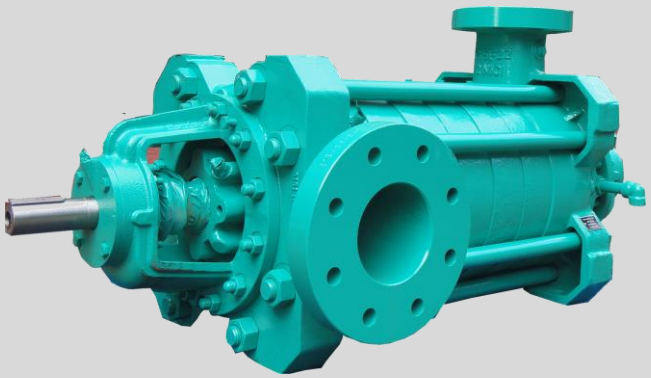

# WILO Mather and Platt – Ring Section Pumps

**en** Installation and Operating Manual

WMPPPL_IOM_RS_RV-003_20201227

## Disclaimer

WILO Mather and Platt is very grateful for your interest in its products. The basic objective of this document is to provide instructions for maintaining and operating WILO Mather and Platt Ring Section pumps. Instructions are compiled for the person having a working knowledge of Ring section pumps and the pumps shall be installed under expert supervision and guidance.

With this document WILO Mather and Platt does not accept any liability for inaccurate installation, operation or maintenance of the product at site. The authorities that install and maintain the pump shall be responsible for hassle free installation operation or maintenance of the product.

This document is prepared with at most care to ensure correct and accurate information, enabling the user to have trouble free installation and operational support. However, there can be few areas for improvement to make this document error free.

We welcome your valuable suggestions to make this document complete in all respects.

| |
|---|
| Pump Type – |
| So. No. – |
| Q (m3/hr.) – |
| H (m) – |
| N (rpm) – |
| P kW – |
| Imp. Dia. – |
| Note: To be filled by the Customer |

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**Fig.1: Pump Handling [Page No. 9, Point No. 3.1]**

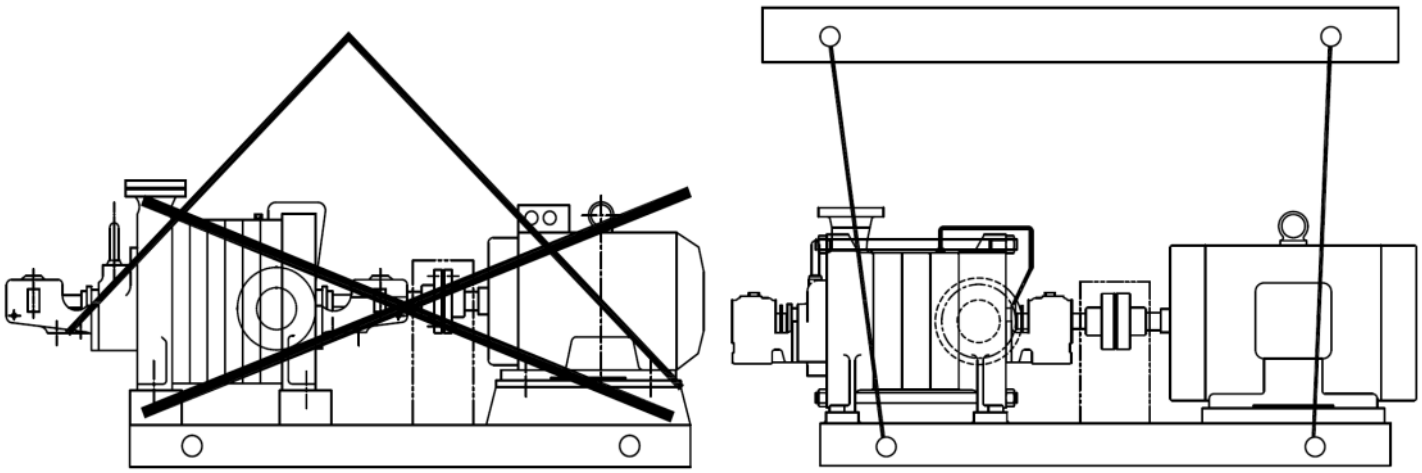


**Fig.2: Pump Foundation [Page No. 15, Point No. 7.2.1]**

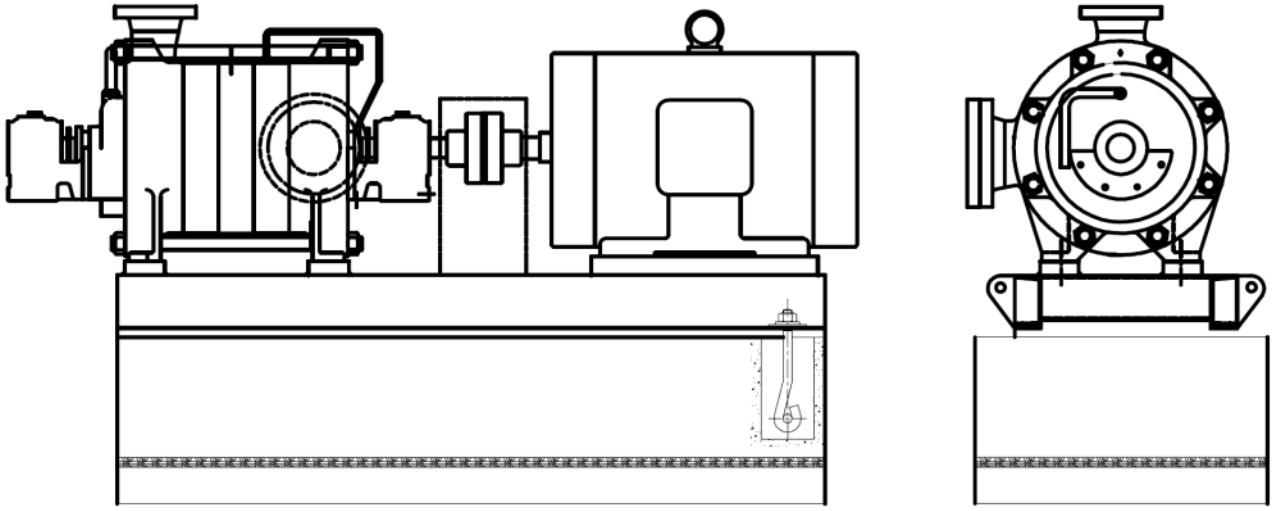


**Fig.3: Leveling of Baseplate [Page No. 15, Point No. 7.2.2]**

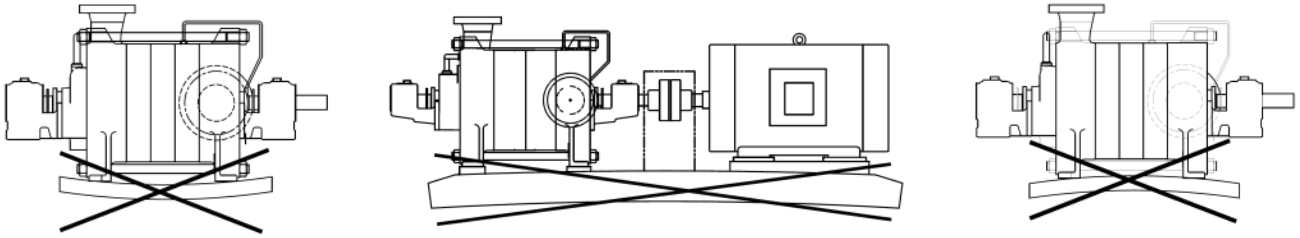


**Fig.4: Coupling assembly [Page No. 16, Point No. 7.2.3]**

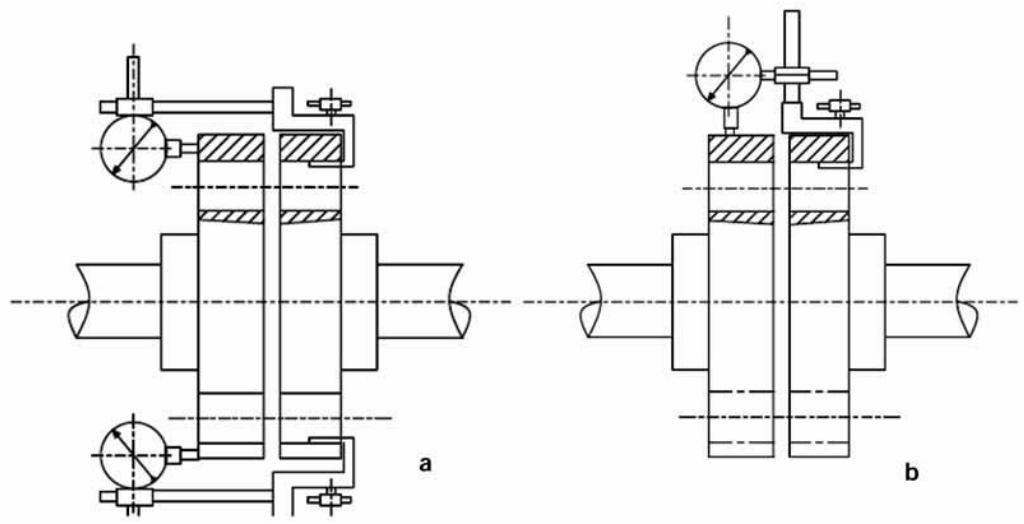



**Fig.5: Suction line [Page No. 18, Point No. 7.2.5]**

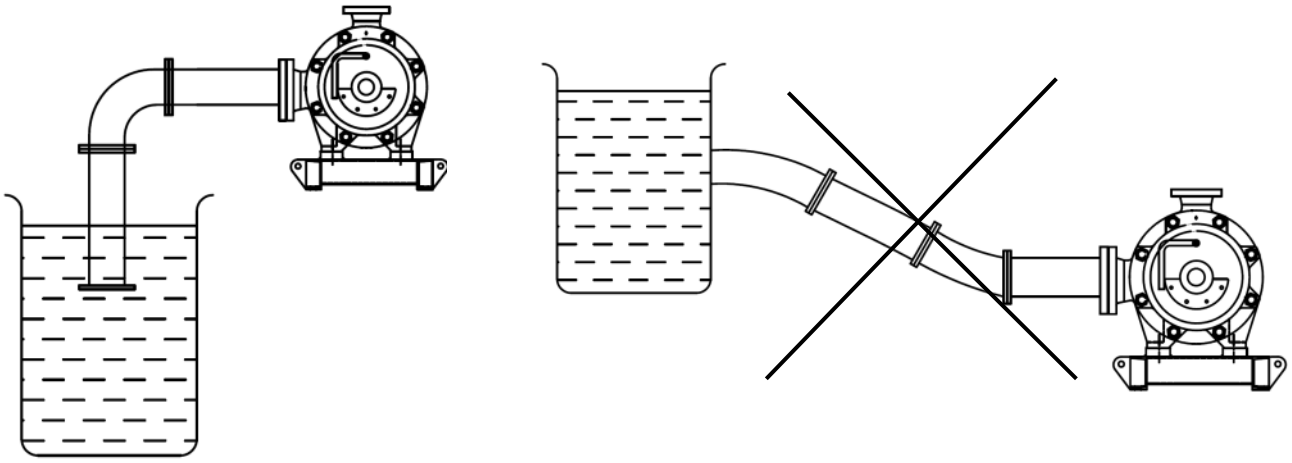


**Fig.6: Suction line [Page No. 18, Point No. 7.2.5]**

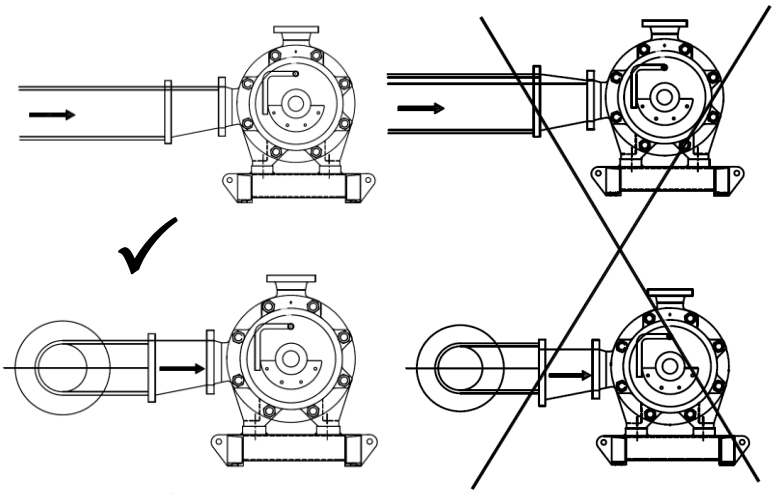


**Fig.7: Suction line** [Page No. 18, Point No. 7.2.5]

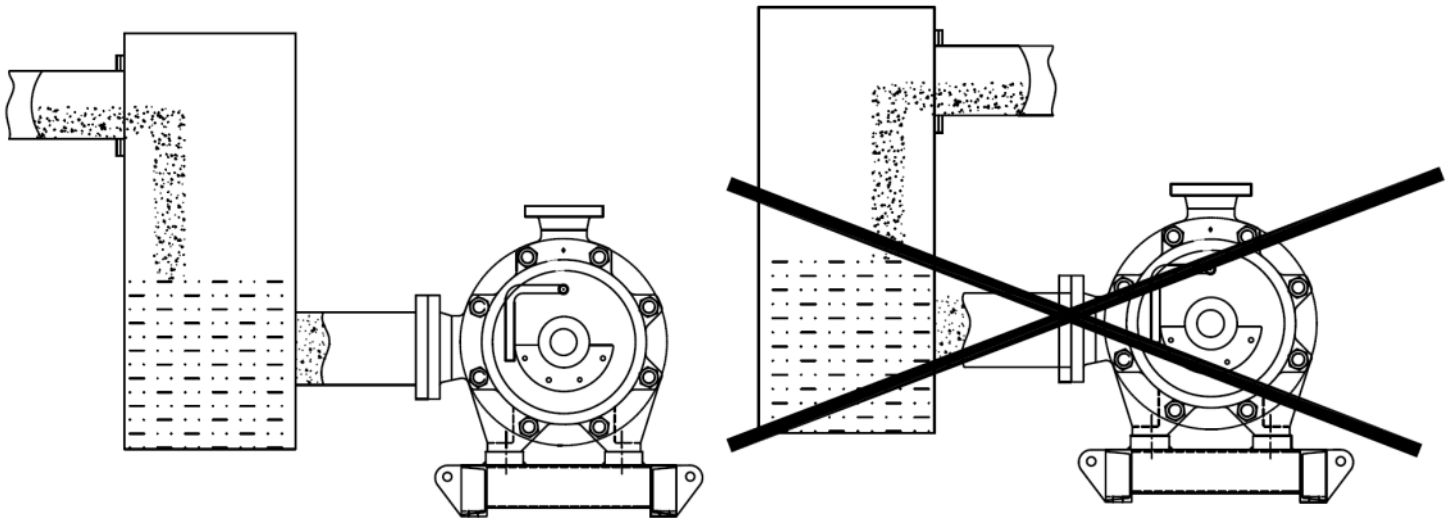


**Fig.8: Suction line** [Page No. 18, Point No. 7.2.5]

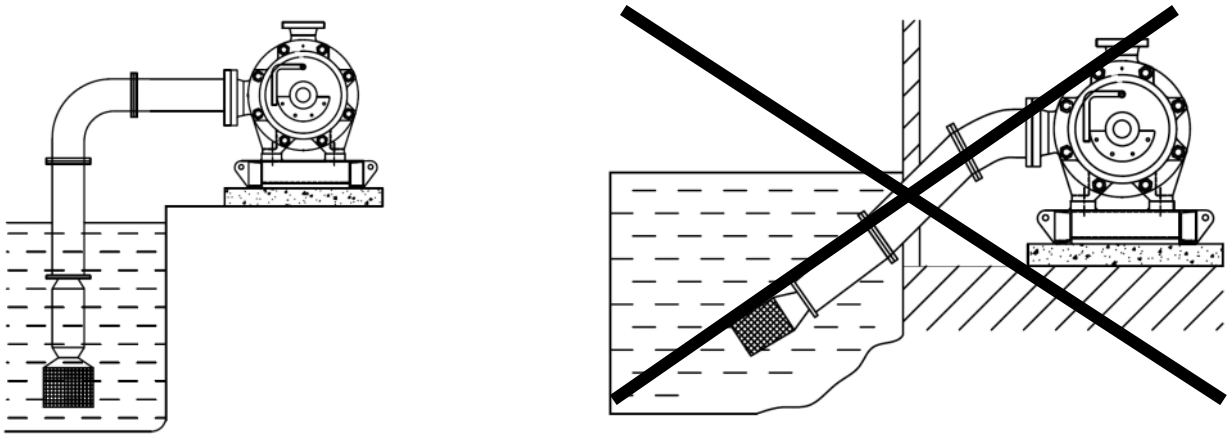
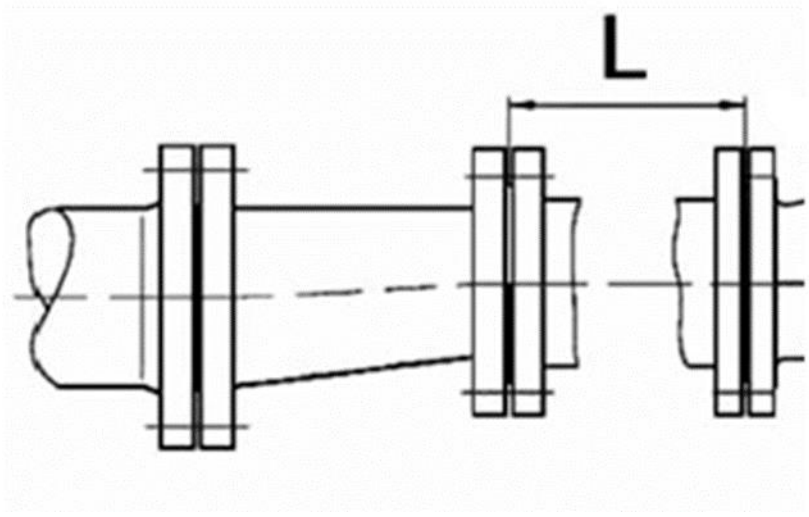
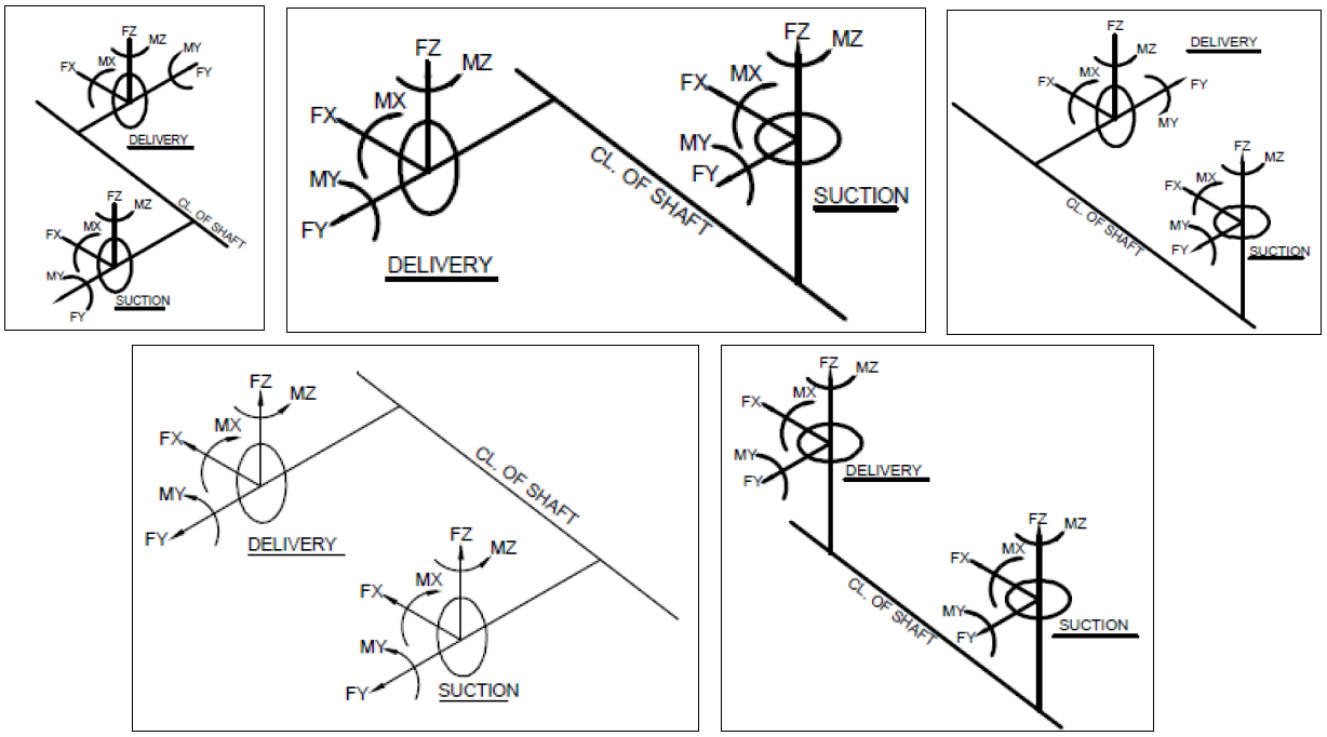


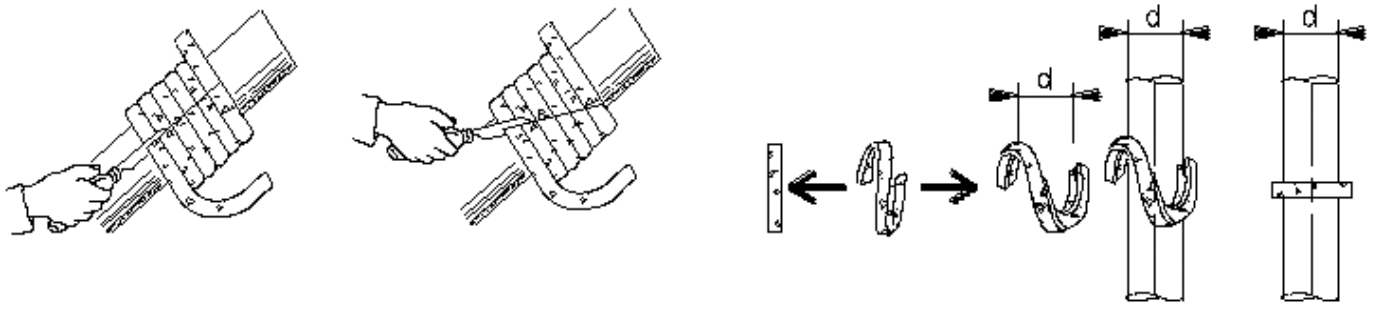
**Fig.9: Suction line** [Page No. 18, Point No. 7.2.5]



## Fig.10: Forces and Moments [Page No. 17, Point No. 7.2.4]




## 10: Suction line [Page No. 9, Point No. 7.2.5



## 1 General information

**About this document**

The language of the original operating instructions is English. All other languages of these instructions are translations of the original operating instructions.

