



WILO Mather and Platt – Sump Pumps

en Installation and Operating Instructions

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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 Sump Pumps. Instructions are compiled for the person having a working knowledge of Sump 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.

Plant Location –
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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Always dismantle the motor before lifting the pump unit.

Fig. 2: PNV pump with self-lubrication: (See Page No. 23; Point no. 9.3.1.2)





*	FASTENERS (ALL)	1SET	SS 316
4963	SUPPORT PIPE (TOP)	1	ERW AISI-316
4962	SUPPORT PIPE (INT)	3	ERW AISI-316
4961	SUPPORT PIPE (BOTTOM)	1	ERW AISI-316
4900	STRAINER	1	AISI-316
4830	COUPLING FLEXIBLE	1SET	CI, ASTM A48 CL.40
4690	MOUNTING PLATE (PUMP)	1	MS ASTM A36
4680	MOTOR STOOL.	1	MS ASTM A36
4580	COUPLING GUARD	2	MS
4250	`O' RING(CASING/BACK COVER)	1	NITRILE RUBBER
4080	GASKET.	1SET	CAF-120
3260	KEY FOR MUFF COUPLING.	8	ASTM A 276 Gr.316
3250	KEY FOR COUPLING.	1	ASTM A 276 Gr.316
3200	KEY FOR IMPELLER.	1	ASTM A 276 Gr.316
3020	LOCK WASHER.	1	MS
3011	LOCK NUT (L. H.)	2	MS
2870	LUBRICATION PIPE LINE	1SET	TEFLON + SS304
2834	INT. BEARING SLEEVE.	4	ASTM A 276 Gr.316
2832	PUMP BEARING SLEEVE.	1	ASTM A 276 Gr.316
2830	PUMP BEARING BUSH.	1	FEROFORM
2801	INT. BEARING BUSH.	4	FEROFORM
2800	INT. BEARING BRACKET.	4	ASTM A 743 Gr.CF8M
2780	BEARING SPACER.	1	BS 970,Gr.EN8
2750	BEARING COVER.	1	CI, ASTM A48 CL.40
2710	BEARING CARTRIDGE.	1	CI, ASTM A48 CL.40
2603	THRUST BEARING (3306)	1	MFG.STD.
2430	STUFFING BOX STOOL	1	CI, ASTM A48 CL.40
2420	MECH.SEAL	1	TYPE DR-3, MAKE E.B.I.L.
2060	SPLIT COLLAR	4	ASTM A 276 Gr.316
2050	MUFF COUPLING.	4	ASTM A 276 Gr.316
1821	ADAPTER PLATE	1	MS ASTM A36
1805	INTERMEDIATE SHAFT	3	ASTM A 276 Gr.316
1804	TOP SHAFT	1	ASTM A 276 Gr.316
1800	PUMP SHAFT	1	ASTM A 276 Gr.316
1705	IMPELLER LOCK WASHER	1	ASTM A 276 Gr.316
1700	IMPELLER NUT	1	ASTM A 743 Gr.CF8M
1500	IMPELLER.	1	ASTM A 743 Gr.CF8M
1185	BACK COVER.	1	ASTM A 743 Gr.CF8M
1102	NECK RING	1	ASTM A 743 Gr.CF8M
1054	DELIVERY PIPE (TOP)	1	ERW AISI-316
1000	CASING.	1	ASTM A 743 Gr.CF8M
REF.	DESCRIPTION	QTY.	MATERIAL

Fig. 4: PNV pump with grease lubrication: (See Page No. 23; Point no. 9.3.1.3)



