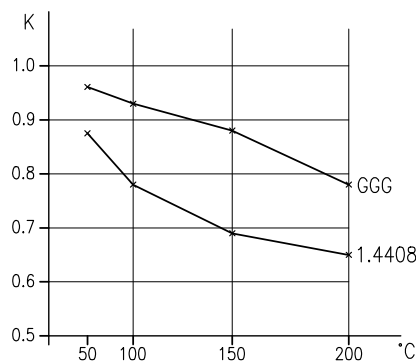


5. Installation / Mounting



Pump size	Suction + discharge flange										
	DN	Fx [N]		Fy [N]		Fz [N]		Σ F [N]		Σ M [Nm]	
		GGG	GS	GGG	GS	GGG	GS	GGG	GS	GGG	GS
25	25	225	450	210	420	255	510	390	780	280	560
35	32	270	540	255	510	315	630	495	990	385	770
40	32	270	540	255	510	315	630	495	990	385	770
45	50	450	900	405	810	495	990	780	1560	543	1085
50	50	450	900	405	810	495	990	780	1560	543	1085
65	65	555	1110	510	1020	630	1260	990	1980	595	1190

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



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

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

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



5.5 Insulation

WARNING



Wetted casing parts adopt the temperature of the pumped liquid.

Risk of burns !

- Insulate casing parts
- Attach protective device

ATTENTION



Heat accumulation in the bearing bracket

Bearing damage !

- Do not insulate the bearing bracket

5.6 Coupling alignment

DANGER



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

Danger of explosion !

- Proper alignment of coupling must anytime be ensured.

WARNING

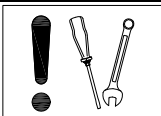


Unintentional switch-on of the pump unit

Risk of injury through moving components!

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

ATTENTION



Offset of pump shaft and motor shaft

Damage of pump, motor and coupling!

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

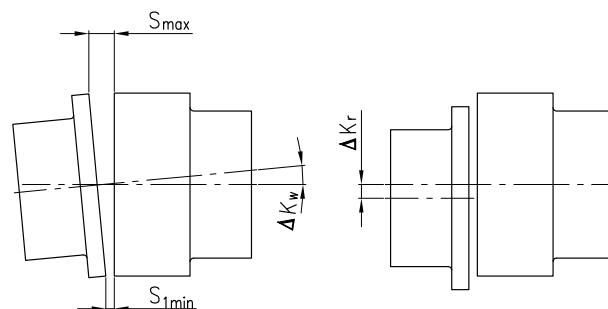


Fig. 10: Angular and radial misalignment of couplings



5. Installation / Mounting

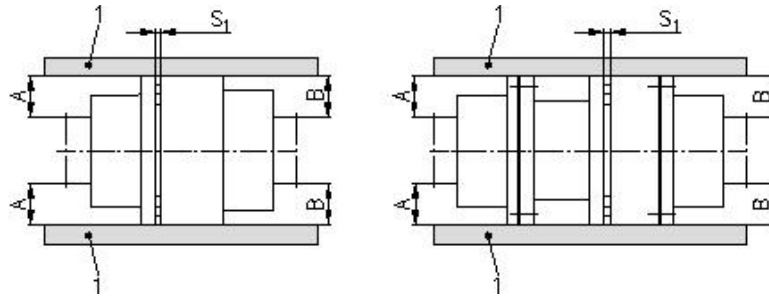


Fig. 11: Coupling alignment

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 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.

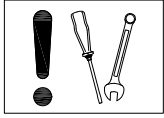
Use shims for height compensation.

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.



5. Installation / Mounting

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

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. Installation / Mounting

5.8.1 Checking rotating direction

DANGER

Temperature rise through parts touching each other

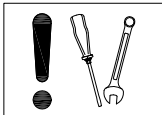


Danger of explosion !

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

ATTENTION

Wrong rotating direction of motor and pump



Damage of the pump!

- Consider the rotating direction arrow on the pump.

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



6. Commissioning / Decommissioning

6.1 Commissioning

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

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

6.1.1 Filling of lubrication oil

ATTENTION



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

Damage of antifriction bearings !

- Check oil level regularly. Oil level = centerline of sight glass
- Oil reservoir must always be sufficiently filled.
- Thread hole of constant level oiler must be horizontal

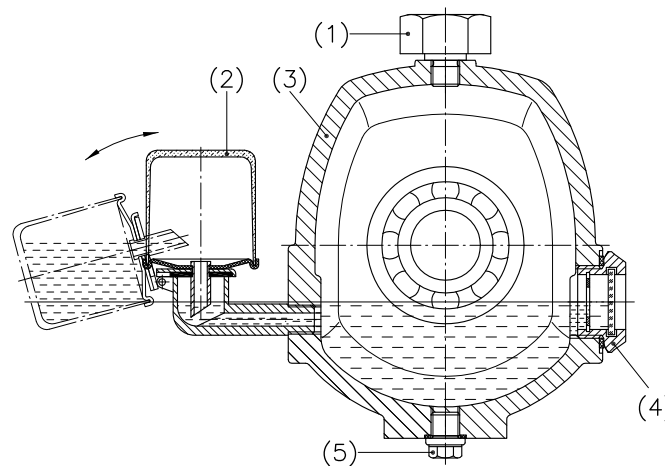


Fig. 12: filling of bearing bracket

1. Unscrew vent plug (1) (see Fig.).
2. Fold down the constant level oiler (2) – away from bearing bracket (3) – and hold it tight.
3. Fill in the oil through the vent plug bore (1) until the filling level reaches the connection pipe of the constant level oiler (2)
4. Fill up the oil reservoir to the maximum.
5. Fold back the constant level oiler (2) to its original position.
6. Screw in the vent plug (1).
7. Check the oil level in the oil reservoir of the constant level oiler (4) after a few minutes.
Oil level = centerline of sight glass. If necessary, repeat steps 4 to 6.