These installation and operating instructions are an integral part of the product. They must be kept readily available at the place where the product is installed. Strict adherence to these instructions is a precondition for the proper use and correct operation of the product.

These installation and operating instructions correspond to the relevant version of the product and the underlying safety standards valid at the time of going to print. Supplied pump will operate trouble free and satisfactorily on the condition that, it is installed with due care and maintained properly.

For hassle free operating life, it is recommended that the pump should operate under specified "Operating conditions". Pump operating conditions are mentioned on the "Nameplate" affixed to the pump.

If operating parameters deviate from the specified parameters as on the "Nameplate", please contact manufacturer."

## 2 Safety

These operating instructions contain basic information which must be adhered to during installation and operation. For this reason, these operating instructions must, without fail, be read by the service technician and the responsible operator before installation and commissioning. The machine operator list must be filled out completely. By signing this list, all persons working on or with the product confirms that they have received, read and understood this operating & maintenance manual.

It is not only the general safety instructions listed under the main point "safety" that must be adhered to but also the special safety instructions with danger symbols included under the following main points.

### 2.1 Designation of information in the operating instructions

**Symbols:**
**General danger symbol**

**Danger due to electrical voltage**

**NOTE:** ...
**Signal words: DANGER!**
**Acutely dangerous situation.**
**Non-observance results in death or the most serious of injuries.**

**WARNING!**
**The user can suffer (serious) injuries. "Warning" implies that (serious) injury to persons is probable if this information is disregarded.**

**CAUTION!**
**There is a risk of damaging the pump/installation. "Caution" implies that damage to the product is likely if the information is disregarded.**

**NOTE:**
Useful information on using the product. It also draws attention to possible problems.

### 2.2 Personnel qualifications

The installation personnel must have the appropriate qualification for this work.

### 2.3 Danger in event of non-observance of the safety instructions

Non-observance of the safety instructions can result in risk of injury to persons and damage to product/installation. Non-observance of the safety instructions can result in the loss of any claims to damages.
In detail, non-observance can, for example, result in the following risks:

- Failure of important product/installation functions
- Failure of required maintenance and repair procedures
- Danger to persons from electrical, mechanical and bacteriological influences
- Property damage
- WILO Mather and Platt does not accept any liability for damage, failures or losses arising due to improper installations, maintenance, repair works, modifications without our consultation and non-observance of safety instructions mentioned in this IOM.

### 2.4 Safety consciousness on the job

The safety instructions included in these installation and operating instructions, the existing national regulations for accident prevention together with any internal working, operating and safety regulations of the operator are to be complied with.

### 2.5 Safety instructions for the operator

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

- If hot or cold components on the product/the unit lead to hazards, local measures must be taken to guard them against touching.
- Guards protecting against touching moving components (such as the coupling) must not be removed whilst the product is in operation.
- Leakages (e.g. from the shaft seals) of hazardous fluids (which are explosive, toxic or hot) must be led away so that no danger to persons or to the environment arises. National statutory provisions are to be complied with.

- Highly flammable materials are always to be kept at a safe distance from the product.
- Danger from electrical current must be eliminated. Local directives or general directives [e.g. IEC, VDE etc.] and local power supply companies must be adhered to.
- Depending on the type, size and capacity (kW), the products produce a sound pressure up to 75 dB (A) to 110 dB (A).
- The actual sound pressure, however, depends on several factors. These include, for example, type of prime mover, installation type; fastening of accessories and pipeline, operating site condition, background noise, etc.
- Once the product has been installed, we recommend that the operator makes additional measurements under all operating conditions.

**⚠ CAUTION!**

**In accordance with the laws in effect, guidelines, standards and regulations, ear protection must be worn if the sound pressure is greater than 110dB (A). The operator is responsible for ensuring that this is observed!**

### 2.6 Safety instructions for installation and maintenance work

The operator must ensure that all installation and maintenance work is carried out by authorized and qualified personnel, who are sufficiently informed from their own detailed study of the operating instructions. Work on the product/unit must only be carried out when at a standstill. It is mandatory that the procedure described in the installation and operating instructions for shutting down the product/unit be complied with. Immediately on conclusion of the work, all safety and protective devices must be put back in position and/or re-commissioned.

### 2.7 Unauthorized modification and manufacture of spare parts

Unauthorized modification and manufacture of spare parts will impair the safety of the product/ personnel and will make void the manufacturer's declarations regarding safety.

Modifications to the product are only permissible after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts will absolve us of liability for consequential events.

### 2.8 Improper use

The operating safety of the supplied product only guaranteed for conventional use in accordance with Section 4 of the operating instructions. The limits values must on no account fall under or exceed those specified in the catalogue/data sheet.

### 2.9 Safety & control devices

Direct controls are applicable when the pump is supplied along with motor/panels. When motor/ panel is in end user's scope of supply, it is advised to go for CE approved motors /panels. Environmental safety

Disposal of any unwanted/scrap material should be disposed in appropriate way so as not to cause any harm to the environment. No hazardous material is used in WILO Mather and Platt Ring section pumps.

ⓘ NOTE

To avoid ambiguity in the use of the word „replace" the words „replace" and „renew" are used in this manual in the following context: Replace – To put back, in its existing state, a part or component that has previously been removed. Renew – To substitute a new part of component for a worn or damaged one.

## 3 Transport and interim storage

Immediately check the pump and transport packaging for damage in transit upon receipt. Take the necessary steps within the periods defined by the transport company in the event of damage in transit.

**⚠ DANGER! Risk of getting crushed!**

**The installation or removal of the product must not be performed by one person alone. Measures should be taken to bar persons from standing beneath a suspended load. Furthermore, it is also prohibited to move suspended loads over exposed workplaces where people are present. The fastening devices should be adapted to the conditions at hand (weather, hooking system, load, etc.) Use suitable fastening devices to handle the weight of the product.**

**⚠ CAUTION! Risk of damage to the pump!**

**Risk of damage due to improper handling during transport and storage.**

**The pump should be protected against humidity, frost and mechanical damage during transport and interim storage.**

### 3.1 Handling (Refer figure 1, Pg. No.3)

**⚠ CAUTION! Risk of damage to the pump!**

**Risk of falling!**

**Pumps should never be lifted with slings engaged below the bearing housing. Eyebolts on pump top casing are only for lifting top casing during maintenance. Do not lift complete pump with the eyebolts. Safe working load of wire ropes reduces with increase in included angle. Never put down or pick up the product when it is not secured. Tilting of the product should be avoided at all costs.**

Only suitable lifting gear and load carrying equipment with valid test certificates and adequate lifting capacity for the loads involved (such as belts/ wire ropes/slings) should be used for lifting & transporting the product. If chains are used, they should be secured against slipping along with protective cover to prevent damage to the product, paint and/or injury to personnel.

When lifting the pump in combination with the bedplate, the lifting tackle should be attached to the lifting lugs provided on the base plate side member. To lift the pump the lifting slings should pass beneath the pump body at suction and delivery flanges (see lifting diagrams – see also general safety Information, chapter 2). These must have sufficient load bearing capacity to ensure that the product can be transported safely.

## 3.2 Delivery

On arrival, the delivered items must be inspected for damage and a check made that all parts are present. If any parts are damaged or missing, the transport company or the manufacturer must be informed on the day of delivery. Any claim made at a later date will be deemed invalid. Damage to parts must be noted on the delivery or freight documentation.

## 3.3 Storage

### 3.3.1 Short-term storage (less than 3 month)

The equipments as shipped have adequate protection for short-term storage in a covered, dry and ventilated location at the job site prior to installation.
If the pump is not installed immediately after delivery, it must be stored in a dry and clean place with sufficient ventilation, no vibration, no freezing and the temperature variations must be smooth. Bearings and couplings must be protected against sand, dust and foreign bodies. To avoid corrosion and jamming, please lubricate the pump and make turn the rotating elements for several turns at least once a week. Pre-packed desiccants may be used to absorb moisture & keep the pump dry. It must be removed before putting the pump on operation.

### 3.3.2 Long-term storage (more than 3 month)

If the equipment will be subject to extended storage condition prior to installation, then the manufacturer must be informed about storage duration, so that special protection can be recommended.

- Place the Ring section pumps horizontally on firm foundation and secure it against falling.
- The machine must be protected from direct sunlight, heat, dust, and frost.
- The rotors or propellers must be turned at regular intervals. This prevents the bearing from locking and the film of lubricant on the mechanical shaft seal is renewed.
- For mechanical seal, we recommend: relative air humidity below 65%, temperature between 15°C and 25°C. Direct exposure of the mechanical seal to heat (sun, heating) as well as to ozone, present or produced by ultraviolet light (halogen or fluorescent lamps), must be avoided because of the risk of embrittlement of elastomeric materials.

## 3.4 Pump returning back to the supplier

Products, which are delivered back to the plant, must be clean and correctly packaged. In this context, clean means that impurities have been removed and decontaminated if it has been used with materials, which are hazardous to health.
The packaging must protect the product against damage.

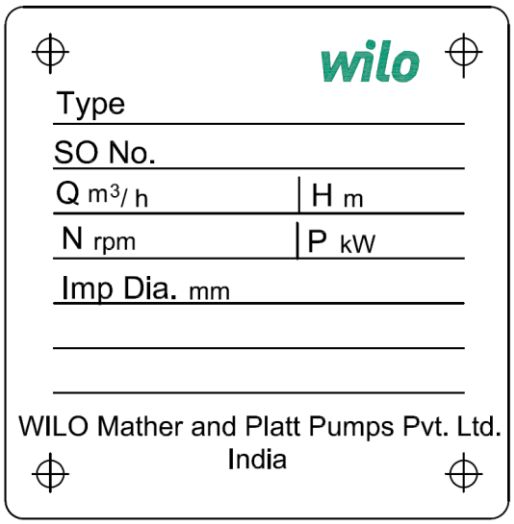
**⚠ CAUTION! Guarantee not applicable!**
**Products, which are not suitably packaged for delivery back, are no longer covered by guarantee!**

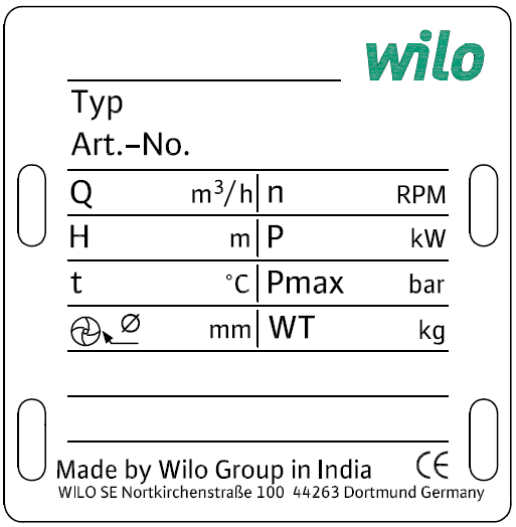
## 4 Intended uses

The pump supplied is intended for specific fluid. Refer pump data sheet and order confirmation. For any change in pumped fluid refer WILO Mather and Platt beforehand. Ring section pumps are used in water supply, water-circulating systems and process, injection water, mine dewatering, water treatment, firefighting, etc. If the operating conditions are different of the specifications given in the order, (i.e. type of liquid, temperature or duty point), the end user must ask a written agreement to WILO Mather and Platt on the new operating conditions before starting the pump.

## 5 Product information

### 5.1 Data plate




### 5.2 Type key

| Pump | Description |
|---|---|
| RN-50A | 50- Discharge Nominal Dia. |
| | A- Type A Hydraulic |
| 3/4 HS PLURO MK-1 | 3- 3" Discharge Nominal Dia. |
| | 4- 4" Suction Nominal Dia. |
| | MK-1- Hydraulic |
| 100/150 IPB T-80 | 100- Discharge Nominal Dia. |
| | 150- Suction Nominal Dia. |
| | T-80- Hydraulic |
| 00/ No. I/No. IA/No. II/No. IIA/No. III/No. IIIA PLURO | Standard PLURO Pump |
| 10/12 PLURO | 10- Discharge Nominal Dia. |
| | 12- Suction Nominal Dia. |
| 6/6 PJ PLURO | 6- 6" Discharge Nominal Dia. |
| | 6- 6" Suction Nominal Dia. |
| 250 PJ PLURO AS/AN | 250- Discharge Nominal Dia. |
| | AS/AN- Hydraulic |
| 4/6 FG | 4- 4" Discharge Nominal Dia. |
| | 6- 6" Suction Nominal Dia. |
| 150 MT | 150- Discharge Nominal Dia. |

### 5.3 General description

**Limits of usage of the standard range**

The technical features of the product have been described in the offer made for this product, especially the fluid compatibility. Please refer to this:

| Property | Value | Remarks |
|---|---|---|
| Speed | 2900, 1450 1/min | model dependent |
| Discharge nominal diameters DN | 32 up to 250 | |
| Limit of fluid temperature (min. /max.)<br><br>– Mechanical seal version [°C]<br>– Gland packing version [°C] | <br><br>-20° up to +120°<br>-20° up to +80° | other on request |
| Limits of ambient temperature (min. /max.) [°C] | -16 up to +40 | other on request |
| Ambient humidity | < 90 % | other on request |
| Max. operating pressure | – | model dependent |
| Motor insulation class | F | other on request |
| Motor protection level | IP 55 | |
| Electrical protection for motor | – | required in place (in accordance with local regulation) |
| Acoustic pressure level, (In accordance with motor performances) | – | refer to the data plate on the motor on in technical leaflets |
| Electrical connections | 3~230V, 50Hz (≤4kW)<br>3~415V, 50Hz (≥5,5kW) | other frequency, voltages, please contact manufacturer |

### 5.4 Scope of delivery

Pump can be delivered

- As a complete pump set including electrical motor, base plate, coupling and coupling guard;
- Either without motor or
- As bare shaft pump without base plate.

### 5.5 Accessories (Optional)

- Companion Flange
- Foundation bolts
- Shims

## 6 Description and function

### 6.1 Description of the product

Ring Section Pumps are vertically split Multi-stage Centrifugal Pumps. The Delivery Pressure is governed by the number of stages, each stage consists of a cylindrical body section.

### 6.1.1 Casing

Casing consists of suction and delivery end covers and middle bodies. The inlet & outlet branches are cast integral with suction & delivery cover. Tappings are provided in the middle bodies for removing airlocks and to receive water seal pipeline and in the end covers for instrumentation. Holes are provided in end covers for bolting them, with the middle bodies in between when the pump is assembled.

### 6.1.2 Diffuser and Passage guide

The Guide passage or Diffusers having vanes are sets of components which abuts the casings of the preceding stage with the stage impeller being centrally disposed and is prevented from rotating by anti-rotation pegs secured in the casings.

### 6.1.3 Neck ring and Neck bushes

To minimize the amount of leakage between high and low-pressure areas of the pump, neck rings are fitted into the casing/middle bodies & neck bushes are fitted into the diffusers or guide passage. Running clearance is provided between neck rings and impeller upper hub & neck bush and impeller lower hub respectively. Neck rings & Neck bushes are renewable to allow this fine clearance to be restored periodically as wear takes place. For smaller pumps, RN 32 & RN 40, Neck rings & Neck bush design are not provided. Running clearance is maintained between impeller neck and casing/middle body.

#### 6.1.4 Rotating Element

The rotating element consists of a shaft on to which is keyed the impeller or impellers. Renewable shaft sleeves protect the shaft from corrosion and erosion. Sleeves are positioned by sleeve nuts, which have their threads left/right-handed as per direction of rotation to prevent them from unscrewing by the rotation of the shaft.

Threaded sleeves are provided in RN pumps.

To minimize the leakage between high and low-pressure areas, impeller neck diameter and hub diameter / distance sleeves are machined to close tolerances to provide fine running clearance. The shafts are carried in antifriction bearings / journal bearings

Bearings are in housings, which are attached to the ends covers of the pump. When the rotating element is carried by two, ring oiled journal bearings, lubrication of the bearings is by oil contained within the housings. These journal bearings may be in plain leaded bronze or in bronze/CI lined with white metal and are split along centerline. Diametric clearance should be 0.25 mm to 0.3 mm. To permit the journal bearings to be overhauled without completely removing the bearing housings, each bearing housing and bearing bush is split along the axis. In each bearing the top half bearing bush is slotted to accommodate an oil ring, which rests on the shaft and dips into the oil contained by the housing. Rotation of the pump shaft induces rotation of the ring, causing it to pass through the oil. Oil adheres to the ring and is carried up with it to be distributed on the journal surface of the shaft.

**NOTE:**

Before starting the pump please cross check the alignment of pump and engine on the base plate, coupling bush fitment, clearness on the periphery of the coupling. If any difference in the center height is observed, please use shims of suitable thickness to overcome the misalignment.

### 6.1.5 Balancing in IPB and PLUROVANE pumps

In order to balance the axial, thrust a special device is employed at the delivery end of the pump, as seen in Annexure-1 this consists of balance valve (70) secured to the shaft with limited axial movement. The valve rotates between the (renewable) combined seating and bush (71) and balance cover (75). The thrust generated by the impeller tends to force the balance valve (70) against its combined seating and bush but the high pressure water bled off from the delivery side of the pump flows along the annular space between the hub of balance valve (70) and combined seating bush (71) to the pressure chamber 'E'. The pressure in this chamber builds up sufficiently to overcome the end-thrust of the impellers. The water then escapes between the face of the valve and its seating into the chamber 'F'. The balance valve in consequence runs on a film of water and does not come into metallic contact with the seating. Water leaking across this valve is called the balance water and is led off to some convenient drain or to the pump suction branch or the storage tank. [Refer Annexure-1 Fig A-1]

**DANGER! Danger of material damage!**

**It is of the greatest importance that the free flow of the balance water should not be restricted in any way, as any restriction will lead to the collapse of the valve. For this reason regulating valves should never be fitted into the balance water pipe.**

### 6.1.5 Balancing in RN pumps

RN 32: The axial thrust is balanced by thrust balancing holes provided in each impeller. Residual axial thrust is taken by the Roller bearing.

RN 40: The axial thrust is balanced by, back vanes provided on each impeller. Residual axial thrust is taken by the Roller bearing.

RN 50, 50A, 65, 80, 100, 100A, 125A & 150: The axial thrust is balanced by, a special device employed at the delivery end of the pump, see Annexure-1. This consists of balance valve (70) secured to the shaft with limited axial movement.
The valve rotates between the (renewable) balance valve seat (71) and stuffing box cover (11). The thrust generated by the impeller tends to force the balance valve (70) against its' seating but the high pressure water bled off from the delivery side of the pump flows along the annular space between the hub of balance valve (70) to the pressure chamber 'E'. The pressure in this chamber builds up sufficiently to overcome the end-thrust of the impellers. The water then escapes between the face of the valve and its' seating into the chamber 'F'. The balance valve in consequence runs on a film of water and does not come into metallic contact with the seating. Water leaking across this valve is called the balance water and is led off to some convenient drain or to pump suction branch or the storage tank. [For Total float value refer table on Pg. No. 40 & Refer Annexure-1 Fig A-2]

**DANGER! Danger of material damage!**

**It is of the greatest importance that the free flow of the balance water should not be restricted in any way, as any restriction will lead to the collapse of the valve. For this reason regulating valves should never be fitted into the balance water pipe.**

### 6.1.5 Sealing system

To prevent leakage along the shaft at the point of emergence from the pump casing, gland packing, or mechanical seals may be fitted in the stuffing box situated at each end of the casing.

### Gland Pack

For Ring section pumps plaited cotton impregnated with oil and colloidal graphite is used.

### Mechanical Seal

For Ring section pumps mechanical seals are used of different type & different make as per application and liquid details. In standard condition i.e. ambient temp 45 deg & for clear water P11 make EBIL or M7N make GENERAL SEALS are used.

### 6.1.6 Wear on Balance valve and Seating

As wear occurs on the balance valve and seating, the rotating element will move towards the suction end of pump. To keep the amount of wear under observation, in the case of pump with balance valve a 'T' mark is made on the shaft when the valve and seating are new. See Annexure-1. The head of the 'T' mark is flush with the outer cover of the driving end bearings. When checking for balance valve wear the rotating element should be pulled to its' limiting position in the direction of the suction end of the pump before observation is made.

## 7 Installation and electrical connection (Motor / pump coupling system)

**DANGER! Risk of getting crushed!**

**The installation or removal of the product must not be performed by one person alone. Measures should be taken to bar persons from standing beneath a suspended load. Furthermore, it is also prohibited to move suspended loads over exposed workplaces where people are present. The fastening devices should be adapted to the conditions at hand (weather, hooking system, load, etc.) Use suitable fastening devices to handle the weight of the product.**

**WARNING! Danger of personal injury!**

**The installation and electrical connection should be performed only by qualified personnel in compliance with local regulations. This section provides instructions on the recommended methods of installing pumping sets on to concrete foundations. Careful attention must be paid to the customer and contractor's installation drawings during the installation procedures to ensure that the pumping set is accurately positioned on the correct datum levels.**

**The existing accident prevention regulations must be observed.**

**WARNING! Danger of electric shock!**

**Any hazards from electrical current should be ruled out. Any instructions from local or general directives [e.g. IEC, VDE etc.] or directives of the local electricity supply companies must be observed.**

### 7.1 Installation of bare shaft pump

It is strongly recommended to use component such as coupling, guards, motors, base plates supplied by WILO Mather and Platt to install a bare shaft pump on a base plate.

It is mandatory that those components should be CE certified and the coupling guard must comply with the regulation EN 953.

#### 7.1.1 Electrical motor selection

* Select an electrical motor with sufficient power margin regarding the motor rating. The table bellow will guide you in this selection.

#### 7.1.2 Coupling selection

Use a semi-flexible coupling to link the pump to the driver. Select the size of the coupling in accordance with the recommendation of the coupling manufacturer. Strictly follow the coupling manufacturer's instructions for the fitting of the coupling between the pump and the motor. (The coupling must comply with the standard EN349). The alignment of the pumps and the motor must be checked after the installation of the pump set on its foundation and when the piping is connected. In addition, an alignment control must take place when the system works at its nominal temperature.

The coupling guard must comply with the EN 953 standards in order to avoid any contact with rotating parts during operations.

#### 7.1.3 Selection of a base plate

Select a base plate in accordance with the local regulations, sufficiently large and strong to support the pump and motor.

#### 7.1.4 Pump set assembling

Fix the pump and motor equipped with their half coupling on the base plate and make the alignment of those elements. It is recommended to fit the coupling guard supplied as accessories by WILO Mather and Platt.

**Note:**

If coupling guard is supplied loose, then kindly drill and fit it on the base plate at proper location.

And if pump is supplied with coupling and motor mounted on the base plate, please ensure proper alignment of pump motor and coupling.

*** Select an electrical motor**

| Shaft power | $P_2 \leq 4$ KW | 4 kW < $P_2 \leq$ 10 kW | 10 kW < $P_2 \leq$ 40 kW | 40 kW $\leq P_2$ |
|---|---|---|---|---|
| Recommended power margin | 25 % | 20 % | 15 % | 10 % |

Example:

- Duty point: 100 m3/h – 35 m – pump efficiency 78 %
- Pump shaft power: 12.5 kW
- Electrical motor rating (including margin):
- 12.5 * 1.15 = 14.3 kW
- IEC motor power rating available: 15 kW

Use a foot mounted motor B3 (IM 1001) which comply with the IEC34-1 standard.

