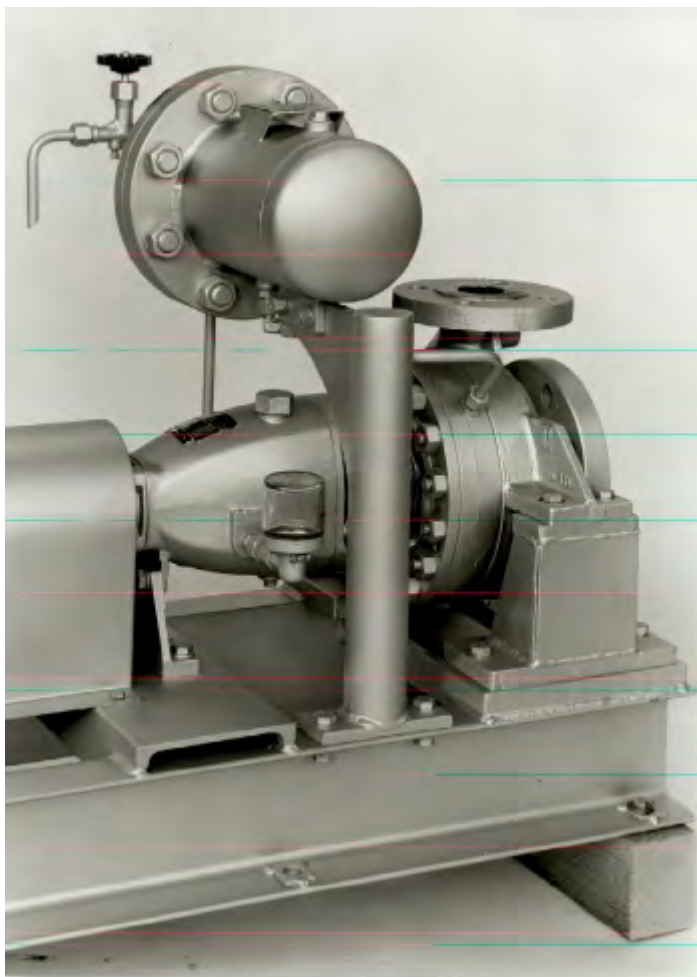


Installation, Operation and Maintenance Instructions

Type HPL / HPR
Frame size I / II



No. 44.HPL/HPR.E0.10/00



Pump sizes:	frame size I	frame size II
	32/200	80/200
	40/200	
	50/200	



DICKOW PUMPEN KG



EC Declaration of Conformity

as defined by Machinery Directive 89/392/EEC Annex II A

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

Series „HPL / HPR“

complies with the following provisions applying to it

Machinery Directive 93/44/EEC, 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)	VDMA 24276
DIN 24250	VDMA 24297
DIN 24260	
DIN 31001	
DIN EN 23661	
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-models HPL / HPR, horizontal volute casing pumps.

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. 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 confirmed 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 tests such as vibration, NPSH-value, noise level etc., will be supplied 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 of the maximum operating pressure unless otherwise specified.

2.4 NAME TAG INFORMATION

A name tag providing information on your pump is located on the bearing bracket. The name tag displays the rated service conditions and the pump serial number.

		DICKOW PUMPEN KG	
		D 84478 WALDKRAIBURG	
Type	[Redacted]		
Item No.	[Redacted]	Imp.Ø	[Redacted] mm
S/N	PB	[Redacted]	
Q	[Redacted] m ³ /h	H	[Redacted] mLC
n	[Redacted] rpm	P	[Redacted] kW
q	[Redacted] t/m ³	P _{NKT}	[Redacted] kW
[Redacted]			

When ordering spare parts, you need to state the pump model, size, serial number and the item number of the required parts. Item number information can be found in section 11. In case the name tag is lost, the serial number is also stamped on the bearing bracket (under the name tag).

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 Work Safety Instructions

The pumps of type HPL / HPR 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 HPL / HPR-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 touch shaft sealing parts when pump is operating and pump casing is pressurized, respectively filled with pumped liquid. Besides, retighten gland packing carefully.
- 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. DESCRIPTION

3.1 FIELD OF APPLICATION

DICKOW-Hot water circulation pumps, type HPL / HPR, have been developed for application in heating plants, for heating calanders, presses, large buildings and other applications which require temperatures $>230^{\circ}\text{C}$ ($>445^{\circ}\text{F}$).

The design of the HPL / HPR-pumps is based on long years of experience in the field of handling hot water and grants high availability and reliability in operation.

3.2 CONSTRUCTION

The horizontal volute casing pumps, type HPL / HPR, are process pumps of back-pull-out design. Disassembly of the rotating hydraulic parts is possible without loosening the suction and discharge flanges. When using spacer-type couplings, the drive motor can also remain bolted on the baseplate while dismantling the rotating unit.

3.2.1 Volute casing, part 102

The casing is of end suction and centerline top discharge type, self-venting. The pumped liquid is sealed from the atmosphere by a confined gasket. Replaceable wear rings are available. The casing will be delivered centerline mounted.

3.2.2 Impeller, part 233 / Pump shaft, part 211

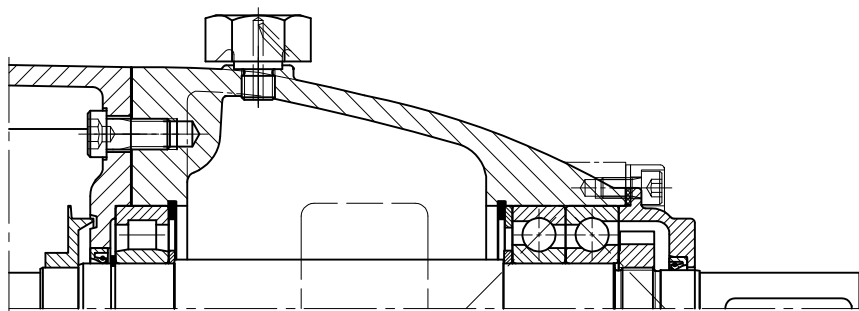
The impeller is keyed to the pump shaft and secured by a shaft nut with „Heli-Coil“ insert. The shaft is separated from the pumped liquid by confined gaskets between impeller hub and shaft nut and impeller hub and shaft sleeve. The impellers are dynamically balanced according to DIN ISO 1940/-part1, grade 6.3 as standard.

3.2.3 Intermediate casing, part 113

The intermediate casing with the integrated cooling jacket connects the volute casing with the bearing bracket lantern, respectively the bearing bracket. The shaft sealing is located in the intermediate casing. Replaceable wear rings are standard.

3.2.4 Bearing bracket, Antifriction bearings

The pump shaft is carried by generously dimensioned antifriction bearings outside the pumped liquid. The bearings are oil lubricated. The oil level is maintained by a constant level oiler. Double-row angular ball bearings of Conrad-type (no filling slots) on coupling side, roller bearings on pump side. Service life more than 25000 hrs.



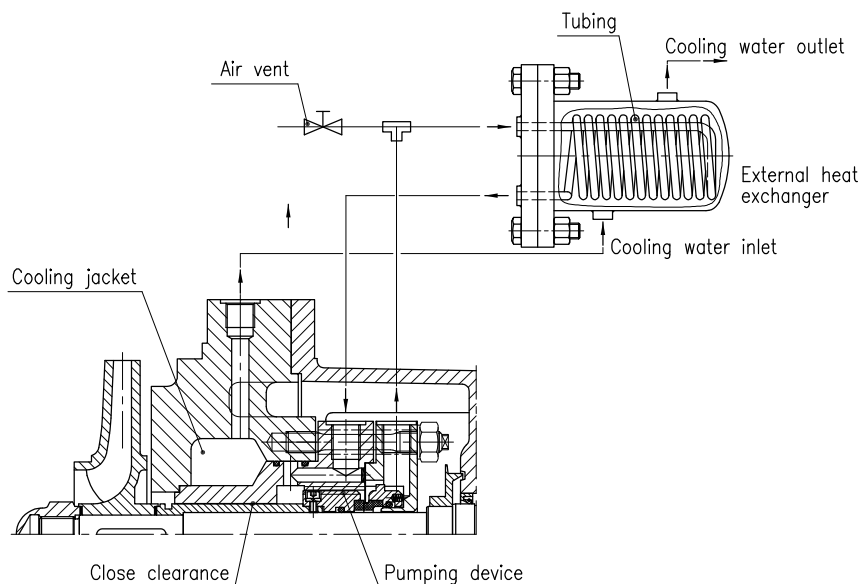
<u>Bearing sizes:</u>	Frame I/25 :	NU 307 / 2 x 7307 BUA
	Frame II/32 :	NU 409 / 2 x 7311 BUA

The radial seal ring, located in the bearing bracket lantern, is protected by an additional deflector which avoids entrance of seal leakage to the oil bath. The bearing bracket lantern is designed as a drip pan and provided with threaded leakage connection.

