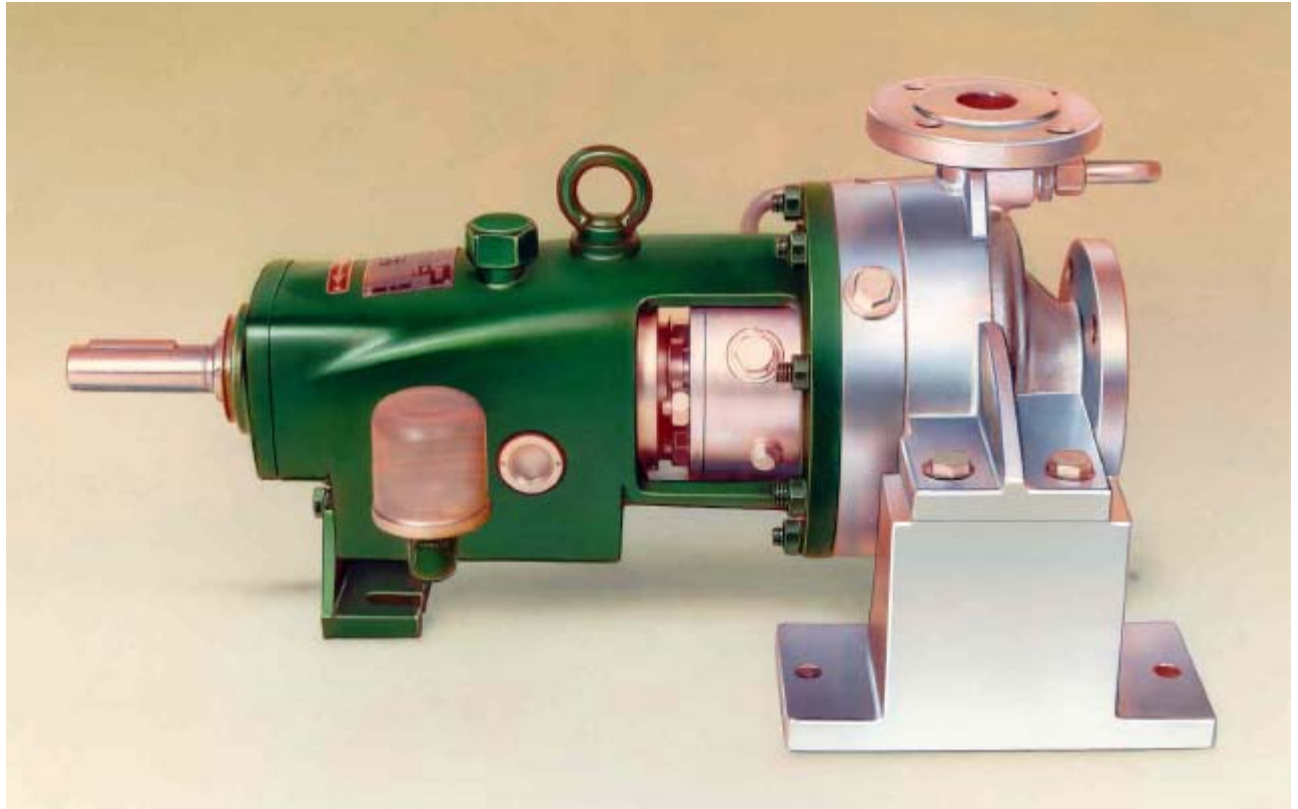


Installation, Operation and Maintenance Instructions

Type NCR
frame size
I, II, III, IV



No. 44 NCR.E1.07/03



Pump sizes:	<u>frame I</u>	<u>frame II</u>	<u>frame III</u>	<u>frame IV</u>
	32/165	32/250	65/320	150/320
	32/210	40/250	80/320	150/400
	40/165	40/320	80/400	150/500
	40/210	50/250	100/250	200/250
	50/165	50/330	100/320	200/320
	50/210	65/165	100/400	200/400
		65/200	125/250	200/500
		65/250	125/320	
		80/165	125/400	
		80/200	150/250	
		80/250		
		100/200		



DICKOW PUMPEN KG



EC Declaration of Conformity

as defined by EC-Machinery Directive 98/37 EG Annex II A
and by the EC-Explosion-Proof Directive 94/9/EG Annex XB

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

Series „NCR“

complies with the following provisions applying to it

EC-Machinery Directive 98/37 EG, Annex I No. 1
EC-Explosion-Proof Directive 94/9/EG Annex II

Applied harmonized European standards in particular

DIN EN 809	EN 1127-1
DIN EN 292 Part 1	EN 13463-1
DIN EN 292 Part 2	EN 13463-5

Applied national technical standards and specifications in particular

DIN 24250	DIN EN 12723	VDMA 24276
DIN 31001	DIN EN 22858	
	DIN EN ISO 9906	
	DIN ISO 5199	

Manufacturer:

DICKOW PUMPEN KG
Siemensstraße 22
D-84478 Waldkraiburg

Importer in country of use

(Signature)

(Signature)

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2. GENERAL INFORMATIONS

2.1 INTRODUCTION

This manual provides instructions for the installation, operation and maintenance of the DICKOW-Process Pump, Type NCR, sealless centrifugal 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 inspection, 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 hereunder 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 certificates B according to EN 10204 (DIN 50049 3.1B), are available on request.

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

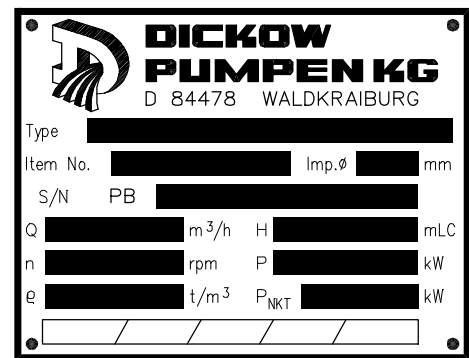
The hydraulic test is performed in accordance with EN ISO 9906, class 2, the pressure test is performed with 1,5-times the maximum operating pressure unless otherwise specified.

2.4 IDENTIFICATION

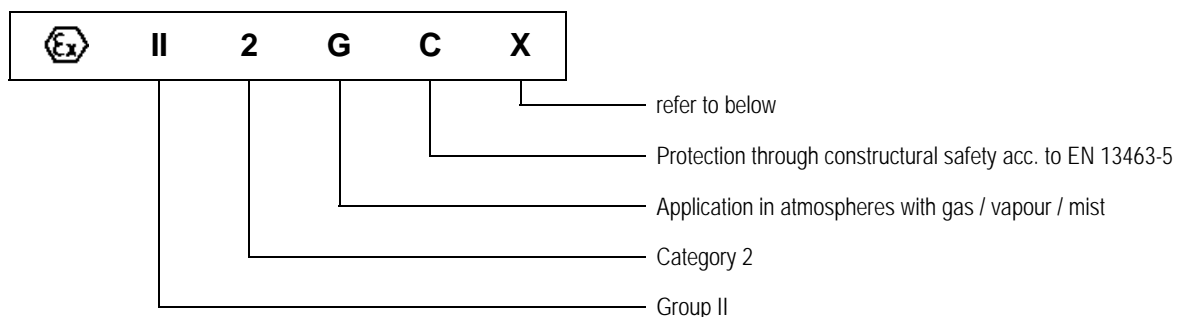
2.4.1 Name tag

A name tag is located on the bearing bracket of each pump providing the information as shown.

