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1 General

Your centrifugal pumps will only give you completely trouble free and satisfactory service on condition that it is installed with due care and properly maintained. It is absolutely essential that the instructions contained in this manual be scrupulously observed, and that the pumps are not operated under conditions which differ from those specified under our 'Operating Conditions'. This operating instruction manual does not take any account of any safety regulations which may apply to the installation site, and the Site Engineer or Site Operator is responsible for notifying our erection staff of any such regulations and seeing that they are complied with.

The type series pump size, main operating data and work order number are all stamped on the name plate affixed to the pump, please make sure to quote this information every time you write to us in respect of queries, repeat orders and more particularly when ordering spare parts.

1.1 Handling

The pumping set should be properly handled and slug for transport. Do not thread the ropes through the eye bolt on the motor. See Fig. 1

During handling do not remove the rubber blankings provided on the suction and discharge nozzles.

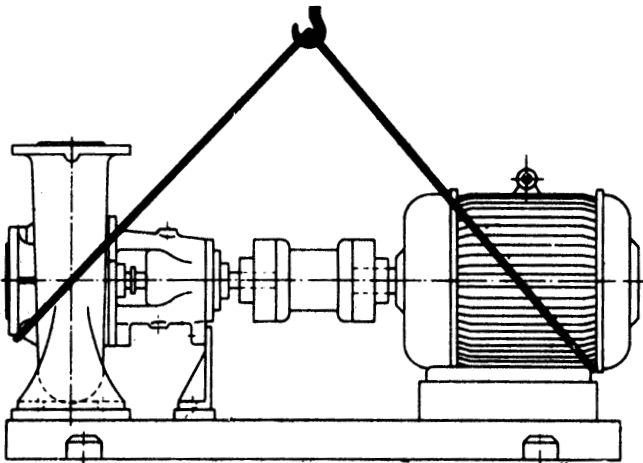


Fig. 1 Pump and driver mounted on combined base plate.

2 Installation (Installation on site.)

2.1 Foundation

Make sure that the concrete foundation has set firmly before placing the base frame along with the pumping set or pump on it. The surface of the foundation should be truly horizontal and perfectly flat. The foundation bolts should be suspended in the base plate.

2.2 Base frame and pump

After placing the base frame along with the pump on the foundation, level it up with the aid of a master spirit level placed on the discharge nozzle and motor pads.

The correct gap between the two coupling halves specified on the foundation drawing must be observed.

Ground plates should always be inserted to the left and right of the foundation bolts in close proximity to the bolts themselves between the base plate or foundation frame and the foundation itself. If the spacing between adjoining anchor bolt holes exceeds 800 mm, additional plates should be inserted half way between the adjoining holes. All plates must lie perfectly flush.

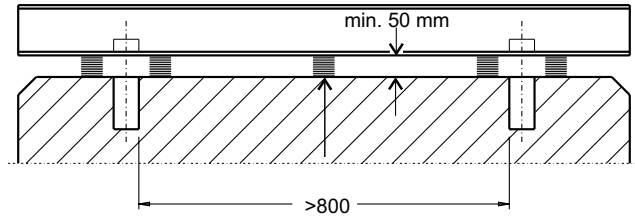


Fig. 2 Provision of necessary ground plates

To ensure silent running, the pumping set can be mounted on vibration dampers (please consult us first). Compensators can be arranged between the pump nozzles and the suction and discharge lines.

After insertion of the foundation bolts, the latter should be grouted in the foundation with grouting mix. When the mix has set firm, the base plate should be levelled up in accordance with section 1.3 and the foundation bolts should be tightened uniformly and firmly. Thereafter the base plate should be grouted in with mix (non shrinking mix if possible), making sure that no cavities remain unfilled. Use vibrator, if necessary.

2.3 Alignment of pump and driver

Accurate coupling alignment requires the manufacture of a coupling alignment jig. This can be made from 20 x 20 flat bar steel. The jig should be attached to the shaft.

See Fig. 3.

The coupling can be considered correctly aligned with the aid of the jigs illustrated if the difference measured does not exceed 0.04 mm both in the radial and axial directions, measurements being taken in 4 planes at 90 °C intervals. The coupling alignment check should be repeated after the piping has been connected to the pump to ensure stress free piping. Prior to alignment individual concentricity of coupling should be checked. It should be within 0.03 mm, if not corrective action should be taken. The coupling should be dynamically balanced in accordance with VDI 2060 (ISO 1940) Q 6.3 for motor driven and Q2.5 for turbine driven pumps.

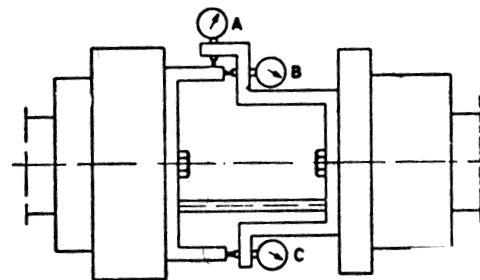


Fig 3. Alignment of a spacer type coupling

2.4 Connecting the piping

Never use the pump itself as an anchorage for the piping. Suction lift lines should be laid with a rising slope towards the pump and suction head lines with a downward slope towards the pump. The pipe lines should be anchored in close proximity to the pump and should be connected to the latter without transmitting any stresses or strains nor should the weight of the piping be loaded on to the pump.

The nominal sizes of the pipelines should be at least equal to the nominal sizes of the pump nozzles. We recommend the incorporation of check valves or non return valves and isolating valves in the system, depending on the type of installation and pump. Any thermal expansion of the piping (due to high temperatures) must be compensated by suitable means, so as not to impose any additional load on the pump.