6. Commissioning / Decommissioning

NOTE



Exceeding oil level causes temperature increase or oil leakage.

For filling quantity and oil quality refer to chapter 7.2.2.

6.1.2 Filling the pump

DANGER

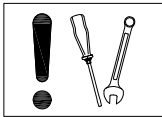
Formation of explosive atmosphere inside the pump



Danger of explosion!

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

ATTENTION



Operation with empty pump

Damage of sleeve bearing / mechanical seal!

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

1. Fill the pump with liquid.
2. Open shut-off valve in suction pipe completely.
3. Open all additional connections completely (e.g. external circulation, external flush)

6.1.3 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.



6. Commissioning / Decommissioning

DANGER

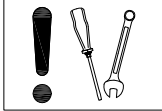


Elevated temperature through decoupling of the magnet coupling

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

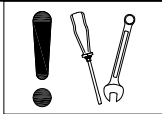


High surface temperatures through hot liquids

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.

6.3 Impeller trimming

Impeller trimming is not possible for this pump type.

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. Commissioning / Decommissioning

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

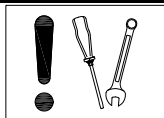


High surface temperature of the containment shell

Danger of explosion / Fire hazard!

- If necessary, monitor the containment shell temperature.

ATTENTION

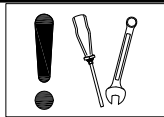


Wear caused by dry run

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 / Life time of antifriction bearings

DANGER



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

Danger of explosion ! Fire hazard !

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



7. Maintenance / Servicing / Inspection

Lubrication of antifriction bearings is normally provided by mineral oils of viscosity grade ISO VG 46 or 68 with a kinematic viscosity of 46-68 mm²/s at 40°C. These can be the following mineral oils for example:

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

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

Pump size	Filling Qty [l]
25 - 40	0,65
45 - 65	0,85

NOTE



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

Particularly suitable are:

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

NOTE



If the ambient temperature is < -20°C low-viscous mineral oils, suitable for low-temperature and of viscosity grade ISO VG 5 or 10 shall be used. Observe the comments in the pump data sheet.

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

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.

7.2.3 Oil change

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



WARNING



Lubricating liquids dangerous to health

Danger for individuals and environment!

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

7.3 Drainage and Disposal

WARNING



Pumped liquids dangerous to life

Endangering for individuals and environment!

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

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

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

7.4 Disassembly of pump unit

7.4.1 General instructions

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

DANGER



Working on the pump unit without sufficient preparation

Risk of injury!

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

WARNING



Improper handling and lifting of heavy components

Personal injury and material damage!

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



7. Maintenance / Servicing / Inspection

7.4.2 Removal of driver

5. Disconnect the motor.
6. Remove coupling guard.
7. Remove the hold down bolts of the motor from the baseplate.
8. Decouple pump and motor by displacing the motor.

WARNING



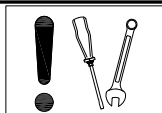
Tilting the motor

Squeezing of hands and feet !

- Secure the motor by lifting or bracing.

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:

Designation	Dimension / size / dwg.No.		for part No.
	pump size 25 - 40	pump size 45 – 65	
Disassembling sleeve	60.1903	60.1903	524
Socket wrench	60.863	60.670	900
Assembly tool	60.1885	60.1886	321.2/213
Knipex-plier wrench	46 mm / 1 ¾"	46 mm / 1 ¾"	940
Inner hexagon cap screw	M4 x 35		940.3
Inner hexagon cap screw	3x M5 x 35	3x M5 x 35	310
Inner hexagon cap screw	M5 x 12	M5 x 12	940.1
Hex-wrench	size 3, 4, 5, 6	size 4, 5, 6	
Special tong	60.1427	60.1427	932.2
Fixing plate	60.1967	60.1968 (45+50) 60.2114 (65)	557/558/940.1
Puller incl. jack plate	60.2094/1883	60.2095/1883	322
Ring screw	M8	M12	bearing bracket
Hook spanner	35-60	35-60	921.1/3



7.4.4 Disassembly of bearing bracket

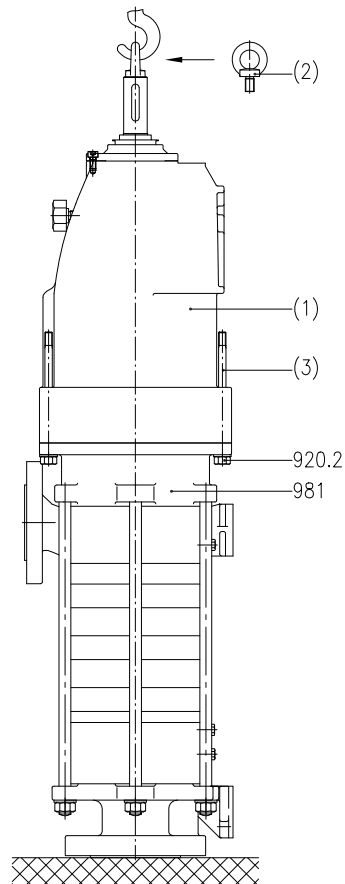


Fig. 13: Disassembly of bearing bracket

1. Remove the motor, consider chapter 7.4.2.
2. Remove the pumps from the piping.
3. Place the pump in vertical position on a clean and even bench.
4. Remove hexagon nut 920.2 from intermediate flange 981.
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 careful.



7.4.5 Disassembly of antifriction bearings

The works according to chapter 7.4.4 are completed.