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.



2.4.2 Identification acc. to Explosion-Proof Directive



Since the effective maximum surface temperature does not depend on the according ignition source, but on the temperature of the pumped liquid, no identification ensues with a temperature class or a temperature. The symbol "X" has been integrated in the identification and the chapter 6.2 (item 7) of this manual refers to the arising surface temperatures.

2.5 SAFETY

2.5.1 Symbol- and Notice Explanation

2.5.1.1 Work Safety Symbol



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 General Instructions for pump's operation

The process pumps of type NCR 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 NCR-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:



- Never operate pump without correctly installed coupling guard.
- 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.
- Never touch shaft sealing parts while the pump is in operation and the pump casing is pressurized.

Attention !

- Never start pump without making sure that the pump is primed and that 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 start operation without connection of the required auxiliary devices for supply and monitoring the shaft sealing.
- Never operate pump with suction valve closed or with clogged suction strainer.

- If it cannot be excluded that larger solids (>0,5 mm) will be contained in the pumped liquid, a filter must be provided on suction side. Suction strainers must have a net „free area“ of at least six to seven times the suction pipe area. Screen with a mesh width of 480 micron is recommended. Pressure losses at rated capacity should not exceed 1 to 1,5 m (3 to 5 ft). There should be a minimum of two pipe diameters of straight pipe between strainer outlet and pump suction flange.

3. PUMP DESCRIPTION

3.1 APPLICATION / DEFINED USE

DICKOW-NCR-pumps are used where ever aggressive liquid is handled at extreme temperatures and where the shaft sealing must meet utmost requirements. NCR-pumps are suitable for a temperature range of -40°C up to 350°C (-40°F up to 662°F) and an operating pressure up to 40 bar. Common shaft sealing systems are available for the different pumped liquids.

For the defined use of the pump it is absolutely necessary that the pump is constantly filled with liquid. The maximum speed is determined with 2900 rpm at 50 cycles and with 3500 rpm at 60 cycles.

3.2 CONSTRUCTION

The DICKOW-Process pumps NCR are single flow, single stage volute casing pump of back-pull-out design with end suction flange and centerline top discharge flange. Disassembly of the rotating hydraulic part is possible without removing the suction casing from the piping.

If spacer-type couplings are used, the drive motor can remain on the baseplate while the hydraulic part is being disassembled.

3.2.1 Volute casing, part 102

The volute casing is sealed on drive side by the intermediate casing. The intermediate casing is screwed to the volute casing by studs. The pumped liquid is sealed from the atmosphere by a confined gasket (metal-to-metal fit). Replaceable wear rings are available in the standard configuration.

The volute casing of standard design is cast en bloc and centerline supported.

Complete drainage of the pump is possible through the drain connection at the bottom of the volute casing.

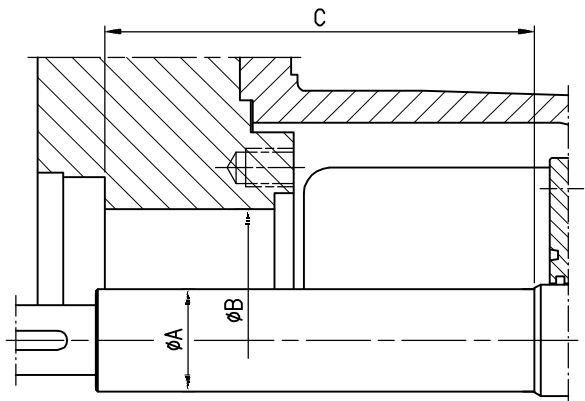
3.2.2 Impeller, part 233

The closed impeller are keyed to the pump shaft and secured by a cap nut with Heli-Coil insert. All impellers are dynamically balanced according to DIN ISO 1940 / part 1, grade G 6.3. The impellers are also hydraulically balanced such that no thrust loads will occur within the performance range. Renewable wear rings are standard.

3.2.3 Intermediate casing, part 113

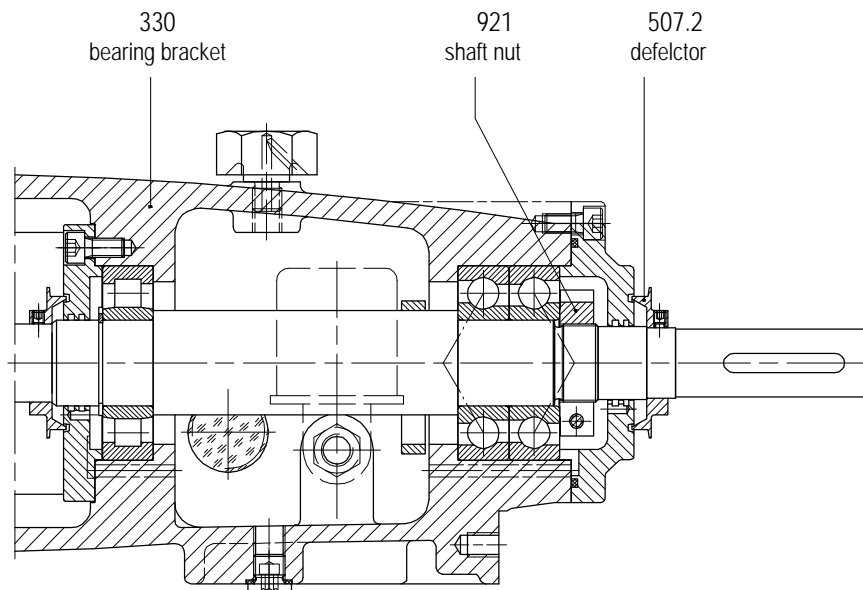
The intermediate casing connects the volute casing with the bearing bracket and holds also the shaft sealing. The design of the sealing chamber complies with the minimum dimensions according to 2.7.1.4 of API 610, 7th edition. Interchangeable wear rings in the intermediate casing are standard.

Frame size	Æ A	Æ B	C
I	32	82	135
II	42	94	154,5
III	53	110	179
IV	62	113	180



3.2.4 Bearing bracket, Antifriction bearings

The pump shaft is carried in generously dimensioned oil-lubricated antifriction bearings of heavy duty design, outside the pumped liquid. The antifriction bearing on coupling side is designed as a rigid bearing with paired angular ball bearings in O-arrangement. A roller bearing – designed as movable bearing – is provided on pump side. The oil level is controlled by a constant level oiler. Bearings have a lifetime of more than 25000 operating hours, even at upset conditions.



The oil bath is sealed from the atmosphere by a replaceable labyrinth seal and protected by deflectors. The bearing bracket is designed as a drip pan and provided with threaded leakage connection.