2.4.1 Auxiliary connections.

The auxiliary connections required for your pump (sealing liquid, as the case may be) are indicated on the installation drawing. For sizes and details of connections see Table-1

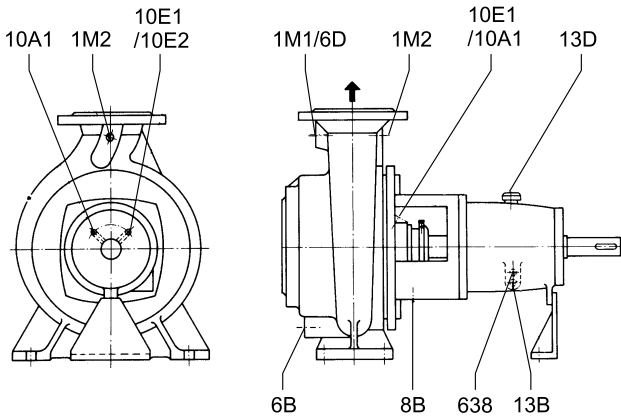


Fig. 4 : Auxiliary connections

| Connections | Pump Sizes | | | Designation |
|-------------|----------------------|----------|-------------------------------------|--------------------------|
| | 65 - 200 65 - 315 | 80 - 250 | 100 - 400 125 - 500 150 - 315 | |
| 1 M .1 / 6D | G 1/2" | G 1" | G 1" | Pressure guage / venting |
| 1 M .2 | G 1/2" | G 1/2" | G 1/2" | Pressure guage |
| 6 B | G 3/4" | G 3/4" | G 1" | Casing drain |
| 8 B | G 1/2" | G 1/2" | G 1/2" | Leakage drain |
| 10 E .1 | G 1/4" | G 1/4" | G 3/8" | Sealing liquid inlet |
| 10 A .1 | G 1/4" | G 1/4" | G 3/8" | Sealing liquid outlet |
| 13 B | G 1/4" | G 1/4" | G 1/4" | Oil drain |
| 13 D | 20 Ø | 20 Ø | 20 Ø | Vent Plug |
| 638 | G 1/4" | G 1/4" | G 1/4" | Constant level oiler |

Table 1

2.4.2 Vacuum balance line

If the pump has to pump a liquid out of a vessel under vacuum, it is advisable to install a vacuum balance line. This line should have a nominal size of 25mm at least. It should be arranged to lead back in to the vacuum vessel at a pint above the highest permissible liquid level. An additional line starting at the pump discharge nozzle facilitates venting of the pump before start up. The vacuum-tight isolating valve E in this connecting line should be closed after the venting procedure and should remain closed while the pump is running. The main isolating valve C in the vacuum balance line must remain open at all times when the pump is running and should only be closed when the pump is shut down (Fig. 5)

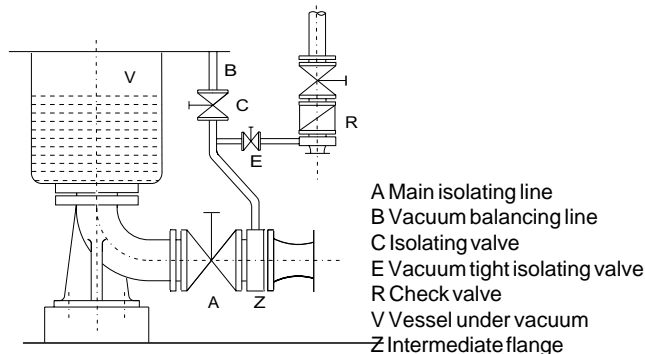


Fig.5 : Vacuum balance line

2.4.3 Coupling guard

In compliance with the accident prevention regulations, the pump may only be operated if it is fitted with a coupling guard. If the customer states specifically that this coupling guard is

not to be supplied by us, it must be provided by the pump operator.

2.5 Measuring instruments

Each pump should be equipped with two pressure gauges, one at the suction nozzle and other at the discharge nozzle; their measuring range should be suitable for the prevalent pressure conditions, and they should be provided with a stop valve. If the suction conditions demand it (e.g suction lift operation), the gauge on the suction nozzle should be pressure vacuum gauge.

2.6 Final check

Check the alignment once more as described in section 1.3. It must be possible to rotate the pump rotor without effort by hand at the coupling.

3 Commissioning, start-up / shutdown

3.1 Preliminary remarks regarding commissioning

3.1.1 Lubricants

Oil lubricated bearings :

The bearing bracket should be filled with oil of either of the following types and specifications.

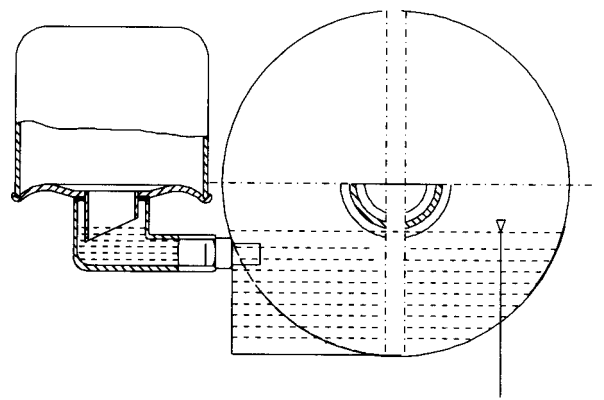
Recommended Lubricants

- Indian Oil : Servosystem 46
- Hindustan Petroleum : Encló 46
- Bharat Petroleum : Bharat Hydrol 68

Procedure

Unscrew vent plug. Pour in oil through the vent plug aperture after removing the reservoir of the constant level oiler, until oil appears in the vertical portion of the connection elbow of the constant level oiler (see Fig. 6)

Then fill the reservoir of the constant level oiler with oil and fit it back into operating position. Screw vent plug in again. After a short time has elapsed, check whether the oil level in the reservoir has sunk. The reservoir should always remain filled. If the vent plug is inaccessible or difficult to reach e.g. the oil can be filled into the bearing bracket through the connection elbow of the constant level oiler.



Oil level in bearing bracket and in connection elbow

Fig 6 : Oil fill

CAUTION:

The oil level should always be situated below the level of the vent slot arranged at the top edge of the connection elbow and this slot should always be perfectly dry. Do not tighten the elbow by applying the force on the reservoir. Use lock nut for this purpose.