4. SHAFT SEALING

4.1 STANDARD DESIGN – Mechanical seal BU HSHF

4.1.1 Assembly drawing



4.1.2 Technical data

Operating: Dead end. The seal casing and the pump casing is separated by a close clearanced water cooled throttle in front of the seal. A pumping device creates an external flow through the water cooled heat exchanger to dissipate the frictional heat, generated by the seal faces. This arrangement cools down the temperature in the seal area to below 75°C (168°F).

Operating limits: Pressure max. 70 bar (1020 psi), temperature up to 280°C (535°F).

Application: Hot water >230°C (445°F)

4.1.3 Heat exchanger

The heat exchanger consists of the carbon steel vessel and the pressurized stainless steel (1.4571) tubing. Design data tubing: 200°C (390°F), 165 bar (2405 psi). Recommended cooling flow 350 – 500 l/h (1.283 – 1.832 Imp.gpm; 1.541 – 2.202 U.S.gpm). The exchanger unit is connected to the support construction on the pump frame and to the mechanical seal casing.

4.2 OTHER SHAFT SEALING DESIGNS

Consider installation drawing, mentioned in the cover sheet of this manual, page 1 "Technical Pump Data".

5. INSTALLATION

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's normal packaging procedure is designed to protect the pump during shipment. Upon receipt store in a covered and dry location.

Long Term - more than six months

Preservative treatment of outer ball bearings and machined surfaces will be required. Rotate shaft several times every 3 months. Refer to driver and coupling manuals for their long term storage procedure.

Handling

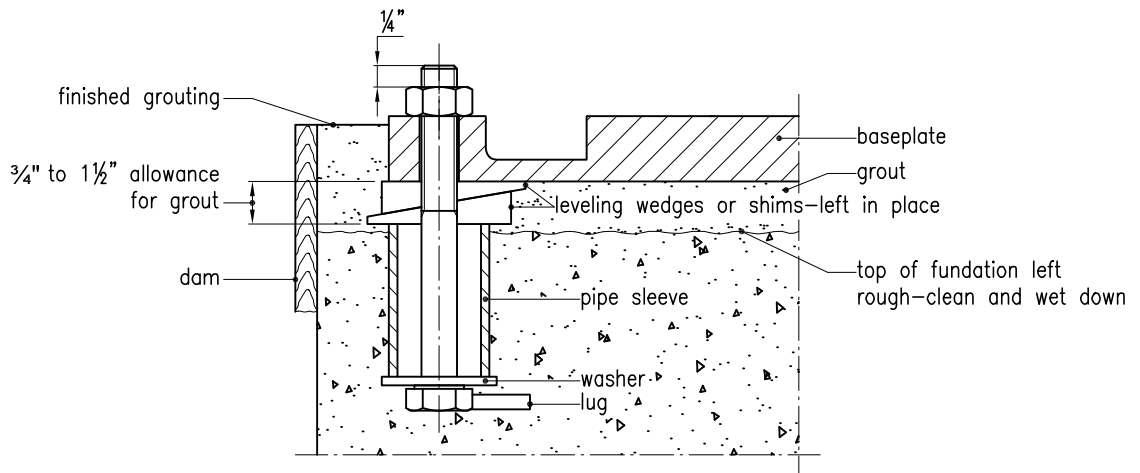
Use care when moving pumps. Lifting equipment must be able to adequately support the entire assembly. Hoist bare pumps, using a sling under the suction flange and bearing housing.

Attention !

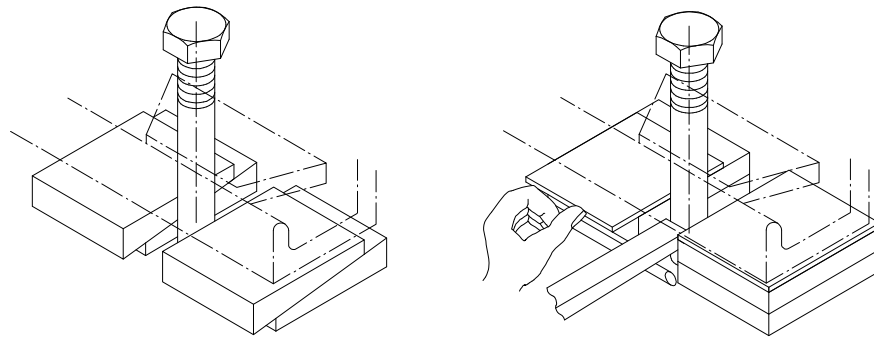
Failure to properly lift and support equipment may result in serious injury or damage of the pumps.

5.3 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 inches) between the shims is suggested on medium size units. A gap of about 19 to 38 mm (3/4 inches to 1 1/2 inches) 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 pump or electrical equipment !

4. Align the driver to the pump as per item 4.5
5. 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 item 4.5 to ensure that no distortion of the pump unit has been caused by stress through piping. Correct piping if misalignment occurs and realign pump and driver.
8. Pump and driver alignment must again be checked at operating temperature.
9. After about two weeks of normal pump operation, the pump and driver alignment should again be checked under operating conditions. If alignment is still correct, the driver feet may be dowelled to the baseplate. 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. Final alignment must always be checked and corrected at the operating temperature of the pump and driver.

5.4 ALIGNMENT OF FLEXIBLE COUPLINGS, Brand „OESTERLING / FLENDER“



Before removing the coupling guard and before starting any alignment procedure, make sure that driver is shut off and secured against unauthorized restart.

Attention !

A flexible coupling should not be used to compensate misalignment of the pump and drive shafts. The purpose of the flexible coupling is to compensate temperature changes and to permit end movement of the shafts without interference with each other while transmitting power from the driver to the pump.

Attention !

If the complete unit is assembled at DICKOW, the coupling is properly aligned when the unit leaves the factory. However, after fastening the baseplate and connecting the pipes, a final alignment check of the coupling has to be done because proper alignment of the complete unit is the responsibility of the owner.

Attention !

The most accurate alignment assures best running life !

Attention !

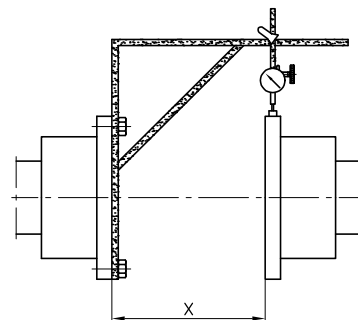
Before starting alignment procedure, remove pump support foot from bearing bracket. After final alignment assemble the support foot again, free of any stress.

5.4.1 Spacer-type couplings

Remove the spacer between the pump and driver. Make a bracket, as shown in the following figure, which can be fastened to one of the coupling halves and which is long enough to reach the other coupling half. Fasten this bracket to one coupling half and a dial-type indicator to the bracket arm so that the indicator button rides on the other coupling half as shown.

Make a chalk mark on the coupling half beside where the button rests and set the dial to zero. To check for parallel alignment, rotate both shafts by the same amount, i.e. all readings are made with the button at the chalk mark.

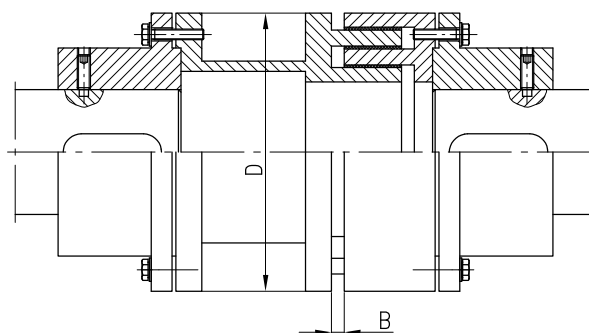
After parallel alignment has been obtained, change the indicator so it rides on the face of the same coupling half and follow the same procedure to check for angular alignment that was used for parallel alignment.



After final alignment is obtained, insert the spacer and bolt the coupling halves. Consider recommended dimension „B“ as given below.

