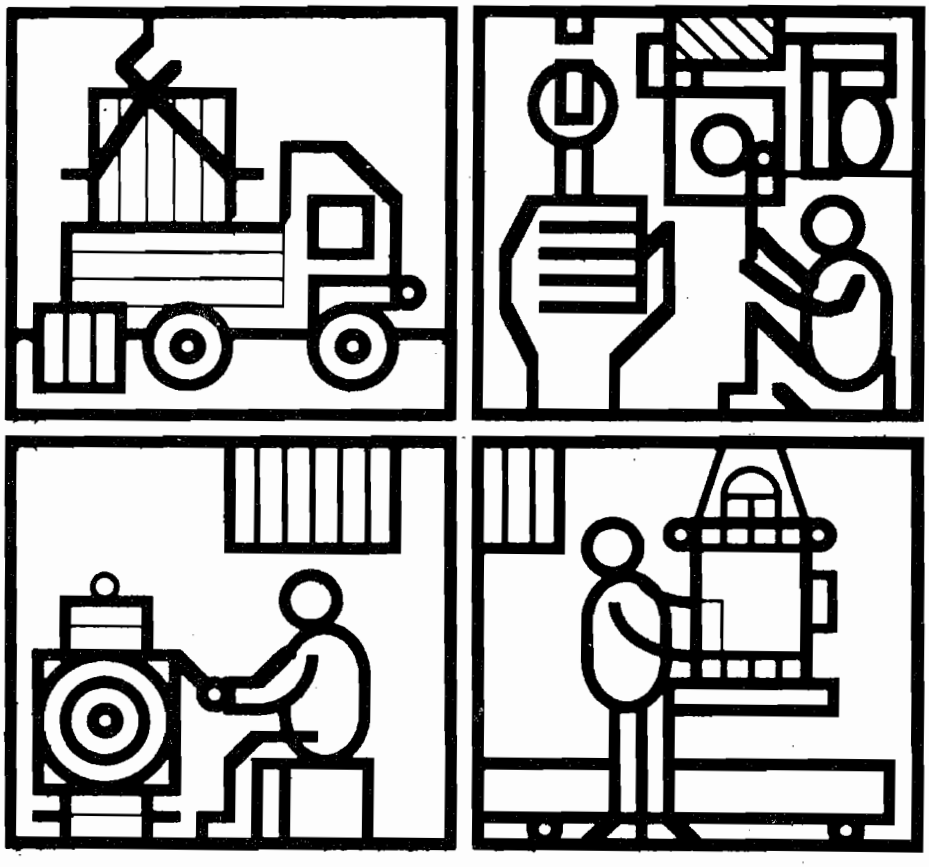
Jyoti Ltd.

'JYOTI'
HORIZONTAL SPLIT CASING PUMP

INSTALLATION,COMMISSIONING,
OPERATION AND MAINTENANCE
MANUAL



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1. GENERAL

As soon as the materials are received at site it should be inspected and checked as per the packing list.The shortages/ damages should be reported immediately.

If the equipments are received at the site well before they can be installed and commissioned, they should be immediatelystored in a dry sheltered location with protective coverings.The bearings must be carefully protected against sand, grit and other foreign matter and the pump impeller should be turned over by hand at frequent intervals to prevent binding or rusting so that the impeller does not get jammed at the wearing rings, if found, the remedy is to dismantle the pump, clean it and reassemble it. Change the grease of the bearings, if it has caked and become stiff.

2. INSTALLATION

2.1 LOCATION OF PUMP

The performance of the pump greatly depends on its location over the sump. The pump should be located in such a way that :

(a) The total suction lift is within the limits specified for the pump. The total suction lift is the sum total of static vertical distance between the centre line of the pump shaft and free level of the water surface in the driest season, depression in water level when the pump is in operation, and friction losses in the foot valve and suction pipe line.

(b) The required submergence at the suction side is maintained and the suction/ delivery pipe line is routed to have shortest length, minimum number of bends and fittings to minimise friction losses.

(c) Ample space is available on all sides of the pump in order that it can be inspected while in operation and conveniently serviced when required.

2.2 FOUNDATION

The pump should be installed on a foundation rigid enough to absorb vibrations and to form a rigid support for the base plate. This is essential for maintaining correct alignment of direct coupled pump sets. The foundation could be of concrete or steel girders.
The recommended method of anchoring foundation bolts is to place them in pipe sleeves with inside diameter approximately two and half times the diameter of the bolt.
After the concrete foundation is constructed, the pipe sleeve is held in place while the foundation bolt may be moved to match with the corresponding hole in the base plate. While building the foundation, allowance should always be provided between the flat surface of the concrete slab and underside of the base plate for the purpose of grouting. A combination of one part pure portland cement, two parts building sand and four parts of grit with sufficient quantity of water forms a grouting mixture. This mixture should form the top layer of the foundation which facilitates proper sitting of the base plate.

While grouting the base plate, check the level with the help of straight edge and master level. Level should be within 0.05 mm/ meter.

2.3 LEVELLING OF BASE PLATE

The pump, motor and base plate are supplied separately at site. The erection is to be carried out in the following manner :

(a) Clean the machined face of the pump base plate and keep it on the foundation. Match the base plate holes with the foundation bolts already in the pockets.

(b) Bring the top surface of the base plate to the desired level with the help of spyirit level bottle.

(c) Insert the packer plates under the base plate, and levelling plates under the jacking bolts. Check the level on the machined surface with the help of straight edge and master level and level the pump base accurately with the help of shims.

(d) Loosen the jacking bolts so that the base plate rests on packer plates and shims only. Tighten the foundation bolts slightly so that any movement is arrested while making the grout and erecting the base plate. Care should be taken so that no undue strain comes on pump base or pump casing either due to tightening of bolts or due to misaligned pipes. The discharge and suction pipes should be properly supported to avoid undue strain on pump casing.

(e) Make the grout and saturate the foundation with water. Grout the base plate/ foundation plate and allow the grout to cure. Repeat the same procedure for levelling the motor base plate. During levelling of motor base plate the motor height should be adjusted and proper alignment of pump and motor coupling should be carried out as per point no. 2.4 .Grouting of motor base plate should done only after ensuring proper alignment of pump and motor half coupling.

