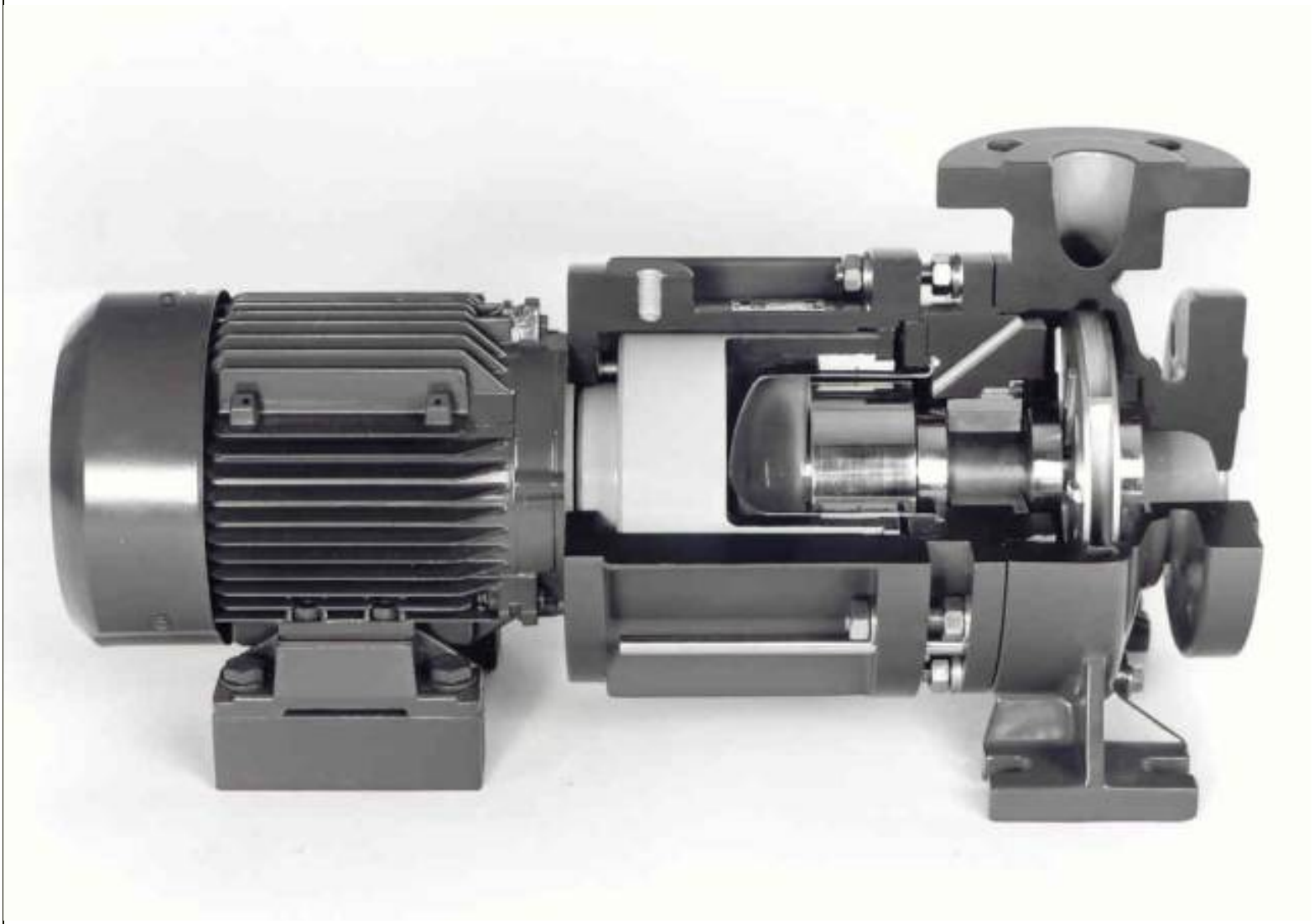
Installation, Operation and Maintenance Instructions

Type KMB CE

No. 44 KMB.E1.04/02



Pump sizes:

26/125
26/170
26/210
40/125
40/165
40/210
50/125

50/165
50/210

DICKOW PUMPEN KG

EC Declaration of Conformity

as defined by Machinery Directive 98/37EG Annex II A

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

Series „KMB“

complies with the following provisions applying to it

Machinery Directive 98/37EG, Annex I No. 1

Applied harmonized standards in particular

DIN EN 809
EN 292 Part 1
EN 292 Part 2

Applied national technical standards and specifications in particular

ISO 2548 (DIN 1944)
DIN 24250
DIN 31001
DIN EN 12723
DIN EN 22858
DIN ISO 5199
VDMA 24276
VDMA 24279

Manufacturer:

DICKOW PUMPEN KG
Siemensstraße 22
D-84478 Waldkraiburg

Importer in country of use

(Signature)

(Signature)

Installation, Operating and Maintenance Instructions for DICKOW – Close Coupled Chemical Pumps with Magnet Drive, Type KMB	44.KMB.E1. 04/02

TABLE OF CONTENTS

2. GENERAL INFORMATIONS

2.1 INTRODUCTION

This manual provides instructions for the installation, operation and maintenance of the DICKOW-model KMB, close coupled sealless pump with magnetic coupling.

It is essential that this manual be thoroughly reviewed and that complete comprehension of the matters explained herein is attained before attempting installation and start-

up.

The design, materials and workmanship incorporated into the DICKOW-Pump are based on years of experience. They assure trouble-free service throughout the lifetime of the pump. However, like any rotating equipment, satisfactory performance depends on correct initial sizing, proper installation, periodic inspec- tion, monitoring of operating conditions (temperature, vibration, flow) and prescribed maintenance. This Manual has been prepared to assist the operator in understanding the workings of the DICKOW-Pump and to assure proper installation, operation and maintenance.

2.2 LIMITED WARRANTY

DICKOW warrants that DICKOW-Pumps and Parts are free, upon installation and start-up per this Manual and under rated use and service, from defects in design, material, and workmanship for a period of one (1) year from date of installation, but not to exceed eighteen (18) months from date of shipment by DICKOW. This warranty does not cover

1. any loss or damage resulting from wear, corrosion, abrasion or deterioration due to normal use in rated service;
2. replacement of service items such as outer antifrictional bearings;
3. products or parts manufactured by others but furnished by DICKOW which, if defective, shall be repaired or replaced only to the extent of the original manufacturer´s warranty;
4. any loss or damages to, or defects in any such products or parts resulting from the misuse or improper storage, installation or operation thereof; or
5. any loss or damages to, or defects in, any such products or parts resulting from any alteration or modification of the products or parts not expressly authorized and approved by DICKOW in writing.

DICKOW shall not be liable, directly or indirectly under any circumstances, in an amount greater than the purchase price nor for consequential or incidental damages, including, but not limited, to: any loss of business or profits, and labor, material or other charges, claims for losses or damages incurred or suffered from, in connection with, or in consequence of the working upon, alteration, or repair of any such defective products or parts by persons or firms other than DICKOW. DICKOW´s liability for breach of warranty here- under is limited solely to the repair or to the replacement, F.O.B. DICKOW facility, as the case may be, of any products or parts which shall have been determined by DICKOW, after written notice to DICKOW, and inspection by DICKOW within the warranty period, to be so defective when shipped by DICKOW.

THIS WARRANTY AND THE LIABILITY SET FORTH HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER LIABILITIES AND WARRANTIES, EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.

2.3 FACTORY INSPECTION

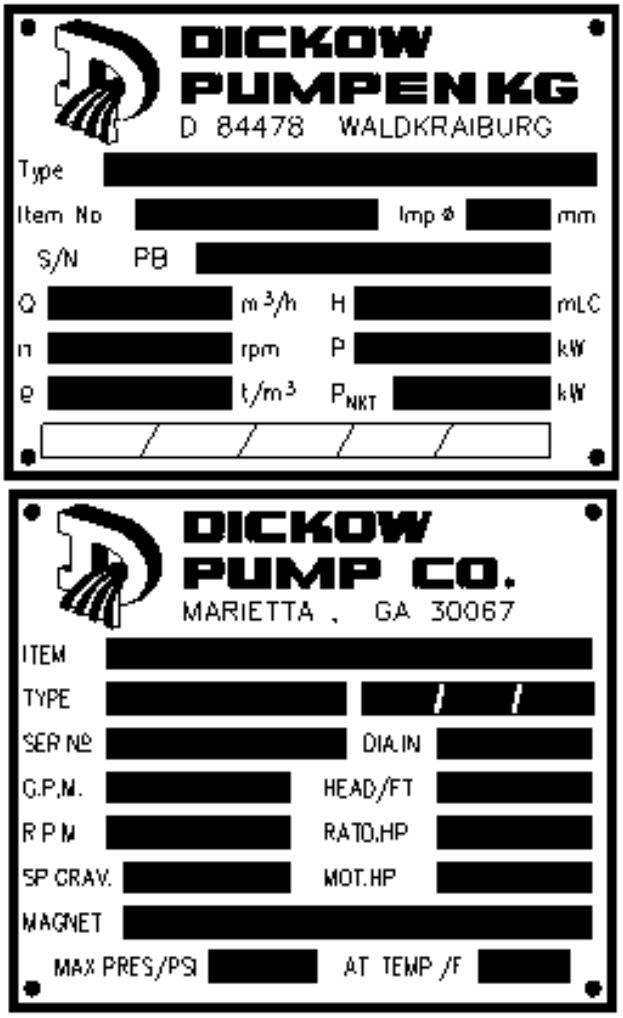
Before delivery, all pumps are performance-tested in our factory test area at the specified speed. Test liquid is water at 20°C (68°F). Test pressure and the specified service conditions (capacity, differential head and absorbed power) are documented and reconfirmed by a shop expert. Inspection test certificates according to EN 10204 (DIN 50049 3.1B), pressure test certificates and performance reports are available on request.

Certificates of further characteristics such as vibration, NPSH-value, noise level etc., are available if specified in the purchase order.

The hydraulic test is performed in accordance with ISO 2548, class C (DIN 1944-III), the pressure test is performed with 1,5-times the maximum operating pressure unless otherwise specified.

2.4 NAME TAG INFORMATION

A **B**



A name tag is located on the motor lantern of each pump providing the following information:

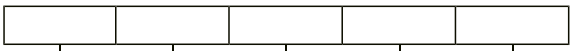
Name Tag „A“

TYPE: Pump type and size
P_{NKT}:..... Maximum transmissible coupling power at operating temp.
IMP. ∅: Installed impeller diameter
S/N PB: Pump serial No.
RTD.PUMP DATA: According to your order

Name Tag „B“

TYPE: Pump type and size - Suction / discharge / nom.impeller dia

SER.NO: Pump serial No.
DIA IN: Installed impeller diameter
RTD. PUMP DATA: According to Purchase Order
MAGNET: Axial magnet length
MAX PRES/PSI: Maximum allowable pressure on containment shell at Temp/°F



Specification of magnetic coupling

Sleeve bearing desing:
2 = shrink fitted

Circulation flow:
1 = internal

Axial magnet length
(mm)

Thickness of containment shell
(mm)

Material:	Containm.shell	Cont.shell adapter	Rotor
1=	1.4571 *	1.4571 *	1.4571 *
2 =	Hastelloy C	1.4571 *	1.4571 *
3 =	Hastelloy C	Hastelloy C	Hastelloy C
4 =	Hastelloy C	Hastelloy C	1.4539 / Hastelloy C

*) 1.4571 equivalent to 316 SS

Attention !

The rated motor power may not exceed the maximum transmissible power of the magnets, otherwise the magnets will slip during start-up.

2.4.1 Spare Parts Orders

When ordering spare parts or when contacting our application engineers about problems, you need to state the pump model, size, serial number, and the item number of the required parts.

2.5 SAFETY

2.5.1 Symbol- and Notice Explanation

2.5.1.1 Work Safety Symbol

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This symbol will be found in this manual at all remarks for operational safety, where risks for health and life of personnel may be posed.
Please observe these points and be cautious in these cases. All cautions should also be passed on to other users. Apart from the cautions in this manual, the generally accepted safety rules must be adhered to.

2.5.1.2 Attention Notice

Attention !

To the items marked with ATTENTION in this manual, special attention must be paid in order to maintain a correct operating procedure and to avoid damage and destruction of the machines and/or other plant equipment.

2.5.2 Work Safety Instructions

2.5.2.1 Special Notice when handling magnetic parts

All magnetic driven pumps contain extremely strong magnets which may pose health risks. The following guidelines must always be observed.

2.5.2.2 Notice to risks of health and accidents

§ When handling magnetic parts, danger from magnet fields is possible. Individuals with artificial cardiac pacemakers should keep distance from pumps with permanent-magnetic couplings and not perform any maintenance or other repairs on such machines.