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

Coupling-Dia D (inch)	OESTERLING 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



Consider item 5.4.1

„Allowable misalignment“

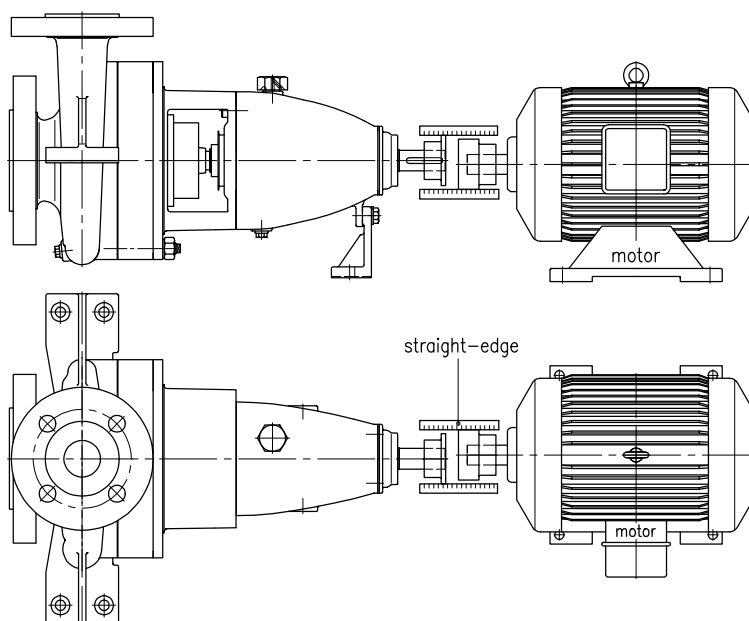
5.4.2 Standard couplings without spacer

There are two forms of misalignment between the pump shaft and the driver shaft as follows:

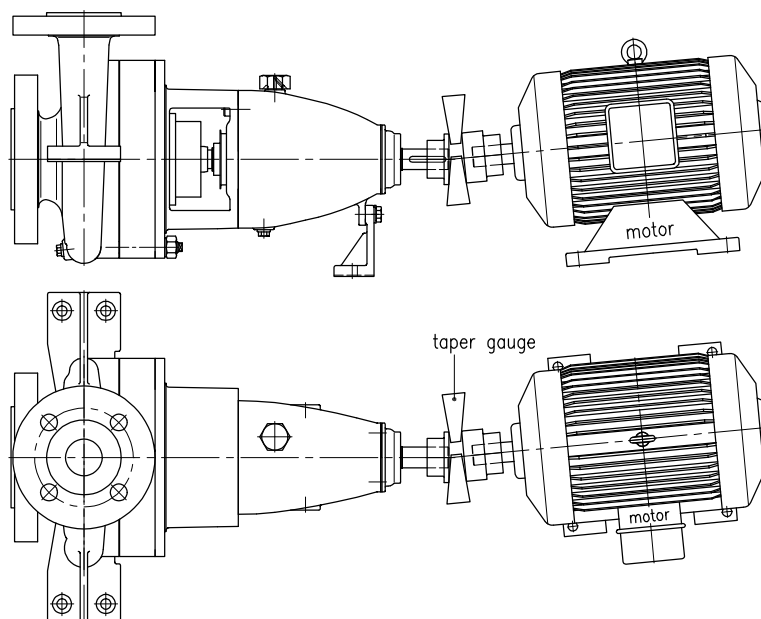
- Angular misalignment - shafts with axes concentric but not parallel
- Parallel misalignment - shafts with axes parallel but not concentric

The faces of the coupling halves should be spaced far enough apart so that they cannot strike each other when the driver rotor is moved hard over towards the pump. Consider the minimum dimension „B“ for separation of the coupling halves as stated in the following figures. The necessary tools for approximately checking the flexible coupling without spacer are a straight edge and a taper gauge.

Checking parallel alignment



Checking angular alignment

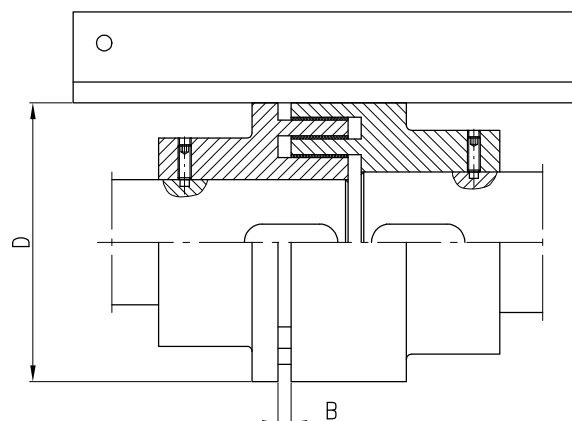


These effects usually occur together so that both angular and parallel misalignment are present. Proceed with checks for angular and parallel alignment by the following method:

- A check for parallel alignment is made by placing a straight edge across both coupling rims at the top, bottom and at both sides. The unit will be in parallel alignment when the straight edge rests evenly on the coupling rim at all positions. Care must be taken to have the straight edge parallel to the axis of both shafts.
- A check for angular alignment is made by inserting the taper gauge or feelers at four points between the coupling faces and comparing the distance between the faces at four points spaced at 90-degree intervals around the coupling. The unit will be in angular alignment when the measurements show that the coupling faces are the same distance apart at all points. Consider minimum dimension „B“ as given below.

Coupling-Dia D (mm)	OESTERLING B (mm)	FLENDER B (mm)
80 - 125	2 - 4	2 - 4
131 - 225	2 - 6	2 - 6
250 - 288	2 - 7	3 - 8

Coupling-Dia D (inch)	OESTERLING B (inch)	FLENDER B (inch)
3.15 - 4.92	0.079 - 0.157	0.079 - 0.157
5.15 - 8.85	0.079 - 0.236	0.079 - 0.236
9.84 - 11.34	0.079 - 0.276	0.118 - 0.315

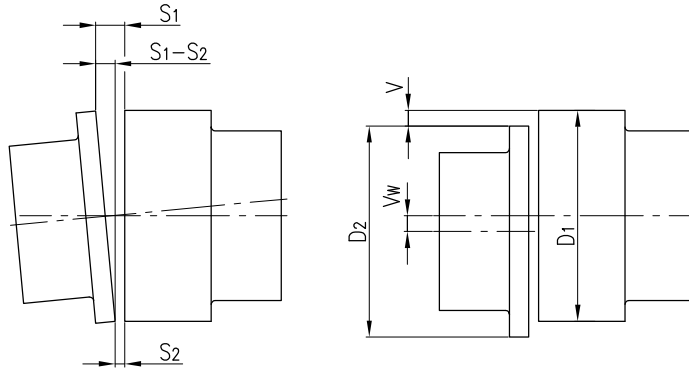


Angular and parallel misalignment are corrected by means of shims under the motor mounting feet. After each change, it is necessary to recheck the alignment of the coupling halves. Adjustment in one direction may disturb adjustments already made in another direction. It would not be necessary to adjust the shims, if used, under the pump.

When the units are lined up cold, recheck after heating up the casing to rated temperature. Correct if parallel alignment differs by more than 0,1 mm (0.004 inches).

5.4.3 Allowable misalignment

The elastic coupling tolerates a certain degree of parallel or angular misalignment, respectively a combination of both.



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 :

$$\begin{aligned} E_z &= 0,3 \text{ mm (0.012 inch) at } 3000\text{-}3500 \text{ min}^{-1} \\ E_z &= 0,5 \text{ mm (0.020 inch) at } 1500\text{-}1750 \text{ min}^{-1} \end{aligned}$$

If one of the available errors (V_w or $S_1 - S_2$) is zero, the total allowable error remains the same.
If $D_2 - D_1$ is zero, then V_w is equal to V .

5.4.4 Special coupling design

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

5.5 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 is guaranteed. If the coupling guard is provided by the user, it must be in accordance with the requirements of DIN EN 809.

5.6 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 openings must be closed by blanks. Avoid penetration of solids to the pump inside during stand still in any case.

General

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

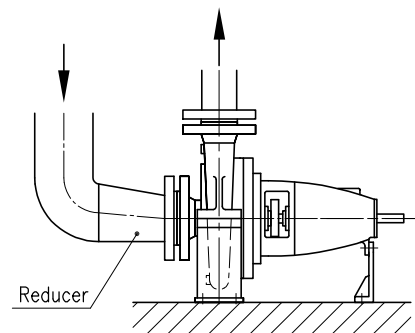
1. All piping must be supported and must line up naturally with the pump flange.
2. Piping runs shall be designed to minimize friction losses.
3. DO NOT make final connection of piping to pump until grout has hardened and pump and driver anchor bolts have been tightened.
4. Piping that handles hot liquids requires proper installation of expansion joints (e.g. horseshoe bend, bellows) so that linear expansion of piping will not cause misalignment.
5. Piping should be arranged to allow pump flushing and draining prior to the removal of pump for servicing.
6. System should be thoroughly cleaned prior to installation of the pumps in order to prevent penetration of solids into the mechanical seal area.
7. Gasket installation and materials must be suitable for the service.