1. Clamp the bearing bracket unit with drive shaft 213 in a jaw chuck/vice. Use braces!
2. Fit the socket wrench – see chapter 7.4.3 – to the fixing screw 900.
3. Remove the fixing screw 900 (left hand thread).
4. Pull out the drive rotor from bearing bracket unit and place it on a clean and even bench.

WARNING



Tilting the drive rotor and bearing bracket unit

Squeezing of hands and feet!

- Secure rotor and bearing bracket unit by lifting or bracing.

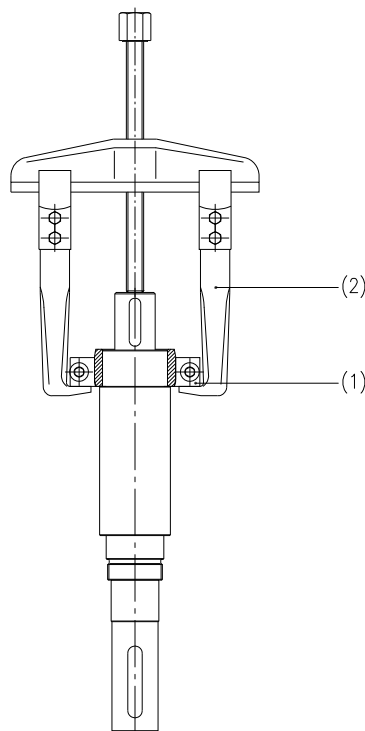


Fig. 14: Disassembly inner ring cylinder roller bearing

5. Fix the drive unit to the bench and secure it against twisting.
6. Remove key 940.2.
7. Loosen grub screw 904.4 and pull off deflector 507.2 from drive shaft.
8. Loosen inner hexagon cap screws 914.9 and remove them together with bearing cover 360.1.
9. Press the drive shaft 213 with a press- or drilling spindle out off the bearing bracket 330.
10. Fit the pull-off device (1) – see chapter 7.4.3 – to the inner ring of cylinder roller bearing and screw it down.
11. Place the puller (2) and pull off the inner ring of cylinder roller bearing.
12. Reinsert key 940.2 and press it in by a Knipex-plier wrench.
13. Clamp the drive shaft 213 in a jaw chuck/vice. Use braces.
14. Loosen shaft nut 921.1 with a hook spanner – see chapter 7.4.3 – (left hand thread).
15. Remove key 940.2.
16. Pull off the antifriction bearing 321 from drive shaft 213 using a puller.
17. Loosen inner hexagon cap screw 914.10 and remove it together with bearing cover 360.2.
18. Press the outer ring of cylinder roller bearing 322 out off the bearing bracket seat.



7.4.6 Replacement of antifriction bearings

Pump size	321	322
25 - 40	6207	NU 207 C3
45 - 65	6208	NU 2208 C3

7.4.7 Disassembly of containment shell

The works according to chapter 7.4.4 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 914.2.
2. Loosen containment shell by jack screws.

WARNING



Axial magnetic forces

Danger of squeezing fingers and hands!

- Use non-magnetic tools only.

7.4.8 Disassembly of impellers

The works according to chapter 7.4.7 are completed.

1. Clamp the pump at the rotor in vertical position in a jaw chuck (1). Protect the rotor by braces.
2. Loosen hexagon nut 920.1.
3. Pull off suction casing 106.
4. Loosen inner hexagon cap screw 914.6 respectively impeller nut 922 (left hand thread).
5. Pull off suction impeller 231.
6. Remove key 940.5 and intermediate ring 509.1.
7. Pull off diffuser 170 with sleeve bearing 310.1.
8. Fit disassembling sleeve – see chapter 7.4.3 – to the shaft sleeve 524 and fasten it.
9. Fit the puller and take off the shaft sleeve.
10. Remove tolerance ring 500.4 and intermediate ring 509.3.
11. Remove side channel stages as follows:
 - Pull off suction disk 558.1/2
 - Pull off side channel impeller 235
 - Remove key 940.1
 - Pull off pressure disk 557.2/1 with sleeve bearing 310.3.
12. Pull off discharge casing 107 together with intermediate ring 509.4.

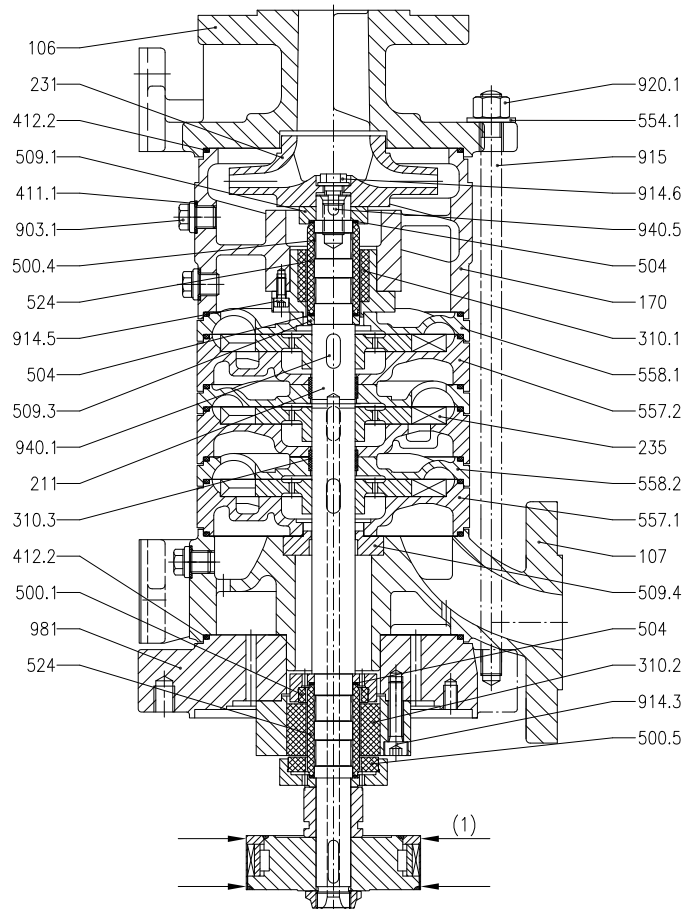


Fig. 15: disassembly of impellers

13. Loosen inner hexagon cap screw 914.3, loosen intermediate flange 981 from the centring and pull it off together with casing screws 915.