3.1.2 Shaft seal

The shaft is sealed at its exit through the casings by soft packed stuffing boxes or by mechanical seals. Mechanical seals can be fitted in lieu of soft packing (or viceversa) at any time during the service life of the pump with a minimum of machining of the stuffing box housing. Regarding machining details refer to the pump manufacturer.

3.1.2.1 Stuffing box

Soft packed stuffing boxes reduce the flow of leakage liquid at the clearing gap between casing and shaft protection sleeve when the pressure inside the pump is higher than atmospheric. Conversely, on pumps which operate on suction lift, the soft-packed stuffing box prevents the ingress of air into the pump. Sealing is effected by means of soft packing arranged in a number of rings in the annular space between the stuffing box housing (151) and the shaft protection sleeve (524) and lightly compressed by the stuffing box gland (452)

3.1.2.2 Packing the stuffing box

The stuffing box will only be able to perform its vital function satisfactorily on condition that it is carefully packed and properly maintained as prescribed.

Before packing, thoroughly clean stuffing box gland (452), packing compartment and shaft protection sleeve (524)

To cut the packing rings to correct length, use a suitable wooden cutting jig (we can supply same on request), to ensure that the packing rings are of the correct length and that their ringbutts come into correct contact with one another (See Fig. 7)

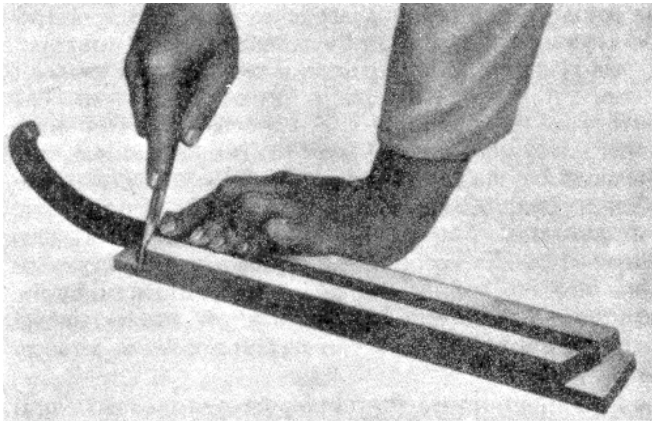


Fig. no. 7 : Cutting the packing rings to length

If the packing rings are either too long or too short, the stuffing box will not be able to perform its function properly. In the case of asbestos-graphite packing material, the rubbing faces of the individual rings should be lightly coated with molybdenum disulphide before insertion in the packing compartment. The first ring is then inserted and pushed home into the compartment with the aid of the stuffing box gland.

The following packing rings are then inserted into the packing compartment one by one, making sure that the butt joint of each ring is offset 90 approx. in relation to the butt joint of the preceding ring; the individual rings are pushed home into the packing compartment with the aid of the stuffing box gland.

The packing rings should only be pressed lightly against one another. They should be inserted in the packing compartment in such a way that a clear gap of 6 to 8 mm is left at the outer end of the compartment for the positive guidance of the stuffing pressure ring.

The inserted packing rings should then be compressed

moderately with the aid of the stuffing box gland (452) and of the nuts. Then the nuts should be slackened again by one to two complete turns, and thereafter tightened lightly by hand.

The correct and even seating of the stuffing box gland (452) should be checked when the pump is subjected to suction pressure, by inserting a feeler gauge between the gland (452) and the shaft protection sleeve. (524)

In the case of the special stuffing boxes, a lantern ring is also inserted in the packing compartment, viz, at the centre of the compartment (between the packing rings). In these cases, an information plate is affixed to the stuffing box housing, showing the position of the lantern ring. The ring must register beneath the drilled hole in the stuffing box housing, to enable the sealing or flushing liquid to flow through the hole and the ring. The sealing or flushing liquid pressure should be 1 to 4 bar above the pressure reigning in the packing compartment of the stuffing box.

The packing of the stuffing boxes should be carried out with great care, to avoid an excessively high radial pressing force of the packing rings against the shaft protection sleeve, which might damage the latter. If the shaft protection sleeve is scored or grooved, even a new packing can not be expected to last very long in service.

A newly packed stuffing box should leak profusely at first. If this leakage does not cease of its own accord after a relatively short period of operation, the nuts on the gland should be tightened slowly and evenly while the pump is running, until the stuffing box only drips slightly. Make sure the stuffing box glands (452) are tightened evenly and not askew, as otherwise the shaft protection sleeves (524) might be damaged.

If the newly packed stuffing boxes start to smoke when the pump is started up for the first time, the pump should be switched off. If the smoking persists after the pump has been started up again and operated several times in succession, the nuts on the gland should be slackened slightly, or the stuffing box should be inspected if necessary.

3.1.2.3 Packing material

When selecting the packing material, make sure it is compatible with the fluid pumped (consult the manufacturer in case of doubt)

Packing material which has been kept in store for a certain period has a longer service life than packing material fresh from the packing manufacturer.

Significance of the numbers punched on this instruction plate is as follows

In this case 3

The no. of packing rings punched for the different packing arrangements are as follows