Frame size	Bearing sizes	
I	2 x 7307 BUA	NU 307
II	2 x 7311 BUA	NU 409
III	2 x 7313 BUA	NU 411
IV	2 x 7314 BUA	NU 313

4. SHAFT SEALING

4.1 MECHANICAL SEALS, DEFINED USE

For each installed mechanical seal, separate operating- and maintenance instructions are supplied giving information on the designations, materials, application limits and operating methods.

According to the explosion proof directive 94/9/EG, mechanical seals are to be considered as components are therefore not provided with a CE-identification, but a declaration of conformity will be issued. The operating instructions for the mechanical seal indicate the arising surface temperature of the atmospheric seal part.

The defined use of the mechanical seal requires the availability of a constant liquid in the sealing gap.

4.2 AUXILIARY EQUIPMENT

Double mechanical seals additionally require a thermosiphon vessel. Installation, function, operating method and monitoring devices are described in a separate instruction manual. Thermosiphon vessels are subject to the Directive 97/23/EG for pressure vessels.

5. INSTALLATION OF THE PUMP

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.

5.1 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.

5.2 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 coupling guard. If required, disassemble and inspect prior to final installation. Refer also to driver manuals for their long term storage.

5.3 ALIGNMENT OF BASEPLATE / BASEFRAME ON THE FOUNDATION

Pre-condition for a proper and troublefree operation of the pump is the accurate assembly of the entire unit. Improper installation inevitably results into increased vibrations (6.4.4) and thus, to damage on the elastic coupling and the antifriction bearings. Therefore, the pump should be assembled by specially trained personnel only or by our own fitters.

If the pump is delivered completely mounted with motor a careful assembly is guaranteed. After examining the unit on site for possible transportation damage, the following steps should be taken:

- Alignment of baseplate or baseframe by means of a water level.
- Elimination of unevenness in the foundation by suitable supports.
- Checking respectively realignment of the coupling acc. to 5.4 after tightening the foundation bolts.

Attention ! The proper alignment of the entire unit prior to start-up is the responsibility of the owner only.

5.4 ALIGNMENT OF FLEXIBLE COUPLINGS Brand „KTR / FLENDER“ - PKA / H

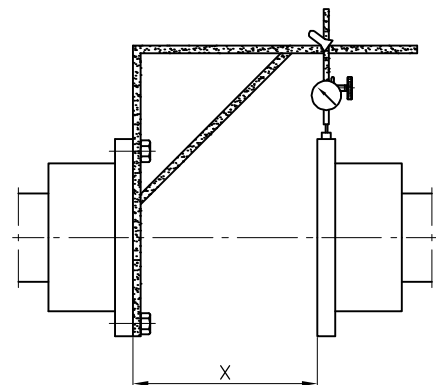
If motor and coupling is mounted on site by the owner, the following must be observed:

Attention ! Before starting alignment procedure, remove the screws from the support foot. After final alignment and before mounting the coupling guard, the support foot must be reassembled again with baseplate and bearing bracket, free of any stress.

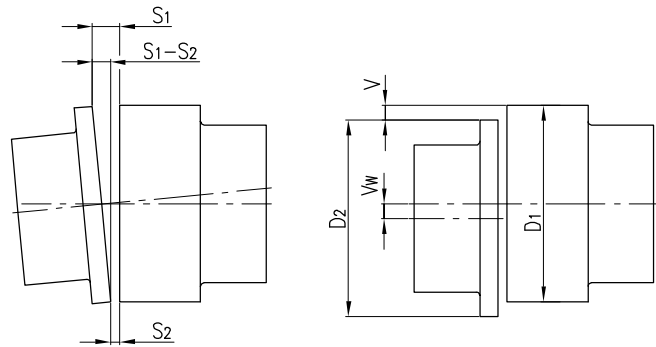
Attention ! After inserting the keys into the shaft grooves, the coupling halves are to be slid onto the shaft ends on pump and motor side until they flush with the shaft surface. It is important that the hub halves are slid on without excessive force. Wedging by using a hammer inevitably causes damage to the bearings or sleeve bearings. After installation, the hub halves are to be secured by threaded pins. If both coupling halves are mounted, the alignment of pump- and motor shaft relative to each other must be checked. Depending on the coupling design, this is done as follows:

The advantages of the back-pull-out design (item 3.2) – such as disassembly of rotating parts without removing the casing from the piping - can only be utilized when using spacer-type couplings (couplings with removable piece). In this case, the driver can also remain on the foundation.

An alignment check is made by using a dial indicator as shown in the following drawing. The distance "X" between the pre-mounted coupling halves complies with the spacer length.



There are two forms of misalignment:



angular misalignment

parallel misalignment

Use the dial indicator as shown and determine the parallel misalignment V_w . Realign if V_w exceeds 0,1 mm. Place the dial indicator now at the coupling end and determine the angular misalignment $S_1 - S_2$.

The units are lined up if the following alignment error E_z is not exceeded:

The available angular misalignment is:

$$S_1 - S_2$$

The parallel misalignment V_w is

$$V_w = V - \left(\frac{D_2 - D_1}{2} \right)$$

The available error E_v is:

$$E_v = V_w + (S_1 - S_2)$$

Allowable misalignment E_z

$$E_z = 0,3 \text{ mm (0.012 inch) at } 3000\text{-}3500 \text{ min}^{-1}$$

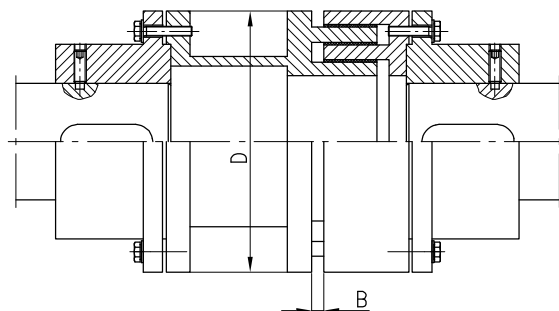
$$E_z = 0,5 \text{ mm (0.020 inch) at } 1500\text{-}1750 \text{ min}^{-1}$$

If one of the two errors is zero, the allowable deviation for the other error may be fully utilized.

Before mounting the distance sleeve, check direction of rotation of the driver (clockwise when viewing the shaft end of the pump). Assembly of the bipartite distance sleeve is done by joining both parts - which are provided with claws and rubber packages - by hand such that the gap "B" is zero. Insert these parts between the hub half faces on motor and pump side and fit them into the centrings. Screw both intermediate parts to the hub halves and tighten the screws evenly and cross wise.

Coupling-Dia D (mm)	KTR B (mm)	FLENDER B (mm)
80 - 86	4	4
97 - 195	5	5
200 - 288	6	6

Coupling-Dia D (inch)	KTR B (inch)	FLENDER B (inch)
3.15 - 3.39	0.157	0.157
3.82 - 7.68	0.197	0.197
7.87 - 11.34	0.236	0.236



After tightening the bolts, check the coupling space "B".

5.5 SPECIAL COUPLING DESIGN

When using couplings of different designs from other manufacturers, consider special alignment instructions that apply to such couplings.