7.4.9 Disassembly of rotor and sleeve bearing

The works according to chapter 7.4.8 are completed.

1. Stress the rotor and clamp the pump shaft in a vise.
2. Loosen shaft nut 921.3 with a hook spanner (right hand thread).
3. 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.

4. Remove key 940.4.
5. Remove distance sleeve 525, start-up ring 500.5 and sleeve bearing 310.2.



7.4.10 Disassembly of shaft sleeve

The works according to chapter 7.4.9 are completed.

WARNING



Possibly available residues of pumped liquid

Danger for individuals and environment!

- Wear protective clothing.

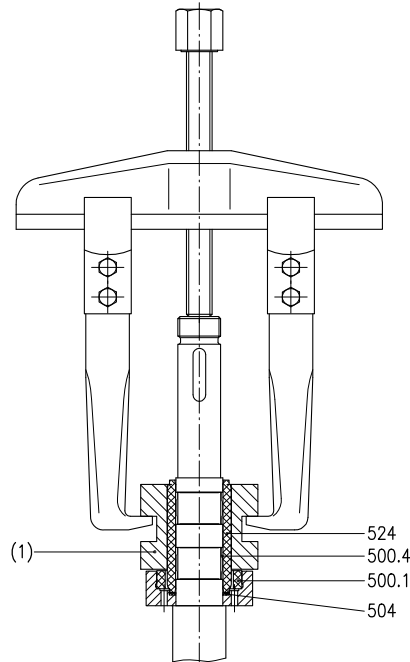


Fig. 16: Disassembling sleeve

1. Clamp the pump shaft unit in a jaw chuck.
2. Fit the disassembling sleeve (1) – see chapter 7.4.3 – to the shaft sleeve 524 and fasten it.
3. Fit the puller and remove the shaft sleeve.
4. Remove tolerance ring 500.4 and start-up ring 500.1.

7.5 Inspection

7.5.1 Impeller, suction and pressure disk

Suction capability is highly dependent on the axial clearance between impellers and suction and pressure disks. The manufacturing tolerances are calculated such that the total axial clearance is 0,18 mm. Natural wear will enlarge the clearance and reduce the selfpriming capability. Wear is very much depending on the nature of the pumped liquid.

Reliable statements about lifetime are therefore not possible. Replacement of the components is generally recommended if traces of wear are distinctly visible.



7. Maintenance / Servicing / Inspection

7.5.2 Magnet coupling

Driven rotor 818.2

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

Drive rotor 818.1

Replace outer magnets if mechanical or chemical damage is visible.

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 10% is allowed. Larger reduction requires exchange of magnet coupling.

Pump size	Magnet length [mm]	Torque [Nm]
25 - 40	18	19
	36	38
	54	60
	72	76
	90	95
	108	114
45 - 65	20	41
	30	63
	40	90
	50	115
	60	138
	70	165
	80	190
	90	210
	100	235
	110	260
	120	280

7.5.3 SiC-Sleeve bearings / Shaft sleeves

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

Pump size 25 - 40	=	0,184 mm
Pump size 45 / 50	=	suction side 0,184 mm; rotor side 0,194 mm
Pump size 65	=	0,194 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:

pump size 25 - 40	→	72,009 mm
pump size 45 - 65	→	80,009 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 and O-rings 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

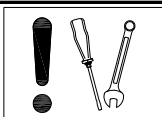


Personal injury and material damage!

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

ATTENTION

Unprofessional assembly

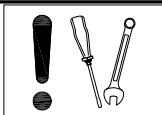


Damage of the pump!

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

ATTENTION

Improper mounting



Damage of outer magnet coupling!

- Use guide rods.

The following must be checked prior to assembly:

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



7.6.2 Assembly of shaft sleeve

1. Slide the start-up ring and the 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

7.6.3 Assembly of rotor and sleeve bearing

The works according to chapter 7.6.2 are completed.

1. Slide on sleeve bearing 310.2, start-up ring 500.5 and new distance ring 504.
2. Slide on distance sleeve 525.
3. Insert key 940.4 and press it in by using a Knipex-plier wrench.
4. Slide on the rotor 818.2.
5. Tighten the shaft nut 921.3 by a hook spanner (right hand thread).

WARNING



Axial magnetic force

Danger of squeezing fingers and hands!

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

7.6.4 Assembly of impellers

The works according to chapter 7.6.3 are completed.

1. Clamp the rotor with pump shaft in a jaw chuck. Protect the rotor by braces.
2. Fit the intermediate flange 981 with casing screws 915.
3. Tighten inner hexagon cap screws 914.3.
4. Fit the discharge casing 107 together with intermediate ring 509.4. Do not forget the O-ring 412.2.
5. Assemble the side channel stages as follows: (Don't forget O-rings 412.2)
 - Slide on the pressure disk 557.2/1
 - Insert the sleeve bearing 310.3
 - Insert key 940.1 and press it in by Knipex-plier wrench
 - Slide on the suction disk 558.1/2

NOTE



Suction (1) and pressure disks (2) are oppositely arranged and both provided with one thin and one thick marking (4). The pressure disk 557.1 (5) must be mounted to the discharge casing (6) with the thin marking upwards. The matching suction disk must also be installed with the thin marking upwards. The thick marking follows next and then thin and thick markings in turn.