3.1.2.4 Dimensions of the packing compartment

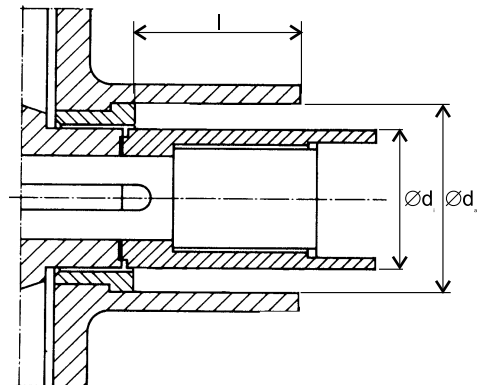


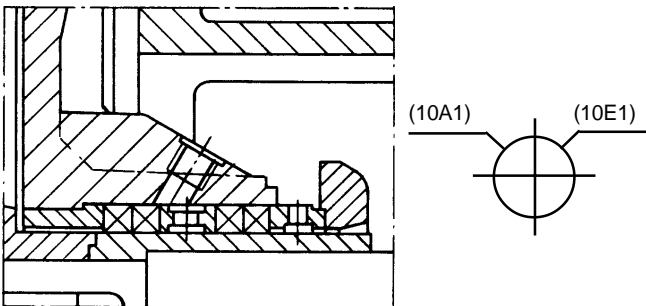
Fig. no. 8 : Stuffing box compartment

| Bearing Bracket | Pump size | Qty. with Lantern ring | Qty. without Lantern ring | di ϕ | da ϕ | l1 | Packing size in mm |
|-----------------|-----------|------------------------|---------------------------|-----------|-----------|----|--------------------|
| P35/80 | 65-200 | 4 | 6 | 45 | 65 | 64 | 10 |
| | 80-250 | | | | | | |
| P45/120 | 65-315 | | | 55 | 75 | 64 | 10 |
| P55/140 | 100-400 | | | 70 | 95 | 79 | 12.5 |
| | 150-315 | | | | | | |
| P65/160d | 125-500 | | | 80 | 105 | 79 | 12.5 |

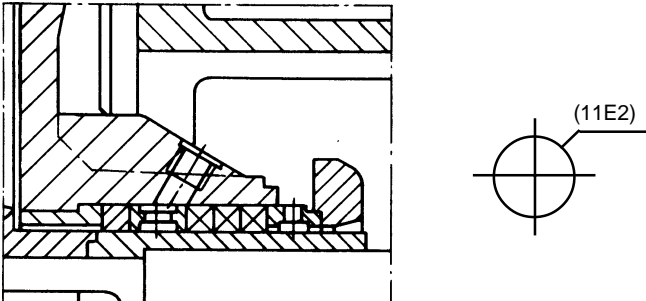
Table 2 (Dimensions in mm)

3.1.2.5 Alternate packing arrangements available

1. Standard packing arrangement - I

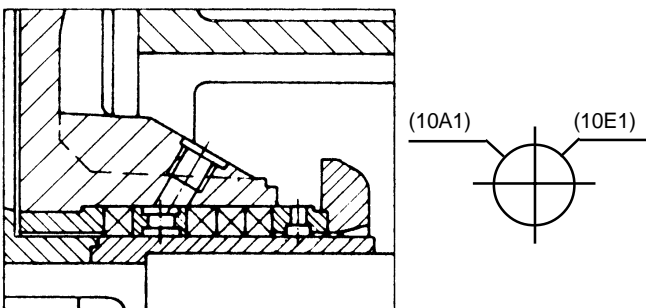


2. Packing arrangement - II



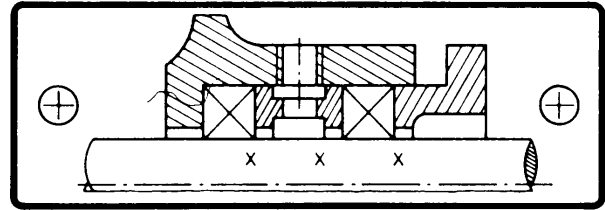
Note : Arrangement, neck ring, Spacer ring, seal cage ring, 3 packings
Rate of flow : Flushing liquid : 20-50 l/min.

3. Packing arrangement - III



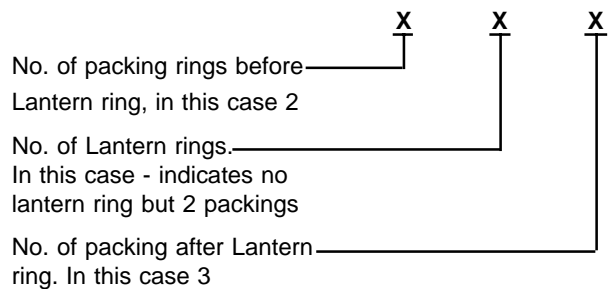
3.1.2.6 Instructions for stuffing box packing arrangement

An instruction plate depicting the required packing arrangement in the picture form is rivetted on the bearing bracket lantern.



Form A : Indicates the packing arrangement without spacer ring, while form B is with the spacer ring.

Significance of the numbers punched on this instruction plate is as follows



3.1.3 Priming the pump

Before start-up, the pump and the positive suction head line, or the suction lift line respectively, must be completely primed with the fluid pumped.

Positive suction head operation: Open the isolating valve in the suction line and vent the pump.

Suction lift operation: Open valve in suction lift line and evacuate the pump and the suction lift line, or prime pump and suction lift line via priming tundish, if a foot valve is installed.

Check the shaft seal while the pump is stopped.

It must be possible to rotate the pump rotor by hand without effort.

If applicable to your installation, open valves in the sealing / flushing lines fully and check the flow of fluid. Open the main isolating valve in the vacuum balance line (if applicable). If your pump is fitted with a mechanical seal, please follow the instructions of the seal manufacturer.

3.1.4 Checking direction of rotation

Check operating voltage of motor. Check direction of motor rotation by switching it on for a short instant with the coupling disconnected. It must correspond to the directional arrow on the bearing bracket and on the pump casing (clockwise viewed from drive end).

3.2 Start-up

Switch pump on with the discharge valve closed. Only after the pump has attained full operating speed should the total head indicated in the data plate be adjusted by opening the discharge valve (watch the pressure gauge on the discharge flange), Only switch on the pump when it is completely stopped. Always use the discharge valve (never the suction valve) to adjust the rate of flow.

Note : When the operating temperature has been attained, nuts 920.1 (connection between distance piece flange and casing) should be tightened. If leakage is observed change/ check the gasket.

3.3 Shutdown

Close discharge valve
 Switch off motor and check that the pump run down smoothly and gradually to a standstill.
 Close suction valve.
 Shut off sealing or flushing liquid supply, and close valve in vacuum balance line, if applicable.
 In case of frost, the pump should be drained or otherwise protected against freezing, if the pump is shut down for prolonged periods.