5.6.1 Suction pipe

Attention !

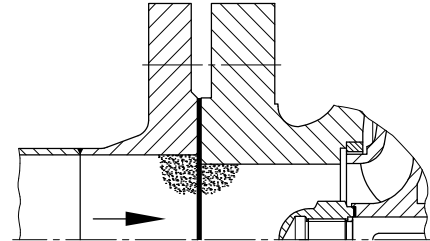
When using volute casing pumps, care must be taken for the NPSH-conditions. The suction piping requires careful design for these pumps. It is especially important that the available NPSH of the system is exactly determined. Suction pipe should be flushed before connection to the pump and the following must 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. Any elbows used should be large radius.
2. Size suction pipe 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 shown in the following drawing.



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. It is wise to install differential pressure control device to avoid cavitation by clogged screen. Screen with a mesh width of 450 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 medium source.

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



7. An isolation valve should be installed in suction line to permit closing of the line for pump inspection and maintenance.
8. Piping should be level or slope gradually downwards from medium source.
9. No portion of piping should extend below pump suction flange.
10. The suction pipe shall be submerged sufficiently below the liquid surface to prevent eddies and air entrapment at the source.
11. If any automatically operating check valve is available in the suction line (may be far away from the pump itself) which may close under certain circumstances, always use minimum flow bypass.

5.6.2 Discharge pipe

1. Isolation and check valves should be installed in discharge line. Locate check valve between isolation valve and pump which will have access for inspection of check valve. An isolation valve is required for isolating, priming, regulation of flow, inspection and maintenance of the pump.
2. Diffusers, if used, should be placed between pump and check valves. 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. An additional bypass line should be installed if minimum pump flow exceeds minimum process flow requirements. Lead the bypass line back to suction vessel, not to pump suction side !
5. If any automatically operating check valve is available in the discharge line (may be far away from the pump itself) which may close under certain circumstances, always use minimum flow bypass.

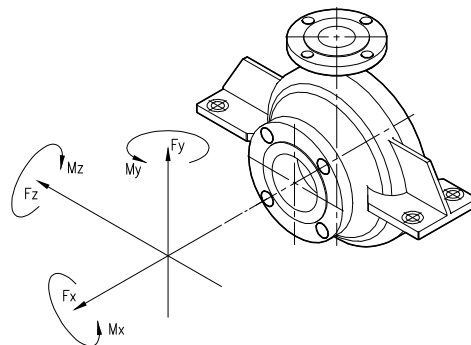
5.6.3 Final piping check

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 per the alignment procedure outlined previously to determine absence of pipe stress. If pipe stress exists, correct piping.

5.6.4 Allowable forces and moments

Values below are independent
from casing material



size	Suction flange (max. values)						Discharge flange (max. values)					
	Fx(N) [lb]	Fy(N) [lb]	Fz(N) [lb]	Mx(Nm) [ftlb]	My(Nm) [ftlb]	Mz(Nm) [ftlb]	Fx(N) [lb]	Fy(N) [lb]	Fz(N) [lb]	Mx(Nm) [ftlb]	My(Nm) [ftlb]	Mz(Nm) [ftlb]
32/200	890 [200]	580 [130]	710 [160]	460 [340]	355 [265]	230 [170]	605 [135]	755 [170]	490 [110]	390 [290]	300 [220]	195 [145]
40/200	1100 [245]	680 [155]	870 [195]	670 [495]	490 [365]	310 [230]	640 [145]	800 [180]	520 [115]	415 [305]	320 [235]	210 [155]
50/200	1335 [360]	890 [200]	1070 [240]	950 [705]	720 [535]	475 [350]	710 [160]	890 [200]	580 [130]	460 [340]	355 [265]	230 [170]
80/200	2350 [530]	1500 [335]	1850 [415]	1700 [1260]	1280 [950]	850 [630]	1070 [240]	1335 [300]	890 [200]	950 [705]	720 [535]	475 [350]

5.7 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 bearing bracket, part 330, to avoid overheating of the antifriction bearings.

5.8 SAFETY DEVICES

Attention !

All safety devices for monitoring bearing temperature, vibration, seal leakage, respectively auxiliary equipment 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.

5.9 DRIVE MOTOR

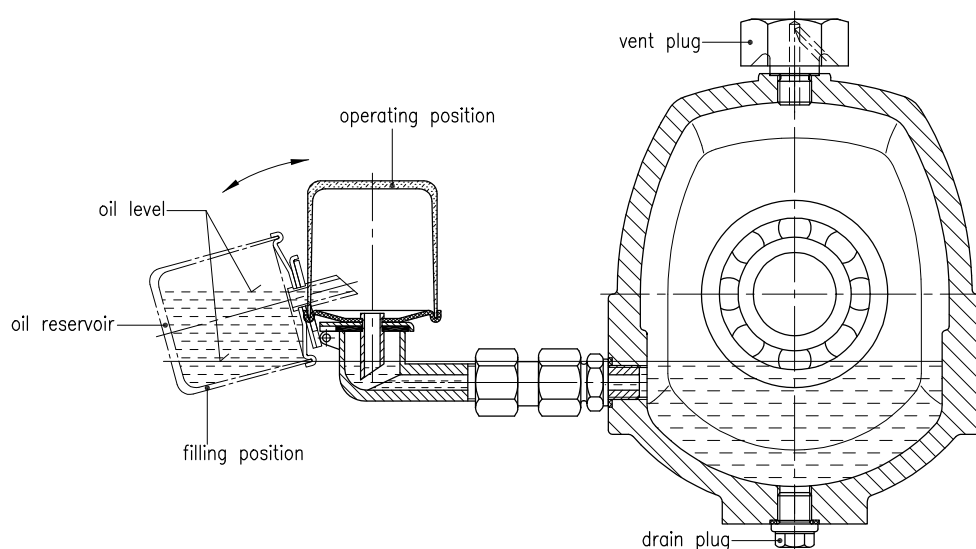
Connection of the electric motor needs specially trained people with permission to do electrical works. All regulations regarding wiring, Ex-proof and safety as well as the motor manual must be observed.

Attention ! Connection of the electric motor as well as of pump monitoring devices is in the responsibility of the owner.

6. OPERATION OF THE PUMP

6.1 START-UP PROCEDURE / LUBRICANT RECOMMENDATION

1. 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. After this, remove the petrol through the drain plug at the bottom of the bearing bracket.







For filling up, remove the vent plug on the top of the bearing bracket. The oil is to be filled in - at back-folded constant level oiler - through the vent plug connection 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. As long as the oil reservoir is filled with oil during operation, the lubrication of the bearing will be sufficient. If the oil level in the container 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 volume depends on
the different frame sizes:

Frame size	Volume		
	Liter	Imp.gal	U.S.gal
I	1,00	0.220	0.264
II	1,25	0.275	0.330

We recommend to select your lubrication oil according to the following table:

Symbole nach DIN 51502				
<div>C 36</div> bzw. HD 20W-20	Aral Vitam GF 46 (GF 36) * (bisher:) *	SHELL Rimula X X 20W-20	BP Energol VS 68 (ISO), BP Energol HLP 68 (ISO), BP Energol HD SAE 20W-20	ESSTIC 68 (50) *, ESSOLUBE HDX 20W/20 (bisher) *

Symbole nach DIN 51502				
<div>C 36</div> bzw. HD 20W-20	FINA CIRKAN 68 ISO, FINA SOLNA 68 ISO, PURFINA MOTOR OIL SAE 20W-20 **	RENOLIN 206, RENOLIN B 15, RENOLIN HD 20W-20	Mobil Vactra Oil Heavy Medium, Mobil HD 20W-20	Rando Oil 68, Ursa Oil P 68, Ursa Oil Extra Duty SAE 20W/20

If above mentioned types are not available and if no others are specified by the manufacturer, any motor oil of viscosity SAE20 (available at petrol stations) can also be used.

- Open valves in the cooling line and check flow rate through heat exchanger:
frame 1 = 350 l/h (1.283 Imp.gpm, 1.541 U.S.gpm)
frame 2 = 500 l/h (1.833 Imp.gpm, 2.202 U.S.gpm)
- Never start pump until properly primed (pump casing and suction pipe must be full of liquid). Shaft sealing components depend on liquid for lubrication and will quickly fail if running dry. Your particular system will dictate method used to prime pump. Make sure that suction valve is completely open, discharge valve partially or completely closed.
- Attention !** After filling the pump with liquid, mechanical seals must not show any visible leakage.
- Attention !** Open venting device on the heat exchanger until liquid penetrates bubble free. Not properly vented mechanical seal will fail soon after start-up.