§ Individuals with implanted defibrillators, metallic prosthetic heart valves, internal wound clips (from surgery), prosthetic joints, metallic wiring, or other metallic prosthetic devices shall avoid working with, being in proximity of, or handling the magnets contained in the pumps.

§ Individuals with sickle cell anemia or those with significant blood pressure elevation shall also avoid work on this unit. Individuals who have had previous surgeries (chest or head) and who do not know if they have metallic clips internally, should avoid work on this unit unless it can be firmly established by the physician that no metallic devices exist.

§ The strong magnetic forces can cause parts and tools to slam together, injuring hands and fingers. Use of non-magnetic tools and special care is recommended.

2.5.2.3 General Notices

§ Credit Cards:
Credit Cards or information on the credit card´s magnetic tape can be erased and shall be kept away from the proximity of all magnets.

§ Computers, computer tapes, computer discs:
Keep magnets away from computers, computer tapes and computer discs or any computer memory device to prevent damage.

§ When handling magnets all watches should be removed. Magnets have affected the workings of mechanical spring driven watches as well as chip and electronically controlled watches.

2.5.2.4 General Instructions for pump´s operation

The sealless pumps of type KMB are manufactured in accordance with state of the Art-Technology and are safe to operate. However, these units bear danger if they are inexpertly installed or handled.

Each person who is in charge of assembly, installation, operating and maintenance of KMB-pumps in a plant, must have read and understood the complete manual and particularly item 2.5 „Safety“.

Special attention must be paid to the following points when operating the pump:

§ When maintaining the pump, power supply to the driver must be interrupted and secured against unauthorized restart.

§ Never disassemble pump before completely drained and cleaned from pumped liquid.

§ Never use heat for pump disassembly.

Attention !

§ Never start pump without making sure it is primed and the pump and suction line is completely filled with liquid.

§ Never run pump with discharge valve closed or below minimum flow.

§ Never run pump dry.

§ Never operate pump without safety devices installed.

§ Never operate pump with suction valve closed or with clogged suction strainer.

3. PUMP DESCRIPTION

3.1 APPLICATION

DICKOW-KMB-pumps are used where ever sealless design is required (i.e. when pumping dangerous, explosive or toxic liquids). Wear resistant inner slide bearings as well as the sealless design increase availability and reduce both maintenance and total costs of ownership.

KMB-pumps are suitable for a temperature range of -50 to 200°C (-58 to 390°F).

3.2 CONSTRUCTION

The model KMB is a sealless single flow centrifugal pump of back-pull-out design with a closed impeller, driven by a synchronous magnetic coupling. The flange to flange dimensions meet the standards of DIN EN 22858.
Disassembly of the rotating hydraulic part, complete with magnetic coupling and bearing, is possible without loosening suction and discharge flange. The bearing bracket with the drive magnets can also be removed without stress-relieving the pump. This enables changing of the ball bearings without draining the pump.

3.2.1 Volute casing, part 102

The volute casing is sealed on drive side by the bearing housing. The bearing housing ist screwed to the volute casing by studs. The pumped liquid is sealed from the atmosphere by a confined gasket. Replaceable wear rings are available in the standard configuration. Raced face flanges are standard.
The volute casing is provided with cast-on feet for mounting on the baseplate.

Complete drainage of the pump including the magnet area is possible through the drain connection at the bottom of the casing in the standard configuration.

3.2.2 Impeller, part 233

The closed impeller is keyed to the pump shaft and secured by the rotor nut. Impellers are dynamically balanced according to DIN ISO 1940/part 1, grade G 6.3. To minimize thrust loads, the impellers are hydraulically balanced.

3.2.3 Bearing housing, part 350 – internal circulation

The bearing housing connects the pump casing with the drive unit. The stationary, wetted sleeve bearing is arranged in the hub of the bearing housing.

Pumps in operation generate eddy currents in the metallic containment shell which heat up the product in the gap between rotor and containment shell. This heat is dissipated thru an internal circulation. The circulation flow leads from discharge to discharge and pressurizes the magnet end to prevent flashing of the pumped liquid in this area. This circulation plan ensures that no pumped liquid of elevated temperature enters the suction side through the impeller eye area. Therefore, handling of boiling liquids with low NPSH-requirements is possible.

The magnet area is self-venting: gas or air in the containment shell area escapes through the internal circulation holes which enable also complete drainage thru the volute casing.

3.2.4 Sleeve bearing

The pump shaft with impeller and driven inner magnet is carried in wetted sleeve bearings. Standard bearing material is „Pure sintered alpha grade Silicon Carbide“ with additional diamond like carbon layer to achieve dry running

capability. Since no axial load occurs due to the hydraulical balance, the sleeve bearings in operation serve as start-up rings only. The SiC components have an almost unlimited life as long as a stable fluid film is available between the sliding surfaces, that means as long as the boiling temperature is not exceeded in the magnet area.

3.2.5 Magnet Coupling

The magnet coupling is a coaxial synchronous type using rare earth magnets. This concept results in a compact design and allows the impeller to turn at the same speed as the motor, i.e. there is no slip between the drive and driven magnets.
Energy is transmitted to the hermetcally sealed liquid end by the outer drive magnets, passing motive force through the containment shell to the internal drive magnets. The inner magnet ring transmits the required torque direct to the impeller. Overload of the magnetic coupling and slipping will not effect demagnetization if a reliable monitoring device prevents overheating of the magnets. Driven rotor and rotor cover are welded such that the inner magnets are sealed from the pumped liquid.

3.2.6 Containment shell, part 817

The containment shell is bolted to the bearing housing and sealed from the atmosphere by a confined O-ring. The containment shell is stressed by the pump pressure only. The shell is fabricated in one piece, no welding joints are available.

Damage of the containment shell through incorrect operation or insufficient control can cause penetration of the product to the atmosphere. For handling dangerous products, appropriate safety- and monitoring devices must be provided.

3.2.7 Motor and motor bearing lantern

The drive motor is screwed to the intermediate flange via the motor lantern. Standard motors of flange/foot design in accordance with DIN IEC 34, section T7, design B35 are provided. The EC Declaration of Conformity confirms the observance of the EMV-Rules 89/336/EWG and the Low Voltage Rules, especially DIN EN 60204, as well as the VBG4. A report of tests according to DIN EN 6024 (VDE 113) § 20 is also supplied.

4. INSTALLATION

Attention !

Installation, foundation and maintenance of pumps handling inflammable liquids AI, AII, AIII, B and other pollutive products may only be performed by companies or their personnel who possess the permission acc. to the local state regulations regarding the water protection law.

4.1 RECEIVING THE PUMP

Inspect the pump as soon as it is received. Make notes of damaged or missing items on the receipt and freight bill. File any claims with the transportation company immediately. Check for identical speed on pump and motor name tag.

4.2 STORAGE REQUIREMENTS

Short Term - less than six months
DICKOW normal packaging procedure is designed to protect the pump during shipping. Upon receipt store in a covered and dry location.

Long Term - more than six months
Preservative treatment of machined surfaces will be required for pumps of material GGG40.3 or GS-C25. Store the pump in a sheltered dry place. Rotate shaft several times by hand every three months by removing the fan cover. If required, disassemble and inspect prior to final installation. Refer also to driver manuals for their long term storage.

4.3 SITE, FOUNDATION

Pumps without baseplates must be bolted to a rigid foundation without strain. The foundation must be able to absorb any vibration and to form a permanent, rigid support for the pumping unit. Casing feet and motor feet must rest completely plain on the foundation surface. If necessary, shims must be provided to avoid inadmissible deformation when fastening the foundation bolts.

If the pump unit mounted on baseplate shall be grouted to the foundation, the following must be observed prior to grouting:

- Levelling of baseplate by use of a water-level.
- Adjusting unevennes of foundation by shims or metal wedges.

Attention !

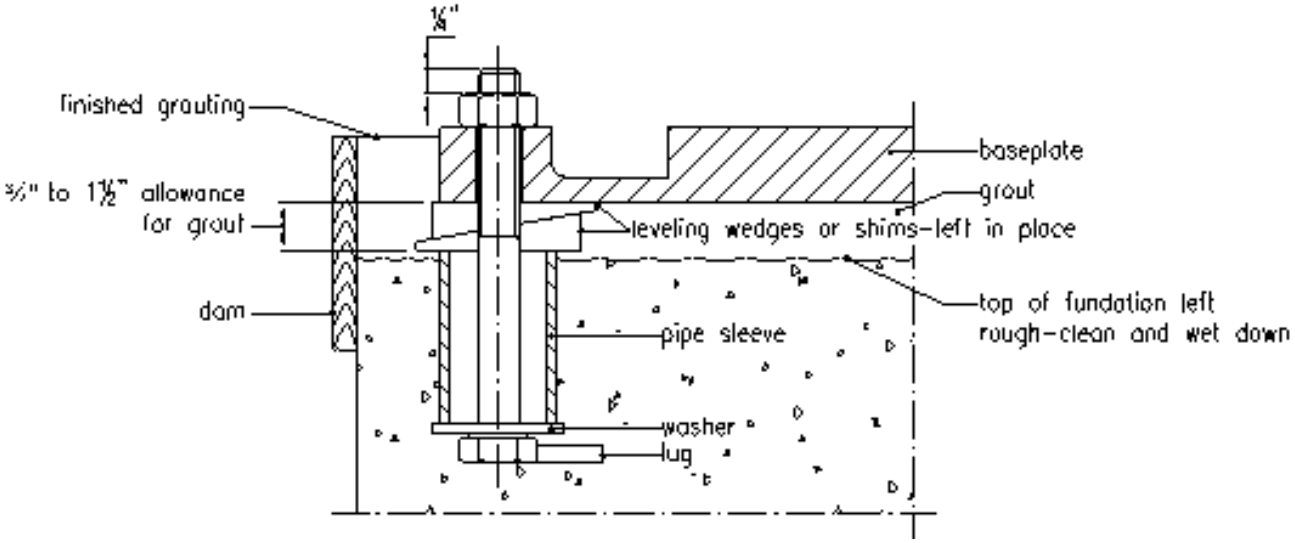
Proper alignment and installation of the complete pump unit before start-up is the responsibility of the owner !

4.4 BASEPLATE LEVELLING, PIPING CHECK

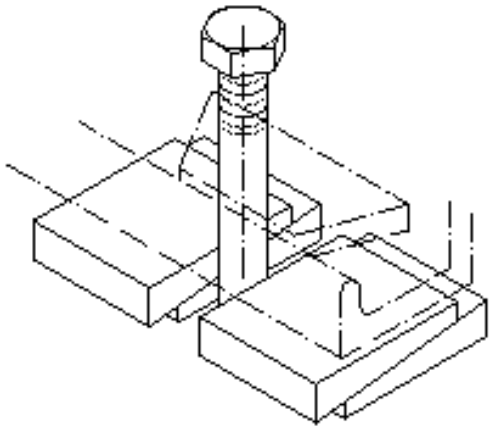
1. When the unit is received with pump and driver mounted on baseplate, it should be placed on the foundation.

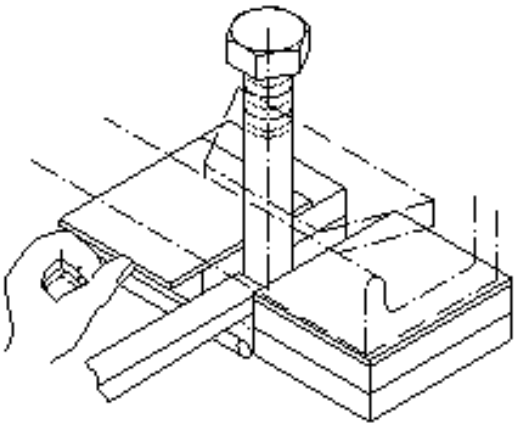
2. The baseplate should be supported on rectangular metal blocks and shims or on metal wedges

having a small taper. The support pieces should be placed close to the foundation bolts. In each case the supports should be directly under the part of the baseplate carrying the greatest weight and spaced closely enough to give uniform support:
A spacing of 610 mm (24 in) is suggested on medium size units. A gap of about 19 to 38 mm (3/4 to 1 ½ in) should be allowed between the baseplate and the foundation for grouting.



Adjust the metal supports or wedges until the shafts of the pump and driver are level. Check the coupling faces as well as the suction and discharge flanges of the pump for horizontal or vertical position by means of a level. Correct the positions, if necessary, by adjusting the supports or wedges under the baseplate as required.





3. Check driver rotation by removing the coupling spacer if available and by bumping the motor starting button (consider item 5.1). If driver rotation is correct, proceed with alignment. If not, reconnect the motor wiring properly and again check for rotation. When the driver rotation is correct, proceed with alignment.