*	FASTENERS (NON WETTED)	1SET	HTS
*	FASTENERS (WETTED)	1SET	ASTM A276 GR SS304
4963	SUPPORT PIPE (TOP)	1	ERW MS
4962	SUPPORT PIPE (INT)	2	ERW MS
4961	SUPPORT PIPE (BOTTOM)	1	ERW MS
4900	STRAINER	1	MS
4830	COUPLING FLEXIBLE	1SET	CI IS 210 FG 260
4690	MOUNTING PLATE (PUMP)	1	MS
4680	MOTOR STOOL.	1	IS 2062 MS Gr.B
4580	COUPLING GUARD	2	MS
4250	`O' RING(CASING/BACK COVER)	1	NITRILE RUBBER
3260	KEY FOR MUFF COUPLING.	6	ASTM A 276 Gr.410
3250	KEY FOR COUPLING.	1	ASTM A 276 Gr.410
3200	KEY FOR IMPELLER.	1	ASTM A 276 Gr.410
3020	LOCK WASHER.	1	IS 2062 MS Gr.B
3011	LOCK NUT (L. H.) 2 IS 2062 MS Gr.B		IS 2062 MS Gr.B
2870	LUBRICATION PIPE LINE 1SET MS		MS
2834	INT. BEARING SLEEVE.	3	ASTM A 276 Gr.410
2832	PUMP BEARING SLEEVE.	1	ASTM A 276 Gr.410
2830	PUMP BEARING BUSH.	1	CIP MARINE
2801	INT. BEARING BUSH.	3	CIP MARINE
2800	INT. BEARING BRACKET.	3	CI IS 210 FG 260
2780	BEARING SPACER.	1	BS 970,Gr.EN8
2750	BEARING COVER.	1	CI IS 210 FG 260
2710	BEARING CARTRIDGE.	1	CI IS 210 FG 260
2603	THRUST BEARING (3306)	1	SKF/FAG
2060	SPLIT COLLAR	3	ASTM A 276 Gr.410
2050	MUFF COUPLING.	3	ASTM A 276 Gr.410
1805	INT SHAFT	2	ASTM A 276 Gr.410
1803	TOP SHAFT	1	ASTM A 276 Gr.410
1800	PUMP SHAFT	1	ASTM A 276 Gr.410
1705	IMPELLER LOCK WASHER	1	ASTM A 276 Gr.316
1700	IMPELLER NUT	1	ASTM A743 GR CF8M
1500	IMPELLER.	1	ASTM A743 GR CF8M
1185	BACK COVER.	1	CI IS 210 FG 260
1102	NECK RING	1	CI IS 210 FG 260
1054	DELIVERY PIPE (TOP)	1	MS IS 1239 HEAVY
1000	CASING.	1	CI IS 210 FG 260
REF.	DESCRIPTION	QTY.	MATERIAL

Fig. 5: Auxiliary Oil Pumps (AOP): (See Page No. 23; Point no. 9.3.2)



Fig. 6: Emergency Oil Pump (EOP): (See Page No. 23; Point no. 9.3.2)



Fig. 7: 4/5 SR.12 KL Model 70 Pump (See Page No. 24; Point No. Technical Data)



Fig. 8: 5/6 EHLG Pump (See Page No. 24; Point No. Technical Data)



Fig. 9: 8/8 Series 6 Model 60 (See Page No. 24; Point No. Technical Data)