.

## 7.2 Installation of the complete pump set

- Before any installation work is carried out, the machine should be inspected for damage that may have occurred during handling, transport & storage.
- Installation within a building (indoor installation): Install the pump in a dry, well ventilated and frost-resistant room.
- Pumping machinery should have adequate access and working room for maintenance operations. Adequate overhead space for lifting devices and working clearance must be provided.
- Installation outside a building (outdoor installation): Install the pump with a suitable protection to avoid rainfalls strong wind and particles which can damage the pump or motor.
- Avoid exposure of the pump to direct sunlight.
- An appropriate solution to avoid frost must be implemented.

**CAUTION! Risk of material damage!**
**Ensure sufficient ventilation/heating if the ambient temperature exceeds/falls below the permitted limit values.**

- Carry out all welding and soldering work prior to the installation of the pump.

**CAUTION! Risk of material damage!**
**Dirt from the pipe system can destroy the pump during operation. Flush the pipe system prior to the installation of the pump.**

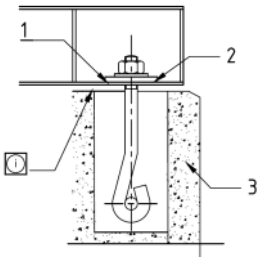
- Provide shut-off valves in front of and behind the pump.

### 7.2.1 Foundations

The foundation should be sufficiently substantial to absorb any vibration and to form a permanent, rigid support for the base plate. The foundation must get large dimensions. Generally, the weight of the foundation is around 2 to 3 time the pump set weight. This is important in maintaining the alignment of a direct connected unit. In building the foundation, the top of the foundation should be left approximately one inch low to allow for grouting. Foundation bolts of the proper size should be embedded in the concrete, located by template. (Figure 2, Pg. No. 3)

Foundation bolt

1 Erection packers
2 Finish grout
3 Concrete




**NOTE:**
Leave top of foundation rough! Do not finish with trowel.

- A pipe sleeve about 2 ½ diameters large than the bolt should be used to allow movement for the final positioning of the bolts. For installations where a low level of noise is expected, built the foundation in a pit lined with appropriate insulation material in order to avoid vibration transmission to the ground.

**CAUTION! Risk of material damage!**
**While tightening pump screws/bolts, pump as well motor should be free and should not be in coupled condition. Pump or motor should not be used as supports while tightening.**

- It is insufficient to check level on the machined pads of base plate with a spirit level because it is possible that some types of errors will not be revealed or will be accepted as being within acceptable limits. These distortions as showed in figure 3 Pg. No. 3. Therefore, it is necessary to use I-beam straight edge along with engineer's master level.

### 7.2.2 Leveling and installing the base plate

**CAUTION! Risk of material damage!**
**Pumps and drivers that are received with both machines mounted on a common base plate are checked for alignment before shipment. However during shipment, storage it may get disturbed. (Figure 3, Pg. No. 3)**

- Use I-beam straight edge and an engineer's master level (with accuracy of 0.02 mm) for leveling the base plate. I-beam should rest on the machined surfaces of the base plate, or on the leveling pads if provided. These machined surfaces where level is being checked must be clean and free from paint, burrs etc.
- Check datum position of base frame as given in G.A. Adjust the level of the base plate by inserting shims between the bed plate and the packer plate until the bed plate is leveled and supported on all the packing plates at the height required for the connection of suction and discharge branches. For checking the levels across two pads, I-beam type straight edge should be used extensively in conjunctions with engineer's master level. Level should be achieved within 0.05 mm.
- When the base plate is leveled, grout the foundation bolts only. Care should be taken so as not to disturb the verticality of foundation bolts. For grouting use rich mix of 1: 1:2 of cement, sand and gravel below 12 mm. Alternatively quick setting grout mix can be used.
- When the grout has set, gently but firmly tighten the foundation bolts. Care must be taken not to distort the base plate or loosen the foundation bolts in the grout by excessive tightening.
- When the grout has set, gently but firmly tighten the foundation bolts. Care must be taken not to distort the base plate or loosen the foundation bolts in the grout by excessive tightening.

### 7.2.3 Alignment of the pumps and its driving units

- When the base plate is leveled and the satisfactory alignment is completed, proceed with connection of suction & delivery piping. Recheck the alignment after piping and run the final grout beneath the base plate. Allow minimum seven days' time for curing. Grout mix in the proportion specified earlier for foundation bolt grouting should be used. It is further recommended that all hollow pockets in the base plate shall be filled after curing of earlier grout.

- The following procedures outline recommended practice given in BS-3170 in 1972 (Appendix A) for checking shaft alignment. This method is independent of the trueness of the coupling or shaft and is, therefore, not affected by canted coupling faces or eccentricity of the outside diameter of coupling, the coupling. Before commencing the alignment, rotate each shaft independently to check that the bearings run freely and that the shaft is true to 0.1mm or better. Check that no damage can be caused when the shaft of the driven unit is turned. Coupling should be loosely coupled, and the halves must be free to move relative to each other, Otherwise gauge Indicators can be incorrect. Where, tightly fitting pins or spring prevent loose the springs or pins should be removed and a line scribed across both half couplings and readings taken only when the two marks are aligned.

**CAUTION! Risk of material damage!**
**All the alignments (angular as well as radial) have to be carried out by using 3 dial indicators, simultaneously.**

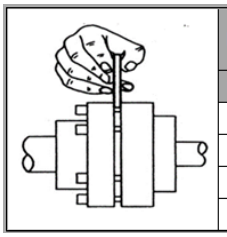
**Angular alignment**
After isolating the driven unit from its power supply, clamp two dial indicators at diametrically opposite points on one half coupling or to the shaft behind it with the plunger resting on the back of the other half of the coupling. Rotate the coupling unit. The gauges are to be in line vertically and set the dial to read zero. Rotate the coupling by $180^0$ and record the readings on each gauge. The readings should be identical, though not necessarily zero. Either positive or negative readings are acceptable provided they are equally positive or negative. Adjust the position of one of the units if necessary rotate the coupling unit. The gauges are to be in the line horizontally and adjust the dial to zero. Repeat the operation outlined above by rotating the coupling by $180^0$

**Radial alignment**
Clamp a dial gauge on one of the couplings or to the shaft as shown in figure with the plunger resting on the rim of the other half coupling. Set the dial zero. Rotate the coupling and note the reading at each quarter revolution. Any variation in the readings indicates the deviation from alignment and the position of one of the units must be adjusted until the readings at each quarter revolution are identical or within the tolerances given below. Refer (Figure 4, Pg. No. 4)

**Alignment Tolerances**

| Speed (rpm) | Parallel tolerance | Angular tolerance |
|---|---|---|
| <1000 | 0.15 mm TIR | 0.15 mm TIR |
| From 1000 to 1800 | 0.15 mm TIR | 0.10 mm TIR |
| From 1800 to 3600 | 0.10 mm TIR | 0.05 mm TIR |
| TIR: Total Indicated reading | | |

**Distance between coupling halves for Motor Driven Pump with Pin-Bush Coupling.**



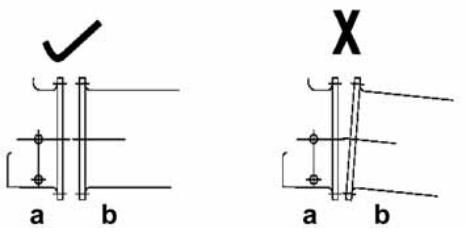
| Rotational Speed | | Gap |
|---|---|---|
| rpm | | mm |
| 1450 | 2900 | |
| 3-55 kW | 3-55 kW | 2 - 4 |
| 75-250 kW | 75-560 kW | 2 - 6 |
| >250 kW | >560 kW | 3 - 8 |

### 7.2.4 Pipe work

No stress must be imposed on the pump casing by the pipe work; neither by the weight of the pipes nor by the tightening of badly fitting pipes. All pipe worked attached to the pump must be fully supported and the mating faces of the pipe flanges must be parallel and all bolt holes coinciding with each other. (See table of maximum forces on flanges) It is important, therefore, that alignment of the pump and motor should be rechecked after the pipes are finally fitted. Resetting or supporting the pipes must correct any deviation in the alignment.

For difficult pumping on the suction side, to stabilize the flow, a pipe length 15 times the diameter of the suction branch should be installed before the suction branch.

- The flow rate in the suction line or inflow line must not exceed 2 – 3 m/s.
- Pipe velocity may need to be reduced further to satisfy pump NPSH requirements and to control suction pipe losses.




Avoid stress on the pump casing
a: pump flange;
b: pipe work

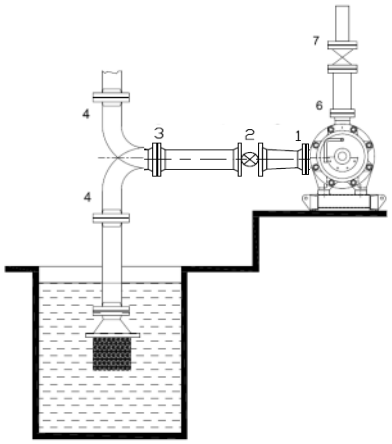
**MAXIMUM ALLOWABLE FORCES & MOMENTS ON RING SECTION PUMPS, FLANGES IN CAST IRON Forces [N] and moments [Nm]**

| Flange size [mm] | | 50 | 65 | 80 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Forces (N) | Fx | 710 | 890 | 1070 | 1420 | 2490 | 3780 | 5340 | 6670 | 7120 | 8450 | 9335 | 10000 |
| | Fy | 890 | 1130 | 1330 | 1780 | 3110 | 4890 | 6670 | 8000 | 8900 | 10230 | 1115 | 7780 |
| | Fz | 580 | 710 | 890 | 1160 | 2050 | 3110 | 4450 | 5340 | 5780 | 6670 | 7335 | 7890 |
| | Fr | 1280 | 1640 | 1920 | 2560 | 4480 | 9620 | 9630 | 11700 | 12780 | 14850 | 16230 | 17650 |
| | | | | | | | | | | | | | |
| Moments (Nm) | Mx | 460 | 690 | 950 | 1330 | 2300 | 3530 | 5020 | 6100 | 6370 | 7320 | 7675 | 7945 |
| | My | 230 | 435 | 470 | 680 | 1180 | 1760 | 2440 | 2980 | 3120 | 3660 | 3905 | 4175 |
| | Mz | 350 | 530 | 720 | 1000 | 1760 | 2580 | 3800 | 4610 | 4750 | 5420 | 5725 | 6060 |
| | Mr | 620 | 970 | 1280 | 1800 | 3130 | 4710 | 6750 | 8210 | 8540 | 9820 | 10235 | 10775 |

### 7.2.5 Suction line

See the sketches for the optimum layout of pump installation for flow and suction lift operation. Ensure that air pockets cannot be created. Unequal nominal widths of the suction branch and suction line must be compensated by eccentric transition pieces (refer figures 5 – 9 Pg. No. 4 & 5)

- It is recommended that a strainer is installed in front of the suction pipe with a filter surface of at least 3 times the pipe cross section (approx.100 meshes/cm²).
- The suction opening of the suction line should be well below the liquid level, and a strainer should be used.
- The strainer must be far enough from the bottom to avoid excessive inlet losses, which could impair pumping performance. It is advisable to check that there is no leakage.
- A shut-off valve should be installed in the feed line. It must be closed for maintenance work. It should be installed in order to avoid air pockets forming in the spindle cap, i.e. with the spindle in a horizontal position or pointing vertically downward.




Layout of pump installation:

1) Eccentric reducer (suction) or concentric reducer (discharge)
2) Isolating valve
3) Suction line
4) Bend
5) Foot valve with strainer
6) Isolating valve
7) Regulating valve

### 7.2.6 Discharge line

**CAUTION! Damage to the pump**

**Pump casings have sometimes been cracked by pressure surges imposed on them through the absence of a non return valve. A back flow can serisouly damage the bearings and the mechanical seal.**

For flow regulation, a valve must be installed behind the pump. If non-return valves are used, they should close smoothly. Pressure shocks must be avoided.

### 7.2.7 Stuffing box packing (figure 11 Pg. No. 6)

**CAUTION! Risk of quick wear or leakages packing should be handled with care and it should not be allowed to pick up the dust or abrasive matter by coming into contact with floors or dirty benches. It is bad practice to hammer packing to facilitate the insertion.**

Pumps are dispatched from our works with the stuffing boxes unpacked; otherwise packing will be aged. The packing is packed with greaseproof paper and dispatched with the pump. The softest possible packing i.e. plaited cotton impregnated with oil and colloidal graphite is recommended for most duties. Required number of and lengths of packing should be cut off so that each length will pass once round the shaft sleeve line and meet to end. The ends of packing must be cut at 45 °. After cleaning the stuffing box and shaft sleeves the packing should be inserted into the stuffing box. Each ring should be pushed into position individually using the glands joint of each ring must be positioned 180° from joints of its neighbor. A logging ring included in the arrangement; should be inserted into the stuffing box at the appropriate time during the packing sequence so that it is aligned with the cooling water connection. The gland should now be fitted square with the pump casing and the nut should be screwed up to little more than finger tightness.

### 7.2.8 Mechanical seal

**CAUTION! Damage to the pump**

**Never start the pump without liquid inside otherwise the mechanical seal will be damaged instantaneously.**

No real operation is required during the setup of the pump. Only filling and venting the pump are mandatory before switching on the main.

### 7.2.9 Pressure gauge connections

**CAUTION! Risk of leakage of the fluid!**

**Never connect a pressure gauge onto the pump when the system is under pressure.**

Pressure gauge connections are available on the pump casing close to the flanges. Then pressure gauge can be connected on suction and discharge side.

### 7.2.10 Electrical connection

**WARNING! Danger of electric shock**

**The electrical connection should be established by an electrician approved by the local electricity supply company in compliance with the applicable local regulations [e.g. VDE regulations].**

- The current type and voltage of the mains connection must correspond to the specifications on the name plate.
- Refer to the motor and panels instruction manual at the time of installation and connection. Motors or electrical control panels are operated with alternating or industrial high-voltage current.
- The electrical connection is established via a fixed mains connection line.
- The local regulations must be adhered to.
- Ensure that there is a provision for isolation of all energy sources and locking. If the machine has been switched off by, a protective device, it must not be switched on again until the error has been corrected.
- The electrical system (machine including protective devices and operating position) must always be grounded. Refer pump GA drawing & respective manuals of motor/electrical control panel for connecting earthing suitable as per motor rating and relevant regulations and standards including proper earthing lug size and fasteners.
- Under no circumstances may any connecting cables touch the pipeline or the pump or motor housing.
- If there is a possibility that people can come into contact with the machine and the pumped liquid (e.g. at construction sites), the grounded connection must be additionally equipped with a fault current protection device.
- To ensure drip water protection and strain relief of the cable connections, use cables with an appropriate outer diameter and screw the cable glands tight. Furthermore, any cables nearby screwed connections for outlet loops should be bent in order to divert any accumulating drip water. Close any unassigned cable glands with the existing sealing discs and screw them tight.

### 7.2.11 Operation with frequency converter

- The rotation speed can be adjusted in the operating limits of the pump given in the technical data. The electrical motors can be driven by a frequency converter in order to adapt the pump performances the duty point required. Please contact WILO Mather and Platt before connecting the frequency converter to the motor to make sure that the electrical motor is compatible with this driver. In any case, please inform WILO Mather and Platt at the quotation stage if the pump set will by driven by a frequency converter this might influence the motor selection.
- The converter should never generate voltages peaks to the motor connection higher than 850V and deliver voltages variations $\Delta U/\Delta t$ greater than 2500 V/µs.
- If the above conditions cannot be fulfilled, an appropriate filter should be place between the frequency converter and the motor. Please contact the frequency converter manufacturer for guidance in the selection of this filter.
- Strictly follow the Frequency converter manufacturer instructions.
- The minimum rotation speed of the pump should never go below 40% of the nominal speed.

## 8 Commissioning

**WARNING! Danger of injury**

**The devices whether on pump/motor/electrical panels must never be dismantled or disabled. They must be checked by an authorized technician for proper functioning before, start-up. Refer to motor & electrical panel instruction manuals for electrical safety & control devices information.**

**WARNING! Danger of pump damage!**

**Do not operate the pump away from specified operating range. Operating beyond duty point may not pose a risk to the operator but will reduce the efficiency of the pump or damage the pump itself. Operation more than 5 minutes, at close valve condition is not recommended. For hot liquids this is not recommended at all. Ensure that always site NPSH-A is more than NPSH-R.**

### 8.1 Cleaning prior to start

### 8.1.1 Pipe work flushing

Before the pumps are brought into service, either on initial commissioning or on re-commissioning after overhaul, the pipe work associated with the pumps must be flushed through. This will clear deposits or scales which may have accumulated in the pipes, and which could damage the internal components of the pumps.

### 8.1.2 Cleaning of Bearings

Where possible, especially if the unit has been in store for a long period before commissioning, the bearings should be cleaned and flushed out with clean white spirit or good quality paraffin. Waste should not be used for this purpose, as particles of foreign matter may be left behind which would cause damage when the bearing is in service. Bearings should be then filled with recommended grade and quality of fresh lubricant to the level. Refer list of lubricants at the end of this manual.

### 8.2 Filling and venting

Fill and vent the system correctly, through air cock. Brief dry running will damage the pump. Please also note that these pumps are not self-priming, which means that the impeller & casing must always be fully filled with fluid to be handled before putting in operation.

**WARNING! Danger of injury!**

**There is a risk of burns if the pump is touched! The entire pump may become very hot, depending on the operating state of the pump or system (fluid temperature).**

**CAUTION! Danger sealing system damage!**

**Any attempt to run the pump dry or partially full may result in seizure of the rotating internal components.**

### 8.2.1 Pumps operating on flooded suction head

When these pumps operate on a flooded open the air release valve situated on top of the pump casing, open the pump inlet isolating valve and vent the air out of the casing. When the liquid issues from the air vent, free of air, the pump is properly primed. The air vent must be closed after priming and before the pumping set is started.

### 8.2.2 Pumps operating on negative suction head

There are two methods of priming pumps that draw their liquid from an elevation lower than the pump inlet branch:

- If the inlet pipe work is fitted with a non-return foot valve, the pump casing and inlet pipe work can be filled with liquid from an external source under pressure. The pressure imposed on the pump by this method must not exceed that for which the pump is designed. In certain cases, priming can be achieved by flooding back from the delivery side of the pump.
- By extracting air or gas from the pump casing. To enable this method to be used, the gland arrangement must be sufficiently air-tight, or it should be liquid sealed from an external supply. For operation details of gas exhausts reference should be made to the manufacturer's instructions. Some form of priming indicator is usually fitted to indicate when the priming operation is complete.

### 8.2.3 Pumps operating on hot liquids

Pumps operating on hot liquids are usually so arranged that the liquid flow into the pump is under pressure. If the saturation pressure of such liquids is above atmospheric pressure, any attempt to prime the pump will result in the liquid "flashing" from the air cocks. For these reasons, the air cocks at the top of the pump casing should be left slightly open when priming boiler circulating pumps until air has been driven out of the casing completely.

The cooling water services of a pump handling hot liquids should be turned on before the pump is primed. These services may supply cooling water to the bearings and / or stuffing boxes. Where the services are functioning, open the inlet valves and start warming the pump throughout. Never cut off the water services while the pump is "on temperature". Where bearings are water-cooled, adjust the cooling water supply until the bearings have a running heat. Over-cooling may lead to condensation of moisture from the atmosphere inside the bearing with consequent contamination of the oil. The suction valve, if provided, must be fully open and the delivery valve must be closed.

## 8.3 Starting the pump

### 8.3.1 Direction of rotation

Disconnect the drive coupling and run the motor to check its direction of rotation. A directional arrow is provided on the pump unit.

### 8.3.2 Pre-starting checks

- Check that the inlet isolating valve is open, and that the delivery valve is closed.
- Check that there is no blockage in the strainer at the end of the suction line.
- Check for free rotation of the unit when coupled.
- Check that suction and delivery pressure gauges are connected. Test and make available any alarm, signals, interlock systems and any of the protective devices incorporated in the auxiliary and main pumping control system.
- Ensure that all electrical checks on motor, relay setting in panel etc. have been carried out in accordance with the instructions of motor manufacturer.
- Ensure that stuffing box sealing water seal connection is provided as shown in GA Drawing.

### 8.3.3 Normal starting and running checks

- When all the foregoing pre-start checks are satisfactory, start the pump and check the direction of rotation (indicated by a direction arrow on the pump casing) otherwise stop the pump immediately for correction of direction of rotation. Then run the pump at its rated speed.
- Check the ammeter reading to ensure that the motor is not being overloaded.
- If applicable, ensure that the stuffing box is not overheating and that there is slight leakage from the gland (about 1 drop per second). There may be at first a tendency for the stuffing boxes to run warm because of the high viscosity lubricant in the packing. During the first few minutes of running with new packing, a small quantity of very viscous fluid will be extruded, but the flow should reduce when the packing has settled down.
- Check the mechanical seal for leak. In the start phase (and also after downtimes) slight leakage can be expected. Visual leakage checks are however required from time to time. Distinctly visible leakage will require an exchange of the seal. WILO Mather and Platt offers a repair set containing all parts required for an exchange.
- Check that the bearing is not overheating. Bearings will normally run at a temperature of 30˚C to 35˚C above ambient temperature. The ideal running temperature of bearings is 40˚C to 60˚C for ball bearings and 40˚C to 55˚C for bush bearings. The temperature should never exceed 82˚C for ball bearings and 75˚C for bush bearings. If the bearings are overheating its cause should be investigated immediately.
- If the foregoing checks are satisfactory, open the delivery valve slowly and bring the pump gradually up to its rated parameters indicated in the data sheet/name plate and based on pressure gauge and ammeter readings. Unless the pump is fitted with a special leak-off device, it should not be run for a long period against a closed delivery valve. Check that the driving unit is not being overloaded during valve opening. Overloading may occur if the pump is discharging into an empty system. If the pumping unit fails to generate at least its rated delivery pressure it must be stopped immediately, the cause ascertained,

- Check vibration of pump set and ensure that vibration level is within limits specified. Check that noise level is within stipulated limits.
- The pumps may be run for 8 hours trial operation and all the parameters like delivery pressure, current, bearing temperature, etc. Be recorded periodically.
- Make the following checks at regular intervals. It is recommended that they be made at every change of shift.
- Check the suction and discharge pressure gauge for normal operating pressure, if there is significant drop in the suction or discharge pressure the pump may have lost its supply. In the event of this fault occurring, the pump must be stopped immediately, and the cause of liquid loss eliminated.
- Check the mechanical seal or stuffing box assembly for overheating.