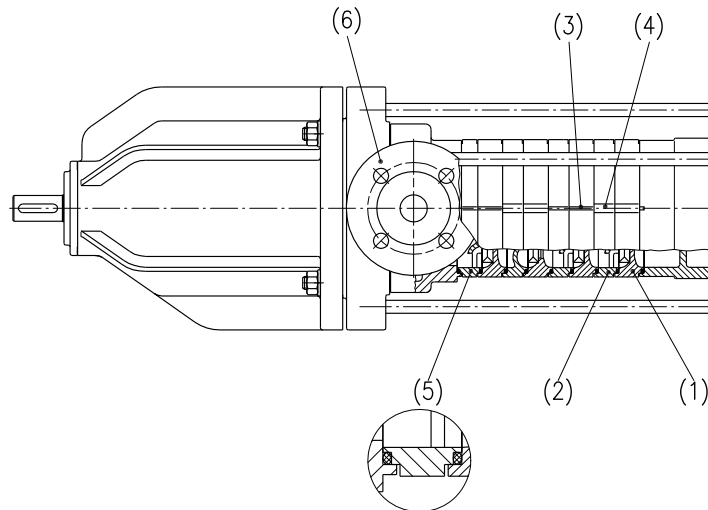


Fig. 17: Assembly of suction and pressure disks

NOTE



For inserting the key 940.1, screw two thread rods (size 25 – 40 = M12 x 1000, size 45 – 65 = M16 x 1000) into the intermediate flange 981 and press suction and pressure disk together using a fixing plate – see chapter 7.4.3.

6. Slide on intermediate ring 509.3 and insert tolerance rings 500.4 in the grooves.
7. Slide on shaft sleeve. Consider chapter 7.6.2 !
8. Slide on diffuser 170 with sleeve bearing 310.1.
9. Slide on intermediate ring 509.1.
10. Insert key 940.5 and press it in by Knipex-plier wrench.
11. Slide on suction impeller 231.
12. Tighten inner hexagon cap screw 914.6 respectively impeller nut 922 (left hand thread).
13. Fit suction casing 106..
14. Tighten hexagon nuts 920.1.

7.6.5 Assembly of containment shell

The works according to chapter 7.6.4 are completed.

1. Fit containment shell. Use new gasket 400.4.
2. Tighten inner hexagon cap screws 914.2 by torque wrench.



7.6.6 Assembly of antifriction bearings

1. Heat up the inner ring of cylinder roller bearing 322 to 80-100°C.
2. Push the inner ring onto the drive shaft 213 up to the shaft collar.
3. Press the outer ring of cylinder roller bearing 322 into the bearing bracket 330 until limit.
4. Fit the bearing cover 360.2 and fasten it with inner hexagon cap screws 914.10.
5. Clamp the drive shaft 213 in a jaw chuck.
6. Heat up the antifriction bearing 321 to 80-100°C and slide it onto the drive shaft 213 up to the shaft collar.

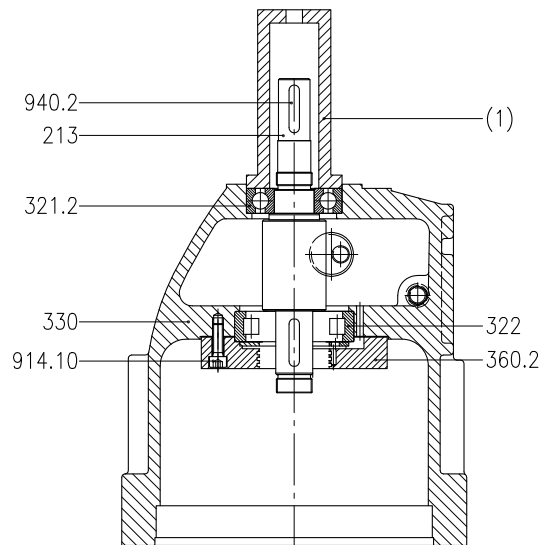


Fig. 18: Assembly antifriction bearing

7. Fit the drive shaft 213 to the bearing bracket seat of the antifriction bearing 321 and press it in with the assembling tool (1) (without spindle) – see chapter 7.4.3. Use a press- or drilling spindle.
8. Screw on the shaft nut 921.2 and fasten it with a hook spanner – see chapter 7.4.3 (right hand thread).
9. Fit the bearing cover 360.1 and fasten it with inner hexagon cap screws 914.5.
10. Fit the deflector 507.2 and secure it with grub screw 904.4.
11. Insert the drive rotor unit into the bearing bracket unit.
12. Screw in the fixing screw 900 and fasten it (left hand thread). Do not forget O-ring 412.14.

7.6.7 Assembly of bearing bracket

WARNING

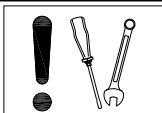


Tilting the pump

Squeezing of hands and feet!

- Secure the pump by lifting or bracing.

ATTENTION



Outer magnets are touching the containment shell

Damage of containment shell or outer magnets!

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



NOTE



Consider the figure in chapter 7.4.4!

1. Screw the ring screw into the thread of 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 intermediate flange 981.
5. Tighten the hexagon nut 920.2 by torque wrench.