Always switch off the main fuse while working on electrical equipment.

4. Align the driver to the pump as per par. 4.5.

5. Grout the baseplate in accordance to par. 4.6.
Do not grout the baseplate to the foundation until pump and driver are correctly aligned.

6. Maintain that piping to the pump is in exact alignment with the pump flanges and imposes no stress on the pumping unit. When the alignment is exact, the piping may be bolted in place.

7. Recheck pump and driver alignment as per par. 4.5 to ensure that no distortion of the pump unit has been caused by stress through piping. Correct piping if misalignment has occured and realign pump and driver.

8. Pump and driver alignment must again be checked at the operating temperature.

9. After about two weeks of normal pump operation, the pump and driver alignment should again be checked under hot conditions. If the alignment has changed realign the unit and recheck after two weeks.

Pumps are not constructed to be used as pipe anchors. Both suction- and discharge piping must be supported independently of the pumping unit and thermal expansion joints provided to guard against expansion loads on the pump. Pipes should be anchored between the expansion joint and the pump and as closely to the pump as possible. Failure to provide proper piping support and expansion joints may impose strains on the pumping unit which will result in serious misalignment. No allowance for thermal expanison is made for motor driven units in mounting the driver. Final alignment must always be checked and corrected at the operating temperature of the pump and driver.

4.5 GROUTING OF BASEPLATE

1. Clean areas of baseplate that will contact grout. Do not use an oil-based cleaner because grout will not bond to it.

2. Build a dam around foundation (see typical foundation layout, page 9). Thoroughly wet foundation.

3. Pour grout slowly through grout holes in baseplate until level with the top of the dam. The use of non-shrink epoxy grout is recommended, follow manufacturer's recommendations. If cementitious grout is used, remove air by tamping or with a vibrator.

4. Allow grout to set.

5. Fill remainder of baseplate with grout. Remove air as required.

6. Allow final grout to set for 48 hours.

7. Tighten foundation bolts.

Alignment check:
Recheck alignment before continuing. Use methods as previously described.

4.6 PIPING

Attention !

Never draw piping into place by imposing force. This would lead to uncontrolled stress on the unit and cause misalignment between pump and driver. Stress through piping will

adversely affect the reliability of the pump. If piping will be cleaned or flushed after installation, suction and discharge opening must be closed by blanks. No solids must get into the pump during standstill

General

Guidelines for piping are given in the „Hydraulic Institute Standard“ (Edition 14, Centrifugal Pump Section) and should be reviewed prior to pump installation.

1. All piping must be supported and must line up naturally with the pump flange.

2. Do not make final connection of piping to pump unit until grout has hardened and pump and driver anchor bolts have been tightened.

3. Piping that handles hot liquids, require proper installation of expansion loops so that linear expansion of piping will not cause mislignment.

4. Piping should be arranged to allow pump flushing and draining prior to the removal of pump for servicing.

5. Gasket installation and materials must be suitable for the service.

6. The allowable forces and moments must be considered.

4.6.1 Suction pipe

Attention !

When using sealless pumps, care must be taken for the NPSH-conditions. The suction piping requires careful design for these pumps. It is especially important that the available NPSH of the system is exactly determined.

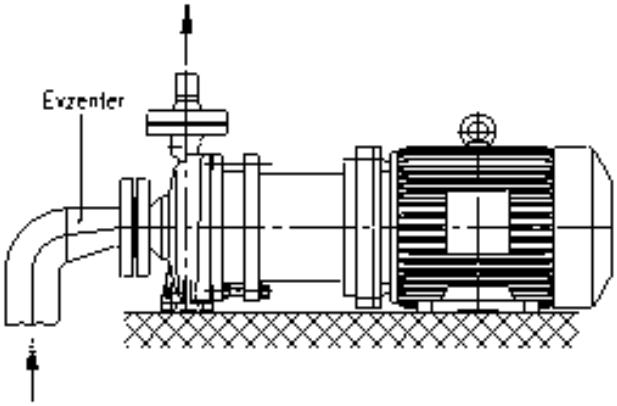
NPSH-available ≥ NPSH-required + minimum 0,5 m (1,5 – 2 ft)

Suction pipe should be flushed before connection to the pump and the following be considered:

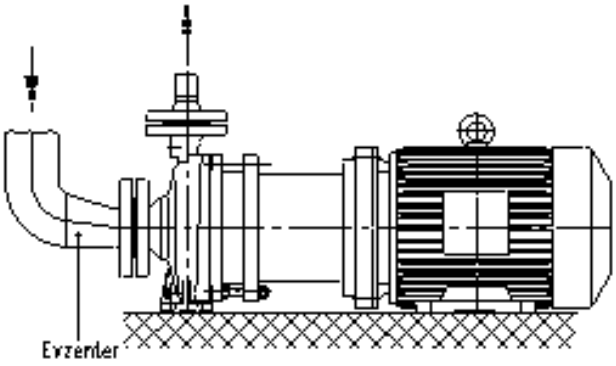
1. Use of elbows close to the pump suction flange should be avoided. There should be a mini- mum of 2 pipe diameters of straight pipe between the elbow and suction inlet. Any elbows used should be of large radius.

2. The size of the suction pipe should be one or two sizes larger than pump suction, with a reducer at suction flange. Suction piping must never be of smaller diameter than the pump suction.

3. Reducers, if used, must be eccentric at pump suction flange as shwon in the following drawing.

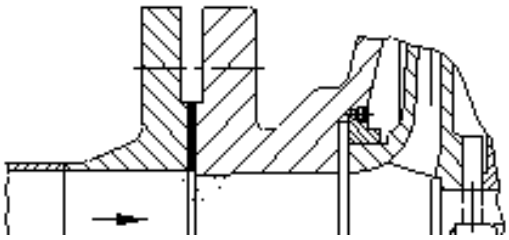


Reducer



Reducer

4. Suction strainer, when used, must have a net „free area“ of at least six to seven times the suction pipe area. Pressure losses at rated capacity should not exceed 1 to 1,5 m (39 - 59"). It is wise to install differential pressure control device to avoid cavitation by clogged screen. Screen with a mesh width of 480 micron is recommended. There should be a minimum of two pipe diameters of straight pipe between strainer outlet and pump suction flange.



5. Separate suction lines are recommended when more than one pump is operating from the same suction vessel.

6. Never connect a larger suction pipe direct to the pump suction flange. Flow eddies reduce the free flow area of the pump. Additional losses reduce the calculated available NPSH, cavitation can occur.

Suction lift conditions

1. Suction pipe must continuously slope upwards towards pump suction to eliminate air pockets.

2. All joints must be air tight.

3. Connection must be provided to fill suction line and pump with liquid before starting the pump.

4. A foot valve should be provided to allow proper filling of pump and suction line before start-up.

Flooded suction conditions

1. An isolation valve should be installed in suction line to permit closing of the line for pump inspection and maintenance.

2. Suction pipe should slope gradually downwards to the suction flange to eliminate air pockets and to ensure a total venting during filling the piping.

3. The suction pipe shall be submerged sufficiently below the minimum liquid surface to prevent vortex and air entrapment at the source.

4.6.2 Discharge pipe

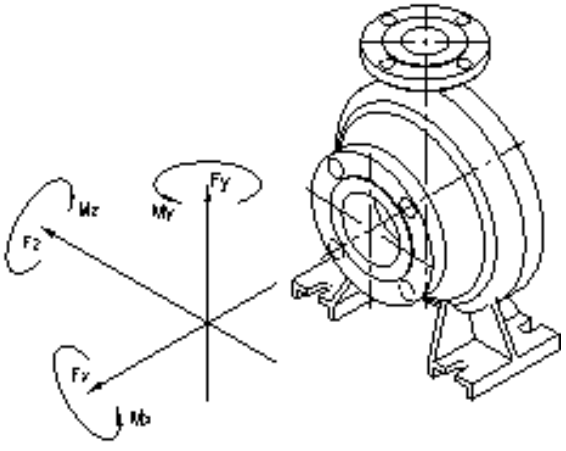
1. Isolation valve should be installed in discharge line to permit closing of the line for pump inspection and maintenance. If an additional check valve is foreseen, it should be placed between discharge flange and isolation valve.

2. Diffusers, if used, should be placed between discharge flange and isolation valve. Maximum allowable opening angle 8°.

3. Cushioning devices should be used to protect pump from surges and water hammer, if quick-closing valves are installed in system.

4. If a bypass pipe is provided for obtaining a minimum flow, the bypass must lead back to the suction source - not to the pump suction pipe right in front of the suction flange !

4.6.3 Allowable forces and moments



Values below are independent from casing material.

Pump size	Suction flange (max. values)						Discharge flange (max. values)					
	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm	Mz(Nm)	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
26/125 26/170 26/210	800	520	640	415	320	207	570	710	462	370	280	185
40/125 40/165 40/210	1100	680	870	670	490	310	640	800	520	415	320	210
50/125 50/165 50/210	1335	890	1070	950	720	475	710	890	580	460	355	230

4.7 INSULATION

Insulation, if foreseen for pumps handling hot liquids, should cover the pump casing parts only. Heat dissipation by radiation must be guaranteed at the surface of the drive lantern 341 to avoid overheating of the magnets. Thus, insulation of the drive lantern is not allowed.

4.8 SAFETY DEVICES

Attention !

All safety devices for temperature, vibration, leakage etc, mentioned in the cover sheet (page 1) must be properly connected to the motor circuit respectively the control panel before start-up. Consider special descriptions and wiring diagrams.

4.9 DRIVE MOTOR

The drive motor is an electric device and must be connected by skilled and trained personnel only. All applicable state and local laws and safety regulations must be observed.

Attention !

The proper connection of the electric motor including the provided pump protection devices is the responsibility of the owner only.

5. OPERATION OF THE PUMP

5.1 START-UP PROCEDURE

When the before mentioned instructions have been performed, the protection strainer on suction side must be checked and possible blanks removed, The pump can then be put in operation as follows:

1. Check for identical speed on pump and motor name tag.

2. Fill up suction pipe and pump completely with liquid. Open suction valve completely. Open or partially open discharge valve.

3. **Attention !** Pumps with heating jacket, type KMBb, need pre-heating prior to start-up to make sure that all the liquid inside the pump is melted. Remove the fan cover and turn the motor shaft by hand. Driver must be secured against unauthorized re-start. If the shaft is blocked, the product inside the pump is not completely liquified. In this case, continue pre-heating until easy rotation is possible.

4. **Attention !** The magnet coupling is sized for direct-on-line starting of the motor. „Star-delta-starting“ must be specified when placing order. If this has not been considered when selecting the magnet coupling, a star-delta start is only possible against closed discharge valve.

   Open discharge valve immediately after start-up !

5. **Attention !** Start-up against closed discharge valve should be avoided if possible because dissipation of the magnet losses in the containment shell area through internal circulation is not ensured in this case. If a start-up or temporary operation against closed discharge valve is required for technical reasons, an appropriate bypass or a temperature control for the containment shell with automatic shut-off of the motor must be installed.

   Bypass lines must lead back to the suction vessel. Returning to the suction pipe, right in front of the suction flange, is not permitted.
   Non-observance of this instruction may cause vaporization in the containment shell area (sleeve bearing failure), respectively demagnetization through overheating.

6. If all points mentioned before have been checked, start driver briefly for a few seconds, shut off and check for smooth run down and the proper direction of rotation. The pump must not come to a jerky stop after shut off.

7. If no problems occur after the test start, the pump can be restarted finally.

Attention ! Immediately observe the pressure gauges. If discharge pressure is not quickly attained, stop driver, reprime and attempt to restart. Adjust discharge valve until rated flow is obtained.

8. **Attention !** Continued operation with dead headed pump will cause overheating within the pump. Flashing of the liquid will damage the sleeve bearing.

9. **Attention !** Start-up with reverse spinning rotor is not possible, magnets will decouple in this case. Avoid spinning at reverse flow by installing a check valve in discharge line.

5.2 OPERATION

1. **Attention !** Always adjust capacity with the valve in discharge line. Never throttle flow by suction valve.

2. Pump and motor should always operate steadily and free of vibrations (see 5.4.1, item 2)

Attention ! A sudden increase of running noise is always a sign of possible trouble.

3. The ampere load specified on the name tag of the drive motor must not be exceeded.

4. When operating with a capacity higher than rated and stamped on the pump name tag, make sure that NPSH-available > NPSH-required.

5. The minimum flow at KMB-pumps is 15% of BEP for the rated impeller.

Attention ! Never operate pump below minimum flow.

5.3 SHUT DOWN

1. Close valve on discharge side slowly.

Attention ! Immediately after closing the valve, the driver must be turned off and checked for steady run-down.