2.4 COUPLING ALIGNMENT

(a) Preliminary alignment by filler gauge

When the pump and motor unit is properly aligned on the foundation along with base plate, the couplings of the unit must be checked for any misalignment. It must be remembered that the flexible couplings are not used to compensate for misalignment of the driver and driven machine. Hence the coupling faces must be checked for both angular and parallel alignment. The check for angular alignment is made by inserting the filler gauge at four diametrically opposite points between the coupling faces and comparing the distance between the faces at these points spaced at 90' intervals around the coupling. The unit will be in angular alignment when the measurements show that the coupling faces are at same distance apart at all points.

The 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 the shafts.

(b) Final alignment by dial gauges

While rotating the couplings halves, at least one pin should be fitted so that coupling halves can rotate together.To check angular alignment, two gauges are clamped in diametrically opposite coupling pin holes of the driving or driven half coupling, the plunger ends of the dial indicator resting on the back of thedriven or driving half coupling respectively. With one gauge at the top and the other at the bottom of the coupling, set both gauges to read zero. Turn the coupling through halfrevolution. If the alignment of the driving and driven units is correct, the readings of both gauges should be same, though not necessarily zero. Either positive or negative readings are acceptable so long as they are equally positive or negative. If the variations of the gauge readings are not alike, the out board end of the driven machine base plate must be raised or lowered until the readings on the gauges show that the an ågular alignment is correct.

To complete the check, advance the position of the couplings by 90 i.e. with the gauges at either side. Set the gauge readings at zero and rotate the coupling through 180í. The variations in readings should again be the same, and any discrepancy shows that the lateral position of the unit needs adjustment.

To check the parallel alignment the dial gauge is clamped on one of the coupling pin holes in the driving or driven half coupling, the plunger end of the dial indicator resting on the rim of the other coupling half. Note the readings on the gauges.Rotate the coupling halves together and note the gauge readings at each quarter revolution. Any variation in the readings shows a deviation of the shaft from centre and until a uniform dial reading is obtained in any position of rotation, adjustments must be made to the position and height of the units.

(c) Tolerances

The amount of misalignment varies with the type of the driven and driving machines. However, the following recommendations are given for achieving proper alignment :

*** For angular alignment**

Coupling up to 300 mm diameter ... ... 0.050 mm (Total dial reading)
Coupling over 300 mm diameter ... ... 0.075 mm (Total dial reading)

*** For parallel alignment**

... ... 0.100 mm (Total dial reading)

After the alignment of the unit , the final readings should be recorded.

2.5 DIRECTION OF ROTATION

The standard pump is assembled for clockwise rotation, when viewed from the driving end. The same pump, however, can be easily reassembled for reverse rotation, if so desired. For this, refer ANNEXURE- III. This feature renders the pump suitable for direct coupling with the primemover revolving in either direction.

2.6 SUCTION PIPE LINE, FOOT VALVE AND STRAINER

Satisfactory working of the pump has much to do with proper laying of pipe line on the suction side. As stated earlier, the total dynamic suction lift should be regulated within the limits as specified by the manufacturer.It is always necessary to make sure that air leaks or air pocket do not develop on the suction side. For this, the following points should be taken care off while planning the system layout and during operation of the pump sets.

(a) Select diameter of the pipe line so that the velocity of water on the suction side is not excessive, the safe limits being 2 to 3 meter/sec., or else, trouble due to cavitation, separation, vibration etc., will follow.

(b) Keep suction pipe line as short as possible but it should be sufficiently long to keep the foot valve (if provided) always submerged in water, or else the recommended submergence value is to be maintained.

(c) Lay suction pipe line such that it rises towards the pump.

(d) Employ eccentric reducers to connect pipes and branches of varying sizes, in order to have smooth flow entry at inlet.

(e) Avoid as far as possible all sudden enlargement or reduction of pipe sections. Use standard connections only.

(f) The pipe line should be connected using gaskets in between them and bolting them through holes provided in the flanges so that they are perfectly air tight.

NOTE :

Whatever type of suction arrangement is chosen, the pipes sould be so installed that it is completely full of liquid at all times. High points where air can collect and act as a cushion, thus stopping or reducing flow , must be avoided at all cost. If suction lift prevails, priming facilities for the pump must be provided.For Ror the foot valve and strainer (if provided), care should be taken for the following points :

* Provide ample opening for the suction strainer so that the combined area of the strainer opening is about 3 to 4 times the pipe suction area.
* Check the quality of the foot valve and make sure that the foot valve flap opens wide enough to permit easy entry of water at the stipulated rate of discharge.
* Check that the foot valve is not in the vicinity of incoming streams, so that no vortices are formed by its side and air does not churn into the pump liquid due to the agitated state of water around the foot valve.
* Make sure that the strainer is not quite closed to the bottom of the sump. This is essential to prevent the strainer holes from choking up by mud and other material accumulated at the bottom of the sump.

2.7 DELIVERY PIPELINE

For laying the delivery pipeline, following care should be taken:

(a) The velocity of the flow in the delivery line should not be excessive, the safe limit being 3 Mts/second.

(b) Use of bends, elbows, Tees, fittings etc. should be avoided as far as possible.

(c) Long radius bends are preferable for all turns.

2.8 PIPE JOINTS

Pipe joints, especially those on the suction side should be absolutely air-tight. Any air leakage on the suction side will impair the vacuum and vitiate the pump performance. When threaded pipes are used, white lead and hemp string should be employed for making the joints leak-proof. For flanged pipes, it should be ensured that the flanges are not bent and suitable rubber gaskets are inserted between the mating flanges.

It is necessary to support at intervals, the suction and delivery pipelines by suitable clamps. Overhanging pipes will tend to strain the pump and cause vibrations.

Leverage of the misaligned pipeline can lead to more serious damages than the more weight of the pipeline. It can lead to vibration, higher power consumption and break-down.