5.6 DOCUMENTATION ACCORDING TO DIRECTIVE 94/9/EG

Couplings are required for a safe operation of the pumps. They are defined to transmit energy and therefore, are subject to the Explosion Proof Directive and will have a CE-marking. A declaration of conformity will also be supplied.

5.7 COUPLING GUARD



Never operate pumps without properly mounted coupling guards (shock protection). If the coupling guard is manufactured and supplied by DICKOW, compliance with the valid technical safety requirements – such as proper stability, sufficient distance to rotating parts and no use of light metal for operation in hazardous areas - is guaranteed. If the coupling guard is provided by the user, it must be in accordance with the above mentioned requirements and meet the standard EN 809.

5.8 PIPING

Attention !

The pump must be stressfree connected to the piping. That means, the connecting flanges of the pipes must be in exact alignment with the pump flanges. Never draw piping into place by imposing force. 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

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

5.8.1 Suction pipe

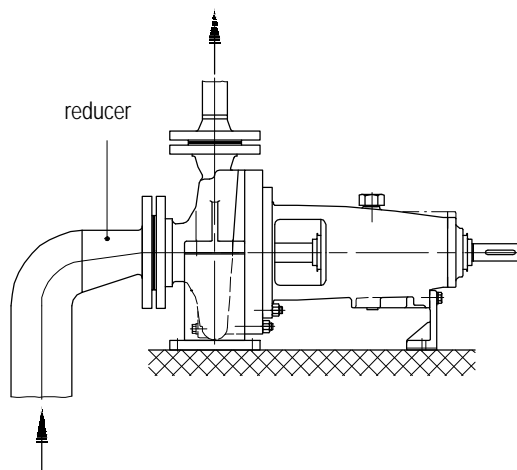
Attention ! When using volute casing pumps, care must be taken for the NPSH-conditions. The suction piping requires careful design for these pumps. It is especially important that the available NPSH of the system is exactly determined.

$$\text{NPSH-available} \geq \text{NPSH-required} + \text{minimum } 0,5 \text{ m (1.5 - 2 ft)}$$

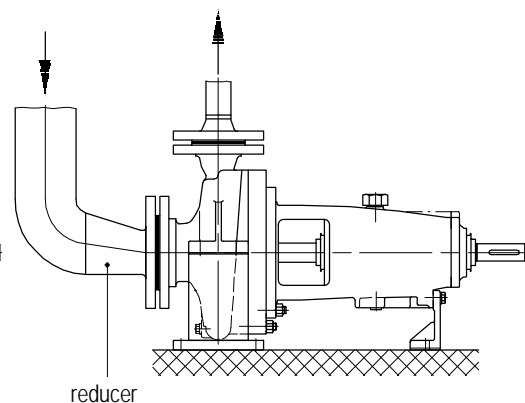
Suction pipe should be flushed before connection to the pump and the following be considered:

1. Use of elbows close to the pump suction flange should be avoided. There should be a minimum of 2 pipe diameters of straight pipe between the elbow and suction inlet.
2. Suction piping must never be of smaller diameter than the pump suction.
3. Reducers, if used, must be eccentric at pump suction flange as shown in the following drawing.

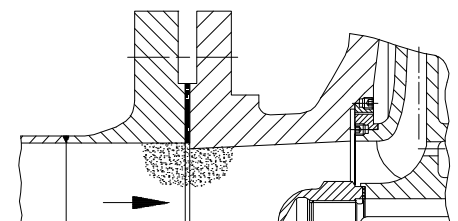
Suction lift conditions



Flooded suction conditions



4. Suction strainers if used must have a net „free area“ of at least six to seven times the suction pipe section. Screen with a mesh width of 480 micron is recommended. Pressure losses at rated capacity should not exceed 1 to 1,5 m (39 - 59"). 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. A foot valve should be provided to allow proper filling of pump and suction line before start-up.
4. Connection must be provided to fill suction line and pump with liquid before starting the pump.

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

5.8.2 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 pipe must lead back to the suction source - not to the pump suction pipe!

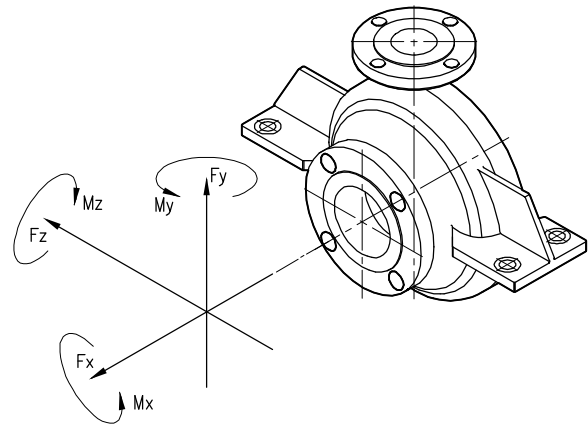
5.8.3 Final piping check

After connecting piping to the pump:

1. Rotate shaft several times by hand to be sure that there is no binding and all parts are free.
2. Check alignment according to the alignment procedure outlined in item 5.3/5.4. to maintain absence of stress through piping. If stress exists, correct piping.

5.8.4 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)
32/165 200 250	890	580	710	460	355	230	605	755	490	390	300	195
40/165 210 250 320	1100	680	870	670	490	310	640	800	500	415	320	210
50/165 200 250 330	1335	890	1070	950	720	475	710	890	580	460	355	230
65/165 200 250 320	1780	1155	1425	1330	1005	680	880	1070	700	670	490	310
80/165 200 250 320	2350	1500	1850	1700	1280	850	1070	1335	890	950	720	475
100/200 250 320 400	2350	1500	1850	1700	1280	850	1425	1780	1155	1330	1005	680
125/250 320 400	3115	2045	2490	2305	1765	1180	1880	2350	1535	1700	1280	850
150/250 320 400 500	4895	3115	3780	3530	2580	1765	2490	3115	2045	2305	1765	1180
200/250	4895	3115	3780	3530	2580	1765	3780	4895	3115	3530	2580	1765
200/320 400 500	6695	4450	5340	5020	3800	2440	3780	4895	3115	3530	2580	1765

5.9 INSULATION

Insulation, if foreseen for pumps handling hot liquids, should cover the volute casing and intermediate casing only. To avoid overheating of the antifriction bearings, a complete heat dissipation by radiation must be guaranteed in the area of bearing bracket 330. Thus, insulation of antifriction bearing and bearing bracket lantern is not allowed.

Insulation can also be required if the specification regarding maximum surface temperature within the explosion proofness must be fulfilled. This is especially the case if the liquid temperature exceeds the allowable temperature of the given temperature class.

5.10 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.

5.11 EARTHING CONNECTION

An earthing connection at the baseplate or frame is provided as standard. Earthing connections must be plugged in any case.

5.12 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 as well as the motor instruction manual must be observed.

