Contents

1 General

Every pump tested in our factory. When testing the pump, we pay special attention to the perfect operation of the pump. Although we as a pump manufacturer aim at securing the high quality of our products, this is not enough to guarantee the perfect operation under the final conditions. Our guarantee will be valid only if the installation, operation, maintenance and repairs of the pumps are carried out in accordance with our installation.

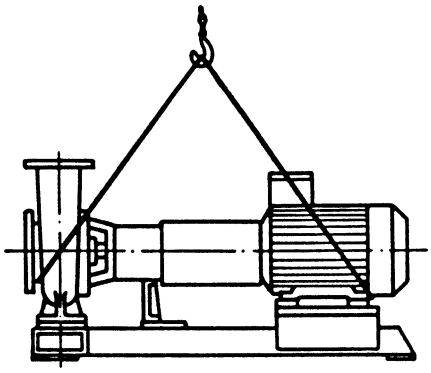
Note : Do not remove the cover plates of plugs protecting the openings before the installation of pipes. Foreign particles inside the pump may damage it at starting.

2 Installation

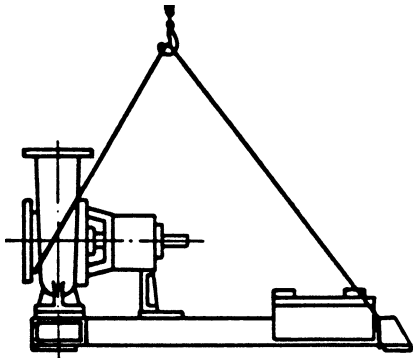
2.1 Hoisting and transportation

The pump-motor-baseplate assembly may be hoisted from

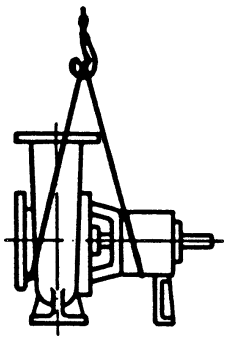
a. Under the pump suction flange and motor, or under the baseplate.



- or b) under the pump suction flange and eyebolts provided on the top face of the base plate



The bare pump is hoisted from under the pump suction flange and bearing housing

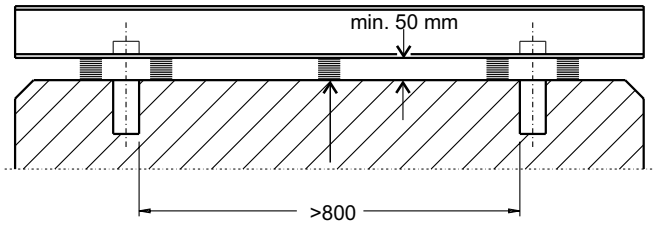


2.2 Installation at sight

Make sure that the concrete foundation has set firmly before placing the pumpset on it. The surface of the foundation should be truly horizontal and perfectly flat. The foundation bolts should be embedded in the base plate.

2.3 Installation of the pumpset

After placing the pump on the foundation, level it up with the aid of a spirit level placed on the shaft or discharge nozzle. The correct gap between the coupling halves specified on the installation drawing must be observed. Shims should always be inserted to the left and right of the foundation bolts in close proximity to the bolts themselves between the baseplate or foundation frame and the foundation itself. If the spacing between adjoining anchor bolts exceeds 800 mm, additional shims should be inserted half way between the adjoining holes. All shims must lie perfectly flush.

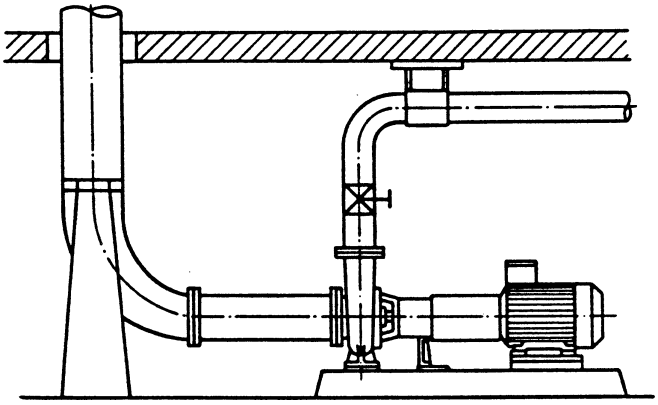


After insertion of the foundation bolts, the later should be grouted in the foundation with mortar. When the mortar has set firm, the base frame should be levelled up in accordance with section 2.7 and the foundation bolts should be tightened uniformly and firmly. Thereafter, the base frame should be grouted in mortar, (non-shrinking mortar if possible) making sure that no cavities remain unfilled.

2.4 Piping

2.4.1 Supports

The pipes must be installed and supported so that forces, vibration and weight of the piping are not directed to the pump. While planning the locations for the support, remember the allowance for thermal expansion.



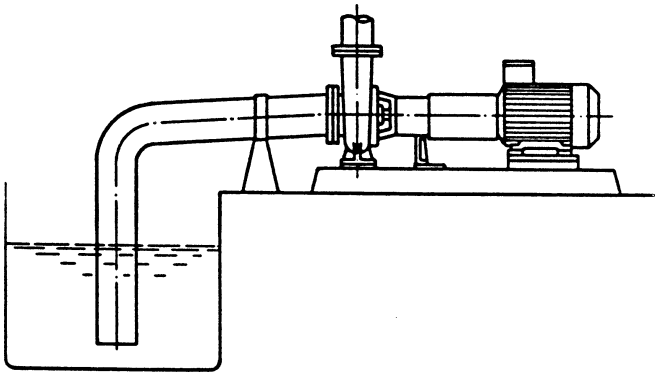
Fit the pipe flanges accurately to the pump flanges. Flanges which have not been properly aligned must not be forced into position.

2.4.2 Suction pit below the pump

The suction pipe must be made as short as possible. Avoid points where air pockets or turblance may be formed.