### 8.3.4 Sealing system

### Gland packing

**CAUTION! Risk of damaging the pump!**

**If the gland plate is too tight, the packing stuff will be immediately damage**

At the beginning of the operation, the leak at the gland packing should be important. It should reduce progressively after several hours by a balanced and reasonable tightening the gland plate. The gland packing must operate without excessive temperature. The correct setting of the gland packing let a permanent leak around 1 or 2 drops per seconds.

If this leak is too much and cannot be adjusted with the gland plate, the packing stuffing's are worn and must be replaced.

### Mechanical seal

**CAUTION! Risk of damaging the pump!**

**A mechanical seal must never operate without fluid and lubrication even for a short period of time.**

Ensure that the pump is completely full of water and vented before starting the pump. Small leakages can occur during the period of running-in, they should disappear after several hours of operation. If the leakages don't stop, shut down the pump disassemble the mechanical seal and control their condition.

### 8.3.5 Normal shutdown

**WARNING! Risk of Burns!**

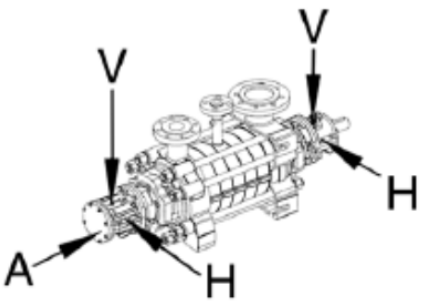
**If the fluid temperature and system pressure is high, close the isolation valves upstream and downstream of the pump. Initially let the pump cool.**

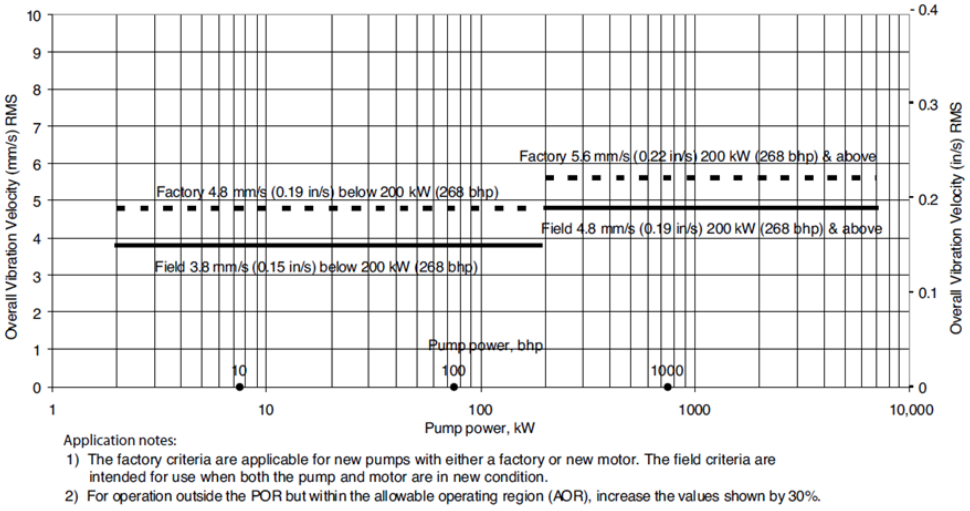
- Close the delivery valve to reduce the load on the driving unit.
- Stop the driver of the pump.
- When the pump has come to rest, close the suction-isolating valve.
- Isolate any ancillary supplies.

### 8.3.6 Emergency Shutdown

In the event of any malfunction of the equipment, switch off the pump set. When the pump has come to rest, close the suction & discharge valves, isolate the driving unit power supply & rectify the fault.

### 8.3.7. Hydraulic Institute Standard (ANSI/HI 9.6.4-2016) Acceptable field vibration limit chart (9.6.4.2.5.1a)




Application notes:

1) The factory criteria are applicable for new pumps with either a factory or new motor. The field criteria are intended for use when both the pump and motor are in new condition.
2) For operation outside the POR but within the allowable operating region (AOR), increase the values shown by 30%.

## 9 Maintenance

**Maintenance and repair work should be carried out by qualified personnel only.**

**WARNING! Danger of electric shock!**

**Any danger from electrical current should be ruled out.**

- **The pump should be electrically isolated and secured against unauthorized switch-on prior to any maintenance or repair work.**
- **Any damage to the connection cable should always be rectified by a qualified electrician only.**

**WARNING! Risk of scalding!**

**At high fluid temperatures and system pressures, allow the pump to cool down first and then depressurise the system.**

### 9.1 Routine maintenance and frequency of inspection

Centrifugal pump requires very little routine maintenance; however, serious troubles can be often avoided by regular observation and analysis of various working parameters. Some of the routine maintenance checks for this purpose are as under:

- To keep daily logbook records of working parameters like suction and discharge pressure, flow rate, current drawn, bearing temperature, etc. These parameters should be recorded twice a shift. Any sudden change should be a signal for investigation. Refer Section Maintenance & Inspection log.
- Check bearings for normal temperature. See 8.3.3
- Vibration & sound level readings should be taken once in a fortnight and values compared with that of previous records.
- Check that there is sufficient leakage from the gland packing to ensure proper cooling and lubrication. (if applicable) For mechanical seal, check that there is no visible leakage.
- For any abnormality observed from the visual/ manual inspection and through maintenance & inspection logs, stop the pump and investigate.
- Fault finding – Many of the common faults which occur on centrifugal pumps and which can be diagnosed by observations are given in the chart under section 10 Faults, causes and remedies.

**Routine maintenance**

| Parts | Action | Period | Remarks |
|---|---|---|---|
| Mechanical Seal | Check for Leakage | Daily | 5.6 gm/hr. per pair of seal face |
| Gland Packing | Check for Leakage | Daily | 40 to 60 drops/min |
| | Check for Leakage | Half yearly | If required replace with new packings |
| Bearings | Check temperature | Weekly | If Bearing temperature exceeds $80^0$ C, the fault needs to be rectified. |
| Suction Pressure | Check Pressure | Daily | |
| Discharge Pressure | Check Pressure | Daily | |
| Flushing | Check Flow | Weekly | Flow through the Flushing pipes must be clear and continuous |
| Vibration | Vibration | Weekly | Refer acceptable field vibration limit chart Pg. No. 21 |
| Voltage and Current | Check for the rated values | Weekly | |
| Rotating element | Check the rotating for wear | Yearly | |
| Clearances | Check the clearances between neck ring and impeller | Yearly | If value of clearance is more, neck ring should be replaced, Ref. Table on Pg. No. 23 |
| Total Dynamic Head | Check Suction and Discharge TDH | Yearly | |
| Alignment | Check the alignment of pump with motor | Half yearly | Refer table for alignment tolerances, Pg. No. 16 |

**NOTE:**

The above Routine Maintenance checklist is for pump only. Refer Motor / Engine manufacturers manual for the respective routine maintenance checks.

### 9.1.1 Technical Data Ring Section Pumps

| Sr. No. | Pump | Connections | | | | | | | | | | | Bearing Drive End | Bearing Non-Drive End | Bearing Lubrication | For Initial charge (Qty.) | For Refill | | For Replacement | | Gland Packing Size | Packing Ring Quantity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CG | PG | AC | CDD | GD | PM | CDS | OD | OLI | MD | CD | | | | | (Qty.) | Duration [Hours] | (Qty.) | Duration [Hours] | | |
| 1 | RN-32 | 3/8" | 3/8" | 1/4" | 3/8" | 3/8" | - | - | - | - | - | - | 6305 | 6305 | Grease | 30 gm | 50 gm | 1000 | 50 gm | 3000 | 8 | 5 |
| 2 | RN-40 | 3/8" | 3/8" | 1/4" | - | 1/2" | 3/8" | 3/8" | - | - | - | - | 6306 | 6306 | Grease | 30 gm | 50 gm | 1000 | 50 gm | 3000 | 8 | 5 |
| 3 | RN-50 | 3/8" | 3/8" | 1/4" | 1/2" | 1/2" | 1/4" | - | - | - | - | - | N306 | N306 | Grease | 30 gm | 50 gm | 1000 | 50 gm | 3000 | 9 | 5 |
| 4 | RN-50 A | 3/8" | 3/8" | 1/4" | 1/2" | 1/2" | 1/4" | - | - | - | - | - | N306 | N306 | Grease | 30 gm | 50 gm | 1000 | 50 gm | 3000 | 9.5 | 5 |
| 5 | RN-65 | 3/8" | 3/8" | 1/4" | 1/2" | 1/2" | 1/4" | - | - | - | - | - | N307 | N307 | Grease | 40 gm | 60 gm | 1000 | 60 gm | 3000 | 10 | 5 |
| 6 | RN-80 | 3/8" | 3/8" | 1/4" | 1/2" | 1/2" | 1/4" | - | - | - | - | - | N308 | N308 | Grease | 50 gm | 90 gm | 1000 | 90 gm | 3000 | 10 | 5 |
| 7 | RN-100 | 3/8" | 3/8" | 1/4" | 1/2" | 1/2" | 1/4" | - | - | - | - | - | N309EC | N309EC | Grease | 50 gm | 90 gm | 1000 | 90 gm | 3000 | 11.5 | 5 |
| 8 | 1/1.5 HS PLURO | 3/8" | 3/8" | 1/4" | - | 1/2" | 1/4" | - | - | - | - | - | N 205 | N 205 | Grease | 30 gm | 50 gm | 1000 | 50 gm | 3000 | 6 | 5 |
| 9 | 1.5/2 HS PLURO | 3/8" | 3/8" | 3/8" | - | 1/2" | 3/8" | - | - | - | - | - | N 206 | N 206 | Grease | 30 gm | 50 gm | 1000 | 50 gm | 3000 | 7 | 5 |
| 10 | 2/2.5 HS PLURO | 3/8" | 3/8" | 3/8" | - | 1/2" | 3/8" | - | - | - | - | - | N 307 | N 307 | Grease | 40 gm | 60 gm | 1000 | 60 gm | 3000 | 7 | 5 |
| 11 | 3/4 HS PLURO MK1 | 3/8" | 3/8" | 3/8" | - | 1/2" | 3/8" | - | 1/4" | 1" | - | - | Bush | Bush | Oil | 0.6 L | * | 1000 | 0.6 L | 3000 | 11 | 5 |
| 12 | 100/125 IPB | 3/8" | 3/8" | 3/8" | - | 3/4" | 3/8" | - | 3/8" | 1" | - | - | Bush | Bush | Oil | 3.0 L | * | 1000 | 3.0 L | 3000 | 10 | 8 |
| 13 | 100/150 IPB T-80 | 1/2" | 1/2" | 3/8" | - | 3/4" | 3/8" | 3/8" | 3/8" | 1" | 3/8" | - | Bush | Bush | Oil | 3.0 L | * | 1000 | 3.0 L | 3000 | 10 | 8 |
| 14 | 150/200 IPB | 1/2" | 1/2" | 3/8" | 3/8" | 1" | 3/8" | 3/8" | 1/4" | 1" | 3/8" | - | Bush | Bush | Oil | 3.2 L | * | 1000 | 3.2 L | 3000 | 11 | 5 |
| 15 | 150/200 IPB MK1 | 1/2" | 1/2" | 3/8" | 3/8" | 1" | 3/8" | 3/8" | 1/4" | 1" | 3/8" | - | Bush | Bush | Oil | 3.2 L | * | 1000 | 3.2 L | 3000 | 11.5 | 5 |
| 16 | 00 PLURO | 3/8" | 3/8" | 3/8" | - | 1/2" | 3/8" | - | 1/4" | 1" | - | - | Bush | Bush | Oil | 0.6 L | * | 1000 | 0.6 L | 3000 | 16 | 5 |
| 17 | 00 PLURO MK1 | 3/8" | 3/8" | 3/8" | - | 1/2" | 3/8" | - | 1/4" | 1" | - | - | Bush | Bush | Oil | 0.6 L | * | 1000 | 0.6 L | 3000 | 16 | 5 |
| 18 | I PLURO | 3/8" | 3/8" | 3/8" | - | 1/2" | 3/8" | - | 1/4" | 1" | - | 3/8" | Bush | Bush | Oil | 0.6 L | * | 1000 | 0.6 L | 3000 | 11 | 5 |
| 19 | NO. I PLURO MK1 | 3/8" | 3/8" | 3/8" | - | 1/2" | 3/8" | - | 1/4" | 1" | - | 3/8" | Bush | Bush | Oil | 0.6 L | * | 1000 | 0.6 L | 3000 | 11 | 5 |
| 20 | II PLURO | 1/2" | 1/2" | 3/8" | 3/8" | 3/4" | 3/8" | 3/8" | 1/4" | 1" | - | - | Bush | Bush | Oil | 1.6 L | * | 1000 | 1.6 L | 3000 | 11 | 5 |
| 21 | II A PLURO | 1/2" | 1/2" | 3/8" | - | 1" | 3/8" | - | 1/4" | 1" | - | - | Bush | Bush | Oil | 1.6 L | * | 1000 | 1.6 L | 3000 | 11 | 5 |
| 22 | III PLURO | 1/2" | 1/2" | 3/8" | 3/8" | 1" | 3/8" | 3/8" | 1/4" | 1" | - | - | Bush | Bush | Oil | 5.7 L | * | 1000 | 5.7 L | 3000 | 11 | 5 |
| 23 | III A PLURO | 1/2" | 1/2" | 3/8" | 1/2" | 1.1/4" | 3/8" | 1/2" | 1.1/4 | 1" | - | - | Bush | Bush | Oil | 5.7 L | * | 1000 | 5.7 L | 3000 | 16 | 5 |
| 24 | 10/12 PLURO | 1/2" | 1/2" | 3/8" | 3/8" | 1" | 1/2" | 3/8" | 1/2" | 1" | - | - | Bush | Bush | Oil | 6.9 L | * | 1000 | 6.9 L | 3000 | 16 | 5 |
| 25 | 3/3 PJ PLURO | 3/8" | 3/8" | 3/8" | - | 3/4" | 3/8" | 3/8" | 3/8" | 1" | - | - | Bush | Bush | Oil | 4.0 L | * | 1000 | 4.0 L | 3000 | 16 | 5 |
| 26 | 4/4 PJ PLURO | 3/8" | 3/8" | 3/8" | - | 3/4" | 3/8" | 3/8" | 3/8" | 1" | - | - | Bush | Bush | Oil | 4.0 L | * | 1000 | 4.0 L | 3000 | 20 | 5 |
| 27 | 4/6 PJ PLURO | 3/8" | 3/8" | 3/8" | - | 3/4" | 3/8" | 3/8" | 3/8" | 1" | - | - | Bush | Bush | Oil | 4.0 L | * | 1000 | 4.0 L | 3000 | 16 | 5 |
| 28 | 6/6 PJ PLURO | 1/2" | 1/2" | 3/8" | - | 1.1/4" | 3/8" | 1/2" | 1/4" | 1" | - | - | Bush | Bush | Oil | 1.6 L | * | 1000 | 1.6 L | 3000 | 16 | 5 |
| 29 | 250 PJ PLURO AS | 3/8" | 3/8" | 3/8" | - | 1" | 1" | - | - | - | - | - | Bush | Bush | Oil | 1.6 L | * | 1000 | 1.6 L | 3000 | 16 | 5 |
| 30 | 250 PJ PLURO AN | 3/8" | 3/8" | 3/8" | - | 1" | 1" | 3/8" | 3/8" | 1" | - | - | Bush | Bush | Oil | 1.6 L | * | 1000 | 1.6 L | 3000 | 16 | 5 |

**CG: Compound Ground; PG: Pressure Gauge; AC: Air Cock; CDD: Casing Drain (Delivery); GD: Gland Drain; PM: Priming; CDS: Casing Drain (Suction); OD: Oil Drain; OLI: Oil Level Indicator; MD: Middle body Drain;**

*** – While refilling of oil lubricated bush bearing level of oil to be checked through oil window at site at every 1000 hrs of running and accordingly the oil to be refilled up to center of oil level window as shown in below figure**

**** – Lubrication of bearings to be replaced after run of 3000 hours or 4 months whichever is earlier**

**Level of Oil in the bearing housing should always be maintained up to the shown level**

## 9.2 Overhaul maintenance

### 9.2.1 General information

After a long period of service, wear will occur in parts of the pump, necessitating the renewal of a few components. Logbook records will indicate wear as gradual deterioration of performance is noticed. Once this is known, pumps should be taken for overhaul. It is recommended that yearly stripping & checking of wear & tear and clearances should be done and overhauling where required.

If related pair of components show a marked degree of wear in relation to the rest of the unit, then it may be sufficient to renew only the heavily worn components. If the wear is uniform throughout the pump, then all wearable components may require renewal.

Measurements should be taken and recorded of all wearable components at the first, and every subsequent overhaul period.

Reference to these records will enable an accurate assessment of the rate of wear to be made, and a reasonably accurate forecast regarding when a particular component may require renewal can be made.

**NOTE:**

The figures given in the table are only valid if the wear rings and the impeller are made with in the same materials of low galling tendencies. For materials with higher galling tendencies (AISI 304/316 etc...), higher clearance is provided (0.125 mm to be added to given values).

| Internal nominal diameter of the wear ring (mm) | Nominal gap at the diameter (mm) |
|---|---|
| 65 | 0.30 |
| 100 | 0.38 |
| 150 | 0.45 |
| 200 | 0.50 |
| 250 | 0.55 |
| 300 | 0.60 |
| 350 | 0.65 |

Information regarding original design dimensions and clearances is furnished in data sheet. Any other information, if needed, can be requested from Service Department, WILO Mather and Platt. Such request must quote name plate number and type of the pump in question.

- The parts most likely to be affected are:
- Impeller
- Mechanical seal
- Neck Rings
- Sleeves
- Stuffing Box Bush
- Bearings
- Coupling Bushes/ membrane set

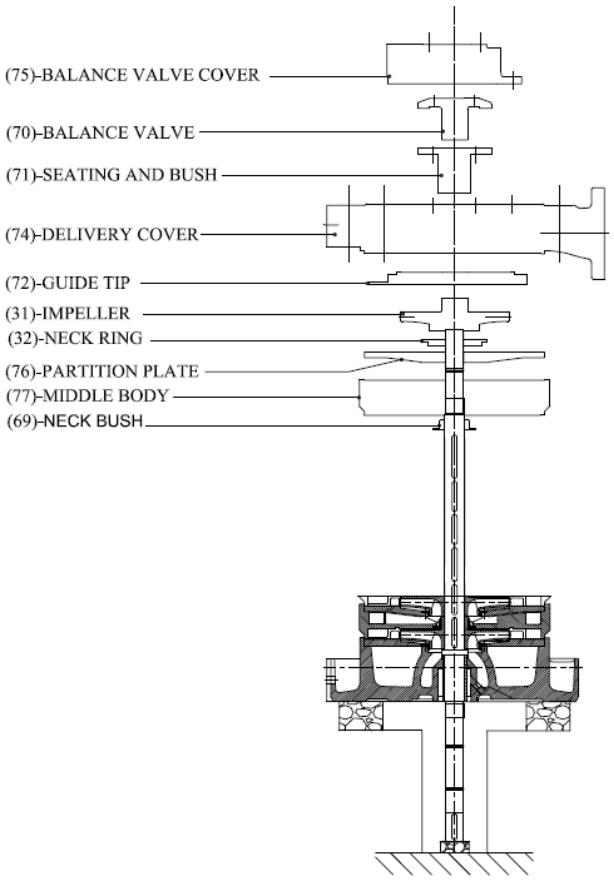
Before commencing dismantling operations, ensure that the following tools and tackles are available:

- A crane / chain pulley block suitable for handling the weight of pumping unit.
- A selection of ring and open-ended spanners in
- Metric sizes.
- Eyebolts in Metric sizes.
- Cotton rope, wire rope and slings.
- Hardwood and metal packing blocks.
- Miscellaneous tools including a set of Allen keys, drills, pin drivers, files etc.
- Extractor / puller for bearing and coupling.
- The torque value to be set for a particular size of screw is dependent upon:
- Material of screw
- Parent metal
- Whether the screw is untreated or plated
- Whether the screw is dry or lubricated
- The depth of the thread
- (See table Pg. No. 39 for values)

## 9.3 Disassembling the pump

### 9.3.1 Disassembling of Plurovane pump

- Isolate the pump motor electrically.
- Isolate the pump system by closing suction and delivery valve.
- Remove the bearing housing. If bearing is fitted it will have to be drawn off with the help of suitable tackle. Before removing the roller bearings, mark location of bearing from the end of the shaft so that it can be refitted at the correct place while reassembly.
- Remove the balance valve cover (75)
- Remove sleeve nuts. Then remove sleeve.
- Withdraw balance valve (70) utilizing threaded holes provided in the valve.
- Remove the stay bars of the pump. If pumps are stripped in horizontal position, pack the middle bodies so that removal of delivery end cover (74) will not allow the pump to drop.
- Draw out the end cover over the spindle.
- Remove balance valve key from the shaft. Then remove combined seating and bush (71)
- The delivery end impeller (31) should then be removed carefully. Removal of subsequent impellers and middle bodies is affected in exactly the same way. Each impeller and key are stamped with a number to enable it to be re-assembled in the same sequence.




**Assembly / Disassembly sequence for PLUROVANE Pump**

- The partition plates(76) which are an easy, fit in the middle bodies and guide tips can be easily removed from the middle bodies. A few sharp blows on the middle bodies may become necessary to achieve this.
- To remove the shaft from the suction, cover the coupling must be removed first.
- If difficulty is observed in removal of the impeller (31), apply heat uniformly over the impeller shrouds inwards towards the hub.

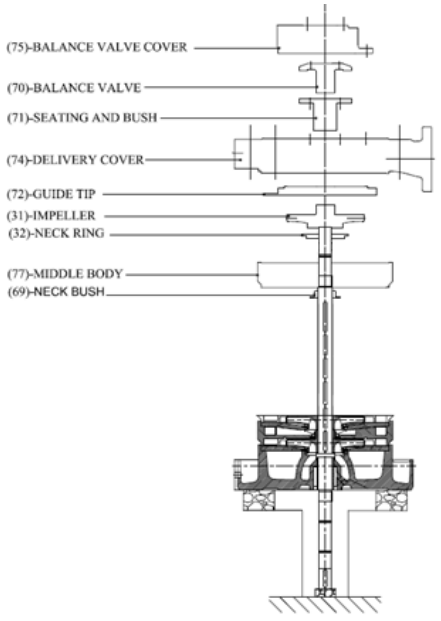
### 9.3.2 Disassembling of RN pump

- Isolate the pump motor electrically.
- Isolate the pump system by closing suction and delivery valve.
- Remove the bearing housing. If bearing is fitted it will have to be drawn off with the help of suitable tackle. Before removing the roller bearings, mark location of bearing from the end of the shaft so that it can be refitted in the correct place at the time of reassembly.
- Remove the stuffing box cover (11)
- Remove the combined sleeve & lock nut (66)
- Withdraw balance valve (70) utilizing threaded holes provided in the valve.
- Remove the stay bars (88) of the pump. If pumps are stripped in horizontal position, pack the middle bodies so that removal of delivery end cover (74) will not allow the pump to drop.
- Draw out the end cover over the shaft.
- Remove balance valve key (86) from the shaft. Then remove balance valve seat (71)

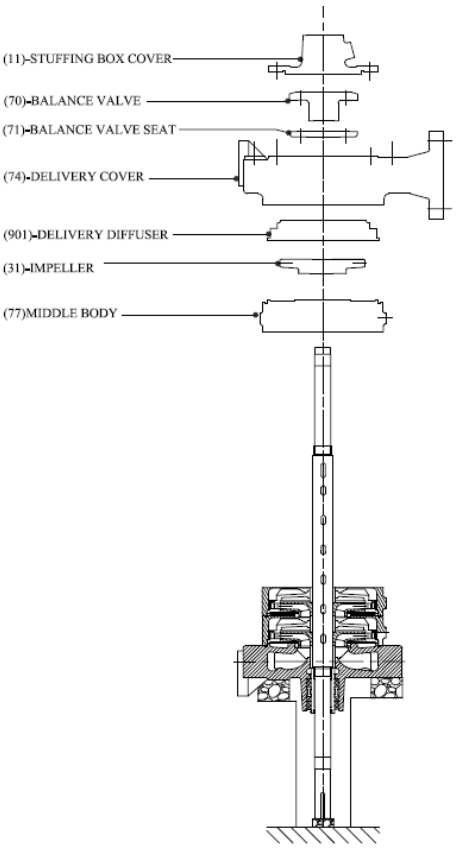
- The delivery end impeller (31) should then be removed carefully. Removal of subsequent impellers and middle bodies is affected in exactly the same way. Each impeller and key are stamped with a number to enable it to be re-assembled in the same sequence
- To remove the shaft from the suction, cover the coupling has to be removed first.