4 Maintenance and lubrication.

4.1 Supervision of operation.

The pump should run smoothly, quietly and vibration free at all times. The pump must never run dry.
 Never run the pump for long periods against a closed discharge valve. The bearing temperature may exceed the ambient temperature by up to 50 °C but must not rise above 90 °C.
 Check the oil level per section 2.1.1. The isolating valves in the auxiliary lines, if applicable, must remain open while the pump is running.
 If the pump has a gland packing, this should leak slightly during operation. The gland should only be tightened lightly.
 Any standby pumps should be started up, then shut down immediately, at least once a week, to ensure they are in constant readiness for operation. Check the condition of the auxiliary connections.
 The flexible coupling elements should be regularly checked and replaced as soon as they show signs of wear.
 It is necessary to maintain a log book on hourly basis, whether the suction and discharge pressure, actual discharge bearing temperatures (pump end and motor end), motor current and voltage should be noted.

4.2 Lubrication and lubricant changes

4.2.1 Lubrication

The antifriction bearings are mineral oil lubricated. See section 4 of the lubricant flowrate.

4.2.2 Oil change

The first oil change must be carried out after 300 hours of operation; all subsequent oil changes after 3000 operating hours.

4.2.2.1 Procedure

Remove the drain plug below the constant level oiler and drain off the oil.
 When the bearing bracket is empty, replace the drain plug and fill with oil as described in section 3.1.1.

4.3 Preservation

If the pump is taken out of service for a prolonged period, it is advisable to dismantle it completely. Proceed as described in section 4.2, "Dismantling". All components should be thoroughly cleaned, dried and all machined surfaces coated, with grease. Thereafter, the pump should be reassembled. All apertures on the pump should be reassembled. All apertures on the pump should be plugged with wooden stoppers soaked in oil or blanked off with wooden cover plates fitted with O rings. A sachet filled with Silica gel (Silica gel absorbs moisture) should be attached to the inside faces of the oil soaked wooden cover plates on the suction and discharge nozzles (i.e inside the nozzles.)

The packing should be removed from the stuffing box compartments and these should be sealed by oil soaked wooden half tubes, each provided with two O rings, in order to

prevent the penetration of moisture (not applicable to pumps fitted with mechanical seals)

CAUTION :

Only use acid free oils and greases when preserving the pump.

5 Special instructions & recommendations.

CAUTION

If a constant level oiler 638 is provided, it must be screwed into the upper tapped hole on the bearing bracket 336 before filling in any oil (see Fig. 7)

5.1 Dismantling and reassembly.

5.1.1 General

CAUTION :

Safeguard the pump against unintentional switching on before proceeding with dismantling.
 The isolating valves in the suction and discharge lines must be closed.
 The pump casing must have cooled down to ambient temperature.

The pump casing must be pressureless and drained.

Always refer to the relevant sectional drawing when dismantling and reassembling the pump.

The process type of construction enables the pump to be dismantled without disconnecting the piping from the pump casing or removing the latter from the baseplate.

If a spacer type coupling is fitted, the driver can also remain bolted on the baseplate.

Handle all components with great care during dismantling, The impeller and coupling should only be pulled off or pushed on to the shaft with the aid of a suitable puller / pusher device.
 After completion of dismantling, all dismantled components should be thoroughly cleaned and examined for signs of wear. Damaged or worn components should be touched up or replaced by new ones if necessary. Deposits on the impeller and inside the casing should be cleaned off.

When cutting new Gaskets, make sure they are of exactly the same thickness as the old ones.

It must be possible to rotate the pump rotor easily by hand after reassembly, without causing any scraping noises. Prime bearing bracket with oil according to 2.1.

5.1.2 Dismantling

5.1.2.1 Standard bearing arrangement.

1. Remove coupling guard.
2. Disconnect spacer sleeve between the pump and motor coupling halves (if a non-spacer type coupling is fitted, the driver must be removed from the base plate)
3. Disconnect auxiliary piping for sealing and leakage liquid.
4. Unscrew hexagonal nuts 920.1 and the bolts 901.4 fixing the support foot 183 to the base plate. Remove the support foot.
5. Loop a rope tightly around the top stay of the bearing bracket lantern (to sustain the weight of the subassembly described below). Force off the distance piece 344, including the bolted-on bearing bracket 330 and pump rotor, by means of the forcing screw 908.1 on the bearing bracket lantern.
6. Carefully pull the complete rotor out of the pump casing and set it down. Unscrew drain plug 903.11 on the bearing bracket & drain the oil. Tilt the bearing bracket to ensure complete removal of oil.

7. Unscrew the impeller screw 906 (right hand thread), remove the O Ring 412.03. Pull off the impeller with a special puller type device of KSB make as shown in fig.9. Remove the key.

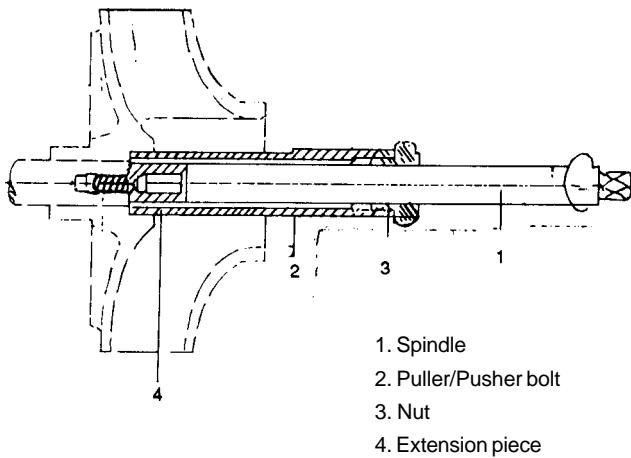


Fig no. 9 Arrangement of Puller

8. Dismantling the shaft seal : Remove the stuffing box gland 452 after unscrewing the hexagonal nuts 920.2. Strip off the stuffing box pressure ring 454, the packing rings 461, lantern ring 458 and the packing rings located behind the lantern ring.