7.6.8 Motor assembly

NOTE



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

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

7.7 Bolt torques

	Bolt torque [Nm]	
	8.8 standard bolt	A4-70 standard bolt
M5	5	4
M6	9	6
M8	22	16
M10	45	30
M12	80	55
M16	195	135

pump size	Bolt torque [Nm] for casing screws 915/920.1	
	C45	1.4122
25 - 40	60	70
45 - 65	150	170



7. Maintenance / Servicing / Inspection

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 torques 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 914.2 = 40 Nm

Bolt torque for impeller nut 922 respectively inner hexagon cap screw 914.6, fixing screw 900 and shaft nut 921 (independent of material)

pump size	922 bzw. 914.6		921 – Bolt torque [Nm]				900 [Nm]
	Bolt torque [Nm]	wrench size	M20 x 1,5	M27 x 1,5	M32 x 1,5	M38 x 1,5	
25 - 40	30	13	80	---	110	---	40
45 + 50			---	90	---	130	
65	120	41					



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
Suction capacity too low	8

Failure number								Problem	Elimination
1	2	3	4	5	6	7	8		
X				X	X		X	Pump or piping not completely vented or filled	Venting respectively filling
X							X	Shut-off valve in suction line not completely opened	Open shut-off valve
X							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
X	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	Readjust the duty point by discharge valve
X				X	X	X		NPSHA too low	Check liquid level in suction tank Reduce resistances in suction line Open shut-off valve in suction line completely
	X							Wrong speed	Check speed
		X		X				Pump unit is not correctly aligned	Check coupling alignment and correct if necessary
		X		X				Pump stressed by piping	Check piping connections and pump mounting
		X		X				Ball bearing damage	Renew antifriction bearings
				X		X		Unbalance of rotating parts	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

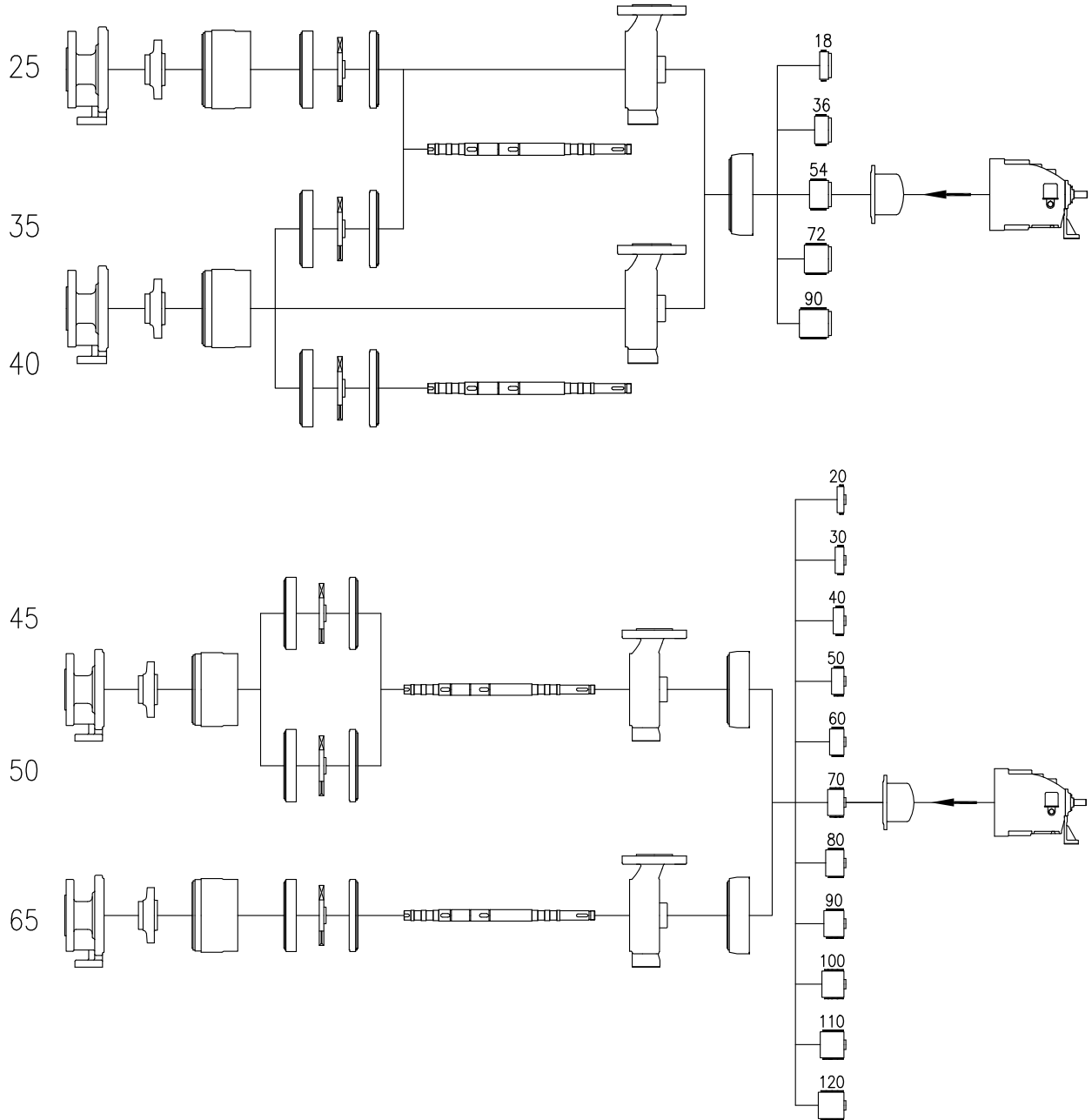


8. Troubleshooting

Failure number								Problem	Elimination
1	2	3	4	5	6	7	8		
		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		Increased thrust load	Consult the factory
					X	X		Boiling point exceedance in containment shell area	Temperature monitor on containment shell Increase pressure in containment shell Increase minimum capacity
						X	X	Abrasive solids	Abrasive solids are not allowed Consult the factory
							X	Axial clearance of impellers too big	Replace parts
							X	Suction height too high	Check liquid level