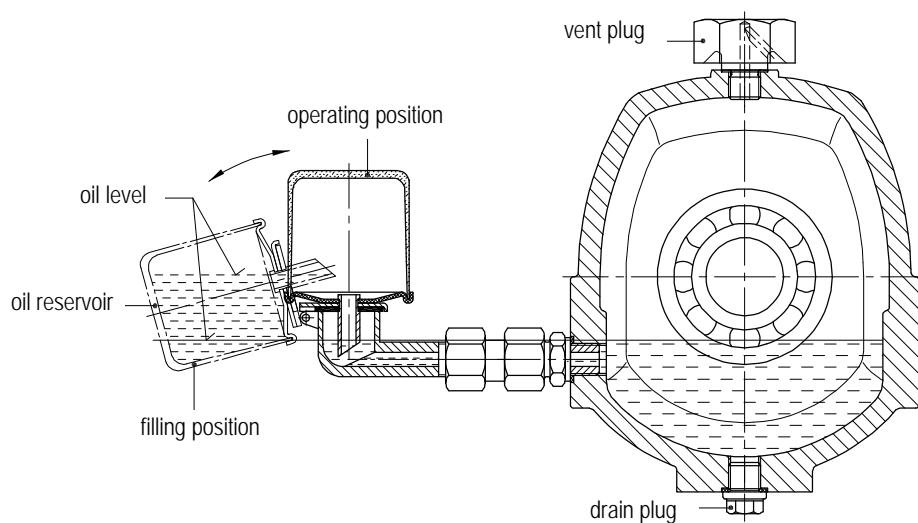
Attention ! The proper connection of the electric motor including the provided pump protection devices is the responsibility of the owner only.

6. OPERATION OF THE PUMP

6.1 START-UP PROCEDURE / LUBRICANTS

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

1. Check for identical speed on pump and motor name tag.
2. Before start-up, the bearing bracket must be filled with oil.
If start-up follows a longer storage period of the pump, it is recommended to fill the bearing bracket first with petrol and rotate the pump shaft several times by hand to clean the bearings from possible impurities.







For filling up the bearing bracket, remove the vent plug 913 from the top of the bearing bracket. Fill in the oil through the vent plug connection - at back-folded constant level oiler - until the filling level reaches the connection elbow of the oiler. Then, fill the oil reservoir in accordance with above figure and put it back to upright position. The oil will run now from the oil reservoir into the bearing bracket until the required level is reached. As long as the oil reservoir is filled during operation with oil, a sufficient oil filling in the bearing bracket is ensured. If the oil level in the reservoir drops down to about 1/3 of the total height, refilling is recommended.





After the first start-up of new pumps, the oil filling should be renewed after 200 operating hours, then once a year.

Filling volumes:	frame size	I	= 0,50 litre
		II	= 1,00 litre
		III	= 3,00litre
		IV	= 6,00 litre

If the following mentioned lubricants are not available and no others are specified by the factory, any motor oil with a viscosity of 68 mm²/sec at 40°C (available at petrol stations) can be used.

Lubricants for antifriction bearings:

Symbols acc. to DIN 51502				
<div style="border: 1px solid black; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">C 36</div> <p>respect. HD 20W-20</p>	<p>Aral Vitam GF 46 (GF 36) *</p> <p>(up to now:) *</p>	<p>SHELL Rimula X X 20W-20</p>	<p>BP Energol VS 68 (ISO),</p> <p>BP Energol HLP 68 (ISO),</p> <p>BP Energol HD SAE 20W-20</p>	<p>ESSTIC 68 (50) *,</p> <p>ESSOLUBE HDX 20W/20</p> <p>(up to now) *</p>

Symbols acc. to DIN 51502				
<div style="border: 1px solid black; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">C 36</div> <p>respect. HD 20W-20</p>	<p>FINA CIRKAN 68 ISO,</p> <p>FINA SOLNA 68 ISO,</p> <p>PURFINA MOTOR OIL SAE 20W-20 **</p>	<p>RENOLIN 206,</p> <p>RENOLIN B 15,</p> <p>RENOLIN HD 20W-20</p>	<p>Mobil Vactra Oil Heavy Medium, Mobil HD 20W-20</p>	<p>Rando Oil 68,</p> <p>Ursa Oil P 68,</p> <p>Ursa Oil Extra Duty SAE 20W/20</p>

3. If cooling is provided, open valves in the cooling line and check the flow.
4. Fill up pump suction pipe completely with liquid. Open suction valve, close discharge valve.
5. If a thermosiphon vessel is available, fill it with buffer fluid up to middle of sight glass. Under consideration of corrosion resistance and the compatibility with the pumped liquid and the environmental conditions, any liquid can be used. The used buffer fluid however must be free of solids, may not tend to sedimentation, should have a high boiling point, high heat capacity and thermal conductivity.

Attention ! Instructions given in the manual for thermosiphon vessel must be observed !

6. The sealing chamber must thoroughly be vented in order to avoid dry running and consequent damage of the seal faces.

Attention ! Instructions given in the manual for mechanical seal must be observed !

7. 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 (clockwise direction when viewing the shaft end). The pump must not come to a jerky stop after shut off.

8. 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.

9. **Attention !** Continued operation with dead headed pump will cause overheating within the pump. Cavitation, break down of the mechanical seal through flashing of the liquid in the sealing gap and thus, temperature increase at the atmospheric seal, may be the consequences and must be avoided in any case.

6.2 OPERATION, MAINTENANCE

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 6.4.4)

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. Bearing temperature and oil level in the constant level oiler must be controlled regularly.
6. Isolation valves in the auxiliary pipes must always be opened during operation.
7. After a longer operation time, the surface temperature at the wetted casing parts – especially the volute casing – will adjust itself according to the liquid temperature. This requires consideration within the bounds of the explosion proofness and the T-classification. Concerning the surface temperature at the mechanical seal, adhere to the instruction manual for the selected seal.

6.3 SHUT DOWN

1. Close valve on discharge side slowly.

Attention !

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

3. Close valve on suction side.
4. Close auxiliary seal flushing.
5. Close cooling water when the pump has cooled down.
6. For shut-down in winter, drain pump and cooling chambers. Open condensate drain connection at jacketed pumps.

6.4 PREVENTIVE MAINTENANCE

DICKOW-NCR-Pumps with oil lubricated antifriction bearings and constant level oilers 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.

6.4.1 Routine Maintenance

1. Gauges

In the suction or discharge line - right in front or behind the pump – manometer or mano-vacuum-meter should be provided for controlling operating conditions. The maximum pressure of these gauges should be 50% above the operating pressure. Install isolation valves and condensers in the measuring lines in front of the gauges.

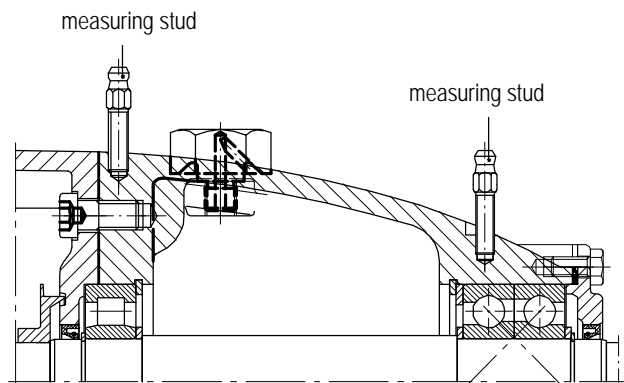
3. Vibration monitoring

All rotating pump parts are properly dynamically balanced, according to DIN ISO 1940/part1, 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.