2. Close valve on suction side.

3. Empty the pump during shut-down in winter

5.4 PREVENTIVE MAINTENANCE

DICKOW-KMB-Pumps with magnet drive and with motors provided with permanent lubricated bearings are designed to be maintenance-free and do not require any adjustments. But without doubt, a routine maintenance program can extend the lifetime of your pump and can prevent serious damage. Well maintained equipment will last longer and requires less repair. You should keep maintenance records to help pinpoint potential causes of problems.

5.4.1 Routine Maintenance

1. Temperature Monitoring

SiC-bearings with diamond layer have in principle an unlimited service life as long as boiling point is not exceeded which causes flashing of the liquid between the sliding faces respectively dry run. The permanent magnets keep their magnetic forces for life unless inadmissible temperatures cause demagnetization. Inadmissible temperature increase can be caused by the following operating conditions:

a) operation against closed discharge valve or below minimum flow.

Attention !

Operation against closed discharge valve can also happen if isolation valves in the downstream piping system close automatically at operational troubles.

b) clogged circulation holes through solid particles,

c) driver slips, respectively the magnetic coupling broke at start-up or decoupled through blocking of the driven rotor.

d) solid particles between rotor and stationary containment shell cause additional friction,

e) dry running by empty pump.

All above mentioned possibilities cause a rapid rise of containment shell temperature. Therefore, it is recommended to monitor magnetic driven pumps by temperature probes in order to ensure an automatic switch off of the pump before serious damage occurs.
Common temperature probes PT100 work sufficiently only at a properly filled pump and rotating inner magnet, but do not provide any dry running protection.

2. Motor load control

In case of dry running or blocked impeller, the pump shaft only transmits the magnetic losses, the motor load drops nearly to zero. A power monitor can switch off the pump before magnet overheating or wrecked bearings will occur. These devices require no additional sensors or auxiliary pipes on the pump and can be installed in the motor circuit also subsequently. They can be considered as the most economic monitoring systems for magnetic coupled pumps.

2. Vibration monitoring

All rotating pump parts are properly dynamically balanced, according to DIN ISO 1940/part 1, grade G 6.3. During performance tests, we check pump vibration and ensure that a rate of velocity = 2,8 mm/s (0.11"/s) will not be exceeded. During operation a vibration rate of 4,5 mm/s (0.18"/s) is allowable. If this rate is exceeded, change ball bearings immediately.

If a vibration rate of more than 4,5 mm/s (0.18“/s) is noted at start-up of a new pump, the reason may be excessive stress from the piping connections or unstable foundation. Please improve before continuing operation.

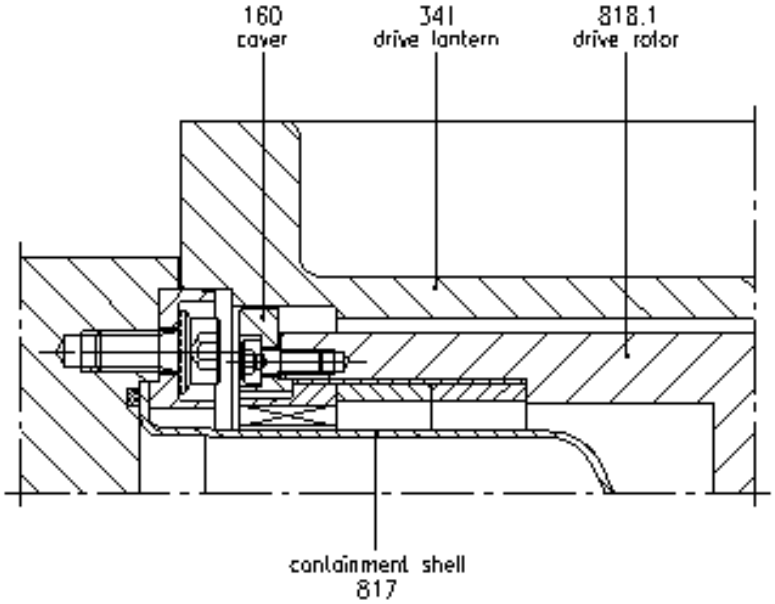
For an easier vibration control of the motor bearings, the drive motor can be provided on request with measuring studs for vibration monitoring in accordance with the SMP-methode (shock-pulse-method). It is recommended to perform vibration measurements in regular intervals and to keep records of the measured values.

5.5 MAINTENANCE - ANTIFRICTION BEARINGS

The drive motors of KMB-pumps have permanent lubricated antifriction bearings. Experience shows that the grease-filling of the bearings will last for several years. For more information about bearing life or regrea- sing periods, refer to drive motor manual. If the pump's vibrations are not monitored regularly, the, the antifriction bearings must be replaced when the specified lifetime is reached.

To avoid damage of the containment shell by worn out ball bearings and eccentric rotation of the outer magnets, the KMB-pumps are fitted with a containment shell protection devices. In case of eccentric running, the cover 160 will first touch the bearing bracket due to the tight clearances between these parts. Operators can recognize such upset conditions by increasing noise, vibration and/or power consumption, and switch off the driver before serious trouble occurs.

Containment Shell Protection Device



However, if no one recognizes such upset conditions, wear between cover and bearing bracket will finally cut the containment shell through the outer magnets. As a result, liquid penetrates to the atmosphere. For handling dangerous liquids, additional control devices are recommeded.

5.6 TROUBLE SHOOTING

Attention !

If the pump does not develop the required performance or if other unexpected things happen during start-up, please consider, that you bought a quality product carefully testet prior to delivery. Before calling DICKOW service pesonnel or disassembling the unit,
please check carefully the pump´s environment. Check simple things, such as forgotten blanks in the piping, motor and pump speed in accordance with the lables, wire connections in the terminal box. Make sure that control devices are properly connected and measuring instruments are calibrated.

5.6.1 No liquid delivered

Problem: Suction line is not completely primed.
Remedy: Fill again pump and suction line. Check foot valve in suction line.

Problem: Block valve in suction line is closed, blanks have not been removed.
Remedy: Open valve, remove blanks.

Problem: Feed- or suction lines contain air pockets which cannot be eliminated by filling up because piping is incorrectly laid out.
Remedy: Check layout of the pipes. Suction line at suction lift conditions must continually slope upwards, at flooded suction conditions gradually slope downwards to the pump

Problem: Pump does not come up to speed.
Remedy: Check start-up conditions, ask DICKOW application engineer for possible installation of stronger magnets.

Attention !

Switch off motor immediately when magnet coupling slips in order to prevent overheating of magnets.

Problem: Star-delta starting is foreseen, magnets de-couple.
Remedy: Start the pump against closed discharge valve. Open again immediately after start-up. Check up the suitability of star-delta-starting with our application engineer.

5.6.2 Pump does not obtain rated flow or head after start-up

Problem: Block valve in suction line is not opened completely.
Remedy: Open valve.

Problem: Motor speed is not identical with the pump speed according to the name tag.
Remedy: Change motor, check up with application engineer.

Problem: Strainer basket filter on suction side is plugged.
Remedy: Clean the filter.

Problem: Suction pipe is leaking.
Remedy: Retighten flange connection on suction side.

Problem: Pump rotates in wrong direction.
Remedy: Change motor wiring.

Problem: Differential head of the system is higher than specified in the order and stamped on the name tag.
Remedy: Check with the application engineer whether the pump can at this stage be equipped with a larger impeller (check power rating of the motor).

Problem: Viscosity of pumping liquid is higher than stated in the order.
Remedy: Check with application engineer.

Problem: Capacity reduces at increasing operating temperature. NPSH-available < NPSH-required.
Remedy: Increase feed head by rising the liquid level on suction side, improve NPSH-available. Installation of inducer improves NPSH-required. Check with application engineer.

Problem: Pump cavitates.
Remedy: As described before.

Attention ! Cavitation creates slide bearing failure. Never operate pump under such upset conditions.

5.6.3 Motor requires excessive power

Problem: Differential head lower than rated.
Remedy: Throttle discharge valve to obtain the capacity according to the name tag. Correct impeller diameter (item 5.7)

Problem: Density or viscosity is higher than specified in the order.
Remedy: Check with the application engineer.

Problem: Motor speed is not identical with the pump speed according to the name tag.
Remedy: Change motor.

Attention **!** If a motor with enlarged drive power is installed, the transmissible power of the magnet coupling as well as the start-up conditions with the new motor data must be checked. Contact application engineer.

5.6.4 Magnet slips during operation

Problem: Short time interruption of motor power. If power comes back before the pump has come to standstill, the high starting torque decouples the magnets.
Remedy: If power cut is conditioned by frequent thunder storms with lightenings, relays must be installed such that a restart of the motor is possible only when the pump has come to a complete stop. At automatic controlled plants, power cut can be caused by overloaded relay. Analyse power consumption records for sudden peak currents.

5.6.5 Pump does not restart after a longer operating time

Problem: Magnets decouple.
Remedy: Check magnets with breakaway torque test, replace rotor if necessary.

Attention !

Permanent magnets keep their designed torque for life. Reduced torque capability is caused by overheating or by corroded protection cover. If over-heating has occured, install additional protection device or change operating conditions.

5.6.6 Pump is noisy and vibrates after start-up

Problem: Base not rigid enough.
Remedy: Stabilize and support the area of pump- and motor feet.

Problem: Foundation bolts are loose.
Remedy: Tighten foundation bolts.

Problem: Pipes vibrate.
Remedy: Support pipes, eliminate strain, refer to item 4.4

Problem: Pump cavitates.
Remedy: Refer to section 5.6.2 - NPSH-improvement.

5.6.7 Pump gets noisy and vibrates after a longer operating time

Problem: Motor ball bearings are worn out.
Remedy: Replace ball bearings according to the instructions in the motor manual. Use brand new originally packed bearings only. Consider sizes, clearances and grease filling as specified in the motor manual. Refer to item 6.1 and 6.2 !

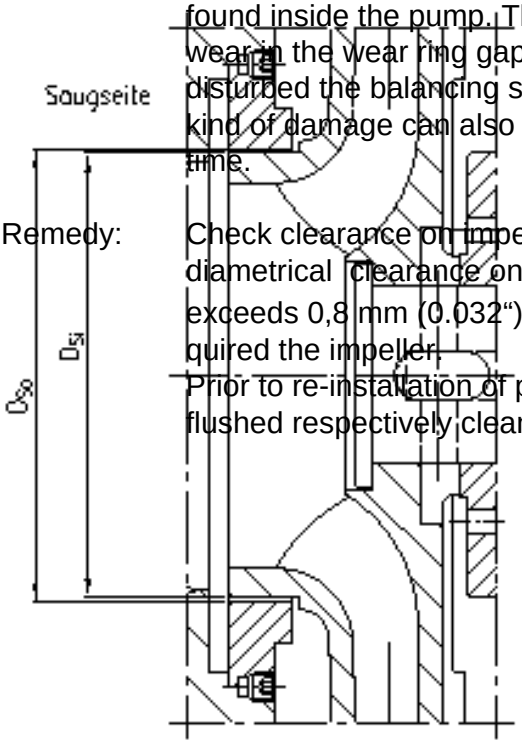
5.6.8 Pump failure through damaged sleeve bearings

Attention !

Damage on the sleeve bearings is not caused through corrosion or wear. Reasons therefore are usually operating upsets. Careful analysis and elimination of possible causes are required. Consider the following notices for analysing the damage.

1. Start-up ring 500.5 at containment shell destroyed

Possible cause: After disassembling, abrasive solids such as welding residues, scales and sediments from the pipes, were found inside the pump. The abrasives caused excessive wear in the wear ring gap on the suction side und thus, disturbed the balancing system within the pump. This kind of damage can also occur after a short operating time.



Remedy: Check clearance on impeller suction side. If the diametrical clearance on suction side (D_{sa} - D_{si}) exceeds 0,8 mm (0.032“), replace wear ring and if required the impeller.
Prior to re-installation of pump, the system must be flushed respectively cleaned.

2. Sleeve bearing 310.1 and shaft sleeve 524 destroyed

Possible cause: If no solids exist, damage of this kind can only be effected through exceeding boiling temperature in the containment shell area. Reasons therefore can be operation against closed valve, below minimum flow, clogged circulation holes or insufficient pressurization caused by a temperature rise when handling volatile liquids.

Remedy:
- Inspect and clean the circulation holes.
- Recalculate the safety against exceeding boiling point according to section 5.2, item 5.
- Installation of an additional bypass.
- Installation of a containment shell temperature monitoring device.

3. Start-up ring 500.5 or sleeve bearing destroyed

Possible cause: Damage of the start-up ring is a result of cavitation. If the NPSH-available drops below NPSH-required, uncontrolled additional thrust loads occur which cannot be absorbed by the balancing system in the pump. These forces effect vaporization of the liquid respectively dry run.