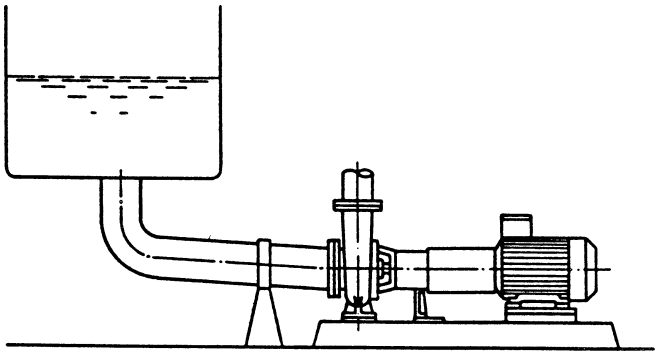
If the liquid level is below the pump, the suction pipe must gradually rise towards the pump.

A sufficient amount of the pipe end must be under the liquid level so that air cannot enter the pump.



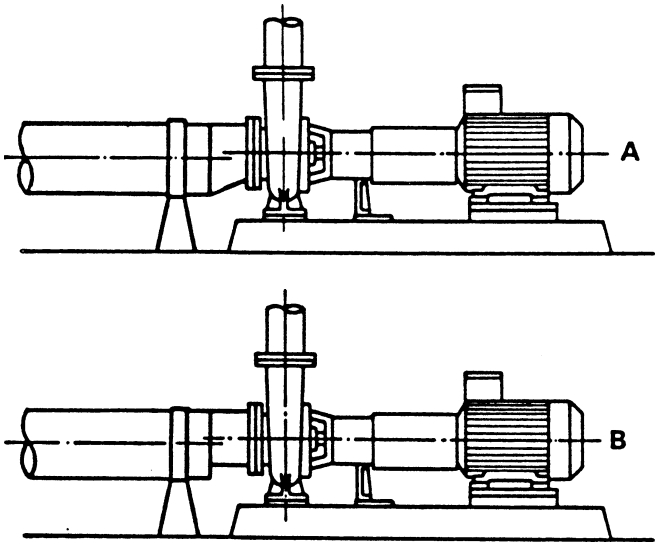
2.4.3 Suction pit above the pump

The suction pipe must descend gradually towards the pump.



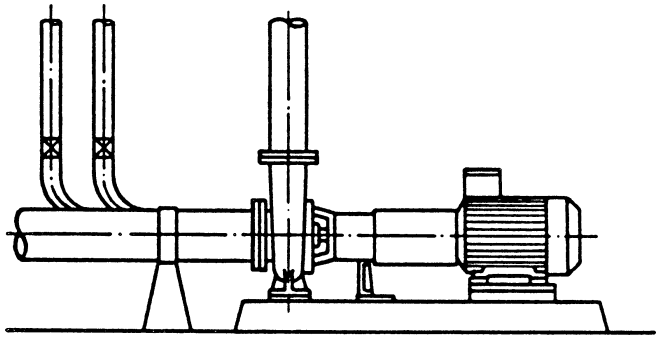
2.4.4 Extension piece

The cones must be eccentric and in such position that the upper level will be horizontal (fig. A). If the extension pieces are used, they must be formed so as that gathering of gases cannot occour. At higher conssistencies (C>4%), conical pipe parts must avoided (fig. B).



2.4.5 Suction pipe connections

If the suction pipe has brances, they must be located as far from the pump as possible, and they must be formed advantageously with regard to the flow.



a) The suction pipe must be made as short as possible.

b) A shut-off valve must be placed in the discharge pipe after the optional check valve.

c) Before commissioning, clean the piping and suction pit carefully. Tools or other things left inside, will damage the pump.

2.5 Auxiliary piping

To guarantee faultless shaft seal operation, it may be necessary to lead sealing, flushing or cooling liquid to the seal. Structure of the axillary piping depends on the construction of the seal in question.

Install throttling valves in the sealing liquid pipes. A rotameter or other flow meter as well as a pressure gauge is also useful in many cases.

If there is a possibility that the pumped liquid might get into the sealing liquid pipes, install the non-return valves in the piping.

Clean the sealing water piping carefully before commissioning.

2.6 Checking the motor for correct rotation

Before commissioning, always check the motor for correct direction of rotation.

It is important to detach the coupling spacer before checking the direction of rotation of the motor. If run in the direction, the pump may be damaged.

The motor rotation must be counterclockwise viewed from the coupling end of the motor. The pump rotation is clockwise viewed from the coupling end.

2.7 Alignment of coupling

Align the coupling to the accuracy given in the enclosure “alignment of coupling”.

The coupling has been pre-aligned at the factory but the alignment may be changed due to faulty hoistings, baseplate support, piping support, thermal expansions etc.

The alignment of the coupling has therefore to be checked and if necessary, the coupling has to be realigned in the following stages :

a. After installing the pump, before grouting

Check the coupling is alignment sufficiently accurately. Notable misalignments are corrected by changing the support of the baseplate.

b. After grouting

Check that the alignment has not been affected by the grouting.

c. After supporting the piping, before starting the pump.

Align the coupling to the accuracy given in the instructions.

d. After running the pump with water

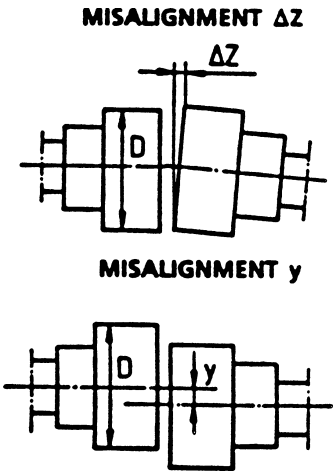
Look for changes if any caused by the running of the pump. Bigger changes are corrected by rectifying the supports of the piping. Tighten the fixing screws of the pump and align the coupling.

e. Hot alignment

If any changes in the alignment of the coupling are noticed, hot alignment of the coupling can be made, if required. During production run, the alignment is carried out immediately after the pump has been stopped and the pump and the motor are at the running temperature. The need for hot alignment depends on the temperature differences and the coupling type selected.