In case of rigid connection of the suction pipe, e.g. with the flanges of a bore pipe, the recommended practice is to interpose flexible armoured hose pipe between the tube well casing flange and the pump suction. This relieves the pump casing from undue strain.

2.9 USE OF VALVES

Foot Valve (if provided)

This valve, introduced at the bottom of the suction pipeline, is meant for priming the pump. Other aspects of this valve have been dealt earlier under the title Suction Pipeline, Section 2.6.

Suction Sluice valve

This valve is used for isolating the pump under flooded suction conditions thus enabling inspection and repair without disturbing the suction pipeline.

Non-return valve

Unless the pump is to deal with a small quantity of water at low head, it is advisable to have a non-return valve fitted before the delivery sluice valve. In absence of the non-return valve, it has been observed sometimes that pump casing are getting racked because of pressure and surge. It is often an advantage to provide these valves with by-pass connection.

This valve should be fitted preferably in the beginning of the delivery line or as near the pump casing as is practicable.

Delivery Sluice valve

This valve usually follows the non-return valve on the delivery side. It is used for regulating the discharge rate i.e. to create controlled working conditions. It is also used for isolating the pump from the supply water tank, thus helping inspection and repairs without causing any disturbance to the delivery pipeline

3. COMMISSIONING

3.1 Commissioning checks

(a) Take no load trial of motor after necessary commissioning checks as per motor manufacturer's recommendation and check the direction of rotation.

(b) Examine how freely the pump rotates by manually rotating the coupling. If the pump is felt heavy on rotation, check :

* Whether the pump is tight in gland packing, if so, remove the packing rings and reset them keeping in mind the instruction (a) under 'Maintenance'.

* Whether the impeller ring / outside diameter of impeller at eye has seized in the casing ring due to the accumulation of foreign particles in the clearance between them. If so, open the top half of the casing and clean the wearing ring, the impeller ring with a fine emery paper.

* Whether grease in the wearing house has caked and become stiff. If so, flush out the existing grease and replenish it with recommended grease.

(c) The gland adjusting nut shouldnot be more than finger tight.

(d) Check the tightness of foundation and pedestal bolts of pump and motor. They should be tightened if found loose. Check for soft feet of the pump casing i.e. tightening of pump casing on unlevelled pads of pump base.

(e) Prime the pump and check up the system for leakage.

(f) When operating on suction head check and record the pressure in the suction line.

(g) If external cooling water is provided, open the valve & ensure flow of water.

3.2 Pump commissioning

(a) Start the pump -motor coupled unit.

(b) Check the delivery pressure to make sure that the pump is properly primed.

(c) Check all piping joints, if found leaking, tighten the bolts, nuts etc.

(d) Adjust gland sealing water supply valve, to maintain a slight drip of water from each of the glands.

(e) After the operating speed has been attained, open the delivery sluice valve slowly and let the pump come gradually to the desired operating point.

(f) The discharge valve (sluice valve) should never be left completely closed for any period of time when the pump starts running at rated speed, as the temperature the water in the pump casing will rise.

(g) The suction valve (if provided) should never be left in an intermediate position. It must always be fully opened when the pump is running. Throttling the suction will not only increase the head against which the pump has to operate but may also lead to destruction of impeller by cavitation, erosion and impair the performance.

(h) Attention should be paid to the current taken by the motor and any unusual rise should be investigated on the spot.

(i) Slight leakage from the stuffing box is normal and essential for satisfactory working of the gland packing. No attempt should therefore be made to eliminate this leakage by undue tightening of the gland.

(j) Check whether the auxiliariesf such as cooling water supply to stuffing box, grease lubrication etc., are operating properly.

4. OPERATION

During operation the following checks are to be made :

a) The pump set must run smoothly and without vibration.

b) The temperature of the bearings must remain constant and if it rises suddenly, the bearings must be inspected.

c) Verify that the water from the stuffing box is dripping properly.

d) Record current, voltage, delivery pressure and suction pressure.

e) When operating with suction lift, any increase in the specified lift and intake of air must be obviated by regulating the level of supply water.

f) If stand-by sets are installed, it is advisable to bring them into service regularly so that all pumps have a turn of normal duty and thus ensure that every set is ready at all times.

g) While stopping the pump, close sluice valve on delivery side and stop the prime "mover. Record the starting and stopping time of the pump.

NOTE : All observations should be recorded and maintained in a Log Book.

5. MAINTENANCE

The pumps are relatively simple in construction and almost all maintenance duties can be carried out without removing the pump from its existing location. The inlet and outlet branches are integral with the larger portion of the casing which also carries the supporting feet.

Replacement/maintenance of pump can be done simply by removing the top casing and taking out the rotating element. Routine maintenance has to be carried out for the following

(a) Stuffing box and Gland Packings

(b) Bearings

(c) Alignment of the pump set

(d) Replacement of worn out components

(e) Noise/vibration

(a) Stuffing box and Gland packing:

For efficient maintenance of the plant, it is imperative to know the function of the gland packing, causes of gland packing failure and remedial measures, correct method of cutting, inserting, replacing and tightening of gland packing rings. Position of the lantern ring should be carefully maintained with respect to the position of the water connection of the stuffing box.

The main job of gland packing is to provide an efficient seal around the shaft and ensure that no air is drawn into the pump. It will reduce leakage but will not stop it altogether. Some drops of water should leak through the packing in order to have proper lubrication for packings. Without lubrication, packing will run dry , become hot and consequently will become harder and score the shaft.

Normally, lubrication becomes available to the packings from the liquid inside the pump casing. The gland should be so tightened that the leakage of the water through it is minimum. If the gland is excessively tightened , it will altogether prevent the liquid leakage and there will be inadequate lubrication to the gland packing. There is also a possibility of atmospheric air entering the casing through the gland creating air pockets and jeopardising the pump performance.

- **Causes of packing failure**

Besides friction and liquid pressure which are always pres••ent, the following

factors also reduce the packing life:

--- Whip or eccentricity of the pump shaft:

--- Abrasives, sand, sludge or other foreign particles entrained in the pump liquid.

--- Chemicals dissolved in the liquid.

--- High temperature of the liquid, which hardens the packings resulting in scoring of shaft.