6. Start driver briefly for a few seconds, shut off and check for smooth run down and direction of rotation if not checked before. Restart after complete standstill.

Attention ! Immediately observe the pressure gauges. If discharge pressure is not quickly attained, stop driver, reprime and attempt to restart.

7. Adjust discharge valve until rated flow is obtained, never throttle pump by suction valve.
8. **Attention !** Open discharge valve immediately after start-up. Do not operate pump with closed discharge valve.

6.2 OPERATING / MAINTENANCE

6.2.1 General considerations:

1. 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.

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

3. **Attention !** The ampere load specified on the name tag of the driving motor must not be exceeded.
4. When operating with a capacity higher than rated and stamped on the name plate, make sure that $NPSH_{\text{available}} > NPSH_{\text{required}}$.
5. **Attention !** Never operate pump below minimum flow. The required minimum flow is at least 15% of the capacity at BEP for the rated impeller.
6. Check periodically the bearing temperature and oil level in bearing bracket. Bearing temperature should not be more than 50°C (120°F) above ambient temperature and not exceed 80°C (175°F).
7. **Attention !** Never close lock valve in cooling lines during pump operation.

6.2.2 Mechanical Seals

Mechanical seals should not show visible leakage during operation, that means they should be drip tight. Avoid steam leakage in any case. If steam leakage occurs during operation, shut off the pump and disassemble the seal unit (consider the installation drawing specified on page 1, technical pump data). Replace the seal faces and O-rings.

Mechanical seals are wear parts because the seal faces are subject to natural wear. Wear depends on the properties of the pumped liquid (lubrication, available solids, viscosity, vapour pressure, reaction to the atmosphere etc.). Therefore, any forecast regarding availability is difficult. We recommend to disassemble and inspect the mechanical seal after 5000 operating hours.

Depending on the wear grade, the next inspection shut down can be determined. It is recommended to keep a spare seal on stock for exchange if unexpected leakage occurs. Stationary and rotating seal faces must be exchanged always together.

6.2.3 Heat exchanger

Attention !

Never operate the pump without cooling flow through heat exchanger. Make sure that the required flow rate of 350-500 l/h is always obtained. Temperature monitoring of heat exchanger is recommended.

6.2.4 Gauges

In the suction and discharge pipe - right in front and behind the pump - two gauges should be provided for controlling operating conditions. The design pressure of these gauges shall not be more than 50% above the expected operating pressure. Install an insulation valve and a condenser in each measuring line.

6.2.5 Lubrication

Oil level is measured through a constant level oiler. Never operate pump with empty oil vessel. Change oil after 200 hours when a new pump is started or when bearings were exchanged, then once a year. Consider lubricant recommendations according to section 6.1

6.2.6 Vibration check

All rotating parts are dynamically balanced. During performance tests, we check pump vibration and ensure that a rate of 2,5 mm/s (0.1"/s) will not be exceeded. Measurement is made on the frame where ball bearings are located. During operation, a vibration rate of 4,5 mm/s (0.18"/s) is allowed. 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 unit, the reason may be misalignment of coupling between pump and motor or unstable foundation.

Keep vibration records and change ball bearings before worn out bearings damage the mechanical seals.

6.3 SHUT DOWN

3. Close discharge valve slowly.
2. **Attention !** Shut down driver immediately after closing the discharge valve.
3. Close suction valve.
4. Close cooling lines after pump has cooled down.
5. Exposure to freezing conditions while pump is idle, could cause liquid to freeze and damage the pump. Liquid inside the pump should be drained. Liquid inside cooling jackets, if supplied, should also be drained.

6.4 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

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.

6.4.1 No liquid delivered during start-up

Problem: Suction line is not completely primed or filled.

Remedy: Fill again pump and suction line. Check foot valve at suction conditions.

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

Remedy: Open valve, remove blanks.

Problem: Suction line contains air pockets which cannot be eliminated by filling up because piping is incorrectly laid out.

Remedy: Layout of the pipes must be checked. Suction lines must continually slope down to the pump.

6.4.2 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 acc. 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: Pump rotates in wrong direction.

Remedy: Change motor connection.

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 larger impeller (check capacity of the motor).

Problem: Capacity reduces with increasing temperature, instable flow.
NPSH-available < NPSH-required.

Remedy: Increase liquid level on suction side to improve NPSH-available. Check with application engineer the possibility of improving NPSH-required through inducer.

Problem: Pump cavitates.

Remedy: as described before.

Attention !

Cavitation causes leaking mechanical seals and wear of bearings.
Never operate pump under such upset conditions.

6.4.3 Motor requires excessive power

Problem: Required differential head in piping system lower than rated.
Remedy: Throttle discharge valve to obtain the rated capacity according to the name tag.
Correct impeller diameter (consider section 6.5).

6.4.4 Pump is noisy and vibrates after start-up

Problem: Base not rigid enough.
Remedy: Reinforce.

Problem: Foundation bolts are loose.
Remedy: Retighten bolts.

Problem: Pump cavitates.
Remedy: Refer to item 6.4.2, NPSH-improvement

Problem: Misalignment of elastic coupling between pump and motor.
Remedy: Realignment of elastic coupling according to section 5.4



Before removing the coupling guard, shut off drive power to prevent accidental start-up.

Problem: Adapter bolts of bearing bracket are not tightened.
Remedy: Fasten adapter bolts.

6.4.5 Pump gets noisy and vibrates after longer operating time

Problem: Pump ball bearings are worn out.
Remedy: Replace them. Use brand new originally packed bearings only.

Problem: Motor ball bearings are worn out.
Remedy: Replace them. Consider motor manual.

6.4.6 Ball bearings run hot

Problem: Coupling space „B“ not maintained, motor shows axial load.
Remedy: Correct spacing according to item 5.4.1.

Problem: Misalignment of elastic coupling between pump and motor.
Remedy: Realignment of elastic coupling according to section 5.4

6.4.7 Mechanical seal is leaking after start-up

Problem : Steam leakage occurs during start-up at operating temperature. The mechanical seal with air-cooled cooling loop was not properly vented and caused dry running of the seal faces by vaporization of the liquid between the faces.

Remedy : Disassemble mechanical seal. Replace the seal faces, start-up again after careful venting of the system.

6.4.8 Mechanical seal is leaking after a certain time

Problem: Seal faces are worn out.

Remedy: Disassemble mechanical seal. Replace seal faces together with O-Rings.

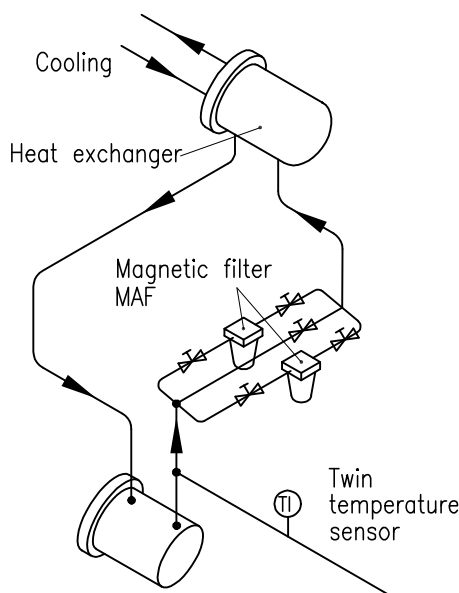
Problem: Cooling system lost its cooling capability, increased temperature in the seal area (temperature at seal casing $>80^{\circ}\text{C}$ / 175°F) caused vaporization of the fluid between the seal faces, seal failed through dry running.

Remedy: Check cooling system, remove residues, treat cooling water.

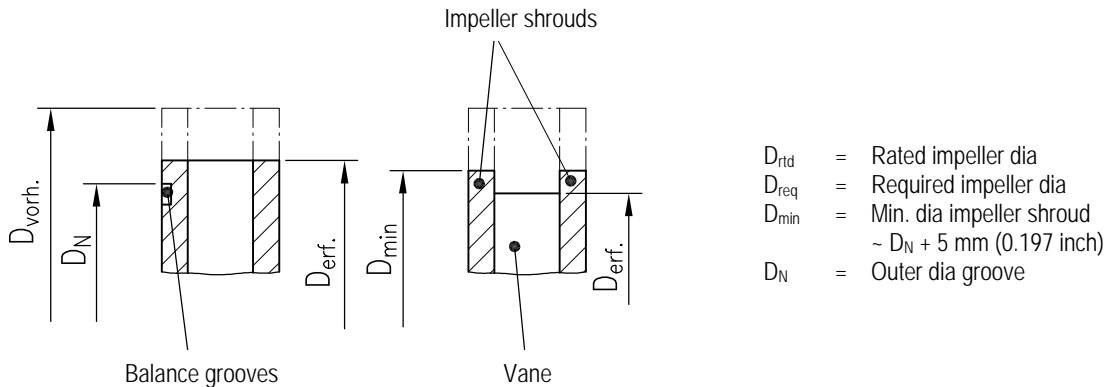
6.4.9 MTBF (meantime between failure) for mechanical seal too short

Problem: Abrasive, ferritic particles (magnetit) or pipe scale are available in the pumped liquid and destroy the seal faces.