### 9.3.2 Disassembling of IPB pump

- Isolate the pump motor electrically.
- Isolate the pump system by closing suction and delivery valve.
- Remove the bearing housing. If bearing is fitted it will have to be drawn off with the help of suitable tackle. Before removing the roller bearings, mark location of bearing from the end of the shaft so that it can be refitted at the correct place while reassembly.
- Remove the balance valve cover (75)
- Remove sleeve nuts. Then remove sleeve.
- Withdraw balance valve (70) utilizing threaded holes provided in the valve.
- Remove the stay bars of the pump. If pumps are stripped in horizontal position, pack the middle bodies so that removal of delivery end cover (74) will not allow the pump to drop.
- Draw out the end cover over the spindle.
- Remove balance valve key from the shaft. Then remove combined seating and bush (71)
- The delivery end impeller (31) should then be removed carefully. Removal of subsequent impellers and middle bodies is affected in exactly the same way. Each impeller and key are stamped with a number to enable it to be re-assembled in the same sequence.
- To remove the shaft from the suction, cover the coupling has to be removed first.
- If difficulty is observed in removal of the impeller, apply heat uniformly over the impeller shrouds inwards towards the hub.




**Assembly / Disassembly sequence of IPB Pumps.**




**Assembly / Disassembly sequence of RN Pumps.**

### 9.4 Examination of Internal components

With the disassembled rotating element, the internal components and clearances can be checked.

### 9.4.1 Neck Ring

Use an internal micrometer to measure the bore of neck ring, taking measurements at intervals around the circumference to check for uneven wear. A comparison between this dimension and that of the impeller neck will indicate the amount of diametrical clearance between the casing neck ring and the impeller neck. If this clearance is 150% or more than the original design clearance, or if the deterioration in hydraulic performances has been such that no further deterioration can be tolerated during the next operation period.

The impeller to neck ring clearance must be restored to the original design value by changing the neck ring and impeller where required. (Ref. Table on Pg. No. 23)

### 9.4.2 Shaft sleeves

The shaft sleeve should be examined to see if it is grooved or generally worn. The outside diameter of the sleeve should be measured, and a comparison made with the bore of the balance valve cover or bore of suction cover through which the sleeve passes. The amount of clearance between the two can thus be checked to determine whether or not it is within acceptable limit.

### 9.4.3 Impeller

A) Inspect the impeller as follows:

- Examine the impeller for damage
- For corrosive/erosion pitting
- Cavitation pitting
- Bent or cracked vanes, inlet and outlet vane end wear.

Any of the above may be repaired, or if damage is extensive, impeller may need replacement. Further information should be sought from Service Dept., Pune before any decision on repair work is taken.

B) Examine around the eye at neck portion for grooving in alignment with spindle axis; slight grooving is acceptable, but deep or profuse grooving must be remedied by machining the impeller by taking a polish cut on neck diameter.

To check wear, around the impeller neck, use precision instruments such as outside micrometer to accurately measure the outside diameter. Measurements should be taken at intervals around the circumference to check the uneven wear. Differences between the neck OD and the neck bush ID measured will give us the clearance between the two. Clearance thus obtained should not be more than 150% of maximum designed clearance. (Ref. Table on Pg. No. 23)

### 9.4.4 Bearings

The Bearings fitted on the Ring section pumps range are grease Lubricated for different Models. For list refer the chart. Steps to follows during Ball bearing checking

- Clean all the components using clean white spirit. Do not use chlorinated solvents such as trichloroethylene and carbon tetrachloride because they introduce a corrosion risk when used on ferrous materials.
- Visually inspect the bearing. The balls, the inner and outer tracks must all be free from chipping, cracks, abrasions or discoloration.
- Check that the parts of the cage are firmly fixed together.
- Visually inspect the bore for any sign of damage. Burrs or any scratches caused during bearing withdrawal should be carefully removed by hand application of a fine oilstone, the treatment being confined to the minimum possible area.
- Visually inspect the outside diameter for signs of fretting, any stains may be carefully polished off, but abrasion must be kept to the absolute minimum that is required, followed by cleaning.
- Check that bearing rotates freely and smoothly. If there is any doubt regarding the serviceability of the bearing it should be renewed.
- Inspect the Bearing Cage as follows:
- Visually inspect the bore for any signs of fretting, any stains may be carefully polished off, but abrasion must be kept to the absolute minimum that is required, followed by cleaning.
- Where fretting has occurred, bearing and housing should be clean and dry, and trial assembled. It is a transitional fit and may be described as a sucking fit without any detectable clearance or play between the outer race and the housing bore. Any assembly, which achieves this, may be considered as being acceptable, provided the bearing is serviceable.

**NOTE:**

An incorrect fit can allow one or both bearing tracks to creep, which will affect the running accuracy and the assembly and dismantling of a pump. Creep is the slow rotation of one track relative to its seating, it is undesirable since the spindle and the bore of the bearing or the housing and the outside diameter of the bearing may become worn. Creep is not due to friction within a bearing but is generally caused due to radial loads rotating or oscillating in respect to fixed point on the track. If creep has occurred the interference fit of the bearing must be restored, either by metal spraying or chromium plating and regrinding the seating to the correct diameter; interference fits must not simulated by knurling, scoring or distortion of the seating on which creep has occurred because such practices are ineffective and creep will quickly reoccur.

Even if the bearing is prevented from creeping it will usually be distorted by the seating, and failure will result caused by local overloading and high frequency vibration.

- Examine the abutment. Abutment for ball bearings must be flat and square with the axis-of rotation.

The radius at the root of an abutment must be smaller than the corner radius of the track located against the abutment. The edge of the abutment must be reduced or chamfered; a burred edge can tilt or distort a bearing track.

- If after inspection, the bearing is reusable, completely coat all parts with a rust preventive oil, working it well into the internal parts of the bearing. Wrap in clean greaseproof paper and store until required for replacement or refit on to the spindle if needed. In case of immediate use, coating of rust preventive oil is not necessary.

### 9.4.5 Journal Bearings

Under normal conditions the shaft journals of the rotating element are uniformly loaded and provided that an adequate supply of clean oil is maintained with the bearing housings, the bearing will usually operate until wear is approximately 150% the original design clearance without detriment to mechanical performance of the pump.

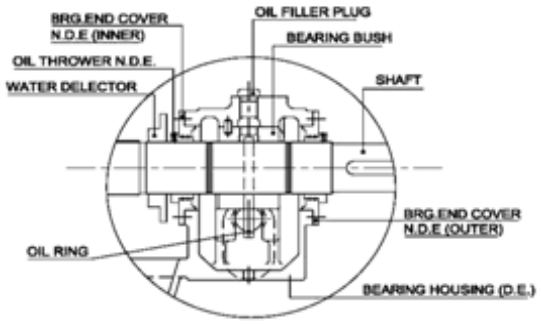
The most positive indication of the loss in bearing efficiency will be given by an increase in level of vibration. This increase may be gradual and difficult to detect or sudden and prominent. But when an increase is detected the reason must be investigated because it is a symptom that the bearings may require renewal even if the allowable degree of wear previously indicated has not been reached.

The white metal lined bearing bushes should be inspected for:

- Excessive clearance by measuring clearance between shaft journal and bush bearing.
- Deep axial or radial grooving which can lead to interrupted oil supply.
- Chipping of white metal lining. If clearance has become excessive or if bearing is not usable the same must be renewed.

After renewing the bushes, blue matching must be achieved with the shaft to ensure uniform contact.

Also check clearances and maintain the record.



BUSH BRG.OIL LUBRICATED ARRGT.

### 9.4.6 Balance valve and balance valve setting

If the balance valve and its' seating have become worn in service, it may be necessary to reface them. The machining of the faces must be exactly square with the bore and the finish must be very finest to produce a smooth face.

### 9.4.7 Mechanical seal

Ensure that the sliding face do not present any scratches or abnormal wear. Verify that the driving collar is well screwed on the shaft at the right place. Check that no material blocks the spring action.

## 9.5 Reassembling the pump

### 9.5.1 Plurovane pumps

- Before re-building, all joint faces should be thoroughly cleaned and all burrs removed from the ends of Impeller bosses, sleeves and sleeve nuts, as it is essential that all faces meet squarely to avoid a bent shaft. It is easier to assemble the pump in two phases.
- First phase consists of sub-assembly of middle bodies and the second phase assembly of these sub-assemblies
- A guide tip is fitted on one side of the middle body and is located by a locating pin. The partition plate is fitted on the other side of the middle body. Suction plate is fitted to the suction cover. Neck ring and neck bush are fitted to partition plate and middle body respectively, by grub screws.
- Support the suction cover in its horizontal position. Drop the shaft through the suction cover and let the shaft rest on a jack. Fit the first impeller key and push the first impeller up home against a locating collar of the shaft. Spread a thin coating of jointing compound, evenly over the comers formed by the suction cover and the suction plate. (A mixture of Red Lead and boiled oil is generally satisfactory), and then place the first middle body assembly in position over the impeller. The body should fall quite easily into its spigots and from this point the process is repeated. Care should be taken to see that the vents of the middle bodies are correctly set on top of the casing.
- When delivery end cover has been fitted, body bolts should be inserted and pinched up, and pump should now be turned into horizontal position and then the body bolts and nuts should be tightened evenly, working diagonally across the cover and tightening each nut a little at a time to prevent uneven strain and to bring the face of the end cover square with the axis of the pump. The shaft should now be adjusted so that the impeller is in the correct running position. The ideal running position is with the centerline of the impeller corresponding with the centerline of the guide tips. As some wear of balance valve will take place, it is advisable to displace the rotor from this central position towards the delivery end of the pump. The amount of displacement should be half the permissible balance valve wear. With the rotor in this position, fit the balance valve such that the face of its stock is in contact with the impeller hub and valve face touches seating face. Then mark shaft as shown in Assembly/Disassembly sequence for PLUROVANE pump Figure.
- Shaft sleeves and sleeve nuts can then be fitted in that order. Balance valve cover and bearing housing should then be mounted. The bearing housing and balance valve cover are located by means of dowel pins and these should be tapped home before tightening the bearing housing. After replacement of the bearing, the concentricity of the sleeves in the stuffing boxes should be checked.

### 9.5.2 RN Pumps

- Before re-building, all joint faces should be thoroughly cleaned and all burrs removed from the ends of Impeller bosses, sleeves and sleeve nuts, as it is essential that all faces meet squarely to avoid a bent shaft. It is easier to assemble the pump in two phases. First phase consists of sub-assembly of middle bodies and the second phase assembly of these sub-assemblies
- Support the suction cover in its horizontal position. Drop the shaft through the suction cover and let the shaft rest on a jack. Fit the first impeller key and push the first impeller up home against a locating collar of the shaft. Spread a thin coating of jointing compound, evenly over the comers formed by the suction cover and the suction plate. (A mixture of Red Lead and boiled oil is generally satisfactory), and then place the first middle body assembly in position over the impeller. The body should fall quite easily into its spigots and from this point the process is repeated. Care should be taken to see that the vents of the middle bodies are correctly set on top of the casing.
- When delivery end cover has been fitted, body bolts should be inserted and pinched up, and pump should now be turned into horizontal position and then the body bolts and nuts should be tightened evenly, working diagonally across the cover, and tightening each nut a little at a time to prevent uneven strain and to bring the face of the end cover square with the axis of the pump. The shaft should now be adjusted so that the impeller is in the correct running position. The ideal running position is with the centerline of the impeller corresponding with the centerline of the Diffuser. As some wear of balance valve will take place, it is advisable to displace the rotor from this central position towards the delivery end of the pump. The amount of displacement should be half the permissible balance valve wear. With the rotor in this position, fit the balance valve such that the face of its stock is in contact with the impeller hub and valve face touches seating face. Then mark shaft as in Assembly/Disassembly sequence for RN pump figure.

- Combined sleeve can then be fitted in that order. Balance valve cover and bearing housing should then be mounted. The bearing housing and balance valve cover are located by means of dowel pins and these should be tapped home before tightening the bearing housing. After replacement of the bearing, the concentricity of the sleeves in the stuffing boxes should be checked.

### 9.5.3 Balance valve setting (RN 50, RN 65, RN 80, RN 100, RN 100A, RN 125A, RN 150) and Plurovane pumps

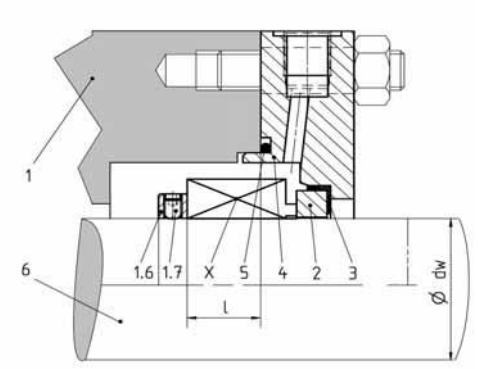
- Fit the seating on the face of the delivery end cover and see that the holding screws are tight.
- Insert the balance valve and push hard up against the hub of the last impeller. Follow with the shaft sleeved and fasten up the whole rotating element endwise with sleeve nuts.
- Push the rotating element over until the balance valve and seating faces are in contact and note the position of the reference point 'T' previously marked, It will be necessary to adjust the length of the balance valve stalk to make this reference point 'T' flush with outer bearing cover when the balance valve is in contact with the seating.
- Having decided upon the amount of adjustment necessary, remove the valve once more and take off the appropriate amount of stalk. Replace the valve and complete the assembly.
- The following table gives the limits of balance valve wear, which must not be exceeded. When the amount of wear reaches the figure shown in the table below, the balance valve must be reset in accordance with the instructions given above.
- [Refer Annexure-1 Fig A-3, A-4]

| Model | Size of Pumps (in) | Movement (mm) |
|---|---|---|
| HS PLURO Pumps | 1.5 | 2 |
| | 2 | 2 |
| | 2.5 | 2 |
| | 3 | 2.5 |
| PB/PJ PLURO Pumps | 0 | 2.2 |
| | I | 2.5 |
| | IA | 3 |
| | II | 2.5 |
| | IIA | 3.5 |
| | III | 4 |
| RN Pumps | 50 | 2 |
| | 65 | 2 |
| | 80 | 2 |
| | 100 | 2 |
| | 125A | 2.5 |
| | 150 | 2.5 |

### 9.5.4 Reassembly of Pump with Mechanical seal

Procedure for Assembly for mechanical seal pump is similar up to assembly of gland packing pump. The Reassembly of mechanical seal is as follows:

- Extreme cleanliness must be observed during installation, and damage to the seal faces and mounting rings must be avoided
- Place the adjusting ring of mechanical seal at its pre marked position
- Place the grab screw(13) at its position on the adjusting ring, but tight it yet
- The O-rings may be oiled to reduce friction, during installation of the seal. EP-rubber O-rings should not come into contact with oil or grease; In this case lubrication with glycerin or water is recommended.
- Never cover the sliding faces with a lubricant as they must be assembled completely dry, clean and dust-free.
- When pressing in stationary seals, make sure that the pressure distribution is uniform. The O-ring must be fitted using water or alcohol only.
- Crowned drive pins must be replaced whenever the seal is dismantled. During insertion of the stationary seats, especially those of special carbon, care must be taken to exert pressure evenly.
- Now check the distance of seal as shown in the figure and adjust its value as per values given table
- For rest parts follow the above explained procedure as per gland pack version pump




1) Pump casing
2) Stationary seat
3) Stationary seat
4) Gland plate
5) O-ring
6) Shaft

X. Mechanical seal
1.6 Abutment ring
1.7 Abutment ring fixing screw

**NOTE:**
While assembling stainless steel component, molybdenum-disulphide paste should be applied to prevent galling/seizure and also to facilitate easy removal in future.

### 9.6 Recommended spare parts

In case of standard operation, we recommend the following list of spare part regarding the period of functioning.

Then in order to facilitate this operation we strongly recommended purchasing a batch of part with the pump in order to reduce the shutdown timing.

**For 2 years of normal operation**:

- Mechanical seal or Packing, ball bearings and bush bearings required for the dismounting of the pump.

**For 3 years of normal operation**:

- Mechanical seal or Packing, ball bearings and Bush

bearings required for the dismounting of the pump, wear rings and their nuts. For the pumps equipped with Gland packing, include the gland plate and lubrication spacer.

**For 5 years of normal operation:**

Then in order to facilitate this operation we strongly recommended purchasing a batch of spare parts with the pump in order to reduce the shutdown timing.

It is strongly recommended to purchase the original spares parts from WILO Mather and Platt. In order to avoid any mistake, we invite you to supply with any spare parts demand, the information mentioned on the data plate of the pump and / or motor.

## 10 Faults, Causes and Remedies

| | Symptoms | Possible cause of trouble and remedies (Each number is defined in the table below) |
|---|---|---|
| – – | Pump does not deliver water | 1,2,3,4,6,11,14,16,17,22,23 |
| – – | Insufficient capacity delivered | 2,3,4,5,6,7,8,9,10.11.14.17,20,22,23.29,30,31 |
| – – | Insufficient pressure developed | 5,14,16,17,20,22,29,30,31 |
| – – | Pump loses prime after starting | 2,3,5,6,7,8,11,12,13 |
| – – | Pump requires excessive power | 15,16,17,18,19,20,23,24.26,27,29,33,34,37 |
| – – | Stuffing box leaks excessively | 12,13,24,26,32,33,34,35,36,38.39,40 |
| – – | Pump vibrates or it is noisy | 2,3,4,9,10,11,21.23,24,25.26.27,28,30,35,41,42,43, 44,45,46,47 |
| – – | Bearings have short life | 24,26,27,28,35,36,41,42,43,44,45,46,47 |
| – – | Pump overheats and seizes | 1,4,21,22,24.27,28,35,36,41 |

| | Causes | Remedies |
|---|---|---|
| 1 | Pump not primed | Ensure that casing is fully filled, and water comes out from air-cock |
| 2 | Pump or suction pipe not completely | Check leaking foot valve in case of negative suction |
| 3 | Suction lift too high | Reduce by lowering pump elevation or increase Water level |
| 4 | Insufficient margin between pressure | Check that NPSH available is at least 1 meter more 1 meter more than NPSH required |
| 5 | Excessive amount of air in liquid | Check the reasons and eliminate Gas gets entrapped in liquid Air may be entering through suction joints |
| 6 | Air pocket in suction line | Ensure pipe fully filled and there is no bend for negative suction |
| 7 | Air leaks into suction line | Tighten pipe joints with solution |
| 8 | Air leaks into pump through stuffing | Ensure stuffing box sealing |
| 9 | Foot valve too small or leaking | Replace / Attend |
| 10 | Foot valve partially clogged | Clean |
| 11 | Inlet of suction pipe insufficiently | Ensure adequate submergence such that foot valve is not exposed |
| 12 | Water seal pipe clogged | Clean or change |
| 13 | Logging ring is improperly located in | Position logging ring centrally under sealing holes of stuffing |
| 14 | Speed too low | Check motor RPM, supply frequency, Motor nameplate speed should be as specified on pump nameplate |
| 15 | Speed too high | Check motor RPM and supply frequency |
| 16 | Direction of rotating wrong | Check correct direction of rotation for motor before coupling to motor |
| 17 | Total head of system higher than design | Check the causes and refer to M&P Measure with pressure gauge |
| 18 | Total head of system lower than pump | Check the causes and refer to M&P Measure with pressure gauge |
| 19 | Specific gravity of liquid different from | Refer to WILO Mather and Platt |
| 20 | Viscosity of liquid different from design | Refer to WILO Mather and Platt |
| 21 | 0peration at very low capacity | Check the causes and refer to M&P, Operate pump at rated duty |
| 22 | Parallel operation of pumps unsuitable | Refer to WILO Mather and Platt with characteristics curves of pump |
| 23 | Foreign matter in impeller | Open and clean |
| 24 | Misalignment | Check with Dial gauge should be within limits and without undue pipe stresses |
| 25 | Foundations not rigid | Check, vibration on Baseplate, check hollowness |
| 26 | Shaft bent | Dismantle and check, Replace shaft |
| 27 | Rotating part rubbing on stationary part | Incorrect assembly, correct the assembly |
| 28 | Bearing worn | Check lubrication, shaft run out, alignment, replace if required |
| 29 | Wearing rings worn | Replace |
| 30 | Impeller damaged | Replace |
| 31 | Casing gasket defective, permitting internal leakage | Replace |
| 32 | Shaft or shaft sleeves worn or scored at | Replace |
| 33 | Packing improperly installed | Use correct grade and size of packing |
| 34 | Type of packing incorrect for operating condition | Use correct grade and size of packing |

| | Causes | Remedies |
|---|---|---|
| 35 | Shaft running' out of center because of worn bearings or misalignment | Rectify |
| 36 | Rotor out of balance, causing vibration | Balance the rotor |
| 37 | Gland too tight, resulting in no flow of liquid to lubricate packing | Adjust gland Ensure sealing water flow |
| 38 | Cooling liquid not being provided to water- cooled stuffing boxes | Provide |
| 39 | Excessive clearance at bottom of stuffing box between shaft and casing, causing packing to be forced into the pump | Check pumps assembly |
| 40 | Dirt or grit in sealing, liquid leading to scoring of shaft or shaft sleeve | Provide clean liquid for flushing |
| 41 | Excessive thrust caused by mechanical failure inside pump or by failure of hydraulic balancing device, if any (in case of multistage pump etc.) | Check pump operation and assembly |
| 42 | Excessive grease or oil in antifriction bearing housing or lack of cooling, causing excessive bearing temperature | Attend |
| 43 | Lack of lubrication | Provide proper lubrication |
| 44 | Improper installation of antifriction | Rectify or replace bearing |
| 45 | Dirt in bearings | Investigate the cause and clean bearing |
| 46 | Rusting of bearings from water in housing | Arrest water ingress |
| 47 | Excessive cooling of water-cooled bearing, resulting in condensation of atmospheric moisture in bearing housing | Reduce cooling water flow |

## 11 Decommissioning and recycling

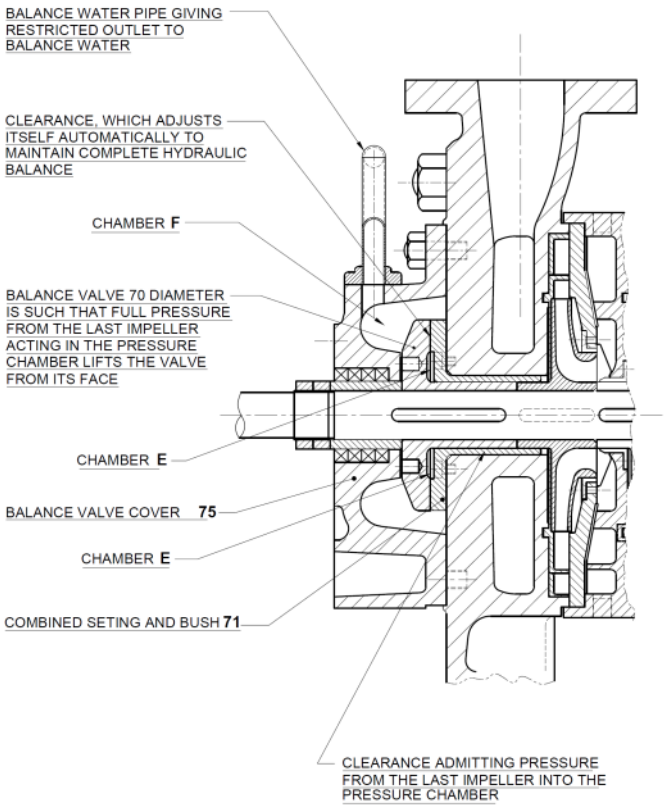
The disposal of all material or debris must be done in order to protect the environment.
The WILO Mather and Platt's pumps do not contain any dangerous substances. The major part of the pump is recyclable.