--- Never replace just one or two packings, they will not seal effectively. Replace all of them together.

- **How to install the packings correctly**

At the time of replacing old packings the stuffing box should be thoroughly cleaned so that the new packings are placed evenly. The shaft/shaft sleeve should be checked carefully for trueness preferably by dial indicators.

The correct size of packing should be selected for the job.

Packing size =1/2 x (Stuffing box bore diameter - Shaft sleeve diameter)

For cutting a proper packing ring, wind the packing a few turns snugly around the shaft sleeve and while it is coiled, cut across each turn at 45Non-return valve.
After installing the packing correctly, tighten the nut progressively on the gland one after the other so that no uneven pressure is imposed on the packings.

Packing rings should be staggered so that their joints do not register with one another in the assembled condition. This can be easily achieved by staggering adjacent packings by 180°.

Note The shaft sleeve must be replaced immediately, if worn out. The replacement of packings alone may not serve any purpose.

(b) Bearings :

The most important single factor in procuring good service from bearings is cleanliness. Nearly 90% of the bearing troubles can be averted if this single fact is kept in mind.

- **Cleanliness consists in :**

--- Utilising only pure lubricants i.e. grease free from dust, dirt, foreign particles etc.

--- Protecting the bearing, the bearing house and the cover from exposure to dusty atmosphere

- **Adhere strictly to the following points :**

--- Never open the bearing house in a dusty atmosphere.

--- Do not open the bearing without cleaning the adjacent surface.

--- Always protect an exposed bearing by protective cover (clean paper or lint free cloth).

--- Use kerosene (preferably carbon tetrachloride or gasoline) for cleaning the bearings. Use a light grade of lubricating oil to wash out carbon tetrachloride or gasoline to prevent corrosion. Lubricate the bearing with fresh grease. * Other points to be taken care of:

--- At an interval of every 1200 running hours, remove old grease and fill in fresh grease

--- The recommended grease is lithium - base grease with good lubrication properties and capable of withstanding high temperature e.g. Veedol Allitho-30 (Tide water) or its equivalent.

Though grease is essential for lubrication, excessive greasing is harmful as it gives rise to friction and overheating. The level of grease is to be maintained at 1/3 or 1/2 of the volume of bearing housing space.

Bearings are protected against the ingress of the gland leakage, dust, sand etc., by means of deflectors. Make sure that the deflectors are intact.

Depending upon the type of bearings used in the pump, the mounting procedure is to be adopted:

A. MOUNTING PROCEDURE FOR SPHERICAL ROLLER BEARING/SELF ALIGNING BALL BEARING

In order to obtain satisfactory bearing performance, it is imperative that strict cleanliness be observed during mounting.

Before spherical roller bearing/self aligning ball bearings are mounted on adaptor sleeve, the internal radial clearance should be measured by using a filler gauge and it should be as per bearing manufacturers catalogue.

Ensure that the internal clearance will be equal in both rows of rollers and the face of both the races are in one plane. While measuring the internal clearances, care must be taken to see that the rollers should not be allowed to roll over the filler gauge blade.

Before mounting the bearing, measure the shaft and housing tolerances, size, ovality etc. Apply the light coat of thin oil on the shaft, slide adaptor sleeve on the shaft and slide the bearing on the adaptor sleeve. Check the axial drive up by measuring the reduction in internal radial clearance of the bearing. The reduction in internal radial clearance and minimum permissible residual internal radial clearance after mounting the bearing should/ be as per the catalogue.

Place the locking washer in position, screw up the lock nut and tighten it. Bend down a suitable tab of locking washer so that it engages in one of the slots in the lock nut. Measure the residual clearance again and see that it is unchanged.

Put adequate quantity of shell alvenia grease- 3 (lithium-base) in the bearing house. Adequate quantity of grease is 1/3 to 1/2 of the capacity of the bearing house. Put the bearing cover and bolt it up.

- **Dismounting of bearings:**

Remove the bearing cover, straighten the tab of locking washer and unscrew the locking nut. Remove the locking washer.

Push back the adaptor sleeve with the help of tubing. Spherical roller bearing will become loose, remove it and then take out the adaptor sleeve.

B. MOUNTING PROCEDURE FOR ANGULAR CONTACT BAL BEAING & DEEP GROOVE BALL BEARING (ALTERNATIVE ARRANGEMENT)

If new bearing is to be mounted, do not take out the bearing from its packing until just before it is to be mounted. Leave the rust inhibiting compound on the bearings except on the outside diameter and bore surfaces, wipe these surfaces with white spirit and dry it with a clean lint free cloth.

Fit the water deflectors over the shaft on driving and non-driving end. Insert felt packing rings in the groove of bearing inner covers, after soaking it in oil. Slide the inner covers over the shaft on either ends, keeping cover facing outward. Fit deep groove ball bearings on shaft from driving end. Insert bearing distance piece on non driving end of shaft and butt it with the shaft. Never apply direct blows to the roller and ball bearings. Always use a length of tubing or dollies, otherwise the ring may crack, the edge may damage or metal fragments may break off, when the bearing is put in operation. The tube should be clean and have flat and parallel ends which are free from burrs. In both the cases, the bearings have light interference fit between the inner ring and the shaft. Place the machined end of the tube against the inner ring and apply blows evenly distributed around its end face, till it butts with the shaft or the bearing distance piece, with an ordinary hammer. Ensure that the bearing does not skew on the shaft. Mounting force should be applied centrally in case of mounting dollies are used. Never apply force to the outer ring while mounting a bearing with interference fit on a shaft. Insert bearing distance piece and lock washer on non-driving end .

Tighten bearing lock-nut and lock the nut by lock-washer. Then fit the bearing house over the bearing by two thread pins. Screw up the threaded pin in the tapped hole provided in the bearing house at diametrically opposite location. Pass these pins through the holes on bearing inner cover. Hold the bearing house centrally over the bearing and tighten nuts over the bearing cover evenly till the bearing house fully slides over the bearing. While fitting' bearing house of the driving end, ensure that 3 mm axial clearance is available on either side of the bearing. Place the rotating assembly with the bearings and bearing houses mounted in the lower half casing. Adjust the axial location in casing and bolt up the bearing houses with the casing and fit the bearing caps.