Remedy: Install magnetic filters in the external circulation line of the mechanical seal.



6.5 IMPELLER TRIMMING



Any existing unbalance of the impellers is eliminated by providing balance grooves in the impeller shrouds. When reducing impeller diameter, it is recommended to trim the impeller shrouds only that far, that diameter D_{min} is maintained. If diameter D_{req} is below D_{min} , reduce the diameter of the vanes only.

Attention !

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

7. DISASSEMBLY

7.1 GENERAL

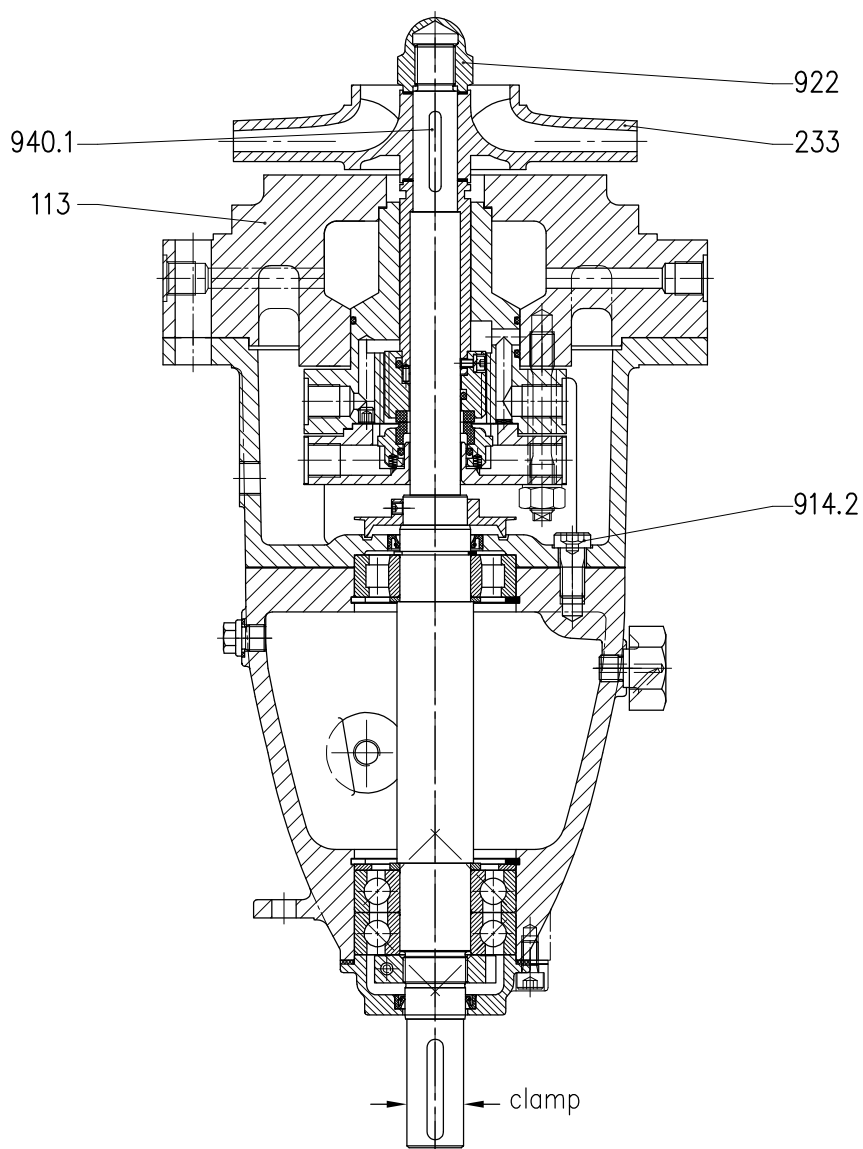


1.

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 must be secured against unauthorized restart. Before disassembling the unit respectively removing the unit from the piping system, cool down the pump, stress-relieve the system, drain the pump completely.

2. Remove water cooling lines or cooling loops.
3. Drain cooling jackets, if available.
4. Remove spacer from coupling if available (5.4.1), otherwise disconnect and remove drive motor.
5. Remove support foot at bearing bracket.
6. Drain oil bath in bearing bracket 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 expansion screw nuts 926.1 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 (according to Figure A) into a work bench or in a chuck jaw. Protect shaft against any damage.
11. Remove impeller nut 922 by wrench (right hand thread).
12. Remove impeller 233 by hand or puller. If puller is required, it must be placed under the vanes.
13. Remove key 940.1



(picture of shaft sealing not obligatory)

Figure A

7.2 DISASSEMBLY OF SHAFT SEALING

7.2.1 Disassembly of standard seal BU HSHF

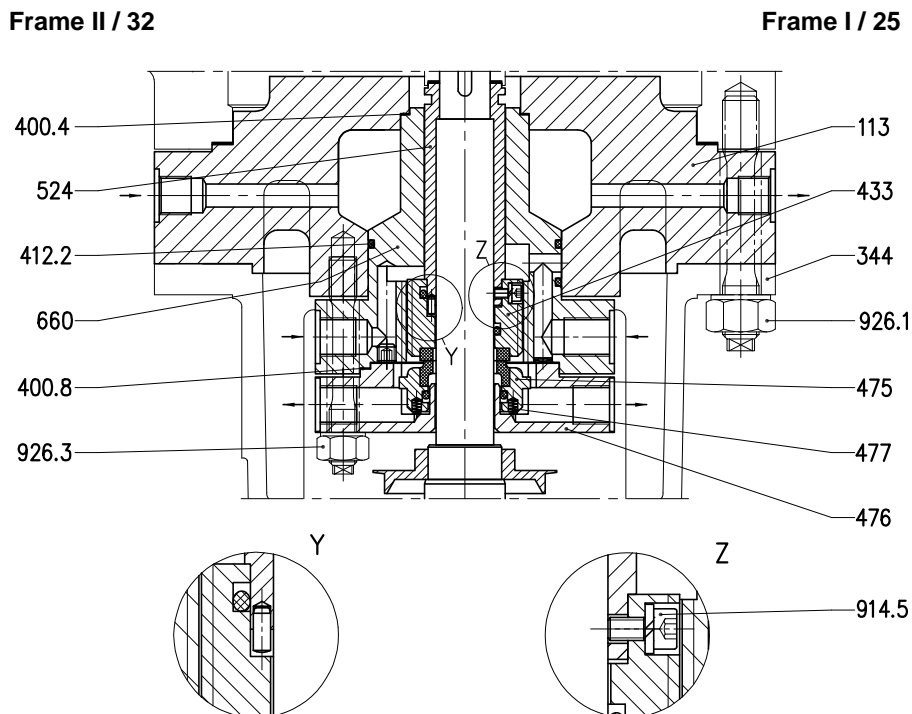


Fig. B

1. Remove expansion screw nut 926.1
2. Loosen connection between intermediate casing 113 and bearing bracket lantern 344. Remove expansion screw nut 926.3.
3. Remove intermediate casing together with the cooling device 660. Place on bench. Remove cooling device from intermediate casing.
4. Remove inner hexagon cap screw 914.5 (frame I/25), remove shaft sleeve 524 by puller.
5. Remove rotating seal member 433 from pump shaft.
6. Remove mechanical seal ring support 476 together with stationary seal ring 475. Place on bench, remove stationary seal member from casing.

7.2.2 Other shaft sealing designs

Disassembly instructions are given on the installation drawing, mentioned in the cover sheet of this manual "Technical Pump Data", page 1.

8. INSPECTION

8.1 IMPELLER

Impeller and wear ring must be free of visual scratches. The total clearance between impeller and wear ring in new condition is 0,6 mm (0.0236 inch) and must not exceed 0,9 mm (0.0354 inch).

When remachining the impeller in the wear ring area, replacement wear rings must be specially made considering the original clearance of 0,6 mm (0.0236 inch).