9. Remove pressure cover 163 from the bearing bracket lantern.

10. Unscrew nuts 920.4 on the connecting studs of the flange between bearing bracket lantern and bearing bracket , and remove the bearing bracket lantern 344.

11. Pull shaft protection sleeve 524.01 together with Flat Gasket 400.04 off the shaft.

Force open the splash ring 524.01 by splaying it with a wedge or a screw driver and then pull it off the shaft.

12. Pull off pump half-coupling from stub shaft with the aid of a puller device.

13. Dismantle pump end and motor end bearing cover 360.1 and 360.2 by unscrewing the screws 914.2/3.

14. Carefully drive out the shaft 210 together with bearings 321.1/2 or 322 towards the motor end.

15. If it is necessary to renew the antifriction bearings 321.1/2 or 322, they should be warmed up by means of a welding torch or a blow-lamp before pulling them off the shaft, and the shaft itself should be kept as cool as possible.

16. Examine wear plate 135.01 for signs of wear and if necessary remove them from pump casing.

For dismantling the wear plate, remove hex head bolt 901.03 together with gasket 411.13. Take care not to damage gasket 411.1 and O ring 412.05

17. Clean all components and inspect them for signs of wear. Touch up any damaged parts or replace them by new ones.

5.1.3. Reassembly

Reassembly proceeds in reverse sequence to dismantling. It should be undertaken with the greatest care, and with the aid of the relevant sectional drawing, to ensure trouble-free running of the pump.

Carefully examine all seals during reassembly O-rings, radial seal rings and gaskets should be examined for any sign of damage and if necessary replaced by new ones. Flat gaskets should in principle always be replaced by new ones. The antifriction bearings, shaft bearing brackets and stuffing box components should be thoroughly cleaned in petrol or benzol. Coat the fits of the individual components with graphite or a

similar lubricant before reassembly, this also applies to the screw threads.

The following points should be carefully observed.

1. Standard bearing arrangement

If new bearings are fitted, make sure that they are of the correct size and type (see 4.2). Heat bearings in an oil bath to 80°C.(175 o F) approx. before slipping them onto the cleaned shaft, until they abut against the shaft shoulders. Replace shaft carefully in the bearing bracket.

2. When mounting the bearing covers 360.01/.02 take care not to damage the gaskets 400.01/.02 and oil seals 421.01/.02. Press neck ring 456.01 into the pressure cover 163. In the case of the packing arrangement illustrated in For packing the stuffing box refer to point No. 3.1.2.6.

For packing the stuffing box refer point No. 3.1.2.3.

CAUTION :

The stuffing box should drip slightly when the pump is running. Any sealing and flushing liquid connections on your pumps should be checked from time to time for unimpeded flow of the fluid. After the gland has been tightened repeatedly in the course of operation until it can be tightened no further, the pump should be repacked completely with new packing.

3. Carefully insert the impeller gasket 400.04 and make sure that all joints and sealing faces are perfectly clean.

The impeller should be pressed onto the shaft only with the help of a pusher device supplied by us. Hammering should never be resorted to. See Fig. 16.

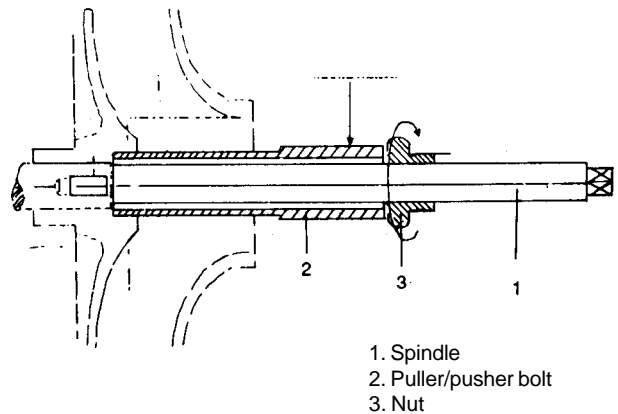


Fig. no. 10 : Arrangement of Pusher.

4. After assembly in the pump casing which has remained in situ in the piping, the coupling alignment should be checked (see item 1.3)

5. Fill in oil in accordance with item 3.1.

5.2 Bearings

The pump is fitted with antifriction bearings as follows

A. Standard bearing bracket

| Pump size | Bearing bracket | Bearings | | Oil fill (cm ³) approx. |
|-----------|-----------------|-----------|------------|-------------------------------------|
| | | Pump side | Drive side | |
| 65-200 | P35/80 | 6307 | 6307 | 500 |
| 80-250 | | | | |
| 65-315 | P45-120 | 6409 | 6409 | 500 |
| 100-400 | P55-140 | 6411 | 6411 | 1500 |
| 150-315 | | | | |
| 125-500 | P65-160d | NU 413 | 6413 | 1800 |

Table 3

5.3 Spares

5.3.1 Ordering spare parts.

When ordering spare parts, always please specify the following data :

Pump type : (KWP in this case)

Part No. :

Works order No.:

The above data are stamped on the data plate fixed on the pump.