5040			
5310	BRG.CARTRIDGE.	1	CI,IS.210,Gr.FG-260.
5300	SUCTION COVER.		CI,IS.210,Gr.FG-260.
4550	GAURD.	2	IS 2062 MS
5220	SOC.HD.GRUB SCREW.	2	HTS ISO4017 CL8.8
5210	EYE BOLT.	4	FORGED MS
5200	COUPLING KEY.	1	EN8,B.S.970.
1	LUBRICATION PIPE.	PIPE. 1 SET IS 1239 C CLASS	
-	MOTOR.	1	STD.
4963	SUPPORT PIPE (TOP).	1	ASTM A106 MS
4961	SUPPORT PIPE.(BOTTOM)	1	ASTM A106 MS
4940	SUCTION PIPE.	1	ASTM A106 MS
4690	BASE PLATE	1	IS 2062 MS
4630	FLEXIBLE COUPLING.	1	CI,IS.210,Gr.FG-260.
4250	'O' RING FOR IMP NUT / IMPELLER.	1	PTFE
4080-1	GASKET. FOR CASING / SUCTION & BACK COVER,	2	MAGNET PAPER.
4080	GASKET. FOR CASING / DELIVERY PIPE.	1	CHAMPION GASKET AF120
3020	IMPELLER KEY.	1	EN8,B.S.970.
3011	SKF LOCK NUT & WASHER, (KM15/MB15)	1 SET	STD.
2832	SHAFT SLEEVE.	1	ASTM A276 410
2830	PUMP BRG. BUSH.	1	LB2,B.S. 1400
2780	BRG.SPACER.	1	EN8,B.S.970.
2750	BRG.COVER.	1	CI,IS.210,Gr.FG-260.
2710	BRG.CARTRIDGE.	1	CI,IS.210,Gr.FG-260.
2603	THRUST BRG. (3315)	1	STD.
1822	ADJUSTING RING	1	IS 2062 MS
1800	PUMP SHAFT	1	EN8,B.S.970,
1707	IMP NUT LOCKING SCREW.	1	HTS ISO4017 CL8.8
1700	IMPELLER NUT.	1	CI.IS.210.Gr.FG-260.
1500	IMPELLER.	1	CI,IS.210,Gr.FG-260.
1181-1	NECK RING (BACK COVER)	1	CI.IS.210.Gr.FG-260.
1181	NECK RING (SUCTION COVER)	1	CI.IS.210.Gr.FG-260.
1000	CASING.	1	CI,IS.210,Gr.FG-260.
1047	DELIVERY PIPE.WITH ELBOW	1	ASTM A106 MS
REF.	DESCRIPTION	OTV	MATERIAL

Fig. 10: Suction Pipe details: (See Page No. 21; Point No. 7.6.2)



Fig. 11: Mechanical seal arrangement (On request): (See Page No. 17; Point No. 4.5)



Fig. 12: Thrust bearing arrangement: (See Page No. 23; Point No. 9.3.2)



Fig. 13: Alignment of pump-motor coupling: (See Page No. 25; Point No. 9.7)



Fig. 14: Details of Flexible coupling: (See Page No. 25; Point No. 9.7)



Fig. 15: Details of Muff coupling assembly: (See Page No. 28; Point No. 10.5)



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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 Safety symbols

General danger symbol:

This symbol indicates safety instructions where noncompliance would affect personal safety and could result in loss of life.

// Danger due to electrical voltage

This symbol indicates electrical safety instructions where noncompliance will involve a high risk to personal safety or the loss of life.



This is not a safety symbol but indicates useful information on using the product. It also draws attention to the possible problems.

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.

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

2.2 Personnel qualifications

All personnel involved in the operation, installation, inspection and maintenance of the unit must be qualified to carry out the work involve.

If the personnel in question do not possess the necessary knowledge and skill, appropriate knowledge and training must be provided.

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

Non-observance of safety instructions provided in these operating instructions can 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
- Loss of any claims to damages
- 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 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.

2.5 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.

2.6 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.

2.7 Improper use

The operating safety of the supplied product only guaranteed for conventional use in accordance with Section 4 of the operating instructions. The limit values on any account must not fall under or exceed those specified in the catalogue/data sheet.

2.8 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 & Platt pumps.



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 & Interim storage

Immediately check the pump and transport packaging for damage in transit upon receipt. Take the necessary steps within the period 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. Further- more, 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 Fig. 1; Page No. 3)

CAUTION! Risk of damage to the pump! Risk of falling!

Pumps should never be lifted with motor mounted on motor stool. Lifting lugs provided on motor stool are to be used only for lifting the pump during maintenance. Pump to be lifted /inserted in part by part. 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, care to be taken so that pump flanges, shaft extensions etc. are not damaged.

To lift the pump see lifting diagrams – see also general safety Information, point 2 Page No. 14) 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 check 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

Our vertical Sump pumps require preparation for storage & regular maintenance during storage. The pump should be considered in storage when it has been delivered to the job site & waiting for installation.

It is suggested that the check of parts & material against the bill of materials be made jointly with the WILO Mather and Platt representative & customer representative.