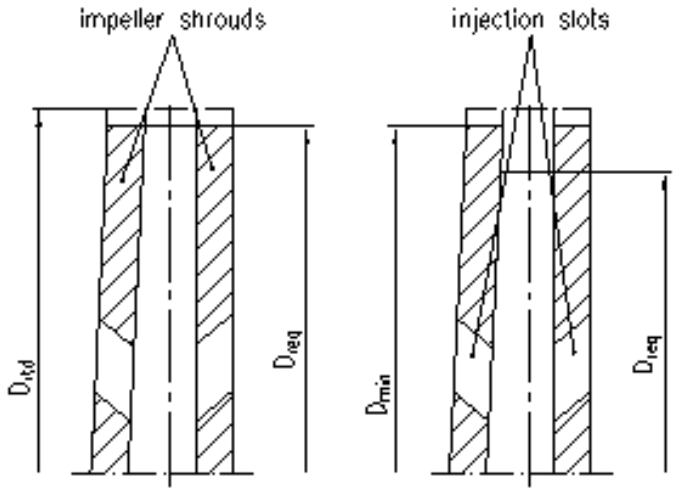
Remedy: Increase liquid level on suction side to improve NPSH-available.
Dropping below NPSH-value can also be caused through partly clogged filter on suction side. Clean the filter and protect the pump by monitoring the pressure loss in the filter. Cavitation can also appear if the pump operates - caused by lower pressure losses in the discharge line - with a capacity higher than the rated capacity as per name tag or data sheet. Throttle discharge valve, respectively correct impeller diameter (refer to section 5.7).

5.7 IMPELLER TRIMMING

5.7.1 Reduced impeller diameter required

Impellers of KMB-pumps are hydraulically balanced for reducing the thrust load. Additional to the wear rings, back vanes or injection slots on both impeller shrouds are provided. Depending on the available balancing devices, the impellers can be trimmed as follows:

1. **Impeller with injection slots**



impeller shrouds
injection slots

D_{rtd} = Rated impeller dia
D_{req} = Required impeller dia
D_{min} = Minimum allowable shroud diameter

a) $D_{req} > D_{min}$ b) $D_{req} < D_{min}$

To avoid break down of the balancing system, the impeller diameter of the following pump sizes cannot be trimmed down.

Pump size	**D_{min}**	
	mm	**inch**
26/125	130	5
26/170	130	5
26/210	160	6.3

40/210	180	7
50/210	185	7.3

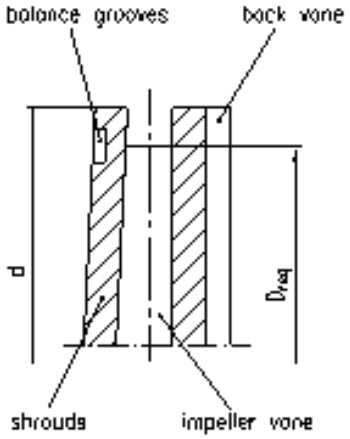
Select required impeller diameter in accordance with the pump performance curve and the available process data. If required diameter > than minimum allowable shroud diameter, trim shrouds and impeller vanes in accordance with figure a).
If required diameter < than minimum allowable diameter, trim shroud and blades to different diameters according to figure b).

2. Impeller with back vanes

The following pump sizes are provided with back vanes:

40/125, 40/165, 50/125, 50/165

Impeller blades, shroud and back vanes must be turned down to the same diameter.



Attention !

Any existing unbalance is eliminated by sinks into the impeller shroud (balance grooves).

It is recommended to trim the impeller shrouds only so far that the balance is maintained. Otherwise, the shroud must be rebalanced after correction. Non-observance may cause increased vibrations and damage to the slide bearings.

5.7.2 Increased impeller diameter required

When increasing the impeller diameter by more than 5%, suitablity of the magnet coupling and motor power must be checked. If increase of motor power is also required, the start-up safety must be checked in accordance with the new motor data.

6. DISASSEMBLY / REASSEMBLY

6.1 REQUIRED TOOLS AND ACCESSORIES

Tools	Drawing No.
Adapter	04.60.863

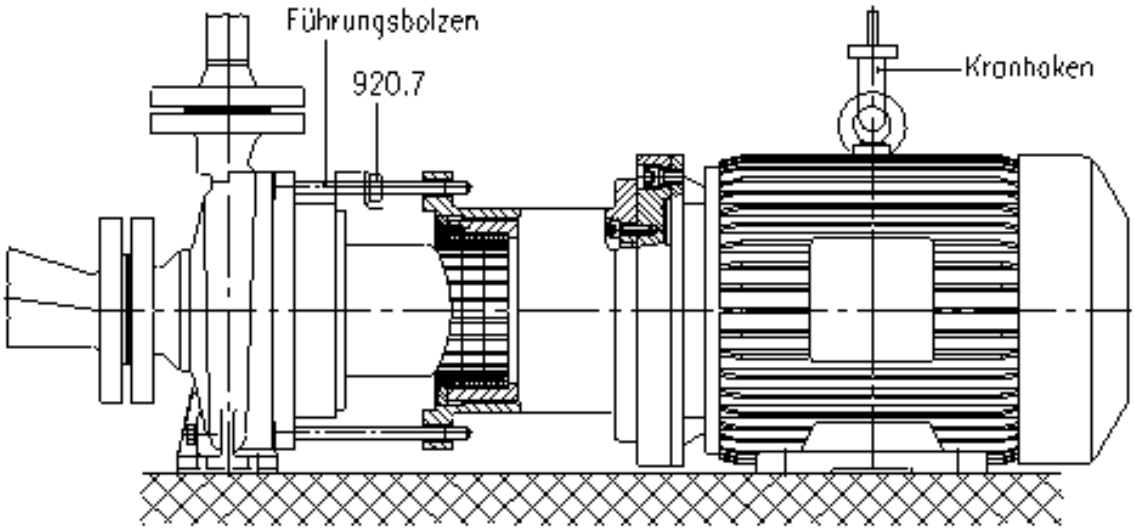
Disassembling unit	04.60.1132
Key - assembling unit	03.60.754
Assembling sleeve	04.60.668

6.2 REMOVING DRIVE MOTOR

guide rod

crane hook

Figure A



Prior to disassembly, power supply to the motor must be interrupted and secured against unauthorized restart. Electrical work must be performed by skilled personnel only and under consideration of the safety rules.
Disconnect and remove safety devices to avoid any damage. Consider the „Safety Instructions“ section 2.5.2

6.2.1 Pump casing remains in the piping system

The separate bolting of the pressurized elements of KMB-pumps enables the dismantling of the drive motor, together with the drive rotor as per Figure A, without emptying the pump. Proceed as follows:

1. Loosen and remove the motor adapter screws and shims if available.

2. Loosen and remove hexagon nuts 920.7 on the bearing housing respectively the motor lantern.

3. Press the motor lantern out off the centring by using jack screws (thread M10 available in the bearing housing) and pull it backwards with a crane.

Attention !

Never dismantle the motor without guide rods !

4. Place the unit on a suitable bench. Keep magnetic drive components and magnetic tools apart from each other.

6.2.2 Disassembling the complete unit

Before removing the pump from the piping system, the pump must be depressurized, cooled down, completely drained and if liquid had been handled injurious to health, thoroughly flushed. In this case, wear protective cloth, gloves and eye glasses when opening the pump.
After the complete unit has been removed, the motor can be removed as described before.

6.3 REPLACING MOTOR BALL BEARINGS

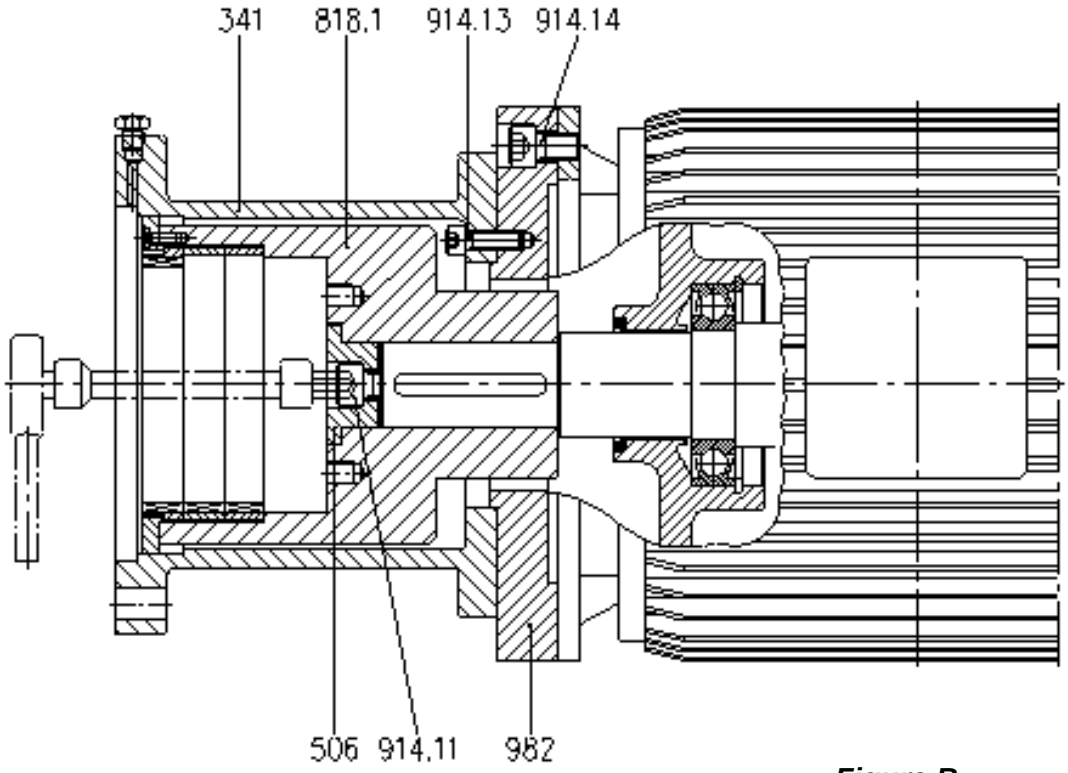


Figure B

1. Loosen and remove inner hexagon cap screw 914.11 with a suitable axel wrench according to

figure B. Remove spring washer 930.2

2. Remove the drive rotor 818.1 and the intermediate ring 506. (thread M10 available in the rotor).

3. Loosen and remove inner hexagon cap screws 914.13 by axel wrench.

4. Remove motor lantern 341.

5. Loosen and remove inner hexagon cap screw 914.14, remove intermediate flange 982.

6. Replace motor ball bearings by adhering to the instructions of motor manufacturer.

Attention ! Motors of enclosure „flame proof EExdII“ may only be repaired or over- hauled in specially qualified workshops. Only original spare parts should be used.

6.4 DISASSEMBLY OF THE HYDRAULIC PUMP PART

1. Place the hydraulic pump part in vertical position on a clean working surface according to figure C to avoid damage to the flange face.

Flange face

Working table

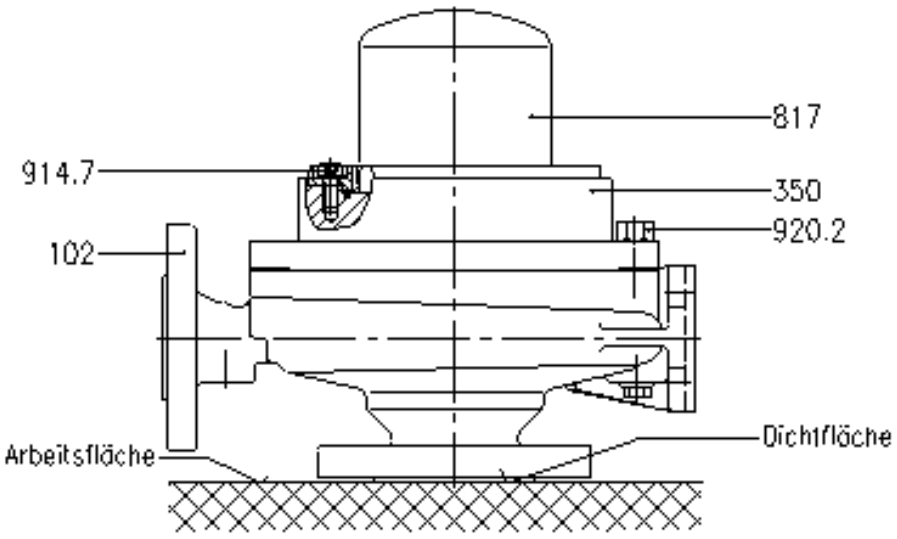


Figure C

2. Loosen and remove containment shell adapter screws 914.7. Remove containment shell adapter ring 511, containment shell 817 and O-ring 412.