Use Lithium-base grease (having drop point above 160° C) for bearings. Grease should be filled up to 1/3 to 1/2 Volume of bearing housing. Re-greasing interval should be 6 months.

- **Dismounting Procedure :**

Remove the bearing caps. Remove bearing with rotating assembly from lower half casing. Disassemble bearing house inner cover. Unscrew the bearing locknuts. Now with the help of puller remove both bearing house from the rotating assembly. Remove the distance piece (if provided). Now with the help of puller remove both bearings from respective bearing houses. Puller should be applied on the back side of the inner ring.

(c) Alignment of the pump set

The alignment may get disturbed on account of :

--- The settling of foundation.

--- Difference between the temperature of the pump and that of the prime mover i.e. motor or engine.

--- Leverage of the pipe line acting on the pump.

(d) Replacement of components

(i) Impeller and casing ring :

The impeller hub and the wearing ring wears out simultaneously. The impeller hub wears out and becomes smaller and the casing ring holes get enlarged.
In order that the user does not have to replace the impeller on account of slight wear on the hub, special under size casing rings are supplied (in spares) whose inside diameter is slightly smaller than that of the standard casing ring. The repair will consist in machining of the impeller hub so that it is concentric with the axis of the shaft and its diameter corresponds to the inside diameter of the new undersize (spare) casing ring.

The casing ring is always required to be replaced when the internal clearance between the impeller hub and casing ring become twice the specified radial clearance.

(ii) Sleeve

Two shaft sleeves are mounted on both sides of the impeller and fitted with the key and locked in position by means of the sleeve nut on both the sides.

The sealing contact is between the impeller hub surface and the mating surface of the shaft sleeve. Care should be taken to see that this contact is maintained, otherwise air will leak into the pump and deteriorate the pump performance.

NOTE :

For smooth running of the pump, the pump assembly should be checked and overhauled once in a year. It is also advisable to keep a logbook for the pump set. This must be kept upto date, and in addition a record of details concerning the prime mover, the performance of the pump such as rate of flow, pressure on the suction and delivery sides, temperature of the water, speed, and temperature of the bearings must be entered regularly. Furthermore, the times of starting and stopping the set should be noted to provide a record of the time the pump has run.

6. TROUBLE-SHOOTING INSTRUCTION

(i) Pump does not start.

(a) If trouble is with the electrical mot••or, refer motor instruction manual.

(b) If the trouble is with the pump, i.e. in case the pump is jammed, disassemble the pump and locate seizing components such as casing rings, gland packings, bearings etc.

(ii) Pump starts in reverse direction.

In case of an electric motor, interchange any two leads of the motor.

(iii) Pump stops suddenly.

The starter might have tripped. Reset the overload disc for the rated motor current as star ,ped on the motor name plate.

(iv) Pump does not deliver water or delivers less quantity.

(a) The pump may have been started without being properly primed.

(b) Pump speed may be quite low. In case of motor driven sets, this may be due to lower voltage and/or frequency at the motor terminals.

(c) Total head acting on the pump (total static lift + friction losses on the suction and delivery sides) may be more than the specified head.

(d) Valve on the suction as well as the delivery sides may be partly, or fully clogged or closed.

(e) The foot valve as well as suction, delivery pipes and fittings might have clogged up, chocking the whole system.

(f) The foot valve may not be fully submerged or the foot valve flap may be leaky. Check whether the strainer holes have a total opening area at least three times that of the pump suction pipe and whether the flap opens fully.

(g) Impeller vane passages might have clogged up due to some foreign materials.

(h) Total dynamic suction lift may be more than what is specified for the pump. In this case, the solution is to lower the pump or change over to higher size of suction pipes and fittings thus minimising the suction losses.

(i) Pump parts might have worn out resulting in hydraulic losses. Check the wearable components such as impeller, casing rings, shaft sleeves, gland packings etc.

(j) Air may be leaking into the pump casing from the suction side. Check whether the threaded or flanged pipe joints on suction side are leakproof, if not, open and refix the joints by applying white lead in case of threaded pipes. In case of flanged pipes, the joint should be brought in

flush position by changing the inclination of the connecting pipe lines or by replacing flanges, if they are bent.When the suction pipes are to be directly connected to a bore pipe of a well, the use of armoured flexible rubber hose pipe becomes essential in order to ensure proper butting of the flanges.Under no circumsta•nces, should the flanges at the bore end or pump end be flushed by force by unduly straining them.

(k) Air may be leaking into the pump casing through the gland.

--- The cooling water connect on/lantern ring groove in the stuffing box may have clogged up. Clean the passage by means of wire.

--- Packings might have worn out, unsuitable or not properly inserted. Repack the stuffing box

--- Shaft sleeve might have scored due to over tightening of the gland. The sleeve must be repolished or renewed and the stuffing box should be repacked. The gland should be tightened evenly.

--- Rough running of pump or shaft whipping.

--- Bearing clearance must be checked and new bearings fitted , if necessary. If this does not help open the pump, check the shaft for concentricity, verify balancing of the whole rotor assembly and check all running clearances.

--- The cock in the sealing water connection tube may be closed.

(v) Pump delivers water when started but stops delivering after some time, i.e. the discharge is intermittent.

a) This may be due to the foot valve being exposed when the pump set is working and getting fully submerged and the pump stops working. Lower the pump set.

b) There may be air leakage either through the suction side or through thegland. Refer to (iv-j) and (iv-k).

(vi) Pump consumes more power.

a) The pump may be running at higher speed.

b) Gland packing may be very tight. Release gland pressure by loosening the nut and tighten the gland progressively so that water is allowed to tickle in drops. If this does not lead to cure, the packing may be twisted or oversize or irregular. Replace the packings.

c) Pump components such as bearings might have given way, increasing friction resistance

d) It may be due to misalignment between the pump and the prime mover.Realign the pump set so that the pump and motor shaft centre lines perfectly coincides with each other.

e) Impeller hub might have seized in the casing ring.

f) The actual total head acting on the pump may be different from that specified for the pump.