NO CLAIMS FOR SHORTAGES WILL BE HONORED BY WILO MATHER AND PLATT AFTER THE MATERIAL HAS BEEN PLACED IN STORAGE.

3.3.1 Short-term storage (less than 3 month)

The equipments as shipped should 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.

- 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.
- 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.
- Heavy components must be placed on supports to keep them off the ground.
- Shafting must be removed from the boxes & coated with preservative, then re-boxed with preservative paper.

3.4 Pump returning back to the supplier

back, are no longer covered by guarantee!

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

3.5 Intended use

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. 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.

4. Product Description

4.1 Pump Casing

Volute type pump casing designed for high stress resistance and maximum performance.

4.2 Impeller

Impeller is of the closed type, with twisted vane design for maximum performance, dynamically balanced. It is keyed at the end of the shaft and secured by means of an impeller nut and locked by means of lock washer to ensure positive locking.

4.3 Back Cover

It is provided with "O-Ring" for positive leak proof joint between pump casing and back cover. Back cover holds the throttle bush at the end of the impeller.

4.4 Stuffing Box

Stuffing box is provided with mechanical seal on request.

4.5 Mechanical seal (Refer Fig. 11; Page No. 11)

Pumps supplied with vapor proof construction or pressurized designs are furnished with an upper stuffing box equipped to take mechanical seal.

4.6 Bearings & lubrication

Press fitted bearing in the back cover and intermediate bearing brackets to support the shafts. The intermediate bush bearings shall be lubricated with the liquid handled by the pump and hence it is necessary that the liquid handled should have sufficient lubricating properties. External water should be supplied to lubricate the bearing, if liquid to be handled contains suspended solids.

Double row angular contact ball bearings are grease lubricated and mounted at the top of the head shaft in the bearing housing. It takes axial thrust and shaft and Impeller weights.

4.7 Shaft

Top, Intermediate and pump shaft of ample strength and rigidity. Bearing span is to keep as per API-610 standard.

4.8 Couplings

Flexible coupling M&P make pin and bush type coupling are standard design. Other makes also supplied on request.

4.9 Muff coupling assembly

The accurately machined muff coupling, and split collars are used to connect the two shafts length wise.

4.10 Support pipes

Support pipes top, intermediate, bottom is fabricated from steel/stainless steel pipes. Flanges are accurately machined faced for parallelism. Holes are provided in pipes for overflow.

4.11 Intermediate bearing bracket

It is rigid housing contains the bush bearings which in turn supports and align the shaft perfectly. It is accurately face machined to maintain the parallelism and accurately bored to keep the perfect alignment.

4.12 Delivery pipe

It is included in standard scope of supply. It brings the pump liquid to mounting plate level.

Delivery pipe flanges are as per ANSI 150 class FF or RF. We can also supply as per IS6392 table no. 17

4.13 Mounting plate

It is machined from both sides and carrying the entire pump weight.

4.14 Motor Stool

It is fabricated from steel and is accurately machined for parallelism of faces and concentric bores to maintain perfect alignment of motor and pump shafts. Motor is mounted on motor stool.

4.15 Lubrication pipeline

Pipelines are connected to bearing brackets to lubricate the bush bearings by pumping liquid or external lubrication.

4.16 Bottom pipe

It is the additional piece provided at the suction side of casing. It is in between the suction strainer and pump casing. It is provided when the installation depth goes above 6m. It is mandatory in AOP & EOP designed pumps.