Coupling diameter D	Speed < 1500 rpm		> 1500 rpm	
	ΔZ max	Y max	ΔZ max	Y max
100	0.08	0.10	0.05	0.08
101-200	0.11	0.15	0.08	0.10
201-300	0.15	0.20	0.10	0.15
301-400	0.20	0.25	0.10	0.15

Check motor for correct rotation with the spacer of the coupling removed. Do not run in the wrong direction, otherwise the pump may be damaged. Read the installation and operation directions carefully before commissioning the pump.



3 Operation

3.1 Start-up checks

Before starting and after service repairs, always make sure that :

a. The motor's direction of rotation has been checked (see section 1.6)

b. The pump can be rotate freely. Rotate the coupling by hand, with the spacer detached.

c. The coupling has been properly aligned.

d. The oil lubricated bearing unit has been filled with oil (see section 3.3).

3.2 Starting

a. Open the valves for sealing water, if any, adjust the pressure and flow.

b. Check that there is abundant leakage at the gland packing. If there is no continuous leakage, slacken the stuffing box gland. If this does not help, remove the packings and re-pack the stuffing box less tight.

c. Fill the pump so that at least the suction pipe and pump casing are filled with liquid. The pump must not run dry even for a moment.

d. Check that the suction valve is fully opened and discharge valve fully closed.

e. Start the motor.

f. Open the discharge valve gradually until the desired amount of liquid is reached.

g. Check that the gland packing leakage is still abundant. If not, slacken immedialey the stuffing box gland. If this does not help and the gland packing becomes hot, stop the pump and investigate.

When the gland packing has been operating trouble-free for 10 minutes, it may be tightened. Tightening it by turning the hexagonal nuts approx. 1/6th of a turn at a time at 5-10 minutes intervals until the leakage is at least 30-80 drops a minute. While tightening, make sure that the stuffing box remains perpendicular to the shaft.

3.3 Adjustment of the output by a valve

If it is necessary to adjust the amount of liquid, do it by adjusting the discharge valve.

Note : Never use the suction valve for adjustment of liquid flow.

3.4 Control during operation

By controlling the pump's operation and output regularly, the possible need for servicing and repairs can be anticipated. This ensures high efficiency of the pump, trouble-free operation and low maintenance cost.

Control the temperature of the gland packing and maintain the leakage at 30-80 drops/min. by adjussting the stuffing box gland.

The flow rate and pressure of sealing water must be kept at the given values.

Check the temperature and vibrations of the bearings regularly. If one or the other increases, it may be a sign of improper lubrication or bearing damage. There are screw holes (2 nos. size M8) in the bearing housing for adjustment.

Unusual noise from the pump should also be investigated, and their cause rectified.

3.5 Stopping

- Close the discharge valve to prevent the pumped liquid from flowing back.
- Stop the motor.
- Close the suction valve if there is reason to doubt
- Close the cooling and flushing liquid valves, if any.
- **If the pump has a sealing fluid valve, it cannot be closed until the pump has been drained or depressurised.**

3.6 Control during stoppages

During longer shutdowns, the pump must be checked every now and then. Rotate the shaft manually a few times. If the liquid handled congeals easily or the pump is exposed to freezing, drain the pump and suction piping for the stoppages.

4 Maintenance

4.1 Change of gland packings

Remove the worn out packings by using a flexible extracting tool (fig. 4.1.1).

Clean the stuffing box and clear the sealing liquid holes, if they are choked.

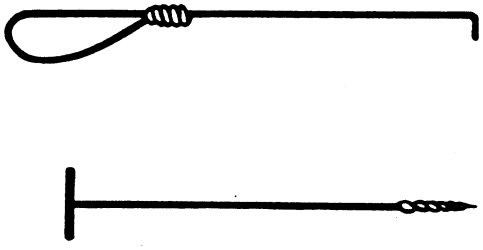


Fig. 4.1.1

Check the shaft protection sleeves and stuffing box for scratches or grooves as a result of wear. Worn or damaged parts have to be replaced.

We recommend the use of precompressed packing rings.

However, if the packing rings have to be cut from a band do as follows :

Wind 4 turns of the band around the wooden pattern of the same size as the shaft protection sleeve (524). Cut the rings direct and axially with a sharp knife with no under-or over-dimensioning (fig. 4.1.2).

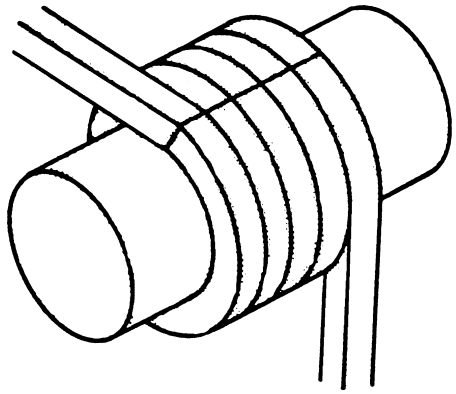


Fig. 4.1.2

Fig. 4.1.3 gives the stuffing box dimensioning as well as the total length of the cut packing rings withouit margin.

Brg. unit no.	Stuffing box dimension in mm	Total length of the packing ring in mm
1	40 x 60 x 10	640
2	50 x 70 x 10	770
3	60 x 85 x 12.5	930
4	70 x 95 x 12.5	1050
5	90 x 122 x 16	1350

Fig. 4.1.3

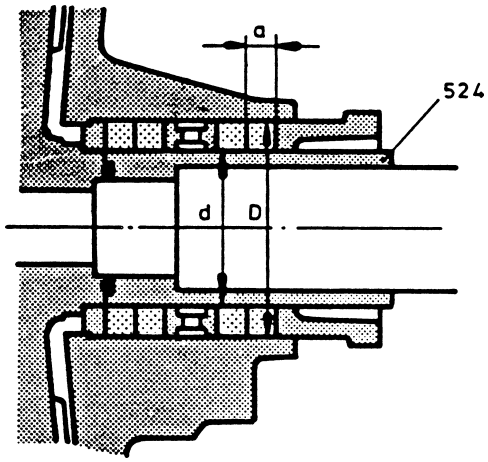


Fig. 4.1.3

When fitting new packing rings, be very precise, and keep the parts clean.

Lubricate the shaft sleeve and packing rings lightly with oil.

Push the first packing ring tight against the neck bush.

The ends of the rings must be exactly against each other.