(vii) Pump makes noise or shows excessive vibration while running

a) Check the foundation. See whether the base plate is properly aligned. Check whether the pump and prime mover bolts are tightened sufficiently.

b) Check whether the suction and delivery pipe are supported by clamps at proper intervals so that on the suction side the overhanging pipeline weight does not have a tendency to strain the pump casing bolts, shafts, bearings etc. and on the delivery side the vibration due to running water may not be transferred to the foundation.

c) Bearings and other components of the pump may have worn out.

d) The noise or vibration may be due to misalignment of the set (Refer alignment procedure).

e) Some components of pump and motor may be rubbing against other components.For checking, dismantle the set and locate the fouling components. Check specifically the impeller and the motor fan.

f) The impeller may have got unbalanced due to the entry of some foreign material. Clean the impeller, and if necessary, have it rebalanced.

g) Foot valve of poor quality might have been used.

h) The pump might be operating against very high suction lift and this may be causing cavitation.

(viii) Pump bearing gets heated.

a) There may be excessive or insufficient amount of grease in the bearings. Both these results in rendering the bearing hot. Maintain grease 1/3 to 1/2 the volume of bearing house.

b) Bearings might have worn out.

c) Grease may be poor quality or there may be dust particles in the bearings. In the latter case, wash the bearing carefully with kerosene and re-grease them. Lithium base grease is recommended.

d) There may be misalignment between the pump and the prime mover. Realign the set carefully.

(ix) Gland gets hot.

a) The stuffing box water passage for cooling the gland might have chocked up. Clean the passage by means of a wire.

b) The shaft might have got bent and eccentric with respect to the stuffing box hole. Stra ghten it.

c) The gland might not have been progressively tightened in a proper manner resulting in excessive pressure on one side. Loosen the nut, take out the gland packing, reinsert it and then progressively tighten the gland just as required. Never tighten the gland excessively as it causes severe wear on shaft rendering the later useless.

d) Gland packing may be twisted, longer, oversize or irregular. Check and reinsert packing of proper size and length with staggered ends.

e) The cock in the sealing water connection tube is kept closed.

(x) Gland packing is getting worn out soon.

a) It may be due to the presence of sand in the pumped liquid.

b) Shaft sleeve might have been scored. Replace the sleeve.

c) Quality of gland packing might be poor. Use packing of good quality.

(xi) Pump does not develop enough pressure.

a) Speed may be quite low.

b) Air may be leaking in to the Pump casing through the suction side or the gland side. Refer (iv-J and iv-K).

c) Pump may be operating against high suction lift.

d) Casing rings may have worn out.

7. RECOMMENED SPARES

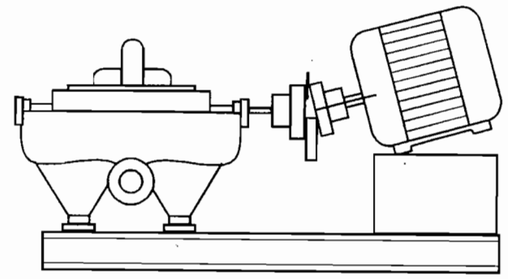
SR. NO.	PART NAME	QTY. PER NO. OF PUMPS 1	2	3	4
1.	Set of Impeller	1	1	1	1
2.	Set of Impeller wearing ring	1	2	3	4
3.	Set of casing ring	1	2	3	4
4.	Pump shaft with key	1	1	1	1
5.	Set of shaft sleeve	1	2	3	4
6.	Set of distance piece	1	2	3	4
7.	Ste of bearing	1	1	2	2
8.	Set of gland packings	2	4	6	8
9.	Ste of coupling (Bushes, pins etc.)	1	2	3	4

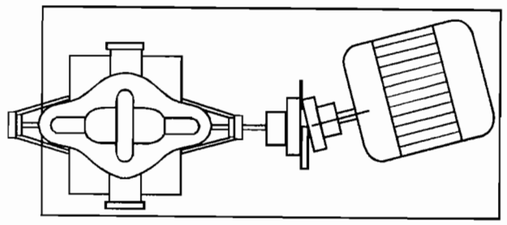
Note:

1. Unless otherwise ordered, pumps are generally provided with casing rings. (Impeller wearing ring is an optional item.)
2. Pumps upto 150 H.S. do not have distance pieces.
3. While ordering spares, the full name plate details have to be furnished.