4.17 Product Name Plate

Product Name plate is affixed on the motor stool. The data on the Name plate is as shown below,

0	wilo	Ð
Туре		
OA N Qm³/h	oH mRPM	
-		
	WILO Mather and Platt Pumps Pvt. Ltd. India	Ð



4.18 Type Key

Description:				
PNV 40-200	Name of the Product series			
OA No.	Order No.			
Q	Duty point flow in m³/h.			
Н	Duty point head in meter			
n	Motor Speed in RPM			
Р	Motor Power in kW			

5. Selection of Motor and Coupling

5.1 Electrical motor selection

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

Shaft power	P ₂ ≤ 22	22 kW < P ₂	55 kW
	KW	≤ 55 kW	< P ₂
Recommended Power Margin	25 %	15%	10%

Example:

- Duty point: 100 m3/h 30 m pump efficiency 78 %
- Pump shaft power: 10.5 kW
- Electrical motor rating (including margin):
- 10.5 *1.25 = 13 kW
- IEC motor power rating available:15 kW

5.2 Coupling selection

Standard Pin-bush type flexible coupling is used to connect top / head shaft to motor shaft.

Couplings can be selected with Cast Iron or Forged steel as standard material. Select the size of the coupling in accordance with the recommendation of the coupling manufacturer. Strictly follow the coupling manufacturer's instructions for fitting the coupling between pump and motor. Use torque or power/100 rpm rating to select suitable coupling in suitable MOC.

Then check if the rated coupling speed is more than pump speed.

Also check the motor shaft dia. for selected motor is less than or equal to the max. Shaft dia. mentioned in the coupling catalogue.

Additional service factor must be considered in coupling selection for special applications.

(Refer table on coupling details in CI MOC)

Example:

• Power: 100 hp, Pump speed: 1480 rpm, Service Factor: 1

(Power/100 rpm) Rating: hp * 100 * SF / rpm : 100*100*1/1480 : 7

Select coupling with hp /100 rpm rating more than 7.

- For other types of couplings such Metaflex / Spacer-Membrane type / Rigid threaded type kindly consult WILO Mather and Platt.
- Care should be taken to consider and maintain gap between motor and pump half side of the coupling.

COUPLING SELECTION CHART FOR STD PIN-BUSH COUPLING						
	Max.	Rating		Max		
Coupling Size	Dia. Ø mm)	Torque (Nm)	hp/100 rpm	Speed rpm	Gap mm	
96	30	125	1.75	7200	4	
112	42	250	3.5	6100	4	
125	48	400	5.6	5500	4	
140	55	520	7.3	4900	4	
160	60	750	10.5	4500	4	
180	70	1050	14.7	3800	4	
200	80	1450	20.3	3400	4	



[•] For Forged Steel / Cast Steel MOC kindly contact WILO Mather and Platt.

• Specified gap to be maintained between pump and motor half coupling.

6. Preparing Foundation

The foundation should be sufficiently substantial to absorb any vibration and to form a permanent, rigid support for the mount plate. The strength of foundation must be adequate for the static and dynamic loads imposed and depend upon local soil conditions.

The foundation must get large dimensions. Generally, the weight of the foundation is around 2 to 3 time the pump set weight. In building the foundation, the top of the foundation should be left approximately equal to mount plate thickness plus 25 mm for packers/shims below, to allow for grouting. Foundation bolts of the proper size should be embedded in the concrete, located by template.



(i) Note:

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

- A pipe sleeve about 2 ¹/₂ 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.
- Ensure that both mount plate faces are parallel within allowable value, free from any distortion as shown in fig. Spirit level, straight edge along with engineer's master level can be used to check flatness.

6.1 Mounting Plate Installation

Mount plate has machined surfaces on both top and bottom sides. The top surface of foundation over which the mount plate rests must be left rough to assist in keying the final grout. After the mount has been leveled by positioning steel packer plates at suitable intervals on the foundation surface, ensure that the surface beneath each packing plate is solid by crushing any protrusion or alternatively each packer plate may be placed on a thin screen of cement.

6.2 Leveling of Mounting Plate

The machined surfaces where level is being checked must be clean and free from paint, burrs etc.