The bearing bracket is also available with four location holes M8, staggered each by 90°, to install measuring studs for vibration monitoring in accordance with the SMP-method (shock-pulse-method). It is recommended to perform vibration measurements in regular intervals and to keep records of the measured values.

Possible appearing damages to antifriction bearings can be recognized in time and serious failures can be avoided by a preventive replacement of the ball bearings.



6.5 BEARING MAINTENANCE

Obtainment of a long service life requires careful monitoring and maintenance of the pump bearings. This includes for instance a constant check of the oil level in the bearing bracket and the bearing temperature. The bearing temperature should not be more than 50-60°C (122-140°F) above the ambient temperature and not exceed 80-90°C (176-194°F).

The oil filling must be changed yearly. The vent holes in the vent screw must not get clogged.

6.6 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 tested prior to delivery. Before calling DICKOW service personnel 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 labels, wire connections in the terminal box. Make sure that control devices are properly connected and measuring instruments are calibrated.

6.6.1 No liquid delivered at start-up

Problem: Suction line is not completely primed or insufficiently filled.

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 line 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.

6.6.2 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 clogged

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.

6.6.3 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 7.7)

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.

6.6.4 Pump is noisy and vibrates after start-up

Problem: Coupling between motor and pump is incorrectly mounted or aligned.

Remedy: Check and correct according to section 5.3 / 5.4.



Before removing the coupling guard, make sure that driver is shut off and secured against unauthorized restart.

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: Pump cavitates.

Remedy: Refer to section 6.6.2 - NPSH-improvement.

6.6.5 Pump gets noisy and vibrates after a longer operating time

Problem: Pump ball bearings are worn out.

Remedy: Replace ball bearings. Use brand new originally packed bearings only.

Problem: Motor ball bearings are worn out.

Remedy: Replace bearings according to the instructions in the motor manual.

6.6.6 Ball bearings run hot

Problem: Misalignment of elastic coupling.

Remedy: Realign coupling as described in item 5.4.

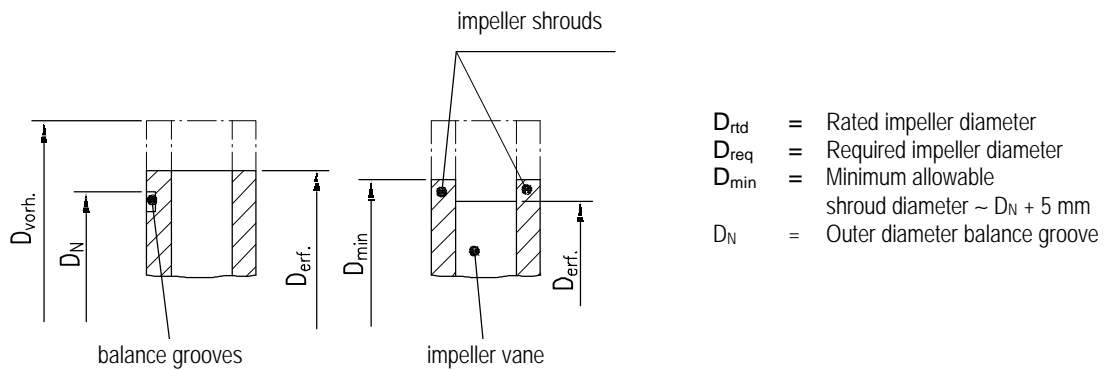
Problem: Coupling space "B" is not maintained. Motor shows axial load.

Remedy: Correct spacing according to item 5.4.

Problem: At high-speed operation, the ball bearings are not sufficiently cooled by the motor exhaust air.

Remedy: Installation of a fan wheel to the coupling half on motor side.
(Temperature reduction 10-15°C (50-59°F).

6.7 IMPELLER TRIMMING




Any existing unbalance of the impellers is eliminated by balance grooves provided in the impeller shrouds. It is recommended to trim the impeller shrouds only that far, that diameter D_{min} is maintained. Otherwise, the impeller must be rebalanced after trimming.

Attention ! Non-observance of these instructions may cause excessive vibrations, worn out ball bearings and leaking seals.

7. DISASSEMBLY

7.1 GENERAL

Independent from the installed shaft sealing system, proceed as follows:

1.  When disassembling the pump unit, the coupling guard must be removed in any case. Prior to this the power supply to the motor must be interrupted and the driver secured against unauthorized restart. Before the rotating part or the complete pump is disconnected from the piping, the pump must be depressurized, cooled down, completely drained and thoroughly flushed if hazardous liquids have been handled. During disassembly and drainage, protective clothing, gloves and eye glasses must be used.
2. Drain and dismantle available fluid reservoirs
3. Remove auxiliary pipings and monitoring devices.
4. Remove spacer from coupling if available (5.4)
5. Remove support foot at bearing bracket.
6. Drain oil bath in the bearing bracket completely through drain plug. Remove constant level oiler. Collect oil in a bucket, protect environment.
7. Remove pump from piping system if required.
8. Loosen and remove adapter nuts 920.2 from intermediate casing 113.

9. Loosen connection between intermediate casing and volute casing by jack screws (thread holes available in the intermediate casing).
10. Remove complete bearing bracket unit and clamp it in vertical position in a work bench or in a chuck jaw according to Figure A. Protect shaft against any damage.