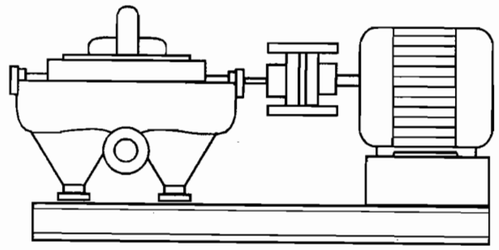
ANNEXURE - I

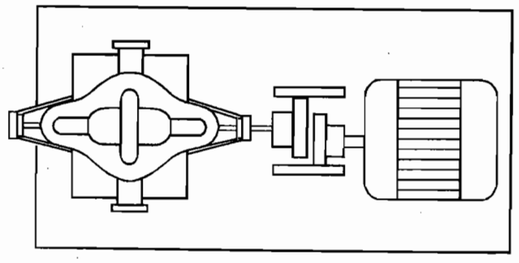
PRELIMINARY ALIGNMENT OF THE COUPLING





CHECKING ANGULAR ALIGNMENT WITH THE HELP OF FILLER GAUGE

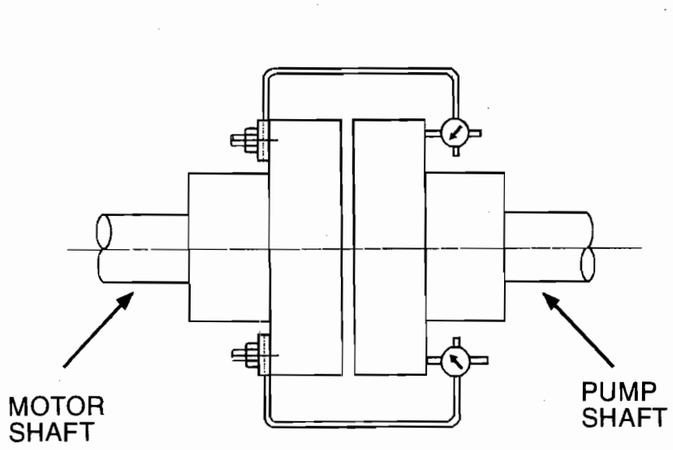


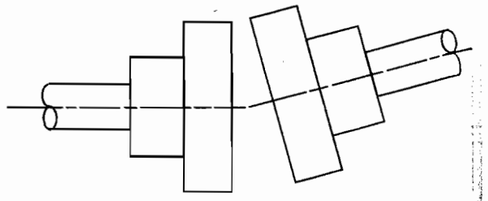


CHECKING PARALLEL ALIGNMENT WITH THE HELP OF STRAIGHT EDGE

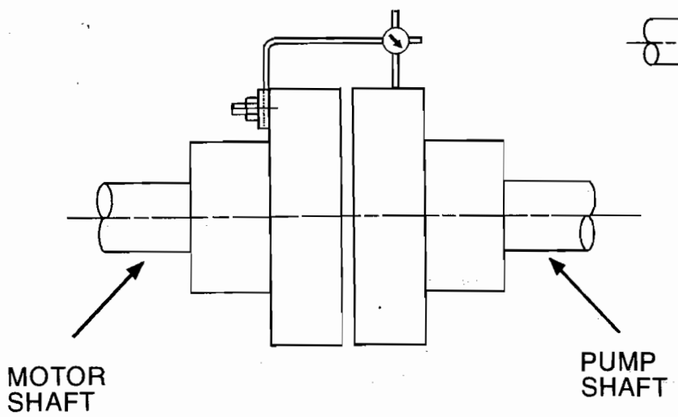
ANNEXURE - II

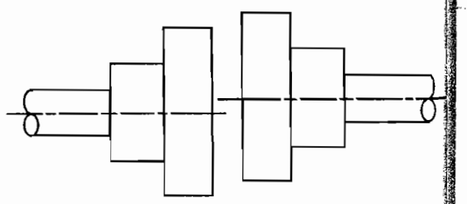
FINAL ALIGMENT OF THE COUPLING WITH THE HELP OF DIAL GAUGES





CHECKING ANGULAR ALIGNMENT

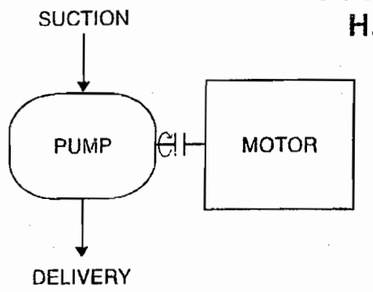




CHECKING PARALLEL ALIGNMENT

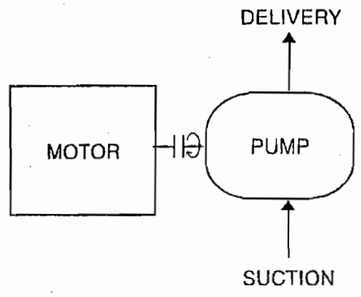
ANNEXURE - III

VARIOUS POSSIBLE ORIENTATIONS FOR H. S. PUMP INSTALLATION



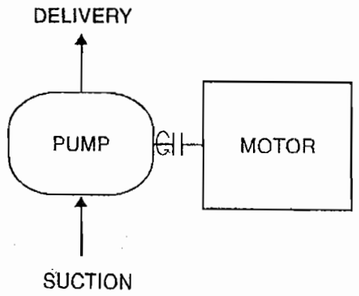
1. STANDARD ASSEMBLY

- With suction & delivery as shown in the sketch.
- With pump direction of rotation " CLOCKWISE" as viewed from the Driving End.



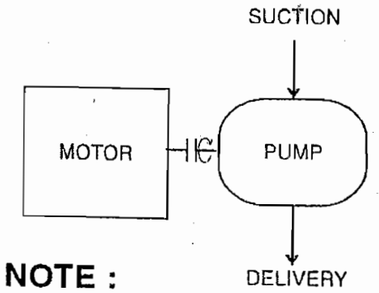
2. STANDARD ASSEMBLY

- With changed position of suction & delivery with respect to 1.
- With pump direction of rotation' CLOCKWISE' as viewed from the Driving End.
- With reorientation of pump/motor location with respect to 1.



3. ALTERNATIVE ASSEMBLY

- With changed position of suction & delivery with respect to 1.
- With pump direction of rotation "ANTICLOCKWISE" as viewed from the Driving End.
- Reassemble the pump as per the "NOTE" below.