The second rings is placed against the first one so that the joints are at 180^0 to each other.

Next put the lantern ring into the seal housing.

Also the last two rings are fitted with the joints at 180^0 to each other.

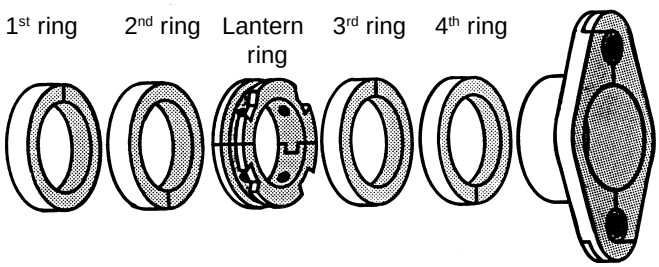


Fig. 4.1.4

After all the packing rings and lantern ring have been fitted, tighten the nuts of the stuffing box by hand.

The gland packing are commissioned according to the instructions under 4.2.

4.2 Grease lubrication

All the grease lubricaated bearings have been lubricated before despatch.

The pump has one cylindrical roller bearing unit and duplex angular contact ball bearings (O-system).

	Pump bearings	
Brg. unit no.	Impeller side	Coupling side
1	40 x 60 x 10	640
2	50 x 70 x 10	770
3	60 x 85 x 12.5	930
4	70 x 95 x 12.5	1050
5	90 x 122 x 16	1350

Fig. 4.2.1

Quality of lubricants and re-lubrication intervals :

Speed of rotation at 50 Hz

	Initial lubrication (g)		Re-lubrication (g)		Re-lubrication interval** (hrs., brg. hsg. temp. <+55^0 C)			
Bearing unit	Impeller side (NUP)	Coupling side (BECBP)	Impeller side (NUP)	Coupling side (BECBP)	740* 1/min.	980 1/min.	1480 1/min.	2950 1/min.
1	30	50	10	15	16000	12000	8000	3000
2	55	85	15	25	14000	1000	6500	2500
3	85	135	20	30	12000	8000	6000	2000
4	145	210	25	40	10000	7500	5000	-
5	220	390	40	60	8500	6000	3500	-

Fig. 4.2.2

* Speed of rotation

** Every 15^0 C rise in the surface temperature shortens the lubrication interval to half.

Type of grease

For normal running conditions when the bearing housing surface temperature is as below 80^0 C, we recommend Lithium or Lithium-Calcium based mineral grease for roller bearings, such as :

BP	HP
Bharat M.P. Grease 2	LITHON 2
Bharat M.P. Grease 3	LITHON 3
Bharat Lanthex EP	

The first re-lubrication should be carried out before the initial commissioning of the pump.

Always consult the manufacturer for the use of any special greases (not mentioned in this manual).

4.3 Oil lubrication

For delivery the bearing housing of the pump has been emptied of the oil. Remember to refill it before starting.

For lubrication, use only high-quality mineral oils of viscosity conforming to ISO VG 46, e.g. :

BP : Bharat Hydrol 46
IOC : Servo Prime 46
HP : Turbinol 46
: Enklo 46

Viscosity of oil at the operating temperature must be not less than 12 cSt (65 SSU). Operating temperature is about 15^0 C higher than the surface temperature of the bearing housing.

Oil changes

After commissioning oil should be changed for the first time after 100 hrs. of operation and thereafter according to fig. 4.3.1.

Bearing housing surface temperature	Oil changes interval
65^0 C	1 year
75^0 C	6 months

Fig. 4.3.1

Bearing unit no.	Oil volume in ltrs.
1	0.2
2	0.5
3	0.6
4	0.9
5	2.2

Fig. 4.3.2

4.4 Adjustment of clearance between wear plate and open impeller

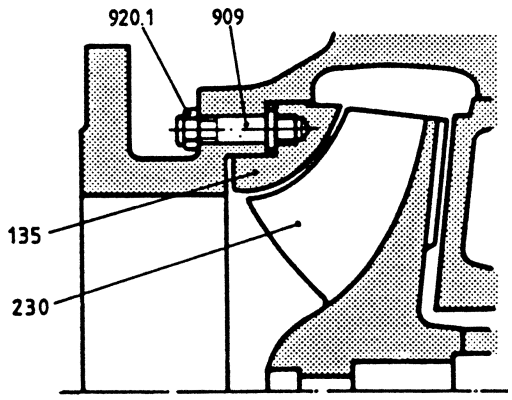
The pump with open impeller (230) has an adjustment wear plate (135). The adjustment of the clearance can be carried out without dismantling the pump.

a. Slacken the hexagonal nuts (920.01) of the adjusting screws (909).

b. Turn each adjusting screw counterclockwise until the wear plate touches the impeller. Now turn the adjusting screws 1/3 turns to obtain a 0.5 mm clearance between wear plate and the impeller.

c. After the adjustment, tighten the hexagonal nuts, whereby the adjusting screws will be locked. The adjusting screws must not turn during tightening.

d. Ensure that the shaft rotates freely, by turning the coupling by hand.



The wear plate can be adjusted all toigether 3-4 mm towards the impeller. If further adjustment is needed, change the imepller and wear plare in order to keep the right clearance.

5 Repairs

5.1 Preliminaries

a. Close the discharge valve

b. Switch off the motor. Make sure that the motor cannot by any means be started during the repairs.

c. Close the suction valve.

e. Open the screwed plug (903.1) at the bottom of the volute casing.

f. Remove the guard (686) and coupling (840) spacer.

g. If the bearing housing is oil lubricated, drain it by opening the screwed plug (903.5).

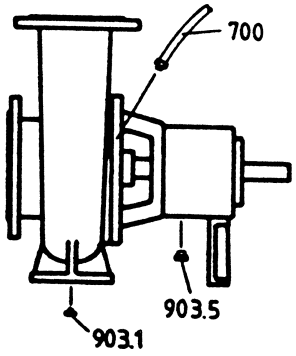


Fig. 5.1

5.2 Detachment of exchange unit

a. Unscrew the hexagonal screws (901.1) of the adapter (344) and the hexagonal screws (901.8) of the support foot from the baseplate.

b. Loop a hoist sling at the maintenance opening of the adaptor or underneath.

c. Pull out the exchange unit by using the hexagonal screws (901.1).