The disposal and recycling of the pump sets must be done in accordance with the local in force regulations. The dismounting must be done by qualified personal.

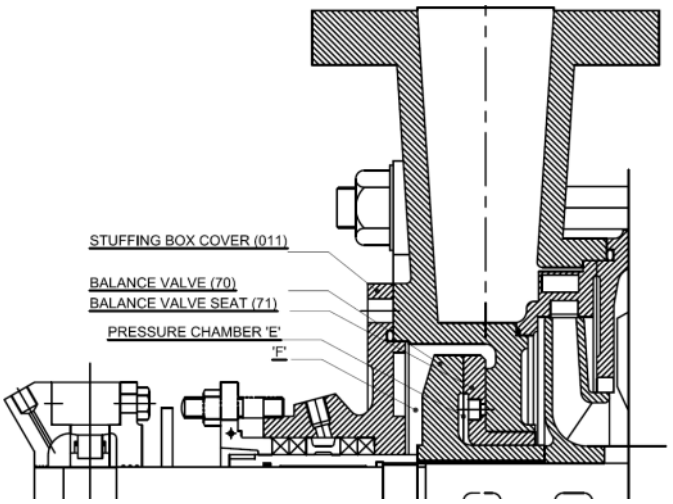
Cleaning and decontamination must be achieved before any transportation or recycling

## Annexture–1

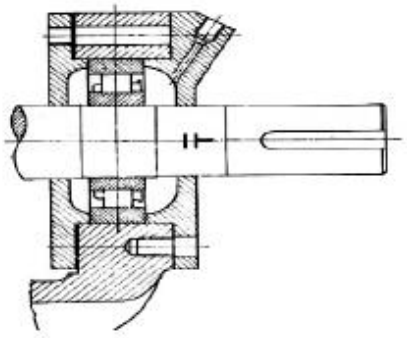
**General arrangement of Balance valve for PLUROVANE pumps [Fig. A–1]**



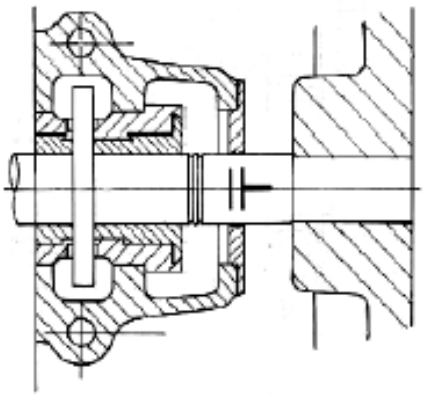

**General arrangement of Balance valve for RN pumps [Fig. A–2]**




**'T' type Balance valve wear Indicator for PLURO Pumps [Fig. A-3]**

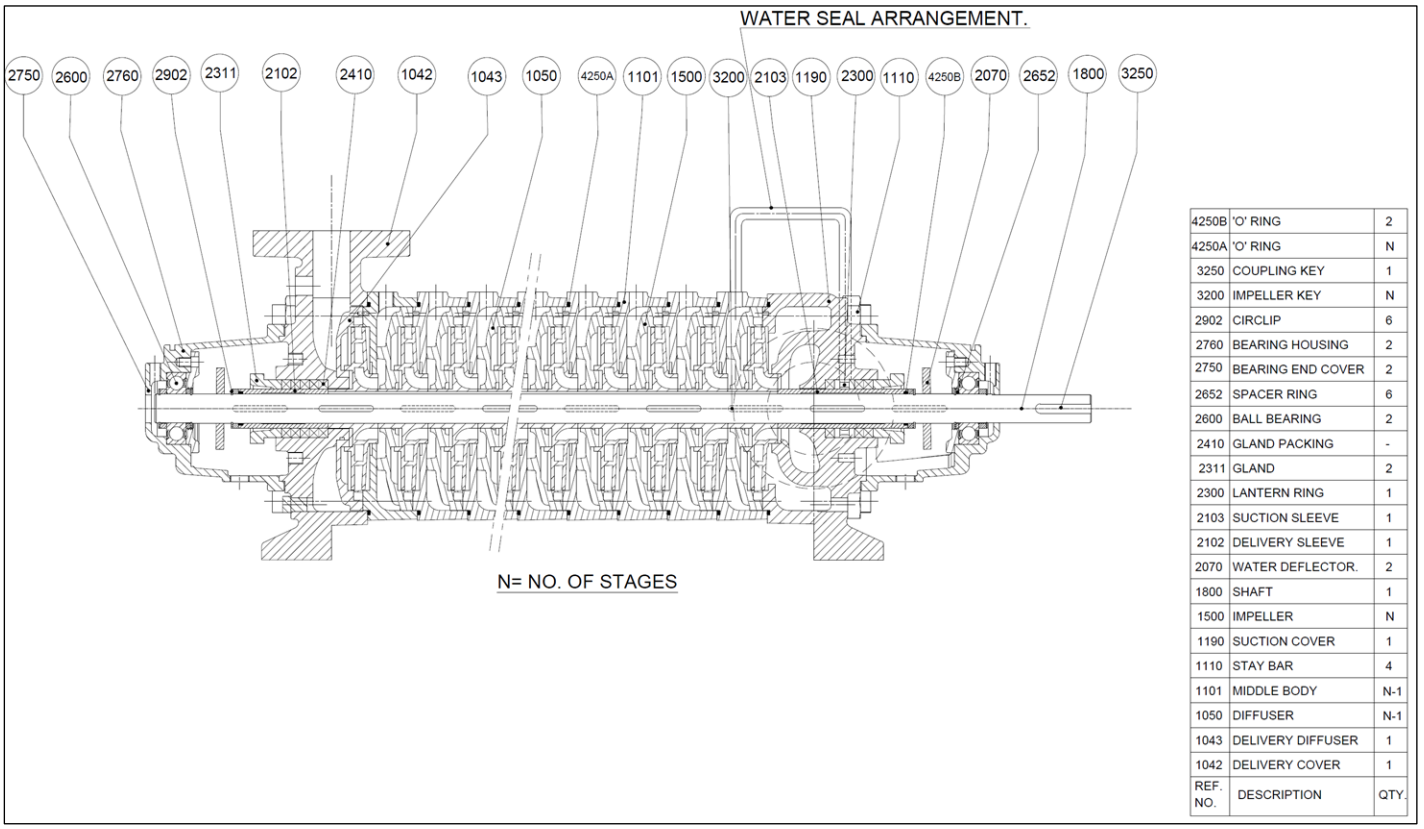


**'T' type Balance valve wear indicator for RN pumps [Fig. A-4]**



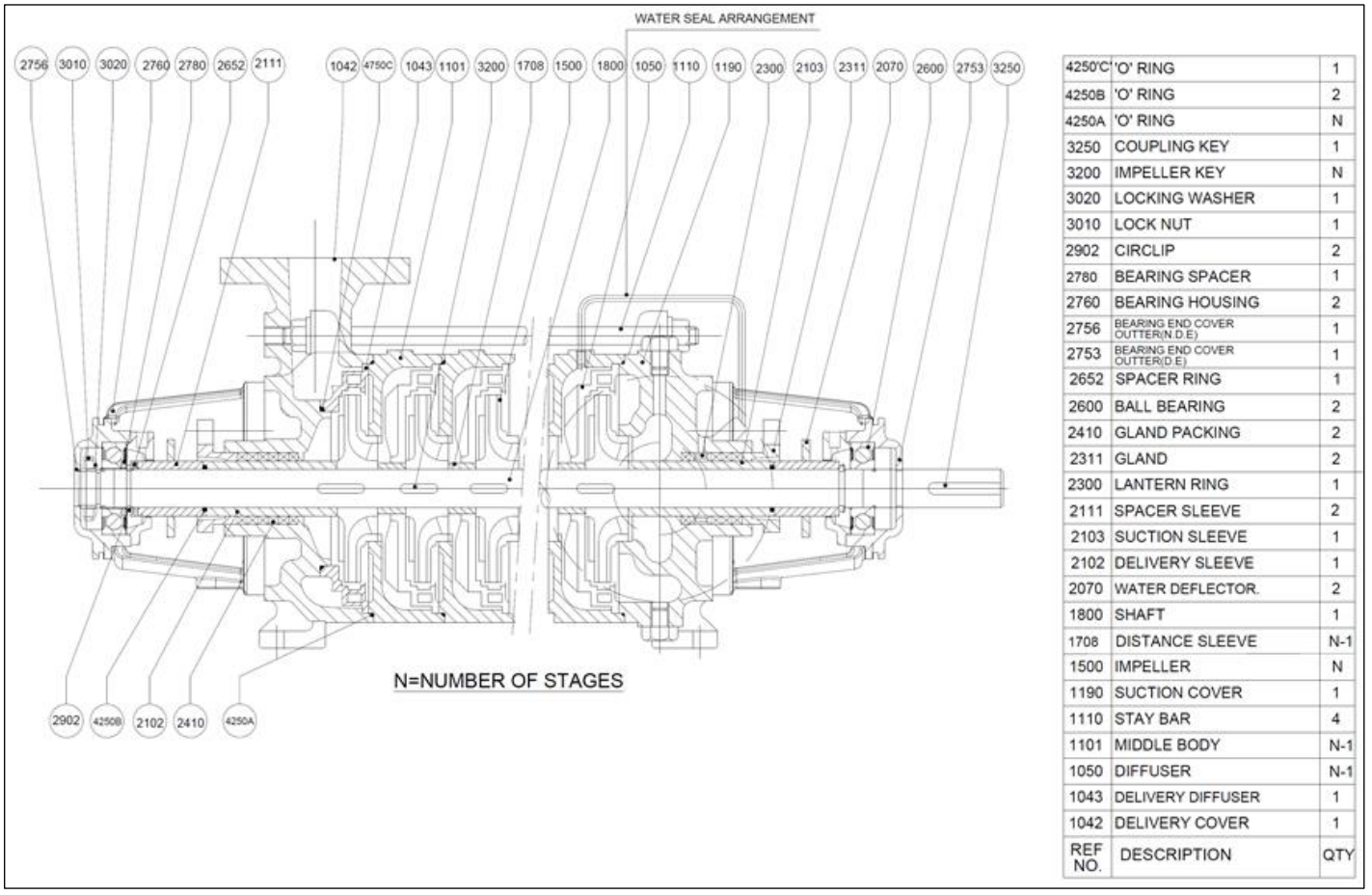
## Annexure-2 Cross Sectional Drawings:

## RN 32 Pump (for ref. only)



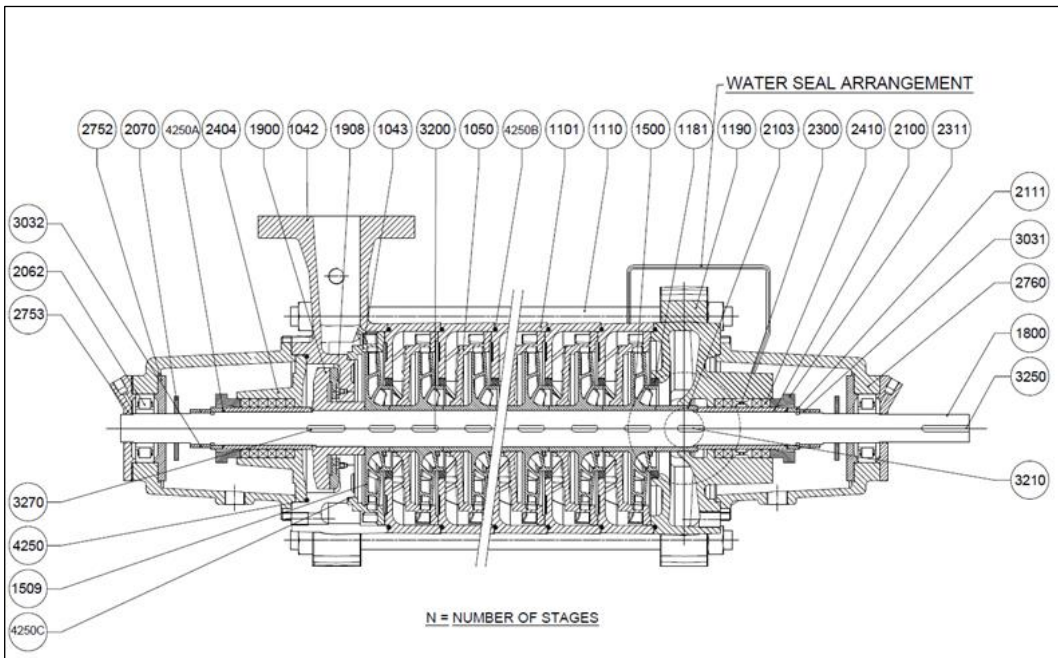

| REF. NO. | DESCRIPTION | QTY. |
|---|---|---|
| 4250B | 'O' RING | 2 |
| 4250A | 'O' RING | N |
| 3250 | COUPLING KEY | 1 |
| 3200 | IMPELLER KEY | N |
| 2902 | CIRCLIP | 6 |
| 2760 | BEARING HOUSING | 2 |
| 2750 | BEARING END COVER | 2 |
| 2652 | SPACER RING | 6 |
| 2600 | BALL BEARING | 2 |
| 2410 | GLAND PACKING | - |
| 2311 | GLAND | 2 |
| 2300 | LANTERN RING | 1 |
| 2103 | SUCTION SLEEVE | 1 |
| 2102 | DELIVERY SLEEVE | 1 |
| 2070 | WATER DEFLECTOR. | 2 |
| 1800 | SHAFT | 1 |
| 1500 | IMPELLER | N |
| 1190 | SUCTION COVER | 1 |
| 1110 | STAY BAR | 4 |
| 1101 | MIDDLE BODY | N-1 |
| 1050 | DIFFUSER | N-1 |
| 1043 | DELIVERY DIFFUSER | 1 |
| 1042 | DELIVERY COVER | 1 |

## RN 40 Pump (for ref. only)



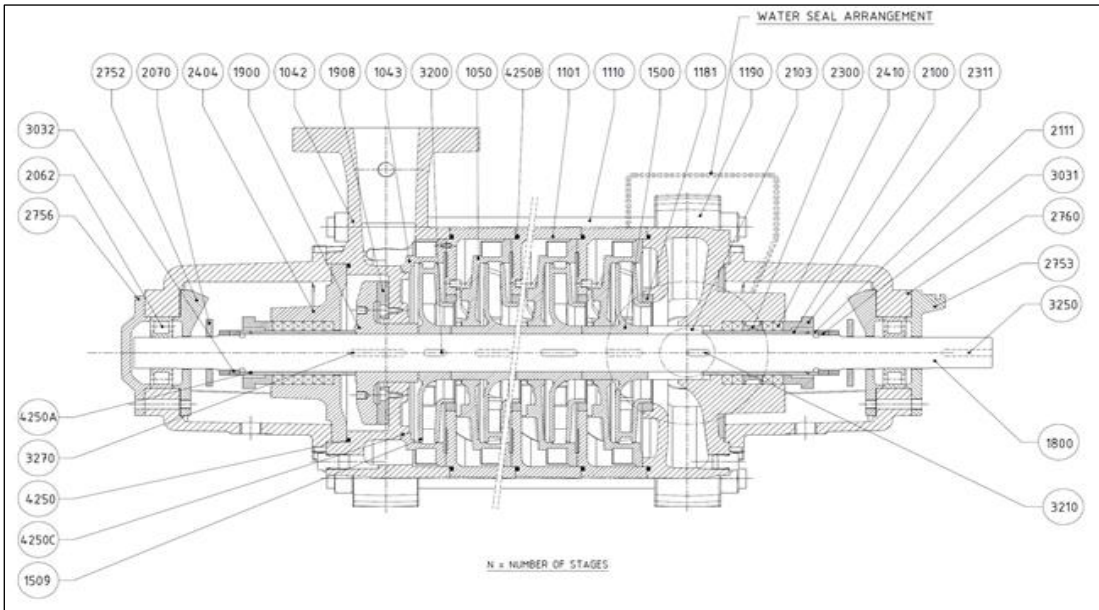

| REF NO. | DESCRIPTION | QTY |
|---|---|---|
| 4250'C' | 'O' RING | 1 |
| 4250B | 'O' RING | 2 |
| 4250A | 'O' RING | N |
| 3250 | COUPLING KEY | 1 |
| 3200 | IMPELLER KEY | N |
| 3020 | LOCKING WASHER | 1 |
| 3010 | LOCK NUT | 1 |
| 2902 | CIRCLIP | 2 |
| 2780 | BEARING SPACER | 1 |
| 2760 | BEARING HOUSING | 2 |
| 2756 | BEARING END COVER OUTTER(N.D.E) | 1 |
| 2753 | BEARING END COVER OUTTER(D.E) | 1 |
| 2652 | SPACER RING | 1 |
| 2600 | BALL BEARING | 2 |
| 2410 | GLAND PACKING | 2 |
| 2311 | GLAND | 2 |
| 2300 | LANTERN RING | 1 |
| 2111 | SPACER SLEEVE | 2 |
| 2103 | SUCTION SLEEVE | 1 |
| 2102 | DELIVERY SLEEVE | 1 |
| 2070 | WATER DEFLECTOR. | 2 |
| 1800 | SHAFT | 1 |
| 1708 | DISTANCE SLEEVE | N-1 |
| 1500 | IMPELLER | N |
| 1190 | SUCTION COVER | 1 |
| 1110 | STAY BAR | 4 |
| 1101 | MIDDLE BODY | N-1 |
| 1050 | DIFFUSER | N-1 |
| 1043 | DELIVERY DIFFUSER | 1 |
| 1042 | DELIVERY COVER | 1 |

## RN 50, 50A & 65 Pumps (for ref. only)



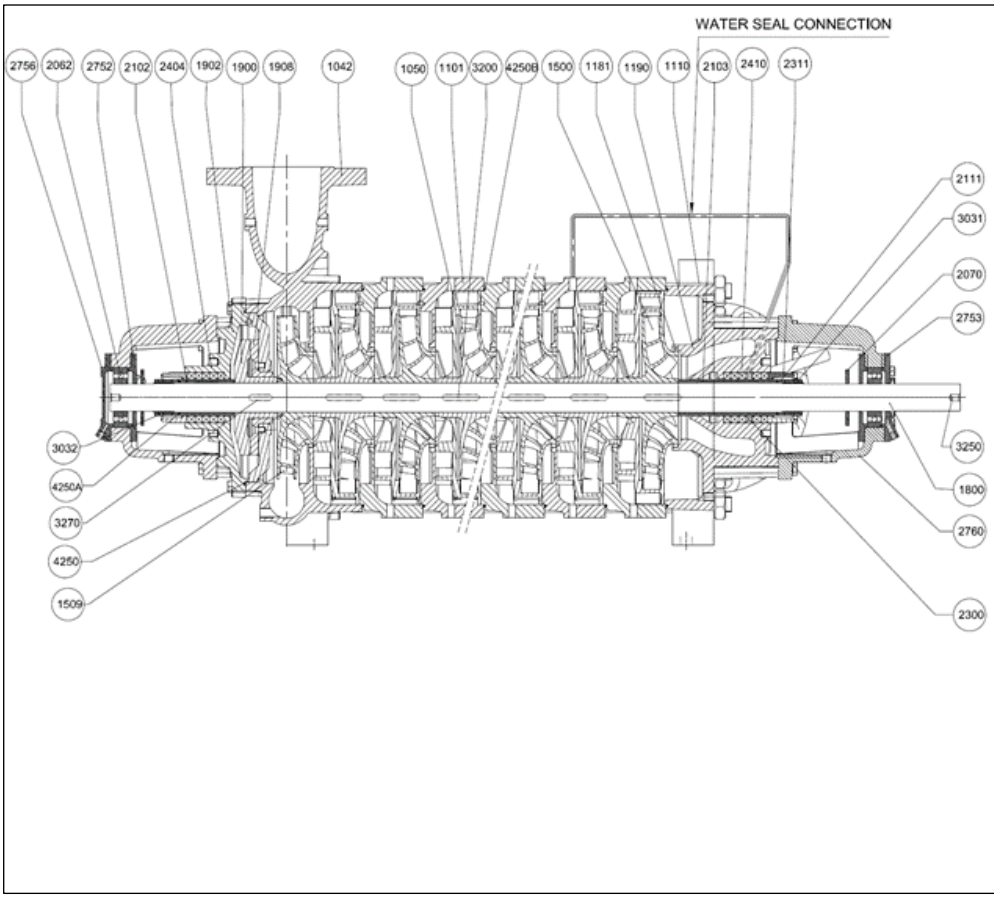

| SR. NO. | DESCRIPTION | QTY |
|---|---|---|
| 4250C | 'O' RING. | 1 |
| 4250B | 'O' RING. | N |
| 4250A | 'O' RING. | 2 |
| 4250 | 'O' RING. | 1 |
| 3270 | BALANCE VALVE KEY. | 1 |
| 3250 | COUPLING KEY. | 1 |
| 3210 | SLEEVE KEY. | 1 |
| 3200 | IMPELLER KEY. | N |
| 3032 | SLEEVE NUT (RH) | 2 |
| 3031 | SLEEVE NUT (LH) | 2 |
| 2760 | BEARING HOUSING. | 2 |
| 2753 | BEARING END COVER (OUTER). | 2 |
| 2752 | BEARING END COVER (INNER). | 2 |
| 2410 | GLAND PACKING. | - |
| 2404 | STUFFING BOX COVER. | 1 |
| 2311 | GLAND | 2 |
| 2300 | LANTERN RING. | 1 |
| 2111 | SPACER SLEEVE. | 2 |
| 2100 | SLEEVE. | 2 |
| 2103 | SUCTION SLEEVE. | 1 |
| 2070 | WATER THROWER. | 2 |
| 2062 | CYLINDRICAL ROLLER BEARING. | 2 |
| 1908 | BALANCE VALVE SEAT. | 1 |
| 1900 | BALANCE VALVE. | 1 |
| 1800 | SHAFT. | 1 |
| 1509 | DELIVERY IMPELLER. | 1 |
| 1500 | STANDARD IMPELLER. | N-1 |
| 1190 | SUCTION COVER. | 1 |
| 1181 | NECK RING. | N |
| 1110 | STAY BAR. | 8 |
| 1101 | MIDDLE BODY. | 4 |
| 1101 | MIDDLE BODY. | 8 |
| 1050 | STANDARD DIFFUSER | 12 |
| 1043 | DELIVERY DIFFUSER. | 1 |
| 1042 | DELIVERY COVER. | 1 |