3. Loosen and remove nuts 920.2 that connect volute casing and bearing housing.

4. Remove bearing housing 350 by jack screws from volute casing 102.

5. Take off bearing housing unit including driven rotor and impeller.

6. Clamp the bearing housing unit in vertical position in a vice or jaw chuck according to Figure D. When clamping the impeller, use protection cheeks.

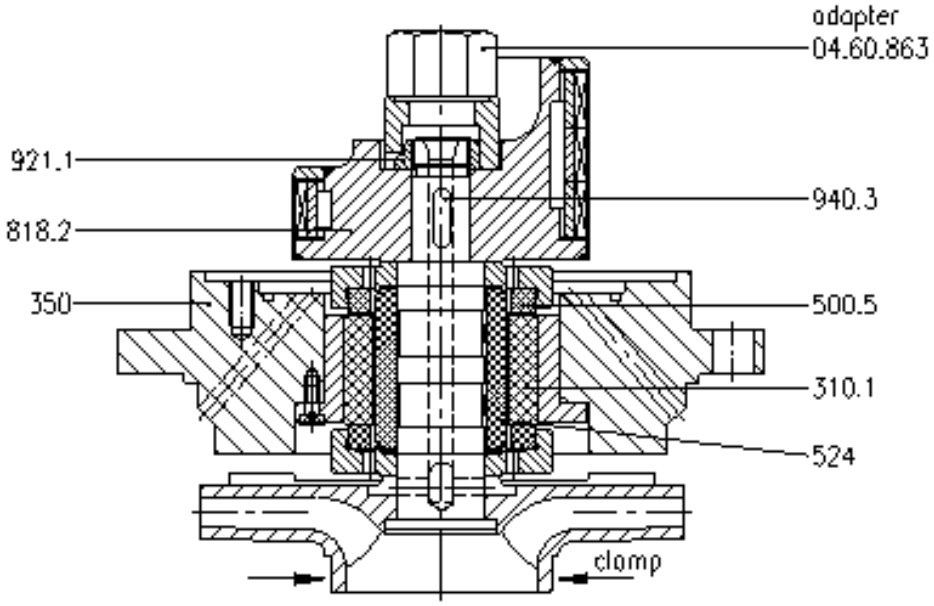


Figure D

7. Loosen and remove rotor nut 921.1 (left hand thread) with a pin spanner. For 36 and 54 mm rotor, use the adapter 04.60.863.

8. Remove the driven rotor 818.2, store it away from magnetic parts.

9. Remove key 940.3 carefully. Avoid damage of sleeve bearings.

10. Remove the start-up ring 500.5

11. Remove bearing housing 350, together with stationary sleeve bearing 310.1.

12. If the shaft sleeve must be replaced (refer to section 7 „Inspection“), use the disassembling unit 04.60.1132 and proceed according to Figure E as follows:

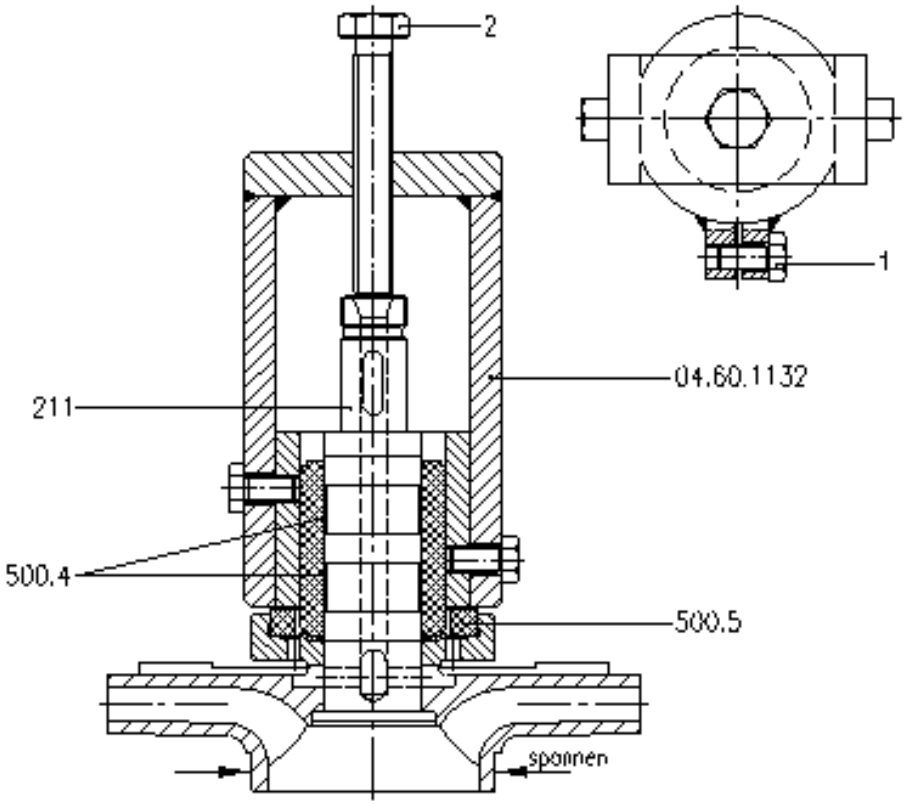


Figure E

- § Position the disassembling unit on the shaft sleeve 524.
- § Fasten the unit by clamping screw 1.
- § Turn the jack screw 2 until the sleeve is completely off.
- § Remove the slotted tolerance rings 500.4 from pump shaft.

Regardless of careful draining and cleaning of the pump before disassembling, traces of pumped liquid are remaining between shaft sleeve and pump shaft. When disassembling the shaft sleeve, consider the Safety Data Sheet for pumped liquid, protect skin and wear eye glasses.

13. Remove start-up ring 500.5

14. Remove impeller from pump shaft.

6.5 REASSEMBLY OF HYDRAULIC PUMP PART

Attention !

Before starting reassembly, the disassembled parts must be inspected according to section 7 in order to ensure proper running.

Attention !

If the SiC-shaft sleeves have been disassembled respectively replaced, the distance rings 504 and tolerance rings 500.4 must also be replaced.

Proceed reassembly according to Figure F as follows:

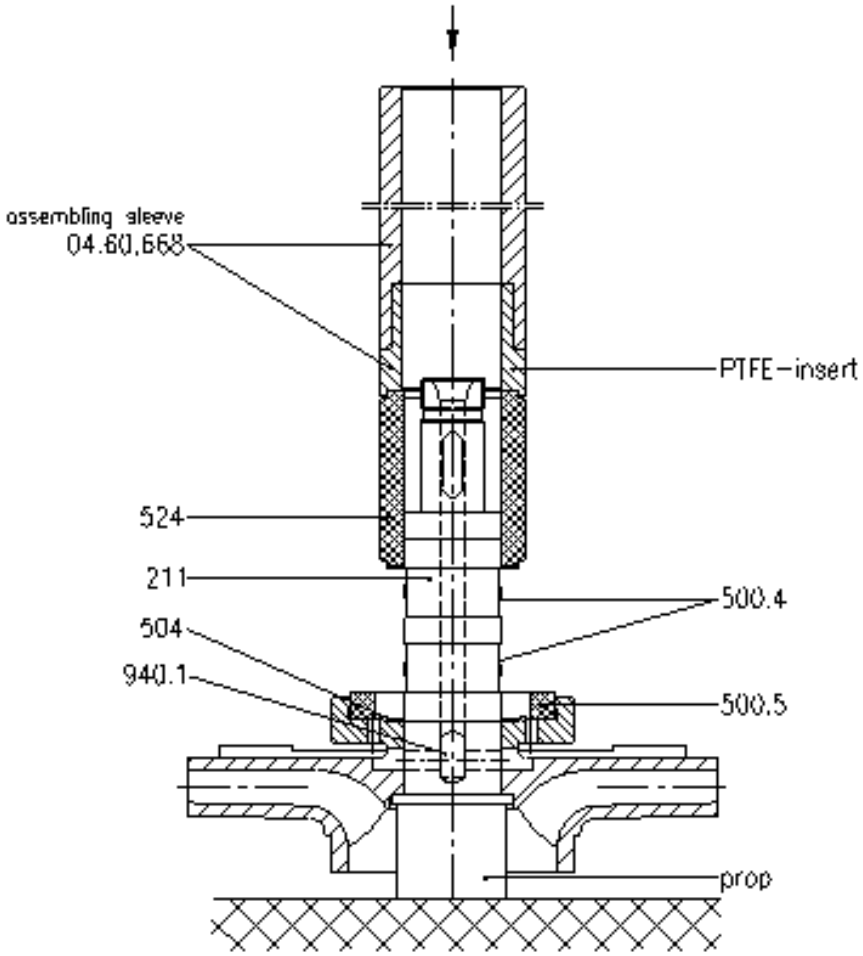


Figure F

1. Place the key 940.1 to the pump shaft. Fit impeller on the pump shaft.

2. Install the start-up ring 500.5 with the renewed distance ring 504 over the shaft until they rest.

3. Insert the new tolerance rings 500.4 in the shaft grooves.

4. Provide a supporting piece and place the preassembled unit on the working table of a drilling machine.

5. Push the shaft sleeve 524 down until it rests on the upper tolerance ring 500.4

6. Place the assembling sleeve and press the shaft sleeve down until it rests on the distance ring 504.

7. Clamp the impeller of the preassembled unit in vertical position in a jaw chuck according to Figure D.

8. Place the bearing housing with the assembled sleeve bearing until it rests on the start-up ring.

9. Push the upper start-up ring onto the pump shaft until it rests.

10. Insert the key 940.3 by hand into the keyway.

11. Press the key with the key assembling unit down to the bottom of the keyway to avoid any damage of the sleeve bearing unit.

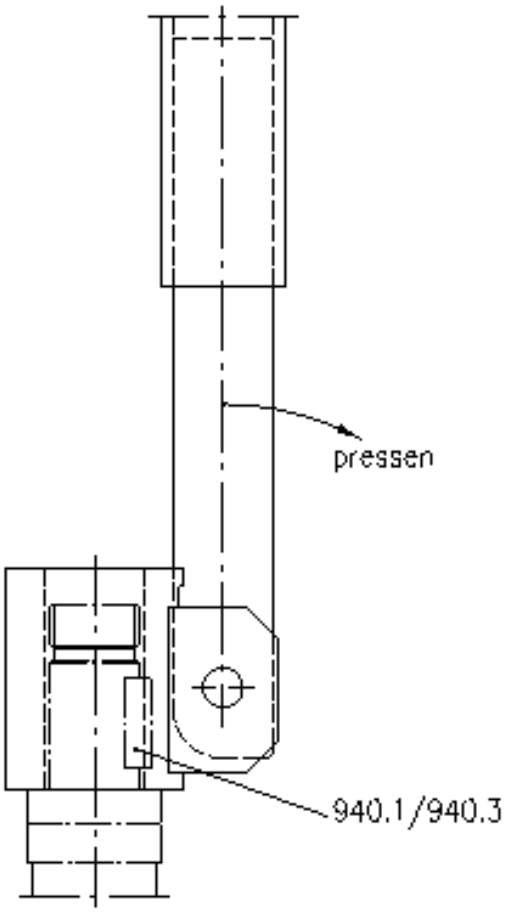
12. Place the drive rotor 818.2 on the pump shaft and fasten it by rotor nut 921.1

13. Place the O-ring 412 in the bearing housing, fit the containment shell 817 to the bearing housing.

14. Place the adapter ring 511 and fasten adapter screws 914.7.

15. Place the volute casing on the work bench according to Figure C, fit the new casing gasket 400.5 to the casing.

16. Connect the preassembled bearing housing unit with the volute casing, circulation holes must point exactly to the bottom and to the top of the casing. Fasten the bearing housing with the adapter nuts 920.2.



03.60.754

Figure G

6.6 TORQUE SETTINGS

Torque settings			
Part No.	**Designation**	**Nm**	**ftlb**
914.7	Adapter screw - containment shell	42	31

914.11	Adapter screw - drive rotor		
	motor size 71 (M5)	6	5
	motor size 80 (M6)	9	7
	motor size 90 (M8)	23	17
	motor size 112/100 (M10)	45	33
	motor size 132 (M12)	80	59
	motor size 160/180 (M16)	195	144
	motor size >180 (M20)	370	274
920.2	Adapter nut - volute casing A4-70	40	30
	8.8	80	59
920.7	Adapter nut - motor lantern A4-70	40	30
	8.8	80	59
921.1	Adapter nut - rotor	80	59

7. INSPECTION

7.1 MAGNET ASSEMBLY

1. Driven rotor 818.2

Surface must be free of cracks and bulges. Check parallelism by a bevelled steel edge. Bulges are sign of leaking rotor cover, pumped liquid causes corrosion on the inner magnets.