- Provide suitable packer plate (25 mm to 30 mm thick) or taper wedges on the foundation one each of either side of foundation bolt. It is advisable to provide thin layer of cement below the packer plate.
- Lift the mount plate and lower it on the foundation. Insert the foundation bolts through the holes in the mount plate and screw a nut on to each bolt until the bolt protrudes through the nut by a length, which is sufficient to accommodate a lock nut.
- Adjust the level of the mount plate by inserting shims between the mount plate and the packer plate until the mount plate is leveled. And support on all the packing wedges at suitable height. For checking the levels & straightness, I-beam type straight edge should be used extensively in conjunctions with engineer's master level. Level should be achieved within 0.05 mm. Also ensure that elevation of baseplate is adjusted suitably.
- For grouting use rich mix of 1:1:2 of cement, sand and gravel below 25 mm, alternatively quick setting grout mix can be used.
- When the grout has set, gently but firmly tighten the foundation bolts. Do not distort the mount plate or loosen the foundation bolts in the grout by excessive tightening. Carefully re-check the level of the mount plate and make adjustments that are necessary by fine shimming. Ensure that the mount plate is leveled, as per the site datum level, various centerlines etc.

7. Installation

7.1 List of Essentials to made available at site prior to installation.

Set of I-Beams of erection.

- Set of Slings, Shackles, wire ropes, eye bolts, wrenches.
- Set of spanners, Allen keys, hammer, scrapper, screw drivers.
- Skilled manpower, ladder, sufficient lighting, Helmet, Safety jacket, Safety Shoes etc.

7.2 Location

The pump should be located to allow room for installation, access, ventilation, maintenance and inspection with ample headroom for lifting. Refer to the general arrangement drawing for the pump set. If the pump is furnished with external flush lubricated bearings, the fluid lines must be accessible from the pump location.

Also, important, especially in the larger flow units, is proper sump design. When more than one pump is installed and used at the same time in the same sump, the location and spacing of the pumps are important. Guidelines and the pump placement as outlined in the "Hydraulics Institute Standards" are recommended.

7.3 Part Assemblies

- Pump are shipped completely assembled except driver & mechanical seal
- When mechanical seal is furnished, they should be installed before the motor is put in place.
- The driver will be mounted after the pump is installed.
- When the pump shipped all the threads and all the openings are covered. This protection should not be removed until installation. If the pump is removed from service, this protection should be reinstalled.

7.4 Pump Mountings

The pump may be mounted directly on the pit using the pump mounting plate.

a) The pump was checked during assembly at the factory to make sure the pump shaft rotated freely by hand. Handling during shipment, storage, or preparation for installation could have caused distortions resulting in pump shaft bending. Check the shaft to make sure that it will rotate freely by hand.

b) Check all bolts and nuts for tightness, then carefully lower the assembled pump into the pit, taking care not to damage lube lines or float control equipment. Make sure that any equipment used to lift the pump or any of its components is capable of supporting the weights encountered. Make sure that all parts are properly rigged before attempting to lift.

c) Pump mounting plate must maintain level from one side of the plate to the other and be supported evenly at all points before being bolted down.

d) If the sump doesn't provide a level mounting surface for the pump, drive wedges under the mounting plate/pit cover until pump levels out. The wedges must be able to support the weight of the entire pumping assembly and hold the assembly steady enough that no excess vibration occurs.

e) Do not bolt the discharge flange of the pump to the piping until the baseplate foundation is completely installed.

f) Run piping to the discharge of the pump. There should be no piping loads transmitted to the pump after connection is made.

7.5 Driver Mounting

- Before the motor is installed, be sure to connect the motor half coupling hub and the pump half coupling hub onto their respective shafts.
- Carefully lift the motor and place it on the motor stool of the pump.
- Turn the motor frame to one of the four positions where the motor bolt holes line up to the motor stool. Select the position of the motor to suit the desired conduit box location. Install the motor hold down bolts. In some instances, a motor adapter may be furnished. In this case the adapter must be installed before the motor can be mounted.
- Motor to pump alignment is controlled by fits within the adapter and cannot be adjusted.
- Locate the coupling and source of electrical power but DO NOT INSTALL THE COUPLING DRIVE ELEMENT AT THIS TIME.
- Connect the motor terminals to the leads from the starter panel. Make sure the motor shaft and/or coupling is not touching any part of the pump shaft or pump half coupling. Rotate the motor shaft by hand to make sure it is free to rotate when energized.