## RN 80 Pump (for ref. only)



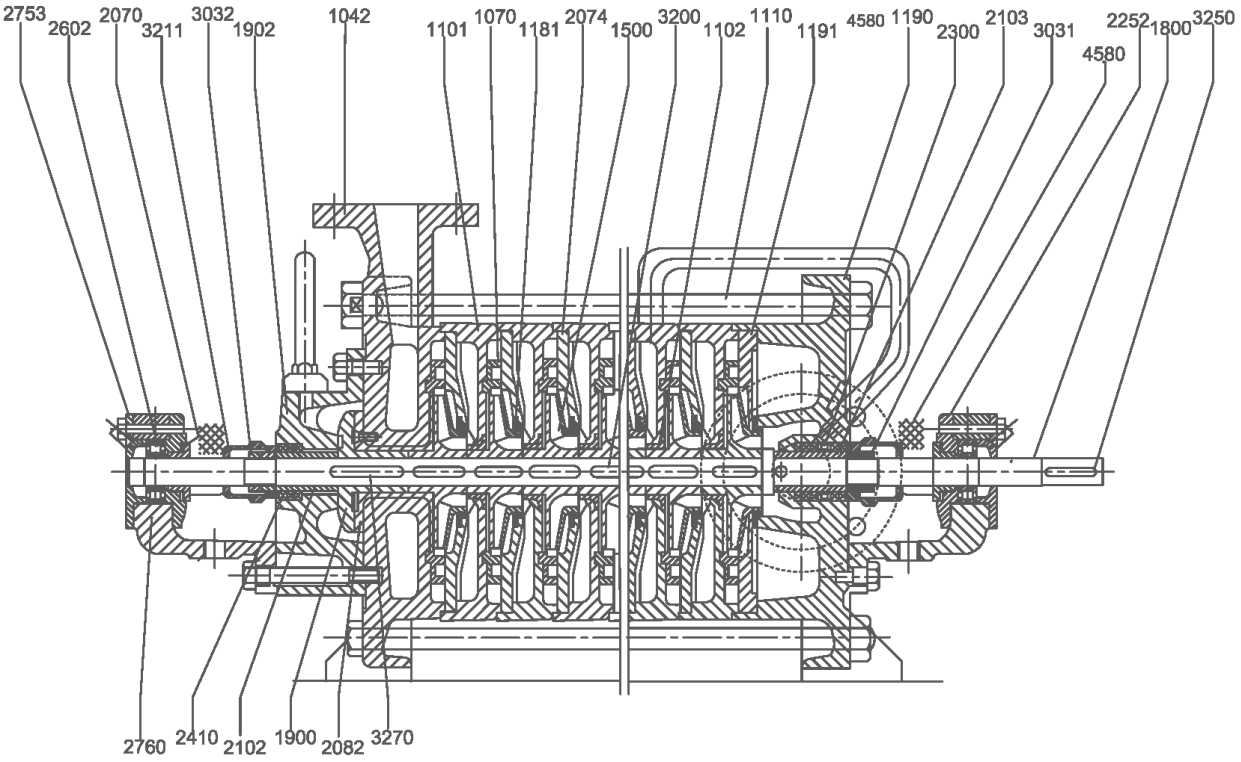

| SR. NO. | DESCRIPTION | QTY. |
|---|---|---|
| 4250C | 'O' RING. | 1 |
| 4250B | 'O' RING. | N |
| 4250A | 'O' RING. | 2 |
| 4250 | 'O' RING. | 1 |
| 3270 | BALANCE VALVE KEY. | 1 |
| 3250 | COUPLING KEY. | 1 |
| 3210 | SLEEVE KEY. | 1 |
| 3200 | IMPELLER KEY. | N |
| 3032 | SLEEVE NUT (RH) | 2 |
| 3031 | SLEEVE NUT (LH) | 2 |
| 2760 | BEARING HOUSING. | 2 |
| 2756 | BEARING END COVER (OUTER NDE). | 1 |
| 2753 | BEARING END COVER (OUTER DE). | 1 |
| 2752 | BEARING END COVER (INNER). | 2 |
| 2410 | GLAND PACKING. | - |
| 2404 | STUFFING BOX COVER. | 1 |
| 2311 | GLAND | 2 |
| 2300 | LANTERN RING. | 1 |
| 2111 | SPACER SLEEVE | 2 |
| 2100 | SLEEVE | 2 |
| 2103 | SUCTION DIST. SLEEVE | 1 |
| 2070 | WATER DEFLECTOR. | 2 |
| 2062 | CYLINDRICAL ROLLER BEARING. | 2 |
| 1908 | BALANCE VALVE SEAT. | 1 |
| 1900 | BALANCE VALVE. | 1 |
| 1800 | SHAFT. | 1 |
| 1509 | DELIVERY IMPELLER. | 1 |
| 1500 | STANDARD IMPELLER. | N-1 |
| 1190 | SUCTION COVER. | 1 |
| 1181 | CASING RING. | N |
| 1110 | STAY BAR. | 8 |
| 1101 | MIDDLE BODY. | N-1 |
| 1050 | STANDARD DIFFUSER | N-1 |
| 1043 | DELIVERY DIFFUSER. | 1 |
| 1042 | DELIVERY COVER. | 1 |

## RN 100, 125, 125A & 150 Pumps (for ref. only)



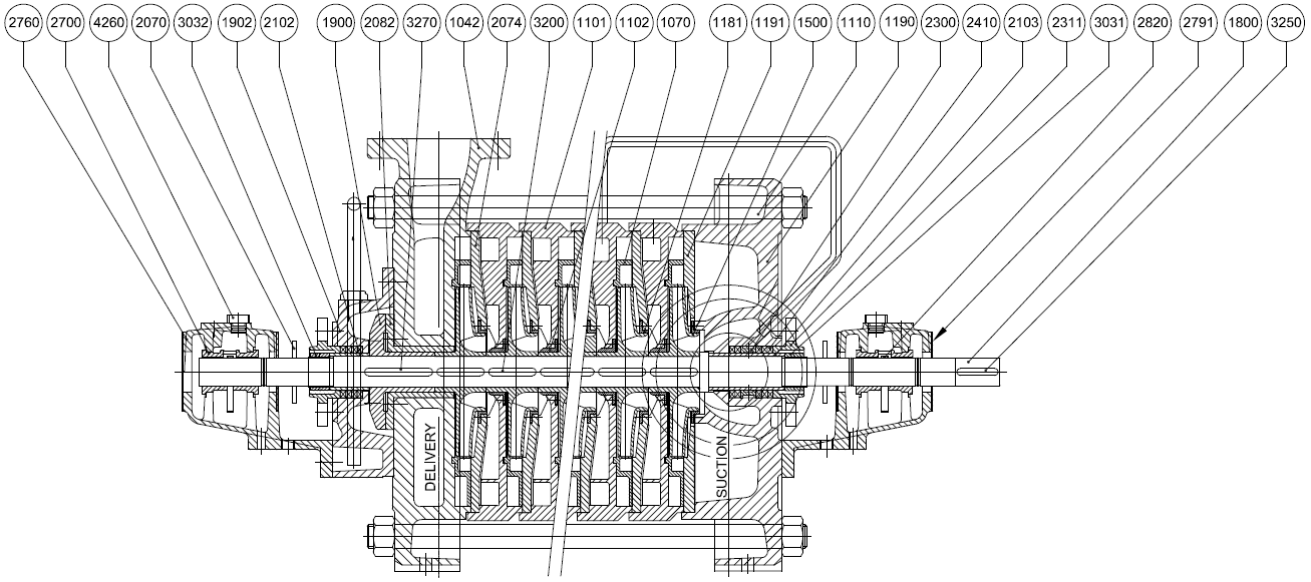

| | | |
|---|---|---|
| 4250B | 'O' RING. | N-1 |
| 4250A | 'O' RING. | 2 |
| 4250 | 'O' RING. | 1 |
| 3270 | BALANCE VALVE KEY. | 1 |
| 3250 | COUPLING KEY. | 1 |
| 3200 | IMPELLER KEY. | N |
| 3032 | SLEEVE NUT (RH) | 2 |
| 3031 | SLEEVE NUT (LH) | 2 |
| 2760 | BEARING HOUSING. | 2 |
| 2756 | BEARING END COVER (OUTER) NDE | 1 |
| 2753 | BEARING END COVER (OUTER) DE | 1 |
| 2752 | BEARING END COVER (INNER). | 2 |
| 2410 | GLAND PACKING | - |
| 2311 | GLAND | 2 |
| 2300 | LANTERN RING | 1 |
| 2111 | SPACER SLEEVE. | 2 |
| 2103 | SUCTION DISTANCE SLEEVE. | 1 |
| 2102 | DELIVERY DISTANCE SLEEVE. | 1 |
| 2070 | WATER DEFLECTOR. | 2 |
| 2062 | CYLINDRICAL ROLLER BEARING. | 2 |
| 1908 | BALANCE VALVE SEAT. | 1 |
| 1902 | BALANCE VALVE CHAMBER. | 1 |
| 1900 | BALANCE VALVE. | 1 |
| 1800 | SHAFT. | 1 |
| 1500 | STANDARD IMPELLER. | N |
| 1190 | SUCTION COVER. | 1 |
| 1185 | BACK COVER PLATE | 1 |
| 1181 | NECK RING. | N |
| 1110 | STAY BAR. | 8 |
| 1101 | MIDDLE BODY. | N-2 |
| 1050 | STANDARD DIFFUSER | N-1 |
| 1042 | DELIVERY COVER. | 1 |
| SR. NO. | DESCRIPTION | QTY |

## PLUROVANE Pump (for ref. only)



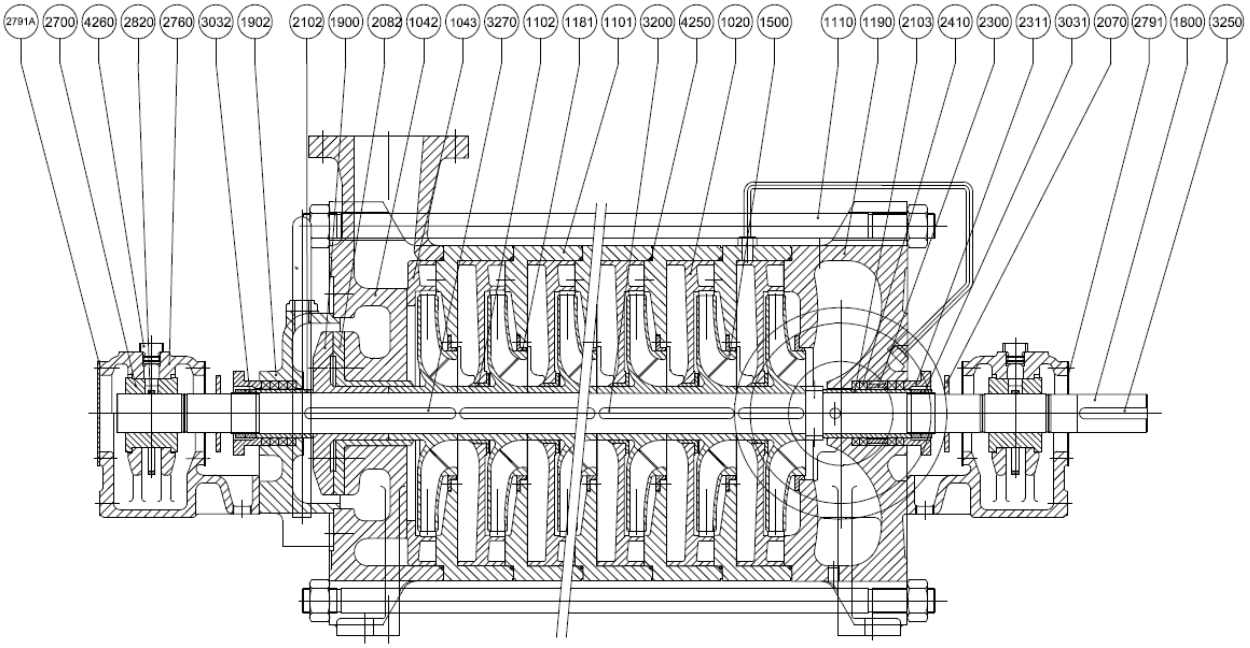
| No. | Part No. | Part Name | Qty | No. | Part No. | Part Name | Qty |
|---|---|---|---|---|---|---|---|
| 1 | 1042 | Delivery cover | 1 | 16 | 2102 | Delivery sleeve | 1 |
| 2 | 1070 | Guide tips | N | 17 | 2103 | Suction sleeve | 1 |
| 3 | 1101 | Middle body | N–1 | 18 | 2252 | Bearing cover (Inside) | 2 |
| 4 | 1102 | Neck bush | N–1 | 19 | 2300 | Lantern ring | 1 |
| 5 | 1110 | Stay bars | 8 | 20 | 2311 | Gland (Split) | 2 |
| 6 | 1181 | Casing ring | N | 21 | 2410 | Gland packing | – |
| 7 | 1190 | Suction cover | 1 | 22 | 2602 | Roller bearing | 2 |
| 8 | 1191 | Suction plate | 1 | 23 | 2753 | Bearing cover (outside) | 2 |
| 9 | 1500 | Impeller | N | 24 | 2760 | Bearing housing | 2 |
| 10 | 1800 | Spindle | 1 | 25 | 3031 | Sleeve nut (L.H.) | 2 |
| 11 | 1900 | Balance valve | 1 | 26 | 3032 | Sleeve nut (R.H.) | 2 |
| 12 | 1902 | Balance valve cover | 1 | 27 | 3200 | Impeller key | N |
| 13 | 2070 | Water thrower | 2 | 28 | 3250 | Coupling Key | 1 |
| 14 | 2074 | Partition plate | N–1 | 29 | 3270 | Balance valve key | 1 |
| 15 | 2082 | Combined seating & bush | 1 | | | | |

## PLURO Pump (for ref. only)



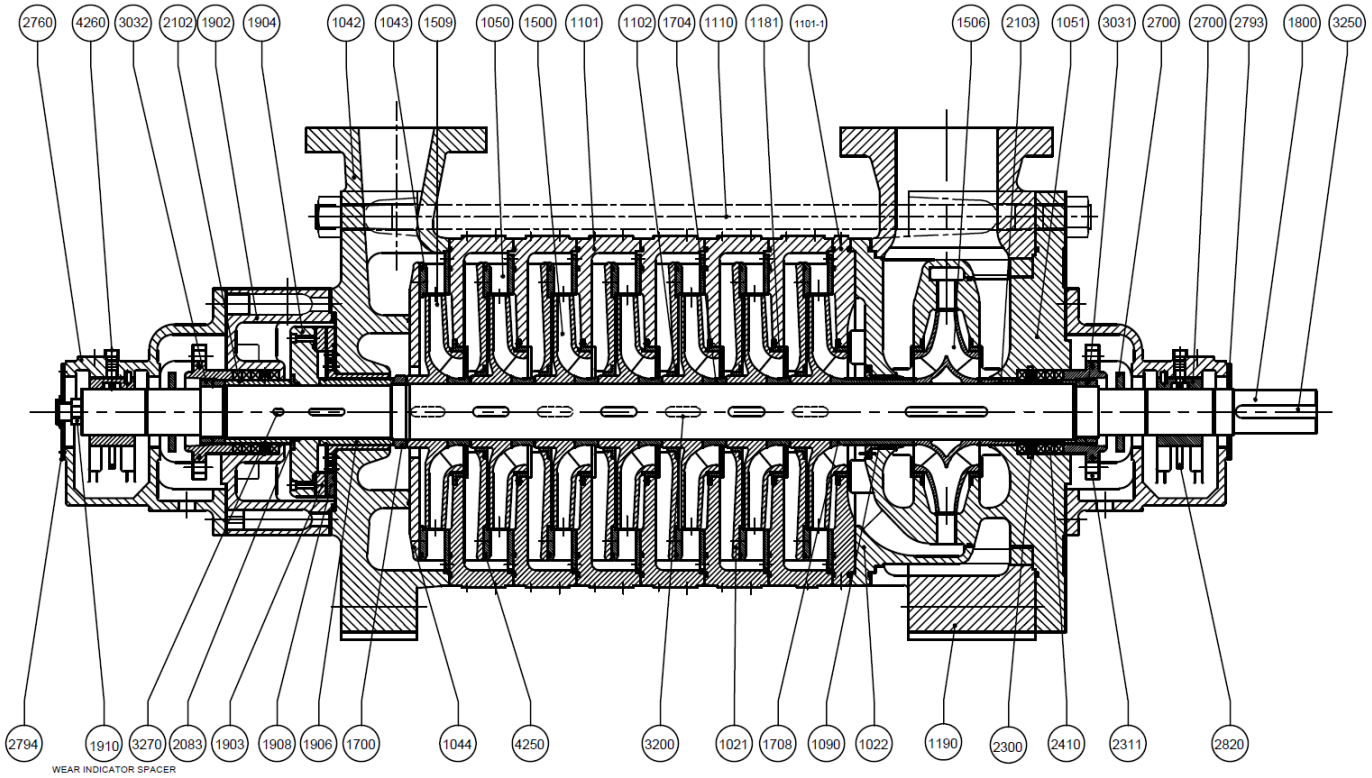

| No. | Part No. | Part Name | Qty | No. | Part No. | Part Name | Qty |
|---|---|---|---|---|---|---|---|
| 1 | 1042 | Delivery cover | 1 | 17 | 2311 | Gland | 2 |
| 2 | 1043 | Delivery diffuser | 1 | 18 | 2312 | Gland bowl | 1 |
| 3 | 1050 | Standard diffuser | N–1 | 19 | 2410 | Gland packing | – |
| 4 | 1101 | Middle body | N–1 | 20 | 2700 | Bearing bush | 2 |
| 5 | 1102 | Neck bush | N–1 | 21 | 2760 | Bearing housing | 2 |
| 6 | 1110 | Stay bars | 8 | 22 | 2791 | Dust cover | 3 |
| 7 | 1181 | Casing ring | N | 23 | 2794 | Dust cover NDE | 1 |
| 8 | 1190 | Suction cover | 1 | 24 | 2820 | Oil ring | 2 |
| 9 | 1500 | Impeller | N | 25 | 3031 | Sleeve nut (L.H.) | 2 |
| 10 | 1800 | Spindle | 1 | 26 | 3032 | Sleeve nut (R.H.) | 2 |
| 11 | 1900 | Balance valve | 1 | 27 | 3200 | Impeller key | N |
| 12 | 1902 | Balance valve cover | 1 | 28 | 3250 | Coupling Key | 1 |
| 13 | 2070 | Water thrower | 2 | 29 | 3270 | Balance valve key | 1 |
| 14 | 2082 | Combined seating & bush | 1 | 30 | 4225 | Setting pin | N |
| 15 | 2102 | Delivery sleeve | 1 | 31 | 4260 | Oil filler plug | 2 |
| 16 | 2103 | Suction sleeve | 1 | 32 | 4580 | Safety guard | 2 |

## IPB pump (for ref. only)




| No. | Part No. | Part Name | Qty | No. | Part No. | Part Name | Qty |
|---|---|---|---|---|---|---|---|
| 1 | 1042 | Delivery cover | 1 | 17 | 2311 | Gland | 2 |
| 2 | 1043 | Delivery diffuser | 1 | 18 | 2312 | Gland bowl | 1 |
| 3 | 1050 | Combined diffuser & return channel | N-1 | 19 | 2410 | Gland packing | – |
| 4 | 1101 | Middle body | N-1 | 20 | 2700 | Bearing bush | 2 |
| 5 | 1102 | Neck bush | N-1 | 21 | 2760 | Bearing housing | 2 |
| 6 | 1110 | Stay bars | 8 | 22 | 2791 | Dust cover | 3 |
| 7 | 1181 | Casing ring | N | 23 | 2794 | Dust cover NDE | 1 |
| 8 | 1190 | Suction cover | 1 | 24 | 2820 | Oil ring | 2 |
| 9 | 1500 | Impeller | N | 25 | 3031 | Sleeve nut (L.H.) | 2 |
| 10 | 1800 | Spindle | 1 | 26 | 3032 | Sleeve nut (R.H.) | 2 |
| 11 | 1900 | Balance valve | 1 | 27 | 3200 | Impeller key | N |
| 12 | 1902 | Balance valve cover | 1 | 28 | 3250 | Coupling Key | 1 |
| 13 | 2070 | Water thrower | 2 | 29 | 3270 | Balance valve key | 1 |
| 14 | 2082 | Combined seating & bush | 1 | 30 | 4225 | Setting pin | N |
| 15 | 2102 | Delivery sleeve | 1 | 31 | 4260 | Oil filler plug | 2 |
| 16 | 2103 | Suction sleeve | 1 | | 4580 | Safety guard | 2 |

## 150 MT pump (for ref. only)




N = NO. OF STAGES.

| No. | Part No. | Part Name | Qty | No. | Part No. | Part Name | Qty |
|---|---|---|---|---|---|---|---|
| 1 | 1910 | Wear indicator Spacer | 1 | 24 | 1903 | Balance valve face | 1 |
| 2 | 4260 | Oil filler plug | 2 | 25 | 1902 | Balance valve cover | 1 |
| 3 | 4250 | 'O' ring | - | 26 | 1800 | Shaft | 1 |
| 4 | 3270 | Balance valve key | 1 | 27 | 1708 | Impeller distance sleeve | 1 |
| 5 | 3250 | Coupling key | 1 | 28 | 1704 | Impeller distance piece | 1 |
| 6 | 3200 | Impeller key | N-1 | 29 | 1700 | Impeller nut | 1 |
| 7 | 3032 | Sleeve nut (RH) | 2 | 30 | 1509 | Delivery impeller | 1 |
| 8 | 3031 | Sleeve nut (LH) | 2 | 31 | 1506 | Suction impeller | 1 |
| 9 | 2820 | Oil ring | 2 | 32 | 1500 | Stage impeller | N |
| 10 | 2794 | Outer duct cover (N.D.E) | 1 | 33 | 1190 | Suction cover | 1 |
| 11 | 2793 | Outer duct cover (D.E) | 1 | 34 | 1181 | Neck-ring | N |
| 12 | 2760 | Bearing housing | 2 | 35 | 1110 | Stay bar | 8 |
| 13 | 2700 | Bearing bush | 2 | 36 | 1102 | Neck bush | N-1 |
| 14 | 2410 | Gland packing | - | 37 | 1101-1 | Middle body (Suction) | 1 |
| 15 | 2311 | Split gland | 2 | 38 | 1101 | Middle body | N-1 |
| 16 | 2300 | Logging ring | 2 | 39 | 1090 | Interstage bush | 1 |
| 17 | 2103 | Sleeve (Suction side) | 1 | 40 | 1051 | Diffuser and stuffing box housing | 1 |
| 18 | 2102 | Sleeve (Delivery side) | 1 | 41 | 1050 | Stage diffuser | N-1 |
| 19 | 2083 | Seal follower | 1 | 42 | 1044 | Delivery plate | 1 |
| 20 | 2070 | Water deflector | 2 | 43 | 1043 | Delivery diffuser | N |
| 21 | 1908 | Balance valve seating | 1 | 44 | 1042 | Delivery cover | 1 |
| 22 | 1906 | Balance valve stalk | 1 | 45 | 1022 | Suction and crossover | 1 |
| 23 | 1904 | Balance valve head | 1 | 46 | | Return channel | N-1 |

## Annexure–3 Oil Grades, Tightening Torque and Float details

## Oil details for Ring section pumps

**Note:** It is unsafe to mix grease of two or more grades in ball bearings. The order of mention has no connection with quality

| Manufacturer | Ring oil/Bush type Bearings | Grease Lubricated Bearing |
|---|---|---|
| Indian Oil Corporation | Servo System–46 | Servogem–2/3 |
| Hindustan Petroleum | Enclo–46 | Lithon–2/3 |
| Bharat Petroleum | Hydral–46 | Multipurpose Grease–3 |

**For Oil Lubrication**:

- ISO Grade 46 oil.
- All above oils are compatible with each other when fresh
- It is unsafe to mix oil of two or more grades for use in bearings
- Number 46 is Viscosity at 40 degree centigrade in centistokes

**For Grease Lubrication**:

- Only lithium base Grease to be used
- Numbers mentioned stands for consistency
- Grease of two different grades should not be used

## Recommended Bolting & Screw torques

Failure of threaded fasteners due to over–tightening can occur by bolt shank fracture or by stripping of the nut and / or bolt's thread. a bolt or screw assembled with a nut of appropriate class is intended to provide an assembly capable of being tightened to the bolt proof load without thread stripping occurring.