Vanes must be free of mechanical damage, pittings and corrosion in the inlet and outlet area.

8.2 VOLUTE CASING / INTERMEDIATE CASING

Wear, caused by erosion, must not exceed a depth of 1 mm (0.0394 inch). Centrings and gasket surfaces must be free of mechanical damage or pittings. Intermediate casing should not show any grooves or corrosion on O-ring seals. Remove residues from cooling area if available.

8.3 BEARING BRACKET / LANTERN / ANTIFRICTION BEARINGS

Centrings must not show any mechanical damage.

Ball bearing seats have to be measured, bearing bracket respectively bearing bracket lantern must be replaced if the maximum diameters as mentioned below are exceeded.

Frame size	Bore "Lantern"		Bore "Bearing bracket" pump side		Bore "Bearing bracket" coupling side	
	mm	inch	mm	inch	mm	inch
I / 25	80,018	3.1503	80,018	3.1503	80,018	3.1503
II / 32	120,022	4.7253	120,022	4.7253	120,022	4.7253

Bearing bracket lantern must not show any cracks in the area of the mounting flange.

Check ball bearings. Replace if the pump has been operating for some time. Use brand new originally packed bearings only, consider sizes according to item 3.2.4. Inspect the radial seal rings for cracks.

8.4 PUMP SHAFT

The pump shaft must be free of corrosion or pittings in the area of the shaft sleeve. The area of the radial seal rings must not show any grooves. Ball bearing seats must be measured. Pump shaft must be replaced if the minimum diameter is below the following values:

Frame size	Ball bearing seats				Impeller seat	
	pump side		coupling side			
	mm	inch	mm	inch	mm	inch
I / 25	35,002	1.3780	35,002	1.3779	27,987	1.1019
II / 32	45,002	1.7717	45,002	1.7717	37,987	1.4956

8.5 SHAFT SLEEVE

Shaft sleeve must be free of corrosion. Visible wear or grooves in the area of the bushings, seal rings, packing rings, O-rings, are not acceptable. Replace if necessary. Lock pins of frame II/32 sleeve should not show any deformations.

8.6 MECHANICAL SEAL CASING / COOLING DEVICE

Must be free of corrosion. Gasket and O-ring seats must be free of mechanical damages. Inspect pumping thread for mechanical damages, remove residues if available.

8.7 MECHANICAL SEALS

Metallic seal parts must be free of corrosion or any mechanical damages. Seal faces must be free of visible wear, grooves or cracks. Replace if necessary. Change seal faces always together. Inspect O-rings for cracks and deformations. Replacement of O-rings and gaskets is generally recommended.

9. REASSEMBLY

9.1 GENERAL

Absolute cleanliness and care are essential when fitting the mechanical seal. Dirt and damage to seal faces or O-rings jeopardize the seal's function. Any protective covering on the faces of a new seal must be removed without trace. Never put lubricant on the sliding faces - mount only in a completely dry dustfree and clean state.

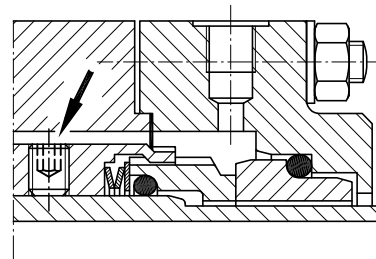
Fitting advice

To reduce the friction on O-rings when mounting seals on a shaft or when inserting seal cartridges in their housing, apply a thin coating of silicon grease or oil to the shaft or housing.

Never allow EP-rubber O-rings (standard on hot water seals) to come in contact with mineral oil or grease. When inserting stationary seats, be careful that pressure is applied evenly and use only water or alcohol to reduce O-ring friction.

Screw locking

If no special provision is made for locking screw threads, insert set screws using a suitable adhesive (e.g. Loctite) after any grease has been removed.



Mechanical seal housing, cooling device

When reassembling, watch the positions of connections to external cooling lines.

9.2 MECHANICAL SEAL "HSHF"

Consider Figure B and proceed as follows:

1. Put the seal ring 475 with pre-assembled O-ring 412.3 on a clean and soft surface to protect the face as shown in Figure C. Fit the springs 477 into the seal ring.

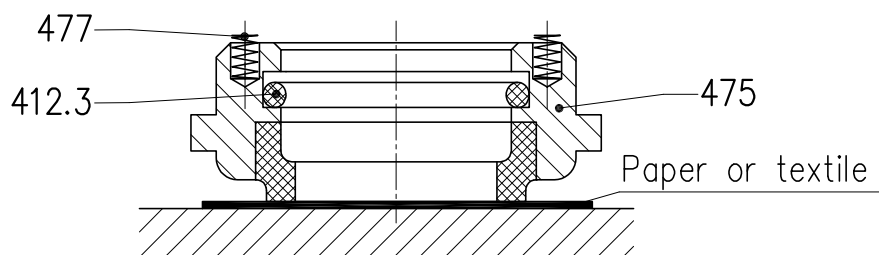


Fig. C

2. Push the seal ring support 476 into the seal ring 475 until the O-ring 412.3 rests.
3. Clamp the preassembled bearing bracket unit in vertical position according to Figure A.
4. Push the mechanical seal casing with the stationary seal onto the pump shaft until it rests on the shaft.
5. Fit the mechanical seal 433 to the shaft sleeve 524. Push the shaft sleeve with seal onto the shaft until it rests.
6. Fit the new gasket 400.4 to the intermediate casing 113. Push the cooling device 660 with O-rings 412.2 into the intermediate casing until it rests.
7. Place the new gasket 400.8 to the mechanical seal casing. Fit intermediate casing into the centring of bearing bracket lantern 344. Take care for the position of cooling connections.
8. Fit mechanical seal casing in the centring of the cooling device. Assemble and fasten expansion screw nut 926.3.
9. Complete reassembly in reversed manner as mentioned in par. 7.1.

9.3 TORQUE SETTINGS

Part No.	Designation	Frame size			
		I / 25		II / 32	
		Nm	ftlb	Nm	ftlb
914.2	Bearing bracket lantern	26	19	38	28
922	Impeller nut	120	89	136	100
926.1	Expansion screw nut	150	110	72	53
926.3	Expansion screw nut	72	53	72	53

10. RETURNING THE PUMP TO THE FACTORY



Pumps returned to the factory for overhauling or repair, can 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 hot water pumps, 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).

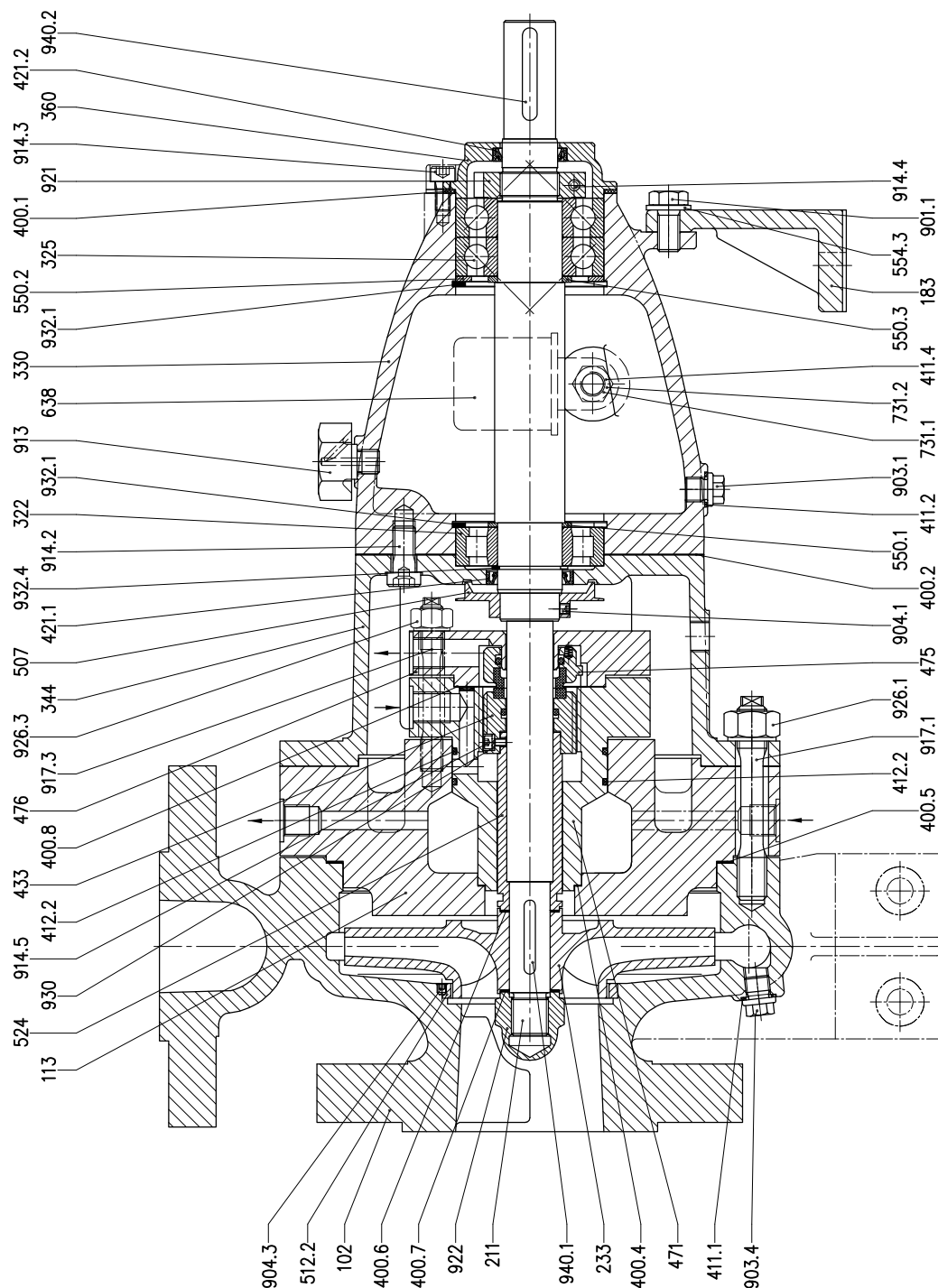
Above work safety instructions apply also for complaints on new pumps which have already been in contact with liquid.