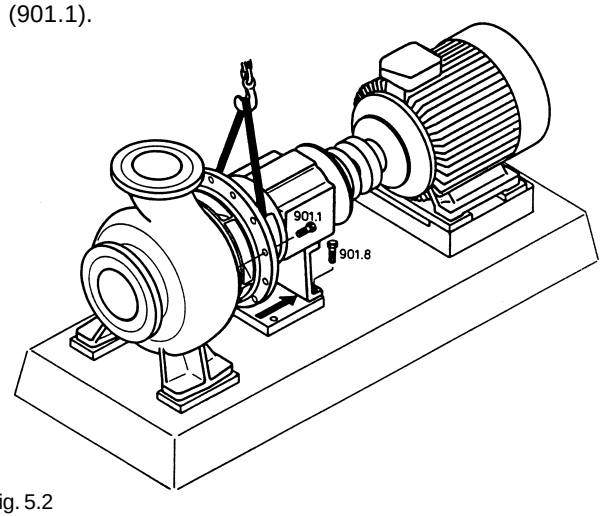


Fig. 5.2

5.3 Dismantling of the exchange unit.

Detachment of the impeller.

a. Fasten the exchange unit firmly to vice bench.

b. Open the socket head screw (914.1) of the impeller (230) using hex wrench.

c. Prevent the shaft (210) from rotating at the coupling.

d. Detach the impeller by turning it counter clockwise. Push pieces of wood between the impeller vanes to ease the detachment. Never use metal bars or the like, because they might damage the impeller vanes.

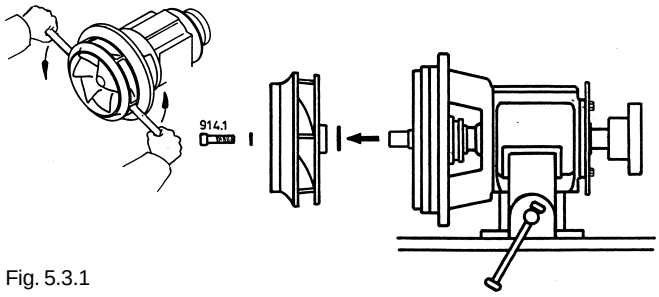


Fig. 5.3.1

Detachment of adapter

Unscrew the hexagonal screws (901.3) of the adapter (344) and draw the adapter out using the said screws.

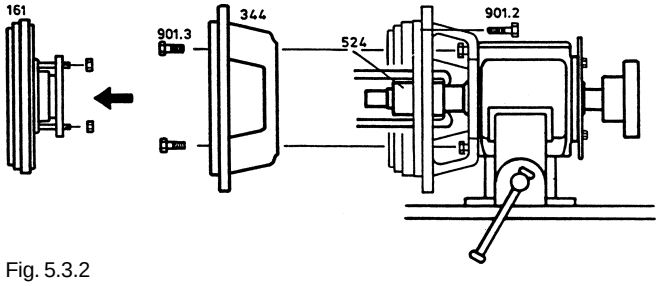
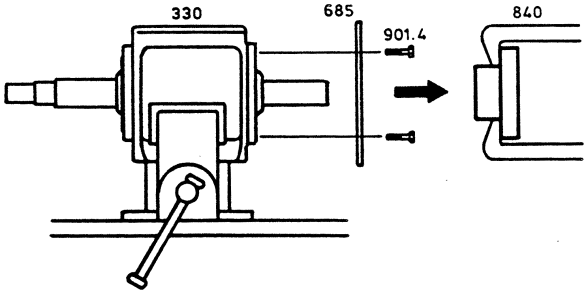


Fig. 5.3.2

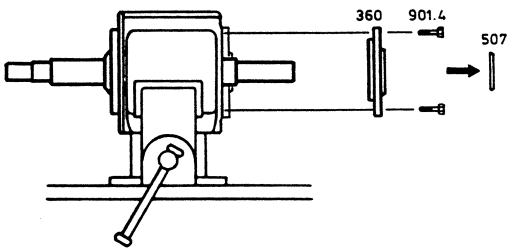
5.4 Dismantling the bearing unit

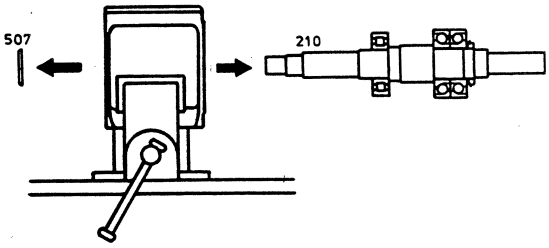
a. Fasten the bearing unit frirmly to the vice ebnch at the bearing housing. (330).

b. Detach the coupling half (840) using an extractor.



c. Draw the bearing cover out using the hexagonal screws (901.4).

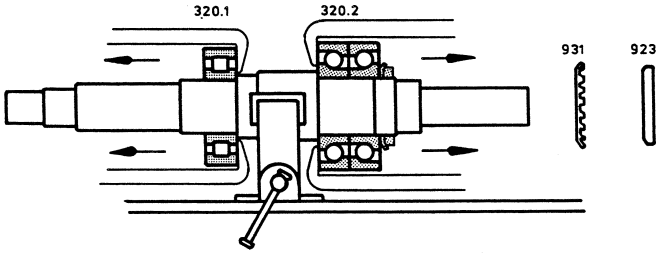




d. Strike the pump side of the shaft (210) with a soft hammer, whereupon the shaft with its bearing will come off the bearing housing. Simultaneously the deflector comes off.

e. Fasten the shaft with its bearing to vice bench and detach the bearing nut (923) and lock washer (931).

f. Bearings (320.1, 320.2) are detached from the shaft with an extractor or by means of a hammer and punch.