If grooves or erosion on the rotor surface exceed a depth of 0,2 mm, the rotor must be replaced.
In case of chemical attack or corrosion, the material resistance must be checked.
Rear impellers must not have any signs of cracks or corrosion.
Change rotor if operational trouble appeared as decribed in section 5.6.5.

2. Drive rotor 818.1, outer magnets

Outer magnets must in general be replaced, if mechanical or chemical damage is visible (consequence of containment shell leakage).

7.2 WEAR RING / IMPELLER

The total clearance between impeller and wear ring - based on the diameter – is 0,6 mm (0.0236 inch) in new

condition. If the clearance exceeds 0,8 mm (0.0315 inch), the wear ring must be replaced (consider also section 5.6.8, item 1).

The impeller must be free of corrosion and may not show any scouring or mechanical damage. The sliding surfaces in the wear ring area may not have any visible grooves. If impellers have to be re-machined in the wear ring area, a specially machined wear ring is required considering the above mentioned original clearances.

7.3 SILICON CARBIDE SLEEVE BEARINGS / START-UP RINGS

The total clearance between shaft sleeve 524 and the stationary sleeve bering 310.1 is 0,13 to 0,185 mm in new condition (0.0051 to 0.0073 inch). If a clearance exceeds 0,215 mm (0.0085 inch), replacement is required.

Shaft sleeves, stationary sleeve bearings and start-up rings may not have any visible grooves, scales or other damages.

7.4 BEARING HOUSING

Check internal circulation holes. Possible pittings must not exceed a depth of 1 mm (0.039"). Centrings, gasket surface and O-ring groove must be free of mechanical damage or corrosion.

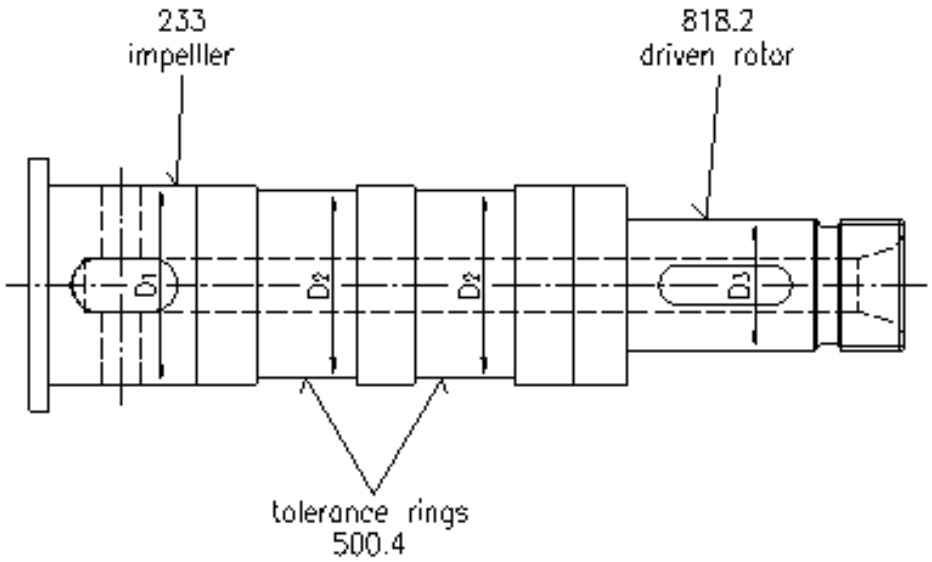
7.5 MOTOR LANTERN 341

Replace if mechanical damage or cracks are visible. If the lantern was exposed to liquid leakage, check for corrosion.

7.6 CONTAINMENT SHELL 817

Surface must be free of cracks. Replace if any groove or corrosion attack exceeds a depth of 0,2 mm (0.008"). In case of chemical attack, check material resistance.

7.7 PUMP SHAFT 211



Surfaces and threads must be free of cracks, pittings or any other visual damage. Check internal circu- lation holes, make sure that they are open. Keyways should not show any deformations. Inspect the critical diameters as shown above. Replace if actual diameters are below the values indicated in the following table.

Minimum diameter mm (inch)		
D_1	D_2	D_3
29,98 (1.180")	28,18 (1.109")	19,98 (0.786")

8. RETURNING THE PUMP TO THE FACTORY

Pumps returned to the factory for overhauling or repair, may be disassembled or main- tained by our service personnel only if the pumped liquid is clearly defined by the pump user. According to the „Decree for dangerous Goods“ a „Safety Data Sheet DIN 52900“ completely filled in must accompany the shipping documents.

For non-toxic and non-explosive liquids, a transport control sheet with Attention Notice for danger and handling must be undetachable fixed on the pump (a copy attached to the delivery note).

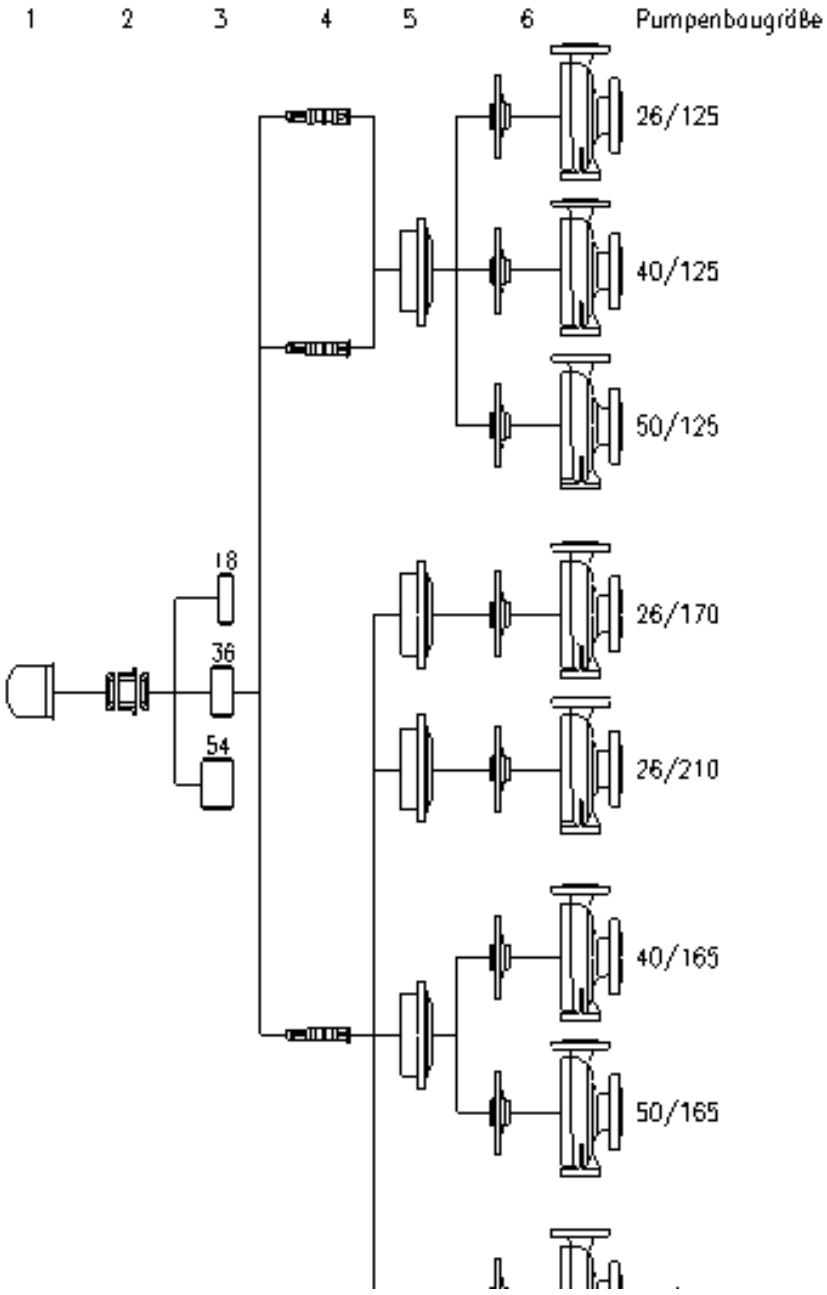
Above work safety instructions apply also for complaints on new pumps which have already been in contact with liquid.

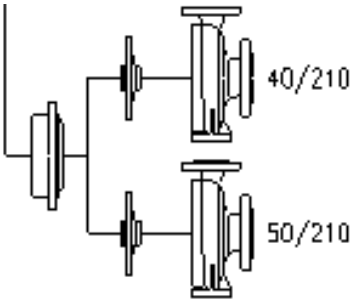
All pumps must be completely drained, flushed and neutralized before returning to the factory in order to avoid endangering of personnel, unnecessary costs for disposal and delay in handling.

9. INTERCHANGEABILITY CHART

pump size

1 *Containment shell*
2 *SiC-bearing*
3 *Driven rotor with outer magnets*
4 *Pump shaft*
5 *Bearing housing*
6 *Volute casing with impeller*





Magnet Drive Assembly	Max. Rated Power - Magnet coupling kW / HP *							
	60 Hz				50 Hz			
	3500 1/min		1750 1/min		2900 1/min		1450 1/min	
mm	kW	HP	kW	HP	kW	HP	kW	HP
18	7,0	9.4	3,5	4.7	5,8	7.8	2,9	3.9
36	14,0	18.8	7,0	9.4	11,6	15.5	5,8	7.8
54	21,0	28.1	10,5	14.1	17,4	23.3	8,7	11.7