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

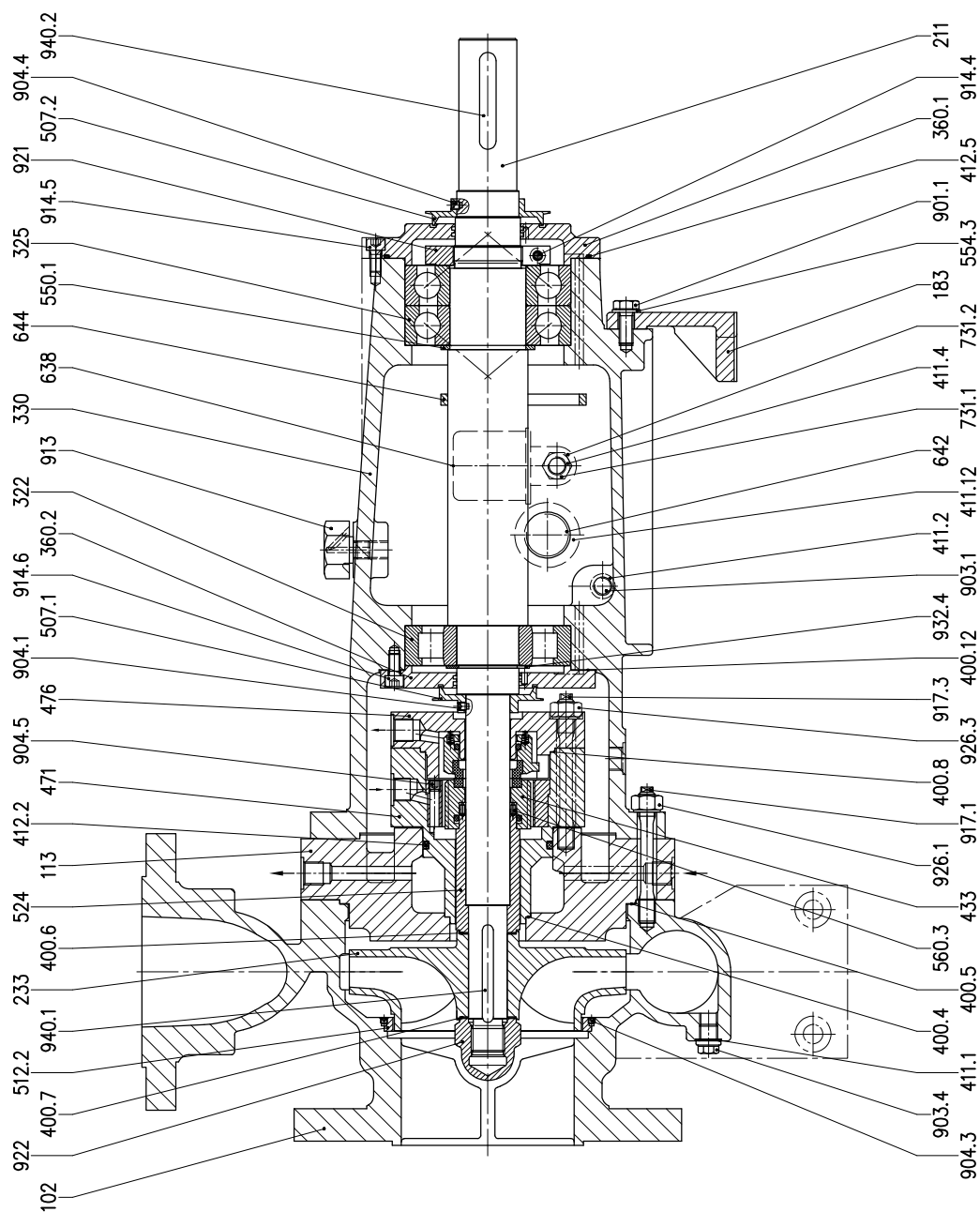
11.1 SECTIONAL DRAWING – Type HPL

Drawing No. 54.HPL.5



11.2 SECTIONAL DRAWING – Type HPR

Drawing No. 54.HPR.2



11.3 PARTS LIST and MATERIAL SPECIFICATION for Standard design

Part No.		Standard - Materials
	Designation	HPLhu + HPRhu
102	Volute casing	1.7706
113	Intermediate casing	1.7706
183	Support foot	GG25
211	Pump shaft	1.4021
233	Impeller	GG25
322	Roller bearing	St
325	Angular ball bearing	St
330	Bearing bracket	GG25
344	Bearing bracket lantern	GG25
360	Bearing cover	GG25
360.1	Bearing cover	GG25
360.2	Bearing cover	St37
400.1	Gasket	Vulkolan
400.2	Gasket	C-4500
400.4	Gasket	C-4500
400.5	Gasket	Graphite / SLS
400.6	Gasket	C-4500
400.7	Gasket	C-4500
400.8	Gasket	C-4500
400.12	Gasket	C-4500
411.1	Joint ring	C-4500
411.2	Joint ring	C-4500
411.4	Joint ring	C-4500
411.12	Joint ring	C-4500
412.2	O-ring	Viton
412.3	O-ring	Perbunan
412.5	O-ring	Perbunan
421.1	Radial seal ring	Viton
421.2	Radial seal ring	Viton
433	Mechanical seal	as per order
471	Mechanical seal casing	St37
475	Seal ring	as per order
476	Seal ring support	St37
477	Spring for mech.seal	as per order
507	Deflector	1.4571
507.1	Deflector	1.4571
507.2	Deflector	1.4571
512.2	Wear ring	GG25
524	Shaft sleeve	1.4571
550.1	Disk	St
550.2	Disk	St
550.3	Disk	St
554.3	Washer	St
560.3	Pin	1.4571

Part No.		Standard - Materials
	Designation	HPLhu + HPRhu
638	Constant level oiler	St/galvanized + glass
642	Oil level sight glass	Al
644	Centrifugal ring	1.4571
660	Cooling device	St37
731.1	Pipe union	45S20K
731.2	Pipe union	St
901.1	Hexagon head bolt	4.6
903.1	Screwed plug	9S20K
903.4	Screwed plug	9S20K
904.1	Grub screw	1.4571
904.3	Grub screw	1.4571
904.4	Grub screw	1.4571
904.5	Grub screw	1.4571
913	Vent plug	Plastic
914.2	Inner hexagon cap screw	8.8
914.3	Inner hexagon cap screw	8.8
914.4	Inner hexagon cap screw	8.8
914.5	Inner hexagon cap screw	1.4571
914.6	Inner hexagon cap screw	8.8
917.1	Expansion screw	1.6580-tempered
917.3	Expansion screw	1.6580-tempered
921	Shaft nut	St
922	Impeller nut	9S20K
926.1	Expansion screw nut	C35
926.3	Expansion screw nut	C35
930	Spring washer	1.4305
932.1	Circlip	FSt
932.4	Circlip	FSt
940.1	Key	1.4571
940.2	Key	1.4571