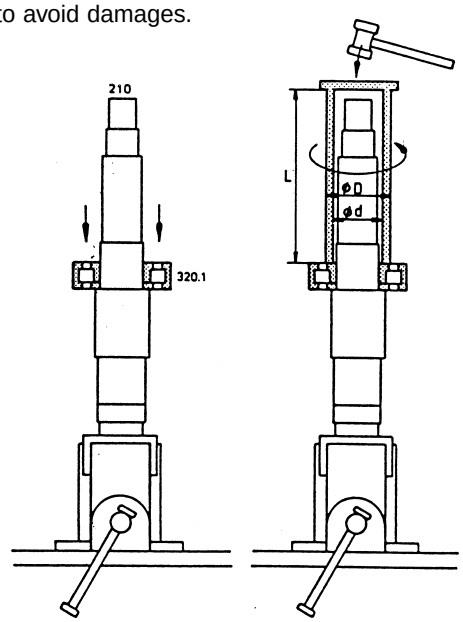


Note : Always replace the bearings once they have been removed from the shaft with new ones.

5.5 Assembly of bearing unit

a. Check the shaft (210) with its shaft protection sleeve (524) for eccentricity, between centres. Maximum allowable eccentricity is 0.05 mm.

b. Fasten the shaft to the vice bench with the impeller end of the shaft upwards. Use soft sheets between the vice clamp jaws to avoid damages.



Bearing unit no.	Ødm	ØDm	L (min)
1	37	50	160
2	47	60	180
3	57	71	195
4	67	80	250
5	87	100	290

Fig. 5.5.1

d. Turn the shaft so that the coupling side is upwadrs, fasten it to the vice bench.

e. Repeat the procedure in 2 and 3 above, for the duplex angular contact bearing.

Note : It is absolutely essential that the bearings are placed correctly according to the O-system (back to back).

f. Place the lock washer (931) on the shaft.

g. Tighten the antifriction bearings by means of the bearing nut (923) tightly against the shaft shoulder, using a suitable hook wrench.

h. Bend the teeth of the lock washer into the bearing nuts slots.

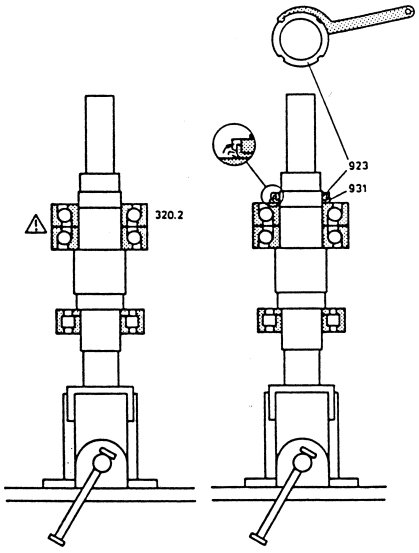


Fig. 5.5.2

i. Tighten the bearing housing (330) vertically in the vice bench with the coupling side upwards.

j. Heat the bearing housing up to +80^0 C to ease the assembly of the shaft unit.

k. Tap the labyrinth ring (423) into the bearing housing with a soft hammer. Ensure the water holes are underneath.

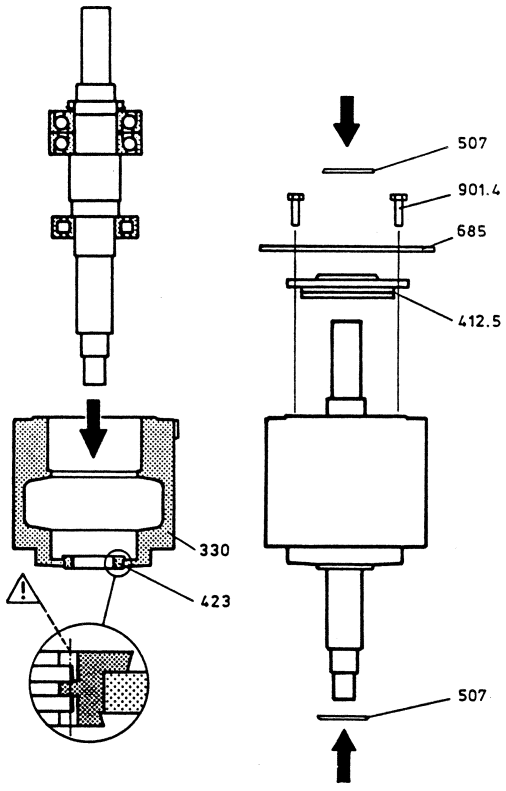
l. Lower the shaft carefully into the bearing housing. Make sure not to damage the labyrinthring.

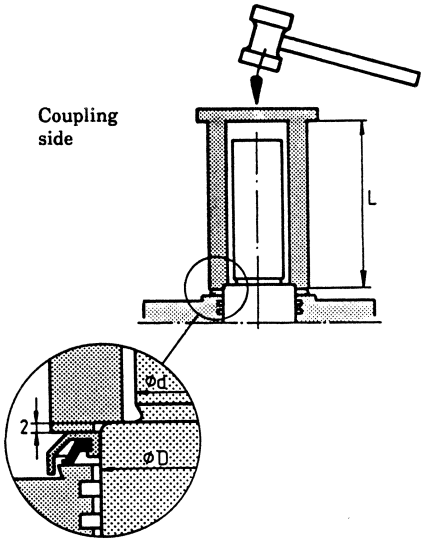
m. Grease the O-ring (412.5) of the bearing cover lightly and stretch it into its groove.

n. Set the bearing cover cautiously on its place. Take care that the water holes in the labyrinth ring will end up underneath. Secure to the bearing housing with the hexagonal screws (901.4).

o. Tighten the hexagonal screws of the bearing cover.

p. Place the deflectors (507) with care onto the shaft by using a tool shown in fig. 5.5.5. Grease the rubber lip before installation.





Bearing unit	Coupling side		
no.	Ød	ØD	L min.
1	24	35	160
2	32	45	180
3	42	55	195
4	48	65	250
5	75	85	290

Fig. 5.5.3

Bearing unit	Impeller side		
no.	Ød	ØD	L min.
1	30	35	160
2	40	45	180
3	50	55	195
4	60	65	250
5	80	85	290

Fig. 5.5.4

5.6 Asssembly of the exchange unit

a. Fix the adapter (344) to the bearing housing (330) with the hexagonal screws (903.1).

b. The shaft seal and the casing cover (161) are assembled according to the assembly drawing.

c. Fit the O-ring (412.4) between the impeller (230) and the shaft protection sleeve.

d. Fix the casing cover (161) to the adaptor wwith the hexagonal screws (901.2).

e. Prevent the shaft rotation from the coupling end and insert the impeller (230) on its place.