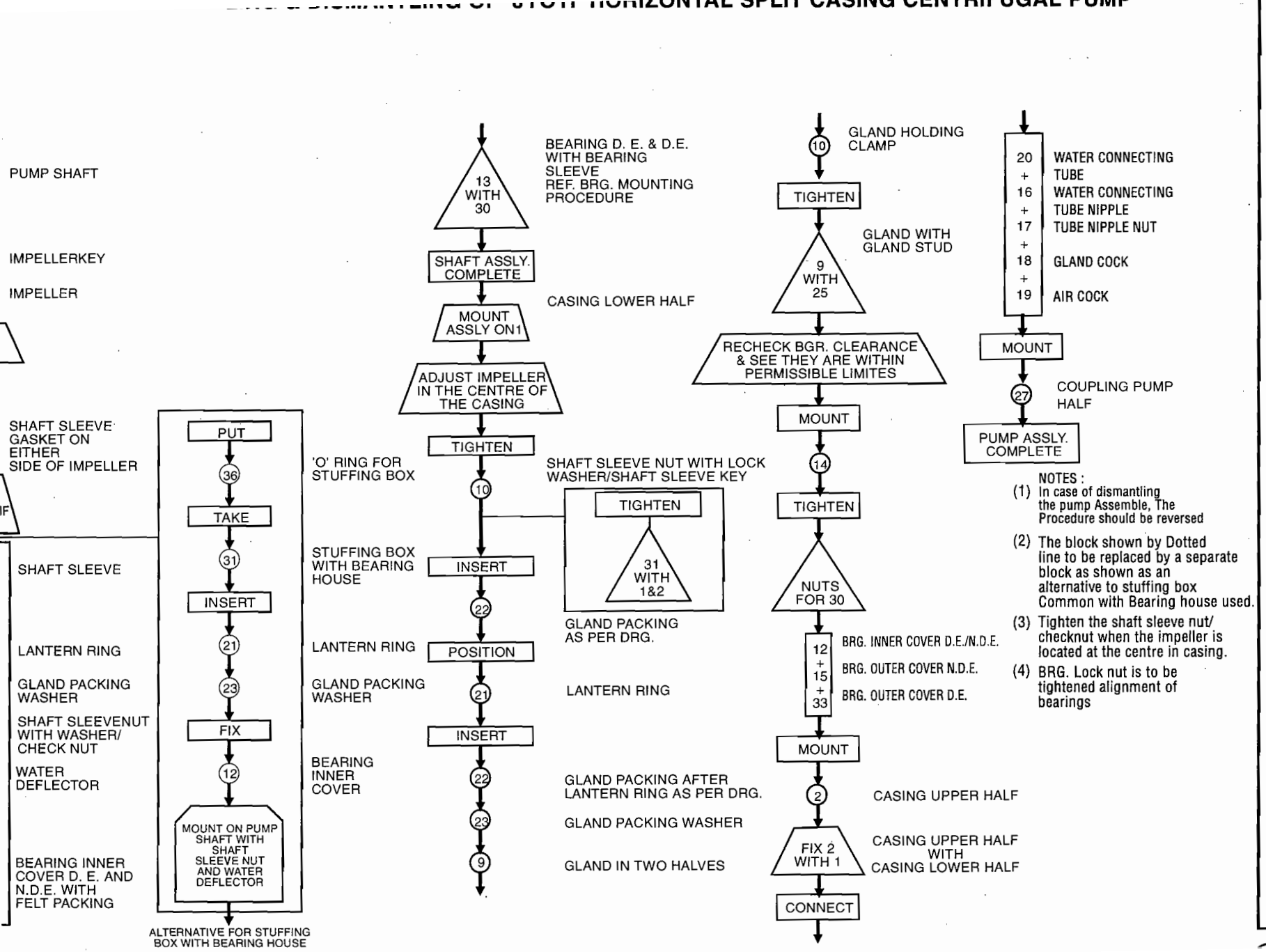
4. ALTERNATIVE ASSEMBLY

- With changed position of suction & delivery with respect to 3.
- With pump direction of rotation " ANTICLOCKWISE" as viewed from the Driving End.
- With reorientation of pump/motor location with respect to 3.

NOTE :

As per the site requirement, If the pump assembly needs to be changed from 'STANDARD ASSEMBLY' "ALTERNATIVE ASSEMBLY" or viceversa, following changes are to be done while reassembling the pump :

1. Reverse facewise impeller position on shaft.
2. Interchange position of DE & NDE bearing housings on the casing.
3. Refer the FLOW CHART and BEARING MOUNTING PROCEDURE.


PUMP SHAFT
IMPELLERKEY
IMPELLER
SHAFT SLEEVE GASKET ON EITHER SIDE OF IMPELLER
SHAFT SLEEVE
LANTERN RING
GLAND PACKING WASHER
SHAFT SLEEVENUT WITH WASHER/ CHECK NUT
WATER DEFLECTOR
BEARING INNER COVER D. E. AND N.D.E. WITH FELT PACKING
PUT
36
TAKE
31
INSERT
21
23
FIX
12
MOUNT ON PUMP SHAFT WITH SHAFT SLEEVE NUT AND WATER DEFLECTOR
ALTERNATIVE FOR STUFFING BOX WITH BEARING HOUSE
'O' RING FOR STUFFING BOX
STUFFING BOX WITH BEARING HOUSE
LANTERN RING
GLAND PACKING WASHER
BEARING INNER COVER
13 WITH 30
BEARING D. E. & D.E. WITH BEARING SLEEVE REF. BRG. MOUNTING PROCEDURE
SHAFT ASSLY. COMPLETE
MOUNT ASSLY ON1
CASING LOWER HALF
ADJUST IMPELLER IN THE CENTRE OF THE CASING
TIGHTEN
10
INSERT
22
POSITION
21
INSERT
22
23
9
SHAFT SLEEVE NUT WITH LOCK WASHER/SHAFT SLEEVE KEY
TIGHTEN
31 WITH 1&2
GLAND PACKING AS PER DRG.
LANTERN RING
GLAND PACKING AFTER LANTERN RING AS PER DRG.
GLAND PACKING WASHER
GLAND IN TWO HALVES
10
GLAND HOLDING CLAMP
TIGHTEN
GLAND WITH GLAND STUD
9 WITH 25
RECHECK BGR. CLEARANCE & SEE THEY ARE WITHIN PERMISSIBLE LIMITES
MOUNT
14
TIGHTEN
NUTS FOR 30
12 + 15 + 33
BRG. INNER COVER D.E./N.D.E.
BRG. OUTER COVER N.D.E.
BRG. OUTER COVER D.E.
MOUNT
2
CASING UPPER HALF
FIX 2 WITH 1
CASING UPPER HALF WITH CASING LOWER HALF
CONNECT
20 + 16 + 17 + 18 + 19
WATER CONNECTING TUBE
WATER CONNECTING TUBE NIPPLE
TUBE NIPPLE NUT
GLAND COCK
AIR COCK
MOUNT
27
COUPLING PUMP HALF
PUMP ASSLY. COMPLETE
NOTES :
(1) In case of dismantling the pump Assemble, The Procedure should be reversed
(2) The block shown by Dotted line to be replaced by a separate block as shown as an alternative to stuffing box Common with Bearing house used.
(3) Tighten the shaft sleeve nut/ checknut when the impeller is located at the centre in casing.
(4) BRG. Lock nut is to be tightened alignment of bearings