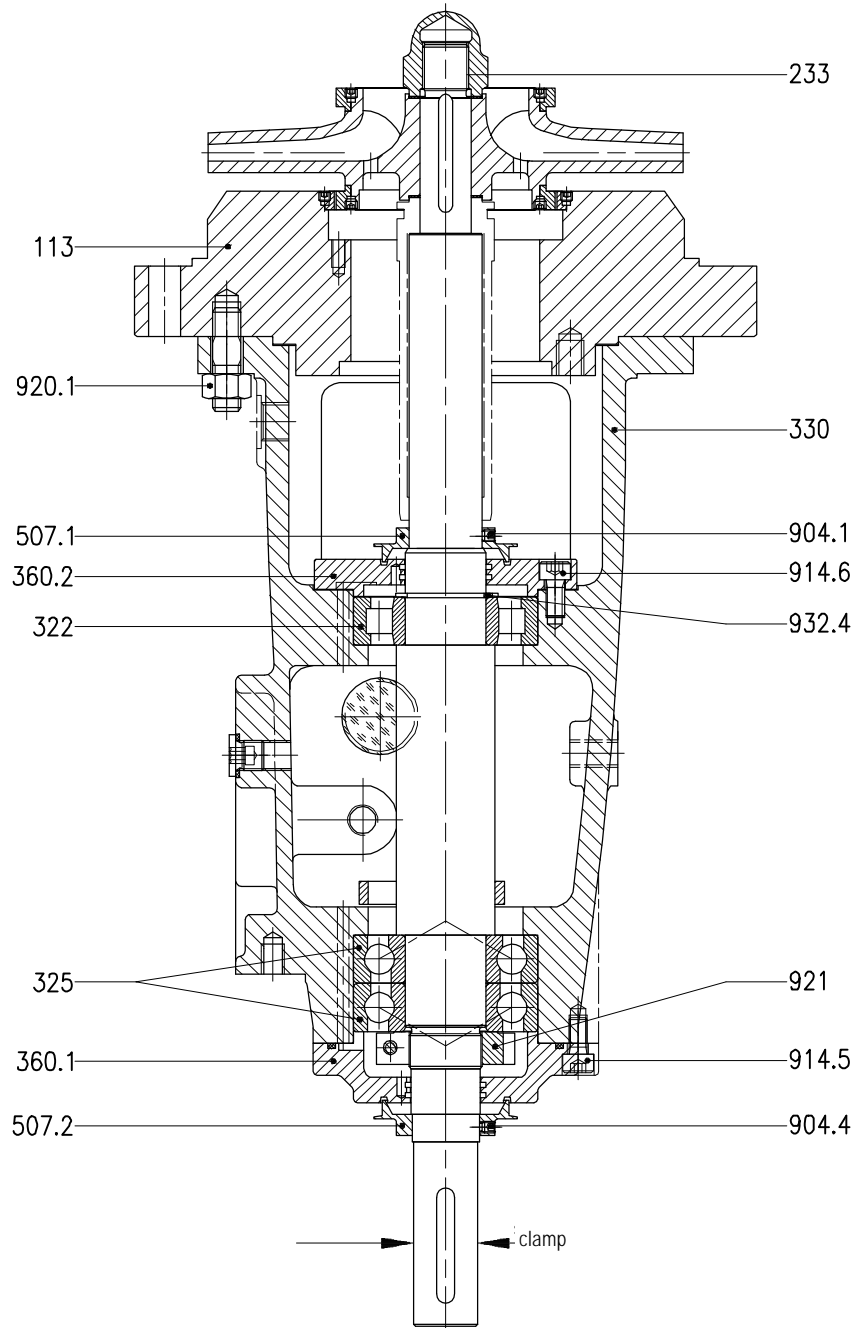


Figure A

11. Loosen and remove impeller nut 922 (right hand thread).
12. Remove impeller 233 by puller. Place the puller under the vanes to avoid damage to the shrouds.
13. Remove key 940.1

7.2 DISASSEMBLY OF MECHANICAL SEAL

For disassembling the mechanical seal, follow the instructions given of the seal manual.

7.3 REPLACEMENT OF ANTIFRICTION BEARINGS

The following procedure concerns the replacement of antifriction bearings after the steps according to item 7.1 thru 7.3 have been performed.

1. Loosen and remove the hexagon nuts 920.1 from the bearing bracket 330.
2. Pull off the intermediate casing 113.
3. Loosen the grub screw 904.1 and remove the deflector 507.1.
4. Loosen and remove the hexagon head bolts 914.6 and pull off the bearing cover 360.2.
5. Remove the circlip 932.4.
6. Remove the grub screw 904.4 and pull off the deflector 507.2.
7. Loosen and remove the inner hexagon head bolts 914.5 and pull off the bearing cover 360.1.
8. Remove the shaft nut 921.
9. Press the shaft down with a drilling machine spindle and out off the bearing seat 325.
10. Remove the inner ring of the roller bearing from the shaft, using a puller.
11. Press the outer ring of the roller bearing 322 out off the seat in the bearing bracket 330.
12. Pull off the angular ball bearings 325 from the seat in the bearing bracket 330, using a puller.
13. When replacing antifriction bearings, only use brand new originally packed bearings as listed in the table.

frame size	antifriction bearings	
	322	325
I	NU 307	2 x 7307 BUA
II	NU 409	2 x 7311 BUA
III	NU 411	2 x 7313 BUA
IV	NU 313	2 x 7314 BUA

8. INSPECTION

8.1 IMPELLER / WEAR RING

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. Diameters of the sliding surfaces have to be measured. The total clearance in new condition is 0,6 mm (0.0236 inch). If the clearance exceeds 0,9 mm (0.0354 inch), the wear ring must be replaced.

8.2 VOLUTE CASING / INTERMEDIATE CASING

Possible pittings must not exceed a depth of 1 mm (0.0394 inch). Centrings and seats of O-rings must not show any mechanical damage, corrosion or erosion. Circulation holes in the intermediate casing must be free of solids or sediments.

Inspect and measure the wear ring according to 8.1. Replace it if necessary.

8.3 BEARING BRACKET / ANTIFRICTION BEARING

Ball bearing seats must be measured. The bearing bracket must be replaced if the following maximum bore diameters are exceeded:

Frame size	Bore "bearing bracket" coupling end mm	Bore "bearing bracket" pump end mm
I	80,018	80,018
II	120,022	120,022
III	140,026	140,026
IV	150,026	140,026

The bearing bracket must be free of corrosion which may be caused by seal leakage. Centrings may not be damaged. The bearing bracket must not show any cracks at the area of support foot.

8.4 PUMP SHAFT

The pump shaft must be free of corrosion and pittings at the area of shaft sleeve and impeller seat. Visible grooves at the area of the radial seal rings are not acceptable. Ball bearing seats and impeller seats must be measured, shafts must be replaced if the measured values are below the following minimum diameters:

Frame size	Ball bearing seats		Impeller seat (mm)
	coupling end (mm)	pump end (mm)	
I	35,002	35,002	21,987
II	55,002	45,002	27,987
III	65,002	55,002	37,984
IV	70,002	65,002	47,984

8.5 SHAFT SLEEVES

Shaft sleeves must be free of corrosion. Visible grooves or damage on O-rings, throttle bushings and packing rings are not acceptable. Replace if required.

8.6 SEAL END PLATE

Seal end plates must be free of corrosion. Centrings, gasket seats, O-ring seats must not show any mechanical damage or wear. Replace if necessary.

9. REASSEMBLY

After inspection and replacement of unusable parts, reassembly is to be done as described in section 7, but in reverse order.

9.1 TORQUE SETTINGS

Part No.	Designation	frame I [Nm]	frame II [Nm]	frame III [Nm]	frame IV [Nm]
920.1	hexagon nut – bearing bracket	8.8 = 80 A4-70 = 50	80 50	190 130	190 130
920.2	hexagon nut –	8.8 = 80 A4 = 50		8.8 = 190 A4 = 130	
	up to impeller dia 250		8.8 = 80 A4-70 = 50		
	up to impeller dia 320		8.8 = 190 A4-70=130		
	up to impeller dia 400				8.8 = 190 A4 = 130
	up to impeller dia 500				8.8 = 360 A4 = 250
922	impeller nut	120	136	158	158

10. RETURNING THE PUMP TO THE FACTORY



Pumps returned to the factory for overhauling or repair, may be disassembled or maintained 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.