5.3.2 Recommended stock of spares for one year of operation

| Part No. | Part Name | Number of pumps installed including stand by pumps | | |
|----------|--------------------------------|--|-------|-----------|
| | | 2 - 3 | 4 - 7 | 8 & above |
| 135.1 | Wear plate | 2 | 3 | 50% |
| 210 | Shaft with keys | 1 | 2 | 30% |
| 230 | Impeller | 1 | 2 | 30% |
| 454 | Stuffing box pressure ring | 1 | 2 | 30% |
| 456 | Neck ring | 1 | 2 | 30% |
| 458 | Lantern ring | 1 | 2 | 30% |
| 461 | Stuffing box packing (4 rings) | 4 | 6 | 40% |
| 524 | Shaft protection sleeve | 2 | 3 | 50% |
| 321.1/.2 | Deep groove ball brg. 2P/U | 1 | 3 | 50% |
| 412.3 | O-rings | 4 | 8 | 150% |
| 421.1/2 | Oil seals (set) | 1 | 3 | 50% |
| - | Set of gaskets | 4 | 8 | 150% |

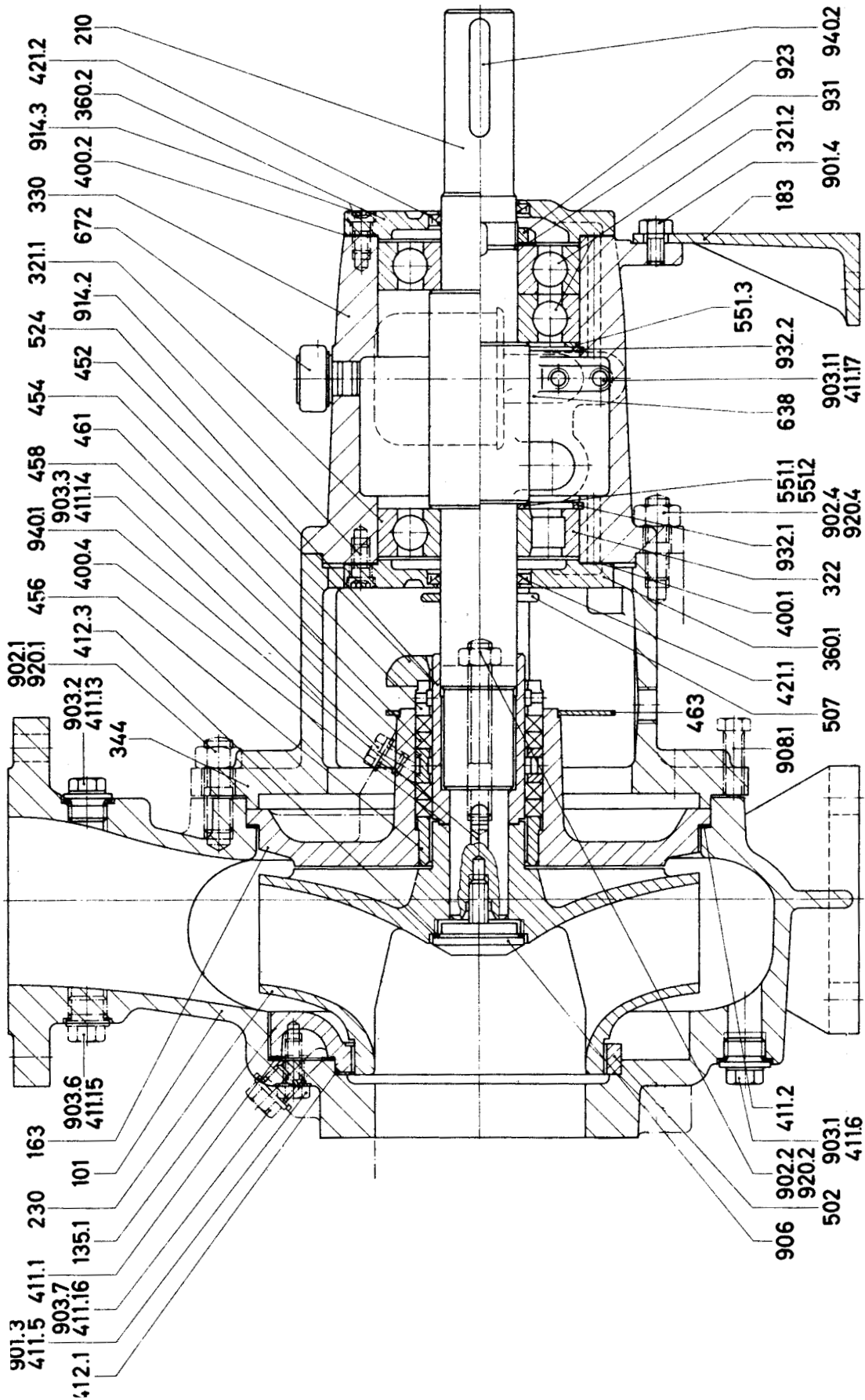
5.3.3 Interchangeability of Components.

Within each horizontal line, components with the same number are interchangeable.

| Part No. | Part Name | Bearing bracket | | | | | |
|----------|----------------------------|-----------------|--------|--------|---------|---------|---------|
| | | 35/80 | | 45/120 | 55/140 | | 65/160d |
| | | 65-200 | 80-250 | 65-315 | 100-400 | 150-315 | 125-500 |
| 101 | Volute casing | 3 | 4 | 5 | 9 | 10 | 12 |
| 135.1 | Wear plate | 3 | 4 | 5 | 9 | 10 | 12 |
| 163 | Pressure cover | 2 | 3 | 4 | 6 | 7 | 8 |
| 183 | Support foot | 3 | 4 | 5 | 7 | 8 | 9 |
| 210 | Shaft | 2 | 2 | 3 | 4 | 4 | 5 |
| 230 | Impeller | 3 | 4 | 5 | 9 | 10 | 12 |
| 321.1/.2 | Deep groove ball brg. 2P/U | 2 | 2 | 3 | 4 | 4 | 5 |
| 330 | Bearing bracket | 2 | 2 | 3 | 4 | 4 | 5 |
| 344 | Bearing bracket lantern | 2 | 3 | 4 | 5 | 6 | 7 |
| 452 | Stuffing box gland | 2 | 2 | 3 | 4 | 4 | 5 |
| 454 | Stuffing box pr.ring | 2 | 2 | 3 | 4 | 4 | 5 |
| 456 | Neck ring | 2 | 2 | 3 | 4 | 4 | 5 |
| 458 | Lantern ring | 2 | 2 | 3 | 4 | 4 | 5 |
| 461 | Stuffing box packing | 2 | 2 | 3 | 4 | 4 | 5 |
| 507 | Splash ring | 2 | 2 | 3 | 4 | 4 | 5 |
| 524 | Shaft prot.sleeve | 2 | 2 | 3 | 4 | 4 | 5 |
| 906 | Impeller cap | 2 | 2 | 3 | 4 | 4 | 5 |