The torque value to be set for a particular size of screw is dependent upon:

1. Material of screw
2. Parent metal
3. Whether the screw is untreated or plated
4. Whether the screw is dry or lubricated
5. The depth of the thread

**Tightening torques – Untreated Screw (black finish); Coefficient of Friction 0.14**

| Property class | Torque | Nominal diameter – Coarse thread | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | M6 | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 | M33 | M36 | M39 |
| 5.6 | Nm | 4.6 | 11 | 22 | 39 | 95 | 184 | 315 | 470 | 636 | 865 | 1111 | 1440 |
| | Ft. lb | 3.3 | 8 | 16 | 28 | 70 | 135 | 232 | 346 | 468 | 637 | 819 | 1062 |
| 8.8 | Nm | 11 | 26 | 51 | 89 | 215 | 420 | 725 | 1070 | 1450 | 1970 | 2530 | 3290 |
| | Ft. lb | 7.7 | 19 | 37 | 65 | 158 | 309 | 534 | 789 | 1069 | 1452 | 1865 | 2426 |
| 10.9 | Nm | 15 | 36 | 72 | 125 | 305 | 590 | 1020 | 1510 | 2050 | 2770 | 3680 | 4520 |
| | Ft. lb | 11 | 26 | 53 | 92 | 224 | 435 | 752 | 1113 | 1511 | 2042 | 2625 | 3407 |
| 12.9 | Nm | 18 | 43 | 87 | 150 | 365 | 710 | 1220 | 1810 | 2450 | 3330 | 4260 | 5550 |
| | Ft. lb | 13 | 31 | 64 | 110 | 269 | 523 | 899 | 1334 | 1805 | 2455 | 3156 | 4093 |

**Tightening torques – Electrically Zink Plated: Coefficient of Friction 0.125**

| Property class | Torque | Nominal diameter – Coarse thread | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | M6 | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 | M33 | M36 | M39 |
| 5.6 | Nm | 4.3 | 11 | 21 | 36 | 88 | 171 | 295 | 435 | 560 | 800 | 1030 | 1340 |
| | Ft. lb | 3.1 | 8 | 15 | 25 | 64 | 126 | 217 | 320 | 435 | 590 | 768 | 988 |
| 8.8 | Nm | 9.9 | 24 | 48 | 83 | 200 | 390 | 675 | 995 | 1350 | 1830 | 2360 | 3050 |
| | Ft. lb | 7.3 | 18 | 35 | 61 | 147 | 297 | 497 | 733 | 995 | 1349 | 1740 | 2249 |
| 10.9 | Nm | 14 | 34 | 67 | 117 | 285 | 550 | 960 | 1400 | 1900 | 2580 | 3310 | 4290 |
| | Ft. lb | 10 | 25 | 49 | 86 | 210 | 405 | 708 | 1032 | 1401 | 1902 | 2441 | 3163 |
| 12.9 | Nm | 17 | 40 | 81 | 140 | 340 | 650 | 1140 | 1660 | 2280 | 3090 | 3880 | 5150 |
| | Ft. lb | 12 | 29 | 59 | 103 | 260 | 485 | 84o | 1239 | 1681 | 2276 | 2535 | 3798 |

## Total Float:

| Pump Model | Number of Stay Bars | MoC | Torque [kgm] | Total Float [mm] | Balance valve wear [mm] |
|---|---|---|---|---|---|
| RN 32 | 4 | CI / CI | 16.02 | 6 | NA |
| | 4 | CS / CI | 18 | | |
| | 4 | CS / CS | 20.28 | | |
| RN 40 | 4 | CI / CI | 6.43 | 4 | NA |
| | 4 | CS / CI | 8.12 | | |
| | 4 | CS / CS | 10.34 | | |
| RN 50 | 8 | CI / CI | 14.04 | 8 | 2 |
| | 8 | CS / CI | 15.8 | | |
| | 8 | CS / CS | 17.7 | | |
| RN 50 A | 8 | CI / CI | 14.04 | 8 | 2 |
| | 8 | CS / CI | 15.8 | | |
| | 8 | CS / CS | 17.7 | | |
| RN 65 | 8 | CI / CI | 21.78 | 8 | 2 |
| | 8 | CS / CI | 24.5 | | |
| | 8 | CS / CS | 27.5 | | |
| RN 80 | 8 | CI / CI | 29.29 | 8.5 | 2 |
| | 8 | CS / CI | 32.98 | | |
| | 8 | CS / CS | 37 | | |
| RN 100 | 8 | CI / CI | 47.96 | 7 | 2 |
| | 8 | CS / CI | 53.9 | | |
| | 8 | CS / CS | 60.5 | | |
| RN-100A | 8 | CI / CI | 48 | 7 | 2 |
| | 8 | CS / CI | 54 | | |
| | 8 | CS / CS | 60 | | |
| RN-125A | 8 | CI / CI | 76 | 7 | 2 |
| | 8 | CS / CI | 86 | | |
| | 8 | CS / CS | 100 | | |
| RN-150 | 8 | CI / CI | 76 | 10.5 | 2 |
| | 8 | CS / CI | 86 | | |
| | 8 | CS / CS | 100 | | |
| 1/1.5 HS PLURO | 8 | CI / CI | 7.32 | 3.75 | 2 |
| | 8 | CS / CI | 13.17 | | |
| | 8 | CS / CS | 16.83 | | |
| 1.5 /2 HS PLURO | 8 | CI / CI | 12.75 | 4.75 | 2 |
| | 8 | CS / CI | 22.94 | | |
| | 8 | CS / CS | 29.31 | | |
| 2 /2.5 HS PLURO | 8 | CI / CI | 18.7 | 4 | 2 |
| | 12 | CS / CI | 22.42 | | |
| | 12 | CS / CS | 28.65 | | |
| 3 /4 HS PLURO MK1 | 8 | CI / CI | 35.5 | 3.25 | 2.5 |
| | 12 | CS / CI | 42.64 | | |
| | 12 | CS / CS | 54.5 | | |
| 100/125 IPB | 8 | CI / CI | 98.5 | 6 | 2.5 |
| | 8 | CS / CS | 133.6 | | |
| | 8 | CS / CS | 170.2 | | |
| 100/150 IPB | 8 | CI / CI | 119.1 | 6.5 | 2.5 |
| | 8 | CS / CS | 161.6 | | |
| | 8 | CS / CS | 205.9 | | |
| 150/200 IPB | 8 | CI / CI | 262 | 8 | 3.5 |
| | 8 | CS / CS | 324 | | |
| | 8 | CS / CS | 420 | | |

| Pump Model | Number of Stay Bars | MoC | Torque [kgm] | Total Float [mm] | Balance valve wear [mm] |
|---|---|---|---|---|---|
| 150/200 IPB MK1 | 8 | CI / CI | 262 | 8 | 3.5 |
| | 8 | CS / CS | 324 | | |
| | 8 | CS / CS | 420 | | |
| 200/250 IPB | 8 | CI / CI | 335 | 12.5 | 3 |
| | 8 | CS / CS | 622 | | |
| | 8 | CS / CS | 622 | | |
| NO. 00 PLURO | 8 | CI / CI | 89.03 | 3.5 | 2.5 |
| | 12 | CS / CS | 80.55 | | |
| | 12 | CS / CS | 103 | | |
| NO. 00 PLURO MK1 | 8 | CI / CI | 89.03 | 3.5 | 2.5 |
| | 12 | CS / CS | 80.55 | | |
| | 12 | CS / CS | 103 | | |
| NO. I PLURO | 8 | CI / CI | 119.75 | 4.97 | 2.5 |
| | 12 | CS / CS | 108.34 | | |
| | 12 | CS / CS | 138.45 | | |
| NO. I PLURO MK1 | 8 | CI / CI | 119.75 | 4.97 | 2.5 |
| | 12 | CS / CS | 108.34 | | |
| | 12 | CS / CS | 138.45 | | |
| NO. II PLURO | 8 | CI / CI | 181.9 | 5 | 2.5 |
| | 12 | CS / CS | 164.58 | | |
| | 12 | CS / CS | 210.32 | | |
| NO. IIA PLURO | 8 | CI / CI | 258.8 | 7 | 3.5 |
| | 12 | CS / CS | 234.16 | | |
| | 12 | CS / CS | 299.24 | | |
| NO. III PLURO | 8 | CI / CI | 356.71 | 5 | 4 |
| | 12 | CS / CS | 322.73 | | |
| | 12 | CS / CS | 412.42 | | |
| NO. IIIA PLURO | 8 | CI / CI | 411.14 | 6.5 | 4 |
| | 12 | CS / CS | 371.99 | | |
| | 12 | CS / CS | 475.36 | | |
| 10/12 PLURO | 12 | CI / CI | 200 | 14 | 2.5 |
| | 12 | CS / CS | 250 | | |
| | 12 | CS / CS | 310 | | |
| 3/3 PJ | 8 | CI / CI | 88.2 | 3 | 2 |
| | 12 | CS / CS | 71.62 | | |
| | 12 | CS / CS | 93.09 | | |
| 4/4 PJ | 8 | CI / CI | 105.5 | 11.5 | 2 |
| | 12 | CS / CS | 86 | | |
| | 12 | CS / CS | 111.36 | | |
| 4/6 PJ | 8 | CI / CI | 134.48 | 4.5 | 2 |
| | 12 | CS / CS | 110 | | |
| | 12 | CS / CS | 141 | | |
| 6/6 PJ | 8 | CI / CI | 166.8 | 7.5 | 3 |
| | 12 | CS / CS | 134 | | |
| | 12 | CS / CS | 173.75 | | |
| 250 PJ AS | 8 | CI / CI | 800 | 10 | 3.5 |
| | 8 | CS / CS | 980 | | |
| | 8 | CS / CS | 1300 | | |
| 250 PJ AN | 8 | CI / CI | 800 | 17.5 | 3.5 |
| | 8 | CS / CS | 980 | | |
| | 8 | CS / CS | 1300 | | |

## Annexure-4 Formats

**Pre-commissioning checklist Pump with Motor**

| Sr. No. | Activities | Checked on | Remarks |
|---|---|---|---|
| 1 | Levelling of Pump set | | |
| 2 | Alignment with and without piping | | |
| 3 | Flushing of pipelines and ensures no leakages | | |
| 4 | Availability of sufficient liquid in sump/suction as per specifications | | |
| 5 | Installation of all instruments | | |
| | Suction and delivery pressure gauges | | |
| | Pressure switches | | |
| | Temperature gauges | | |
| | Any other as supplied/specified | | |
| 6 | Operation of suction, delivery and inline valves | | |
| 7 | Proper supports for piping and other allied equipment | | |
| 8 | Availability of flushing/sealing liquid for stuffing box | | |
| 9 | Availability of sufficient cooling liquid for bearings as specified | | |
| 10 | Free rotation of pump and drive shafts | | |
| 11 | Lubrication of bearings | | |
| 12 | Checking of insulation resistance of motor (if supplied by WILO M&P) | | |
| 13 | Proper cable termination (Clients Scope) | | |
| 14 | Motor Protection Relay Setting (Check with Clients) | | |
| 15 | Check all interlocks as specified/provided | | |
| 16 | No load trial operation of drive | | |
| | Direction of rotation is ok | | |
| | Noise and vibration are within limits | | |
| | Bearing temperatures and winding temperatures are within limits | | |
| | Overall operation is satisfactory | | |
| 17 | Coupling of pump and drive and free rotation of shafts in coupled condition | | |
| 18 | Suction valve is fully opened | | |
| 19 | Pump is fully primed, and all air is vented | | |
| 20 | Delivery valve is closed (if required) | | |
| 21 | Emergency shutdown is possible | | |

**Pump Commissioning Report (Motor Driven Pumps)**

| | | | |
|---|---|---|---|
| **Customer:** | | **Service Ref.:** | |
| **Sr. No.:** | | **Date:** | |
| **Details of Pump** | | **Details of Motor** | |
| Pump Sr. No. | | Motor Make | |
| Type of Pump | | Sr. No. | |
| Head | | Frame Size | |
| Capacity | | Kw / Hp. | |
| RPM | | RPM | |
| Construction | | Voltage | |
| | | Current | |
| **Details of System** | | **Piping Details** | |
| Application | | Suction Pipe Size | |
| Liquid | | Delivery Pipe Size | |
| pH Value | | Valves | |
| Suction | Flooded / Lift | Expansion Joints | |
| **Pump Operating Parameters** | | **Motor Operating Parameters** | |
| Suction Pressure | | Current | |
| Discharge Pressure | | Voltage | |
| RPM | | RPM | |
| DE Bearing Temperature | | DE Bearing Temperature | |
| NDE Bearing Temperature | | NDE Bearing Temperature | |
| Duration of Trial Run | | Winding Temperature (Max.) | |

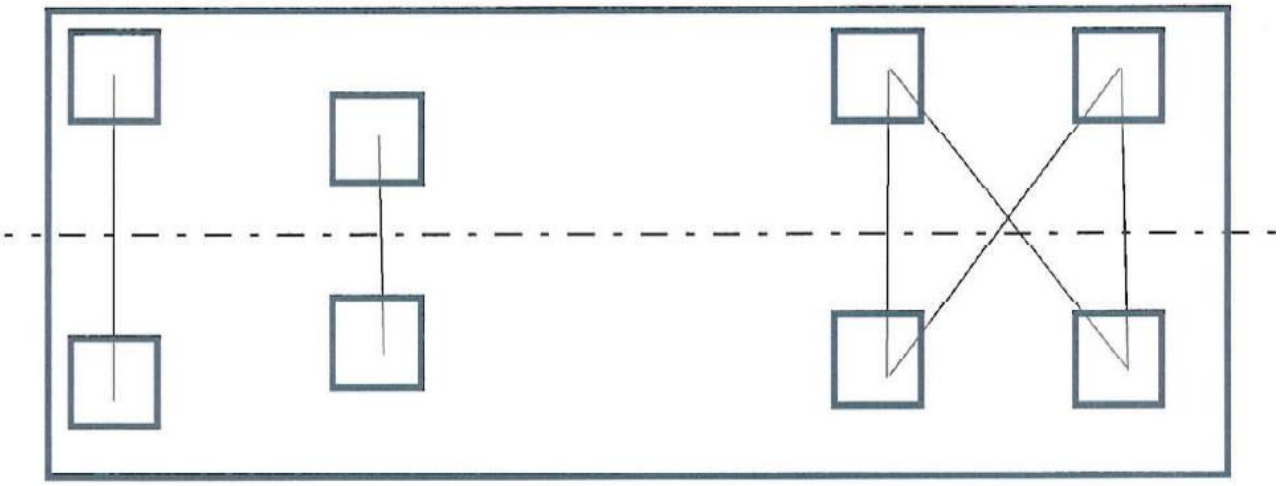
**Observations and Remarks:**

**Customer Representative** **WILO M&P Representative**

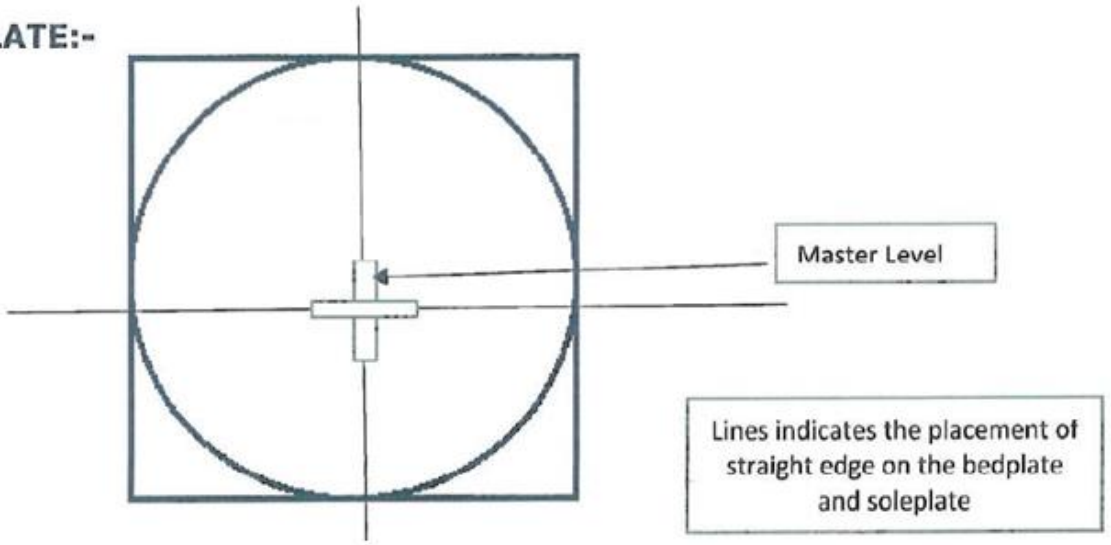
**Pump set Levelling Record**

**Required accuracy of pump set levelling is 0.05 mm**

A) BEDPLATE



SOLEPLATE:-




**Result:**

**Customer Representative** **WILO M&P Representative**

**Pump and Motor / Engine / Turbine Alignment Record**

**A: Before Connecting Suction and Delivery Piping:**

RADIAL

AXIAL

**Gap Between Coupling Halves: _____ mm**

**Actual Gap: _____ mm**

**B: After Connecting Suction and Delivery Piping:**

RADIAL

AXIAL

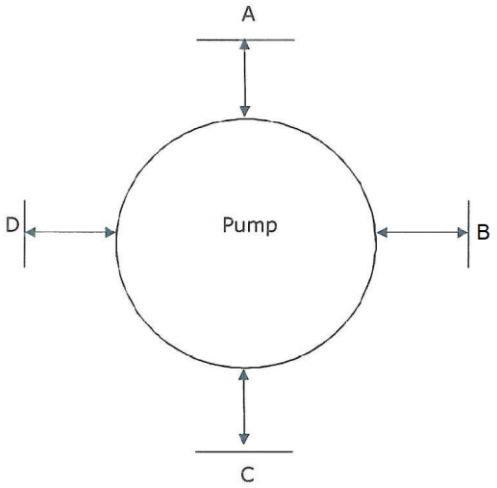
**Gap Between Coupling Halves: _____ mm**

**Actual Gap: _____ mm**

**Customer Representative** **WILO M&P Representative**

**Pump set Noise Level Record**

**Noise level measurement at Pump House Floor**




**Noise Level in dBA:**

| | |
|---|---|
| **A:** | **B:** |
| **C:** | **D:** |

| |
|---|
| **Background Noise (dBA):** |
| **Instrument Details:** |
| **Distance –1 Mtr. from the Pump:** |
| **Make:** |
| **Model:** |
| **Sr. No.:** |

**Customer Representative** **WILO M&P Representative**

**Pump set Vibration Measurement**

**Pump Set Details:**

**Date:**

| | |
|---|---|
| **Pump Sr. No.** | **Motor Sr. No.:** |
| **Pump Type:** | **Make:** |
| **Project:** | |

**Vibration Measurement: (Pk to Pk)**

| Sr. No. | Position | V | | H | | A | |
|---|---|---|---|---|---|---|---|
| | | Displacement | Velocity (mm/sec.) | Displacement | Velocity (mm/sec.) | Displacement | Velocity (mm/sec.) |
| 1 | Pump DE | | | | | | |
| 2 | Pump NDE | | | | | | |
| 3 | Motor DE | | | | | | |
| 4 | Motor NDE | | | | | | |

**Instrument Details:**

| |
|---|
| **Make:** |
| **Model:** |
| **Sr. No:** |

**Customer Representative** **WILO M&P Representative**

**Pump set Bearing Temperature Measurement**

**Pump Set Details:**

**Date:**

| | |
|---|---|
| **Pump Sr. No.** | **Motor Sr. No.:** |
| **Pump Type:** | **Make:** |
| **Project:** | |

**Bearing Temperature:**

| Sr. No. | Position | Temperature | Ambient Temperature | Remarks |
|---|---|---|---|---|
| 1 | Pump DE | | | |
| 2 | Pump NDE | | | |
| 3 | Motor DE | | | |
| 4 | Motor NDE | | | |

**Instrument Details:**

| |
|---|
| **Make:** |
| **Model:** |
| **Sr. No:** |

**Customer Representative** **WILO M&P Representative**

**NOTES**

**NOTES**

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