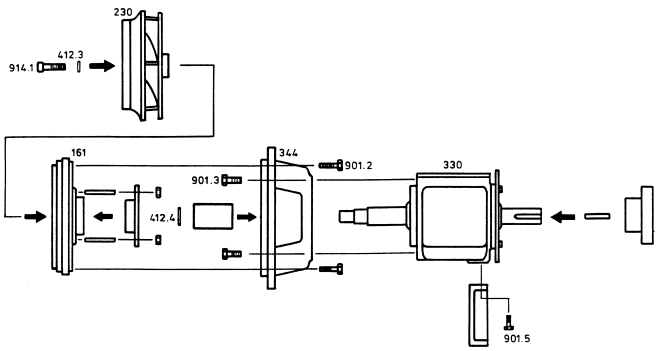


Fig. 5.6.1

f. Lock the impeller with the socket head screw (914.1) on which the O-ring (412.3) has been fitted.

Tighten the socket head screw to values given in fig. 5.6.2

Bearing unit	Screw size	Moment (Nm)	
		Rating Max.	Value Ø
1	M10	30	40
2	M12	50	60
3	M16	130	140
4	M20	250	260
5	M24	420	440
6	M30	800	820

Fig. 4.6.2

Secure the socket head screw (914.1) by bending its flange into one hole on the impeller by using a tool, the head shape and dimensions of which are shown in the drawing (fig. 5.6.3) and table at fig. 5.6.4.

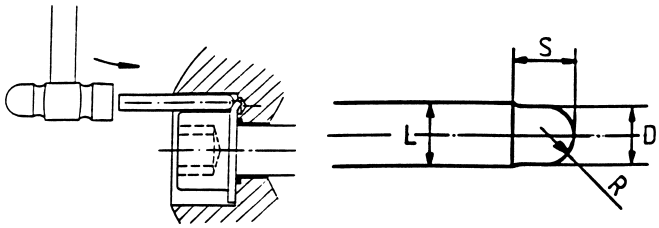


Fig. 5.6.3

Bearing unit	$L^{+0}_{-0.5}$	ØD	R	Smin
1,2	6.5	4	2	6
3,4	7.5	6	3	7
5,6	9	8	4	8

Fig. 5.6.4

The same socket head screw can be secured into the same hole only once. There are two extra holes on the impeller for the later securing.

g. Fix the support foot of the bearing unit by means of the hexagonal screws.

h. Heat the coupling flange to about 100^0 C and push it on the shaft with the front surface at the shaft end level.

Installation of wear plate (open impeller)

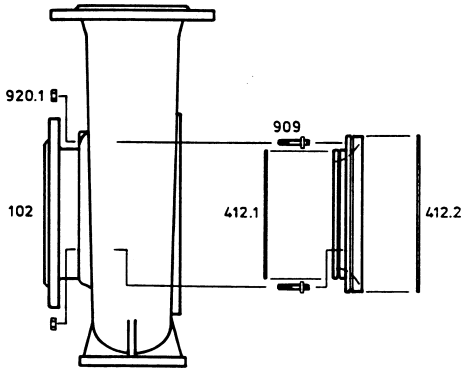


Fig. 5.6.5

a. Grease the O-rings (412.1 & 412.2) lightly and fit them in the grooves of the wear plate (135).

b. Screw the adjusting screws (909) all the way into the wear plate.

c. Install the wear plate into the volute casing (102).

d. Fix the hexagonal nuts (920.1) to the adjusting screws.

5.7 Installation of the exchange unit

a. Loop a hoist sling under the exchange unit for support

b. Fit the gasket (400.1) in the casing cover (161)

c. Install the exchange unit in its place, lubricate the hexagonal screws (901.1) with Molykote Ti 1200 lubricant and tighten them slowly, to values given in fig. 5.7.1

Screw size	Moment (Nm)	
	Rating	Max. value
M12	50	60
M16	130	160
M20	250	300

Fig. 5.7.1

d. Adjusting plates of the same thickness as the gap are placed under the support foot. Do not close the gap by tightening.

e. Fix the support foot (183) to the base plate (890) with the hexagonal screws (901.8).

f. Lubricate the bearing unit with oil or gresae (see section 4.2 and 4.3).