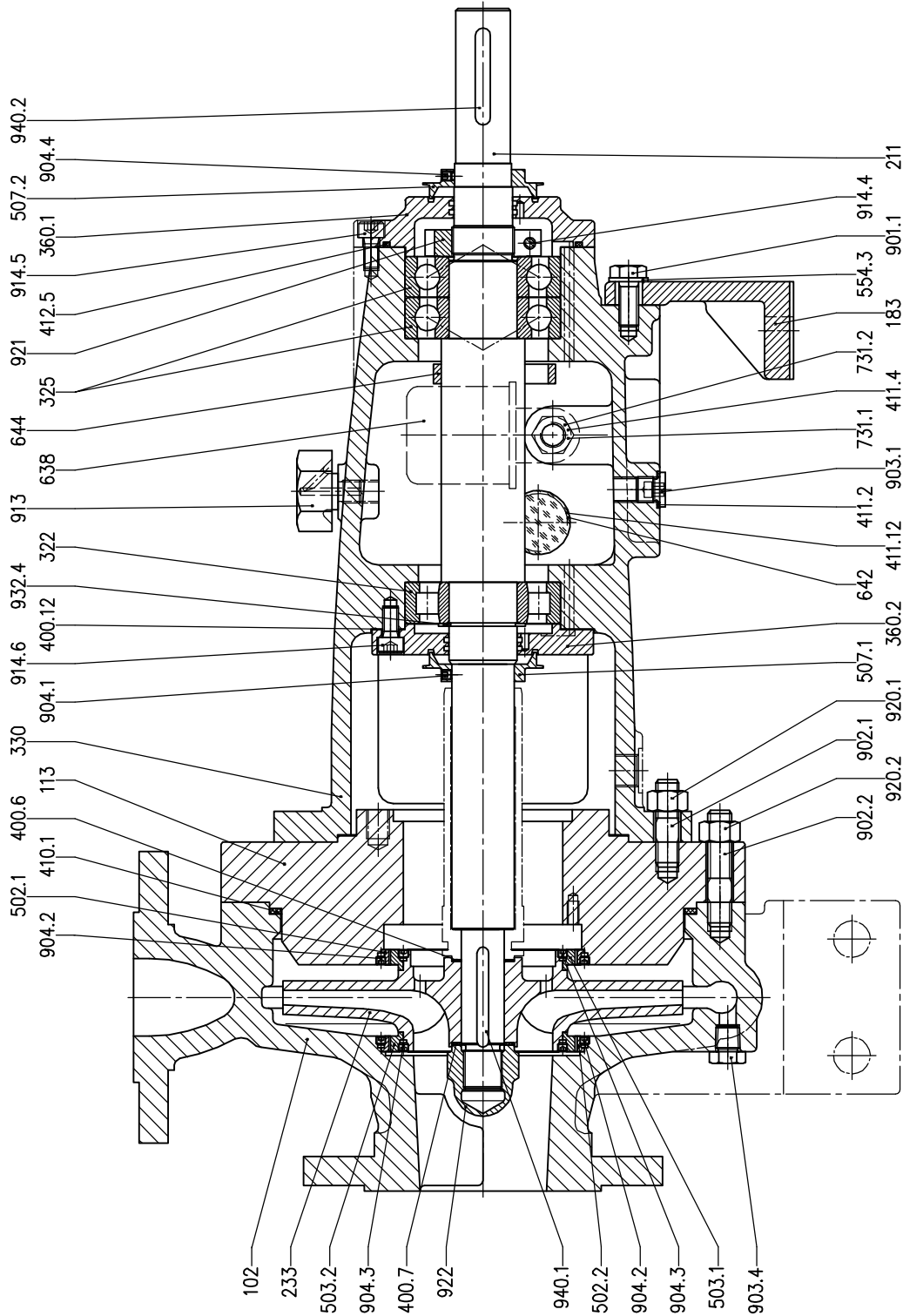
All pumps must be completely drained, flushed and neutralized before returning to the factory in order to avoid endangering of personnel, unnecessary costs for disposal and delay in handling.

11. SPARE PARTS IDENTIFICATION

11.1 SECTIONAL DRAWINGS

11.1.1 Type NCR, frame size I / II / III / IV Standard design

Drawing No. 54.NCR.4



11.2 PARTS LIST and MATERIAL SPECIFICATION for Standard design

Part No.	Designation	Standard - Materials	
		API-Code S-1 Type NCRhu	API-Code A-8 Type NCRh
102	Volute casing	GS-C25	1.4408
113	Intermediate casing	St37	1.4571
183	Support foot	GG25	GG25
211	Pump shaft	CK45	1.4571
233	Impeller	GG25	1.4408
322	Roller bearing	St	St
325	Angular ball bearing	St	St
330	Bearing bracket	GGG40.3	GGG40.3
360.1	Bearing cover	GG25	GG25
360.2	Bearing cover	St	St
400.6	Gasket	Novatec Premium	Novatec Premium
400.7	Gasket	Novatec Premium	Novatec Premium
400.12	Gasket	Novatec Premium	Novatec Premium
410.1	Casing gasket	Graphite	Graphite
411.2	Joint ring	Top Chem 2000	Top Chem 2000
411.4	Joint ring	Top Chem 2000	Top Chem 2000
411.12	Joint ring	Top Chem 2000	Top Chem 2000
412.5	O-Ring	Perbunan	Perbunan
502.1	Casing wear ring	1.2379 250 HB	1.4571
502.2	Casing wear ring	1.2379 250 HB	1.4571
503.1	Impeller ring	1.2379 300 HB	1.4418
503.2	Impeller ring	1.2379 300 HB	1.4418
507.1	Deflector	1.4571	1.4571
507.2	Deflector	1.4571	1.4571
554.3	Washer	St	1.4571

Part No.	Designation	Standard - Materials	
		API-Code S-1 Type NCRhu	API-Code A-8 Type NCRh
638	Constant level oiler	St/galvanized / glass	St/galvanized / glass
642	Oil level sight glass	St/galvanized / glass	St/galvanized / glass
644	Centrifugal ring	St	St
731.1	Pipe union	St	St
731.2	Pipe union	St	St
901.1	Hexagon head bolt	8.8	8.8
902.1	Stud	8.8	A4-70
902.2	Stud	8.8	A4-70
903.1	Screwed plug	St	St
903.4	Screwed plug	St	1.4571
904.1	Grub screw	A4	A4
904.2	Grub screw	8.8	A4
904.3	Grub screw	8.8	A4
904.4	Grub screw	A4	A4
913	Vent plug	St	St
914.4	Inner hexagon cap screw	8.8	8.8
914.5	Inner hexagon cap screw	8.8	8.8
914.6	Inner hexagon cap screw	8.8	8.8
920.1	Hexagon nut	8	A4
920.2	Hexagon nut	8	A4
921	Shaft nut	St	St
922	Impeller nut	St	1.4571
932.4	Circlip	FSt	FSt
940.1	Key	1.4571	1.4571
940.2	Key	1.4571	1.4571