5.4 Sectional drawings and list of components

5.4.1 Standard bearing assembly



List of components

| Part No. | Description | Part No. | Description |
|--------------|----------------------------|------------------|----------------------------|
| 102 | Casing | 456 | Neck ring |
| 135.1 | Wear Plate | 458 | Lantern ring |
| 163 | Pressure cover | 461 | Gland packing |
| 183 | Support feet | 507 | Splash ring |
| 210 | Shaft | 524 | Shaft protection sleeve |
| 230 | Impeller | 638 | Constant level oiler |
| 321.1 | Deep groove ball bearing | 672 | Vent plug |
| 322 | Cylindrical roller bearing | 906 | Impeller cap |
| 330 | Bearing bracket | 908.01 | Hex. bolt / dismantling |
| 344 | Bearing bracket lantern | 923 | Withdrawal nut |
| 360.01 | Bearing cover | 931 | Lock washer |
| 360.02 | Bearing end cover | 932.01 / .02 | Circlip |
| 400.01 - .05 | Flat gasket | 940.01 / .02 | Key |
| 411.01 - .17 | Flat gasket | 901.01 - .04 | Hex. head bolt |
| 412.01 | O - ring | 902.01 / .02 | Stud |
| 421.01 / .02 | Oil Seal | 903.01 - .11 | Plug |
| 452 | Stuffing box gland | 914.02 / .03 | Allen head screw |
| 454 | Stuffing box pressure ring | 920.01 - .02/.04 | Hex. nut - bearing bracket |

6 Faults

6.1 Faults, causes & remedies

| Trouble | Code number Cause-remedy |
|--|-----------------------------|
| Pump delivers insufficient liquid | 1,2,3,4,5,6,7,8,9,10,11,28 |
| Driver is overloaded | 12,13,14,15,23,27,28 |
| Excessively high pump discharge pressure | 15 |
| Excessively high bearing temperature | 22,23,25,26,31 |
| Leakage at the pump | 29 |
| Excessive leakage at shaft seal | 17,18,20,21,22,23 |
| The pump runs rough | 3,6,11,12,22,23,30,31,32 |
| Excessive temperature rise inside the pump | 3,6,32 |

6.2 Cause - Remedy ¹⁾

1. The pump delivers against an excessively high discharge pressure.
Open discharge valve further until the duty point conditions have been attained (adjusted)
2. Excessively high back pressure.
 - Fit an oversize impeller
 - Increase rotational speed (Applies to turbine or I.C. engine driven pumps)
3. The pump and / or piping are incompletely vented or primed.
 - Vent or prime the pump and system completely.
4. Suction line or impeller clogged
 - Remove deposits in the pump and / or piping.
5. Formation of air pockets in the piping.
 - After piping layout
 - If necessary, fit a vent valve
6. NPSH available is too low (on positive suction head installations)
 - Check liquid level in suction vessel
 - Open isolating valve in suction line fully.
 - Install different suction line if necessary, if the friction losses in the suction line are excessive.
 - Check suction line strainer
7. Excessively high suction lift.
 - Clean out suction strainer basket and suction piping.
 - Check liquid level in the pit
 - Alter the suction line
8. Entertainment of air through the stuffing box
 - Sealing liquid passages are clogged; clean them out.
 - If necessary, arrange a sealing liquid supply from an outside source, or increase sealing liquid pressure.
 - Fit a new shaft seal.
9. Reverse rotation
 - Change over two of the phase leads of the power supply cable.
10. Rotational speed is too low. ^{2) 3)}
 - Increase rotational speed
 - Increase voltage power supply
11. Excessive wear of the pump internal
 - Replace worn components by new ones.

12. Pump back pressure is lower than specified in the purchase order.
 - Adjust duty point accurately by means of the isolating valve in the discharge line.
 - In case of persistent over loading, trim the impeller if necessary.²⁾
 13. Specific gravity or viscosity of the fluid pumped is higher than that specified in the purchase order.²⁾
 14. Stuffing box gland tightened excessively or askew.
Adjust the gland as required.
 15. Excessive rotational speed
 - Reduce speed (applies to turbine or I.C. engine driven pump.) ^{2) 3)}
 17. Worn shaft seal
 - Check condition of shaft seal and renew it if necessary.
 - Check flushing liquid or sealing liquid pressure.
 18. Grooving, score marks or roughness on shaft protection sleeve surface.
 - Fit a new shaft protection sleeve
 20. Stuffing box gland or seal cover incorrectly tightened. Wrong type of packing material used.
 - Remedy the fault
 21. The pump runs rough
 - Correct the suction conditions
 - Check alignment of pumping set and realign if necessary.
 - Rebalance the pump rotor dynamically.
 - Increase the suction pressure at Pump suction nozzle.
 22. Pumping set misaligned
 - Check alignment at coupling and realign the set if necessary.
 23. The pump is warped
 - Check piping connections and pump fixing bolts.
 25. Too much or too little lubricant, or unsuitable lubricant quality.
 - Top up lubricant, reduce quantity of lubricant, or change lubricant quality
 26. The prescribed coupling gap has not been maintained.
 - Restore correct coupling gap in accordance with the data on the foundation drawing.
 27. Operating voltage is too low.
 28. The motor is running on two phases only
 - Replace the defective fuses
 - Check the cable connections
 29. The connecting bolts are slack
 - Tighten the bolts
 - Fit new gaskets
 30. The rotor is out of balance
 - Clean the rotor
 - Rebalance the rotor dynamically
 31. Defective bearings
 - Fit new bearings
 32. Insufficient rate of flow
 - Increase the min. rate of flow.
- ¹⁾ The pump should be made pressureless before attempting to remedy faults concerning parts exposed to pressure.
²⁾ Please refer to KSB
³⁾ This fault can also be remedied by altering the impeller diameter.