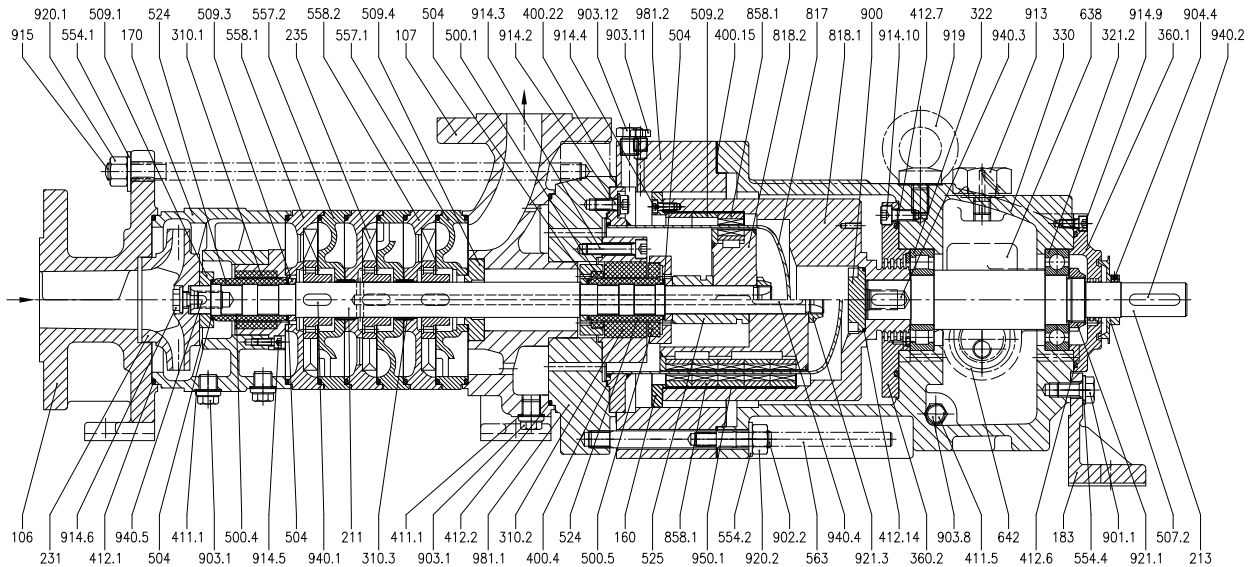
9. Interchangeability





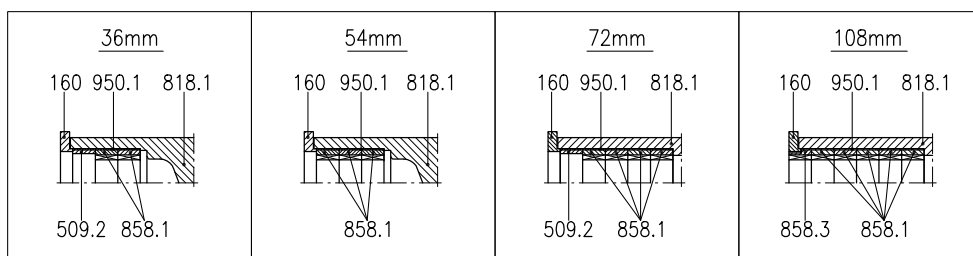
10. Sectional drawings

10.1 Pump size 256 - 406



Sectional drawing SCMR – Pump size 256 - 406
Top magnet coupling = 18 mm magnet length
Bottom magnet coupling = 90 mm magnet length

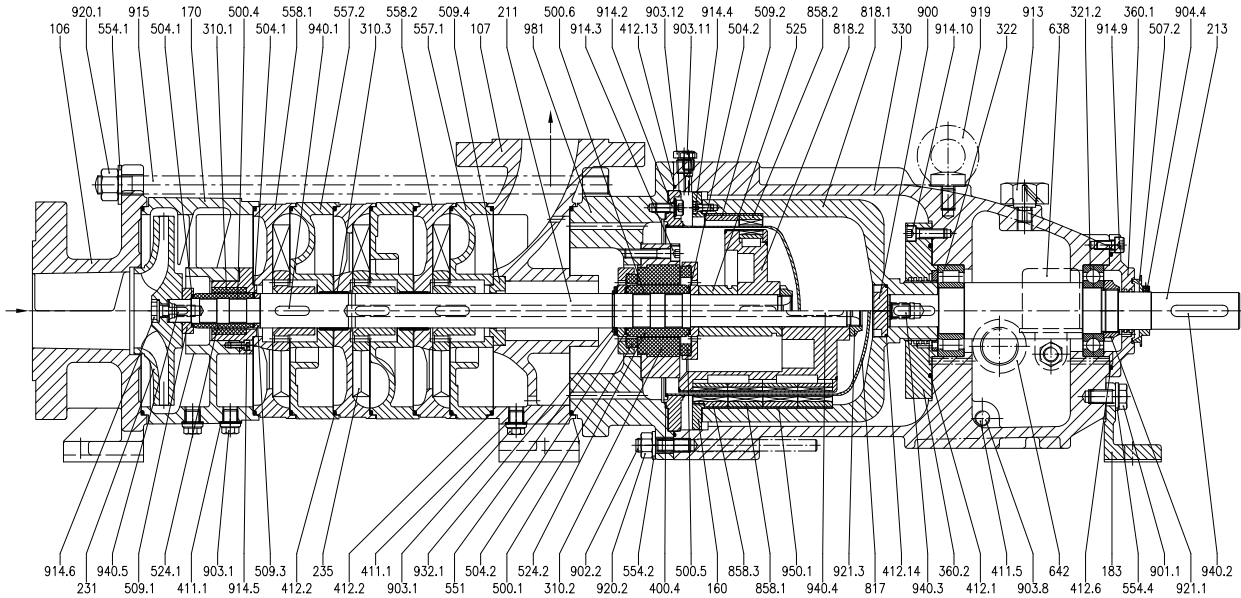
Further possible magnet arrangements:





10. Sectional drawings

10.2 Pump size 456 - 506

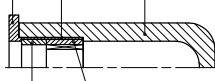
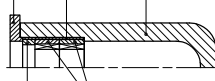
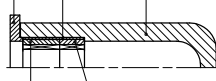
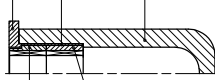

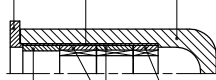
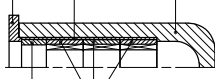




Sectional drawing SCMR – Pump size 456 - 506

Top magnet coupling = 20 mm magnet length

Bottom magnet coupling = 120 mm magnet length

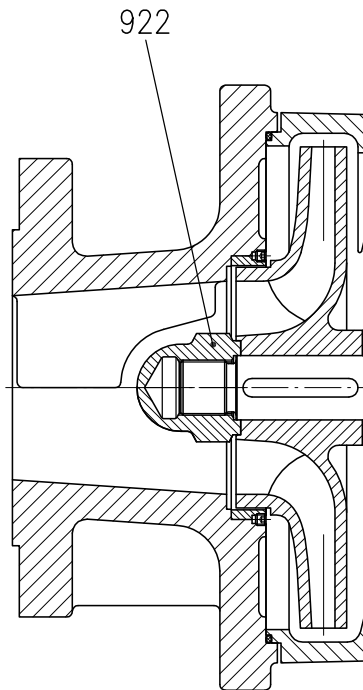
Further possible magnet arrangements:

<p><u>30mm</u></p> <p>160 950.1 818.1</p>  <p>509.5 858.1</p>	<p><u>40mm</u></p> <p>160 950.1 818.1</p>  <p>509.6 858.2</p>	<p><u>50mm</u></p> <p>160 950.1 818.1</p>  <p>858.1 858.2</p>
<p><u>60mm</u></p> <p>160 950.1 818.1</p>  <p>858.3 858.1</p>	<p><u>70mm</u></p> <p>160 950.1 818.1</p>  <p>509.5 858.1 858.2</p>	<p><u>80mm</u></p> <p>160 950.1 818.1</p>  <p>509.2 858.1 858.2</p>
<p><u>90mm</u></p> <p>160 950.1 818.1</p>  <p>509.5 858.1</p>	<p><u>100mm</u></p> <p>160 950.1 818.1</p>  <p>509.6 858.1 858.2</p>	<p><u>110mm</u></p> <p>160 950.1 818.1</p>  <p>858.1 858.2</p>



10. Sectional drawings

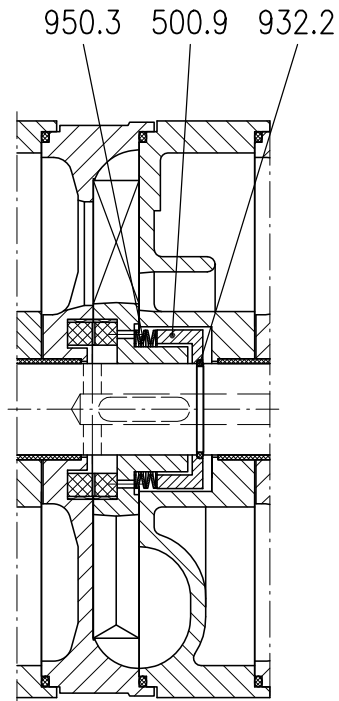
10.2.1 Impeller nut, pump size 65



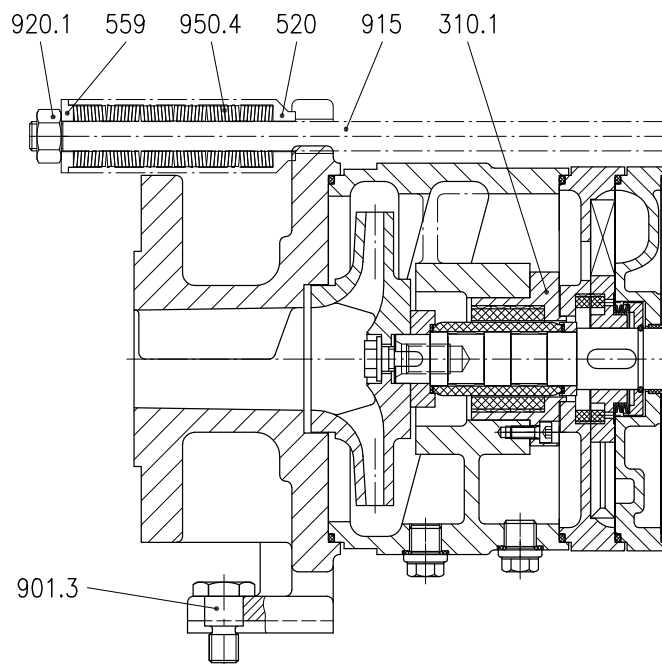


10.3 Special design

10.4.1 wear resistant design



10.4.2 High temperature design (see also chapter 3.5.2)





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 : Side channel pump
Type: SCMR
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	VDMA 24276:2001
EN ISO 9906:2012	


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	
Please fill in this statement for health innocuousness completely and attach it to the pump to be returned to the factory.		
<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:	