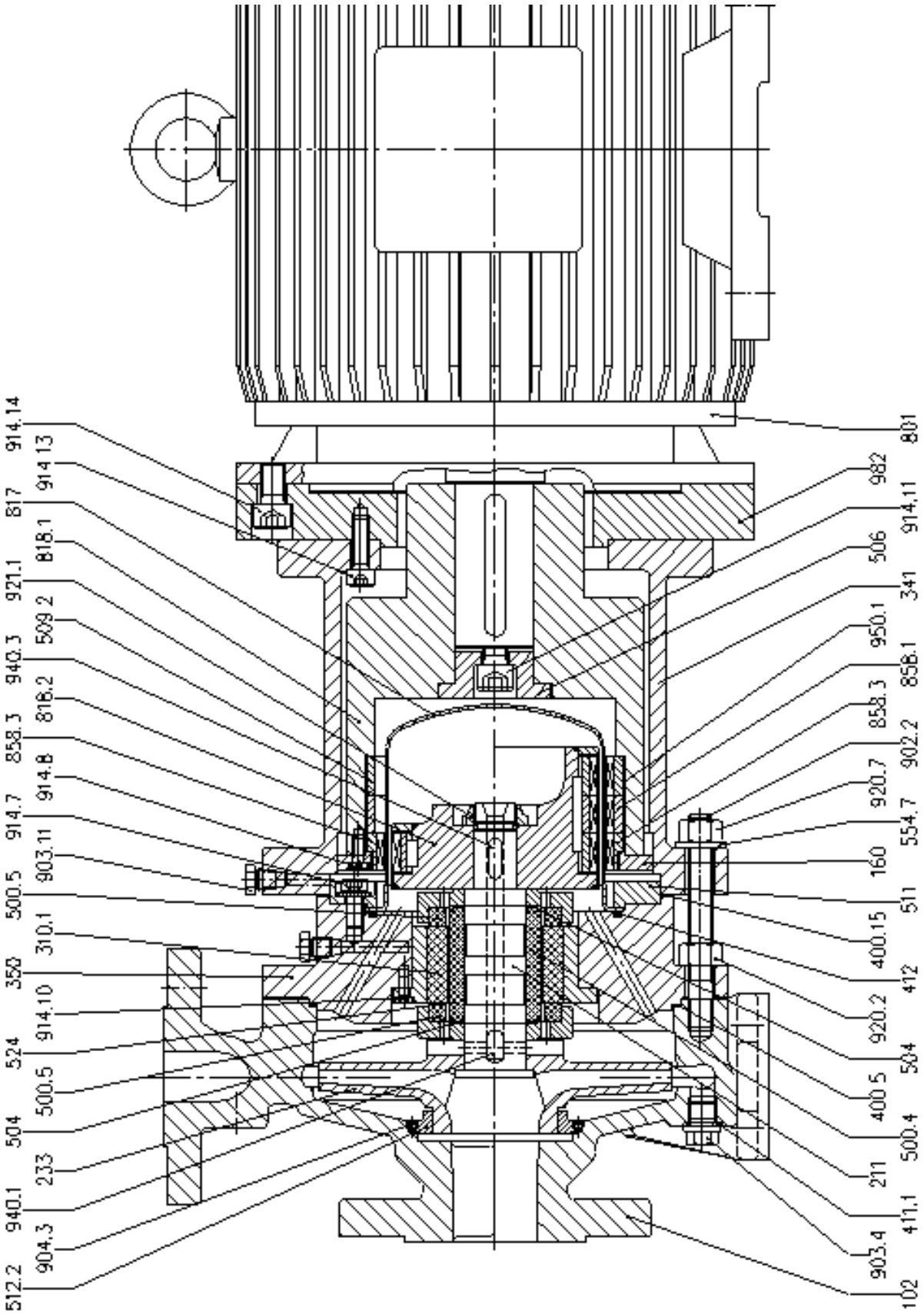
*) based on ambient temperature

10. SPARE PARTS IDENTIFICATION

10.1 SECTIONAL DRAWING - Size 26/170, 40/165, 50/165

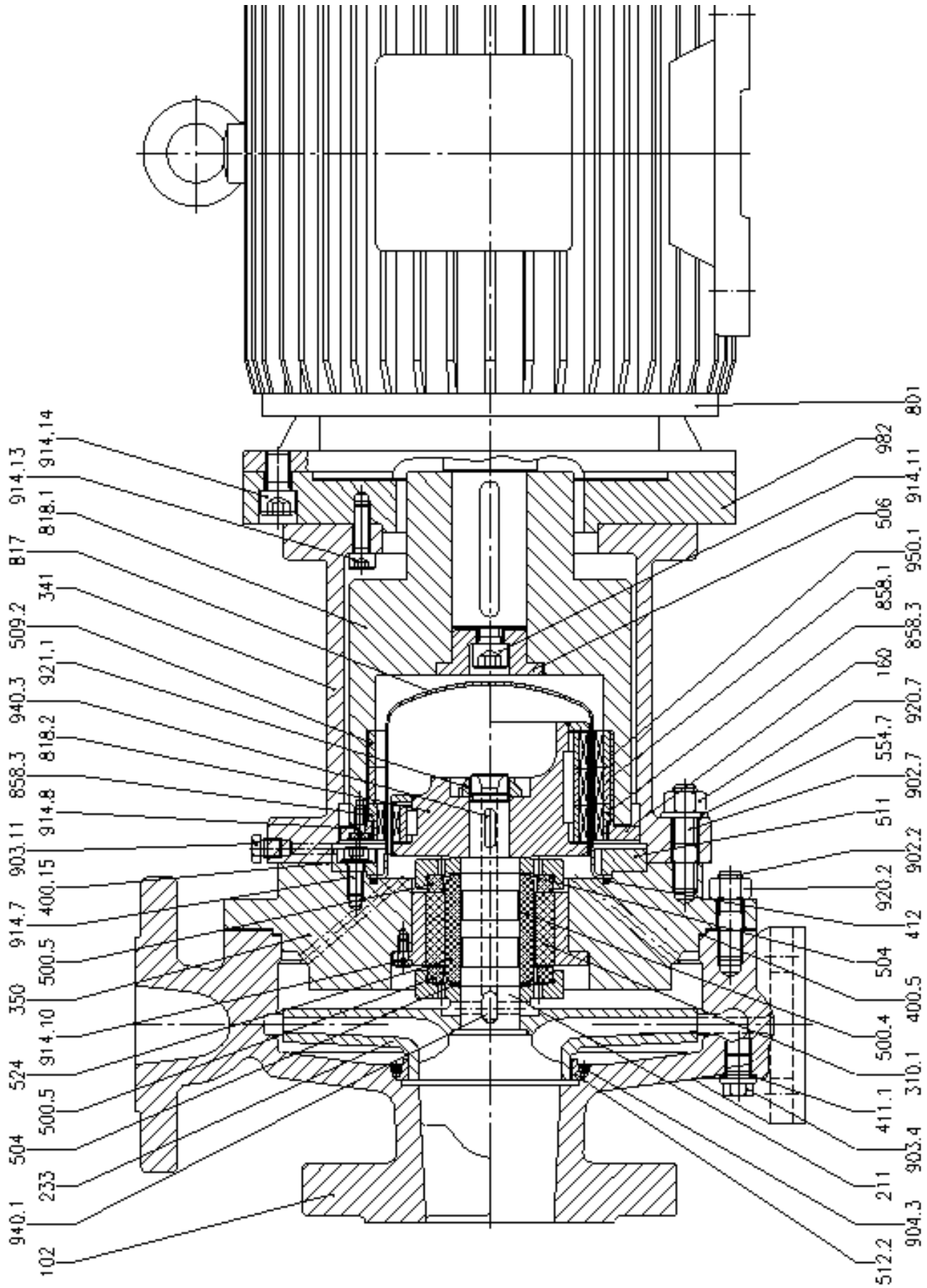
No. 54.KMB.1

Design with 18 mm magnet length | *Design with 54 mm magnet length*



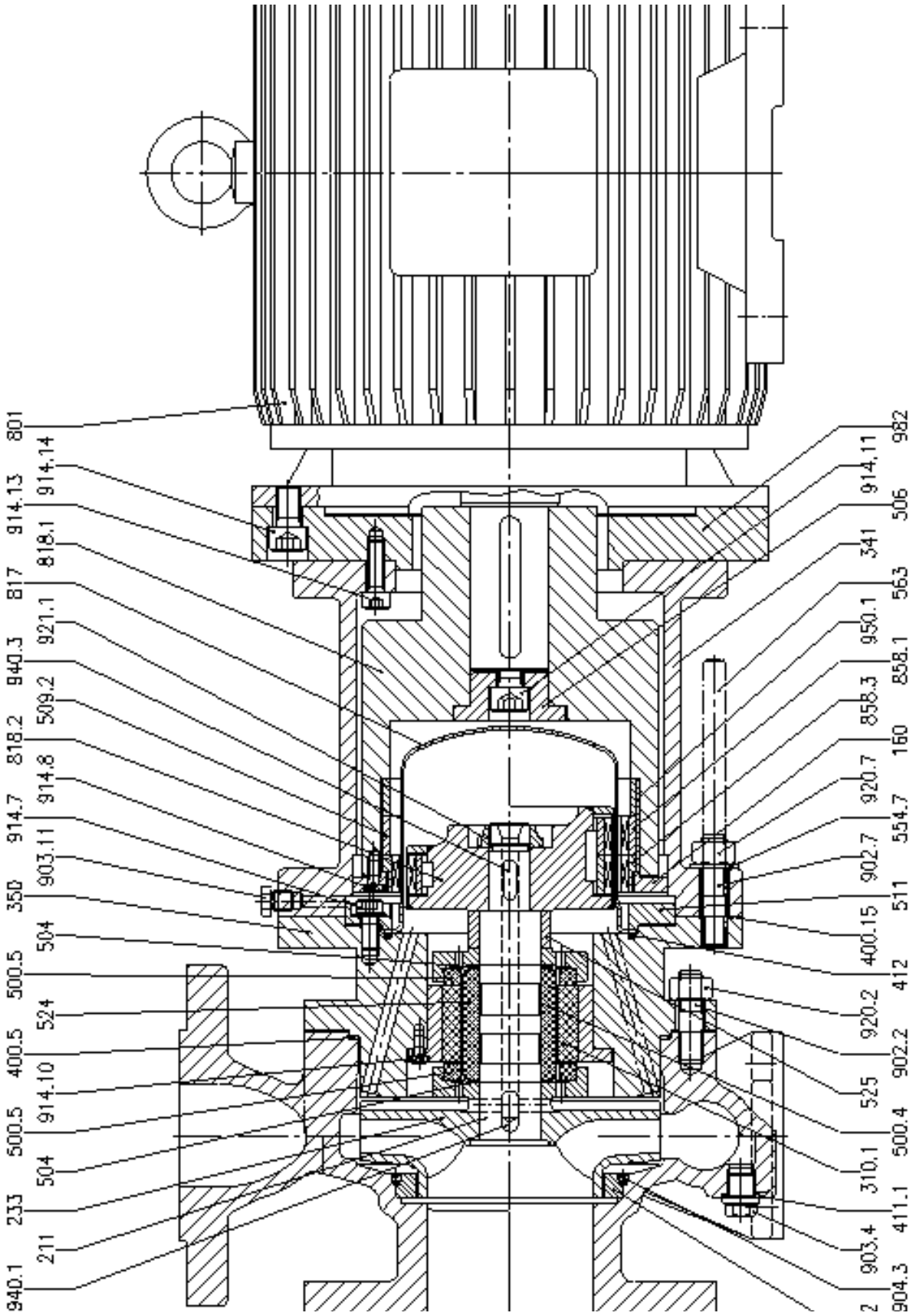
10.2 SECTIONAL DRAWING - Size 26/210, 40/210, 50/210 No. 54.KMB.2

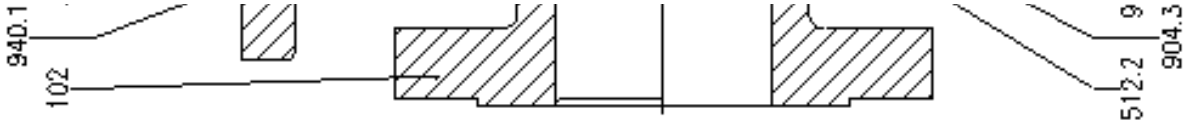
Design with 18 mm magnet length | *Design with 54 mm magnet length*



10.3 SECTIONAL DRAWING - Size 26/125, 40/125, 50/125 No. 54.KMB.3

Design with 18 mm magnet length | *Design with 36 mm magnet length*





10.4 PARTS LIST and MATERIAL SPECIFICATION

Part No.	Designation	Standard-Materials		
		KMBs	KMBhu	KMBh
102	Volute casing	GGG40.3	GS-C25	1.4408
160	Cover	St37	St37	St37
211	Pump shaft	1.4021	1.4021	1.4571
233	Impeller	GG25	GG25	1.4408
310.1	Sleeve bearing	SiC/1.4462	SiC/1.4462	SiC/1.4462
341	Motor adapter	GG25 or St37	GG25 or St37	GG25 or St37
350	Bearing housing	St 52-3	St 52-3	1.4571
400.5	Casing gasket	Novatec Premium	Novatec Premium	Novatec Premium
400.15	Gasket	Novatec Premium	Novatec Premium	Novatec Premium
411.1	Joint ring	Novatec Premium	Novatec Premium	Novatec Premium
412	O-Ring ø 115x3	PTFE	PTFE	PTFE
500.4	Tolerance ring	1.4310	1.4310	Hastelloy C
500.5	Start-up ring	SiC/1.4462	SiC/1.4462	SiC/1.4462
504	Distance ring	Graphite	Graphite	Graphite
506	Retaining ring	St37	St37	St37
509.2	Intermediate ring	GG25	GG25	GG25
511	Adapter flange	St37	St37	St37
512.2	Wear ring	GG25	GG25	1.4571
524	Shaft sleeve	SiC	SiC	SiC
525	Distance sleeve	1.4571	1.4571	1.4571
554.7	Washer 13	St	St	1.4571
563	Guide rod	C45+PB	C45+PB	C45+PB
801	Flange motor			
817	Containment shell	1.4571 or Hastell.C	1.4571 or Hastell.C	1.4571 or Hastell.C
818.1	Drive rotor	St 52-3	St 52-3	St 52-3
818.2	Driven rotor	1.4571/CoSm	1.4571/CoSm	1.4571/CoSm
858.1	Permanent magnet	St37/CoSm	St37/CoSm	St37/CoSm
858.3	Permanent magnet	St37/CoSm	St37/CoSm	St37/CoSm
902.2	Stud	8.8	8.8	A4-70
902.7	Stud	8.8	8.8	A4-70
903.4	Screwed plug G ¼	St	St	1.4571
903.11	Screwed plug NPT 1/8	St	St	St
904.3	Grub screw M5x6	A4	A4	A4
914.7	Inner hexagon cap screw M8x16	100	100	100
914.8	Inner hexagon cap screw M5x10	8.8	8.8	8.8
914.10	Inner hexagon cap screw M5x10	A4-70	A4-70	A4-70
914.11	Inner hexagon cap screw	8.8	8.8	8.8

914.13	Inner hexagon cap screw	8.8	8.8	8.8
914.14	Inner hexagon cap screw	8.8	8.8	8.8
920.2	Hexagopn nut M12	4	4	A4
920.7	Hexagon nut M12	4	4	A4
921.1	Shaft nut GT 20x1,5 left	1.4571	1.4571	1.4571
940.1	Key 8x7x20	1.4571	1.4571	1.4571
940.3	Key 6x6x20	1.4571	1.4571	1.4571
950.1	Spring	St	St	St
982	Flange	St37	St37	St37