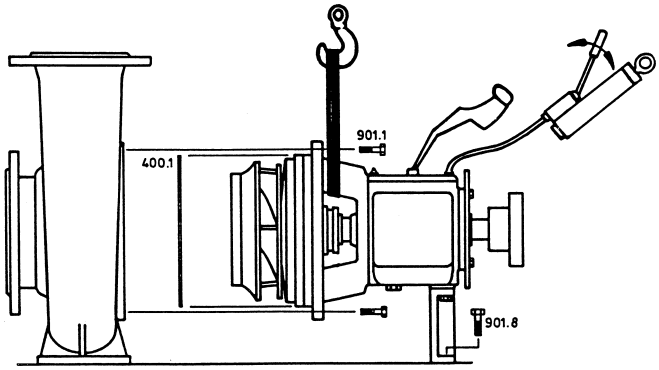


Fig. 5.7.2

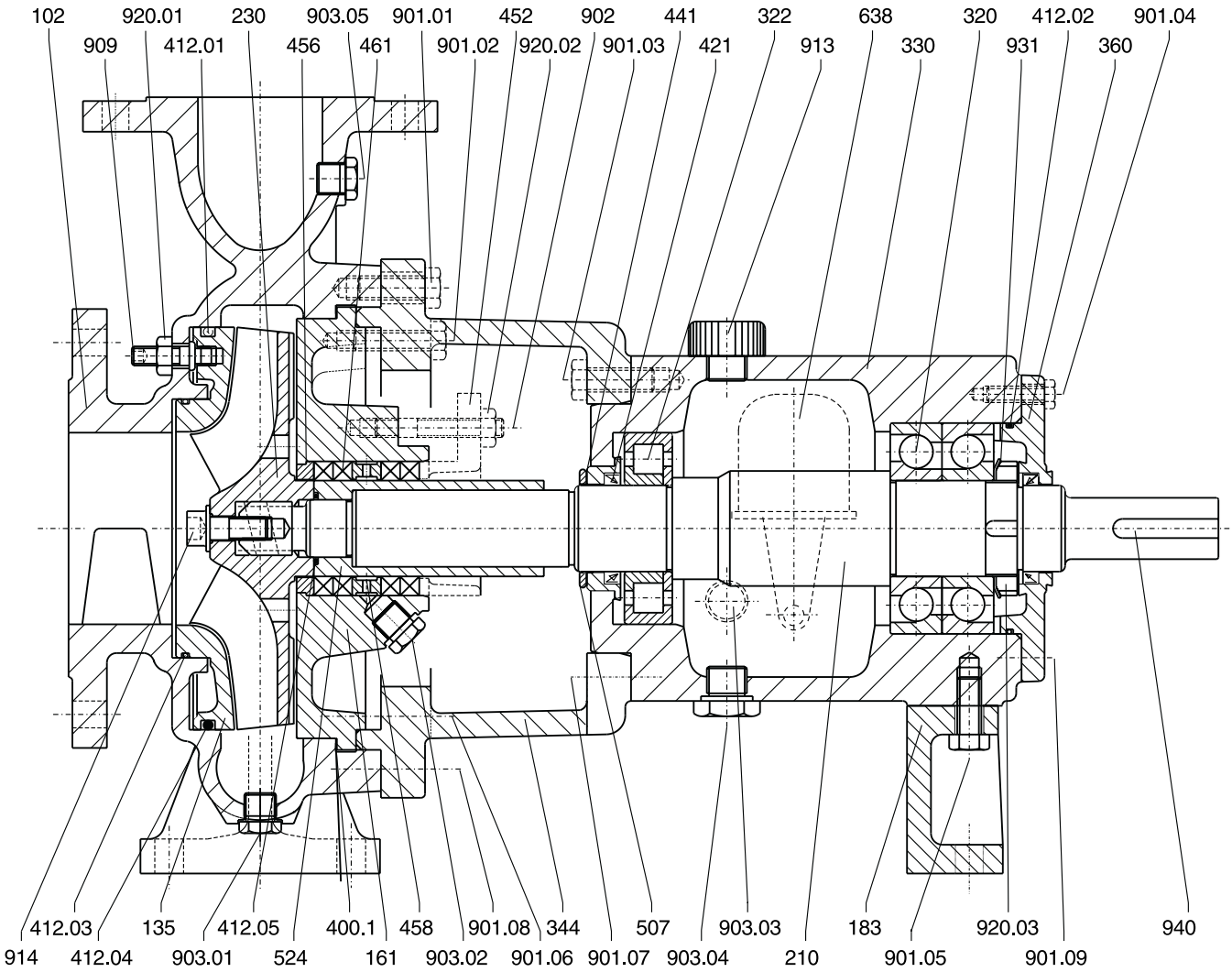
Fig. 4.6.3

6 Spare parts

Recommended stock of spare parts for two year's of operation

Part no.	Description	Number of pumps							
		1	2	3	4	5	6 7	8 9	10 and above
		No. of spare parts							
013	Bearing unit							1	10%
102	Volute casing							1	10%
135	Wear plate	1	1	1	1	2	2	3	30%
161	Casing cover							1	10%
183	Support foot							1	10%
210	Shaft	1	1	1	2	2	2	3	30%
230	Impeller	1	1	1	1	2	2	3	30%
320.1	Antifriction bearing	1	1	1	2	2	3	4	50%
320.2	Antifriction bearing		2		4		6	8	50%
330	Bearing housing							1	10%
344	Adaptor							1	10%
360	Bearing cover							1	10%
400.1,2,3	Gaskets	2 each	4 each	6 each	8 each	8 each	9 each	12 each	150%
412.1-.9	O-ring	2 each	4 each	6 each	8 each	8 each	9 each	10 each	100%
413	V-ring	2 each	4 each	6 each	8 each	8 each	9 each	12 each	100%
423	LAbyrinth ring							1	10%
433	Mechanical seal	1	2	3	4	5	6	7	90%
435	Static seal	1	2	3	4	5	6	7	90%
442	Cooling insert							1	10%
451	Stuffing box housing							1	10%
452	Stuffing box gland							1	10%
456	Neck bush							1	10%
458	Lantern ring							1	10%
461	Gland packing	24	24	24	24	32	32	32	400%
471	Cover plate for seal							1	10%
475	Thrust ring	1	2	3	4	5	6	7	90%
487	Compressore ring							1	10%
507	Deflector	4	4	8	8	8	8	10	100%
524	Shaft protection sleeve	1	2	2	2	3	3	4	50%
542	Throttle bush							1	10%
550	Plate	2	4	6	8	8	9	10	100%
604	Expeller	1	1	1	1	2	2	3	30%
909	Adjusting screw	3	3	3	6	6	6	9	30%
923	Bearing unit	1	1	1	2	2	2	3	30%
931	Lockwasher	1	1	1	2	2	2	3	30%
940	Key	1	1	1	2	2	2	3	30%

7 Sectional drawing and list of components



List of components

Part no.	Description
102	Volute casing
135	Wear plate
161	Casing cover
183	Support foot
210	Shaft
230	Impeller
320	Ball bearing
330	Bearing housing
344	Adaptor
360	Bearing cover
400.01	Gasket
412.01-05	O-ring
423	Labyrinth ring
452	Gland
456	Neck bush

Part no.	Description
458	Lantern ring
461	Gland packing
507	Deflector
524	Shaft prottection sleeve
638	Constant level oiler
901.01-09	Hex. head bolt
902	Stud
903.01-05	Hex. head plug
909	Adjusting screw
913	Vent plug
914	Socket head screw
920.01-03	Hex. nut
931	Lock washer
940	Key