Never check driver rotation unless the pump and driver shafts are disconnected and physically separated. Failure to follow this instruction can result in serious damage to the pump and driver if rotation is in the wrong direction.

- Run the motor and check for proper rotation which should be clockwise when looking down on top of the motor. If rotation is wrong, interchange any two motor connections on three-phase motors. On single-phase motors, follow the motor manufacturer's instructions. After changing the connections, again check the rotation to ensure that the direction is correct.
- Disconnect and lockout the power supply to the driver.
- The coupling can now be fully installed and join the driver and pump shafts together
- Install the coupling guarding.
- While mounting the motor & installing the coupling refer chart on Pg. No. 18.

7.6 Piping

Protective covers are fitted to both the suction and discharge flanges of the casing and must be removed prior to connecting the pump to any pipes.

7.6.1 General piping

If the pump flange(s) have tapped holes, select flange fasteners with thread engagement at least equal to the fastener diameter but that do not bottom out in the tapped holes before the joint is tight.

7.6.2 Suction piping (Ref. fig. 10; Page No. 10)

Pumps typically only have strainers attached to the suction flange of the pump casing. An option for an extension from the suction flange is available and is called a Suction pipe. A suction pipe is useful for applications where there is adequate NPSH at the lowest sump level, but the discharge pressure is critical and must be maintained at a maximum value compared to using a longer column and shaft.

7.6.3 Discharge piping

Install a valve in the discharge line. This valve is required for regulating flow and/or to isolate the pump for inspection and maintenance. When fluid velocity in the pipe is high, for example, 3 m/s (10 ft/sec) or higher, a rapidly closing discharge valve can cause a damaging pressure surge. A dampening arrangement should be provided in the piping.

All piping must be independently supported, accurately aligned and preferably connected to the pump by a short length of flexible piping. The pump should not have to support the weight of the pipe. It should be possible to install discharge bolts through mating flanges without pulling or prying either of the flanges. All piping must be tight.

- Use discharge piping one size larger than the pump discharge.
- Discharge piping should be well supported and connected to the pump such that no strain or weight of the piping is carried by the pump.
- Check pump shaft for freedom of rotation by hand to make sure any discharge piping strain is not causing binding.
- After the pump discharge, the increaser should be the first item in the discharge line, followed by the check valve and gate valve, respectively.
- It is recommended that pressure indicating devices be installed before and after the valves in the discharge line to verify the pump is not being run dry and that the discharge valves are not closed.

The check valve is required to prevent back-flow through the pump on shut-down. This flow can reverse rotation of the pump, potentially damaging the pump, motor and associated equipment.

7.6.4 Allowable nozzle loads



† Tension

Compression

Maximum Allowable Nozzle Loads							
Flange	Delivery Flange			Moments [Nm]			
riange	Forces (N)						
size [iiiii]	FX	FY	FZ	MX	MY	MZ	
40	632	783	516	335	256	168	
50	712	890	578	461	353	231	
65	890	1134	712	692	529	441	
80	1068	1334	890	949	719	475	
100	1423	1779	1245	1329	1003	678	
125	1957	2491	1601	1763	1356	1017	
150	2491	3114	2046	2305	1763	1180	
200	3781	4893	3114	3526	2576	1763	

7.7 Final free rotation check

After connecting the piping, rotate the pump drive shaft clockwise (viewed from motor end) by hand several complete revolutions to be sure there is no binding and that all parts are free. If piping caused unit to be in a bind, correct piping to relieve strain on the pump.

7.8 Auxiliary piping

Check to see if any other connections need to be made to pump, such as fluid injection to stuffing box for seal or packing lubrication (when furnished) and make the required connections.

Check to see that connections are made to the lubrication fittings at pump manifold on mounting plate.

8. Electrical connections

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].

- 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 pump set has been switched off by, a protective device, it must not be switched on again until the error has been corrected.
- The electrical system (pump set 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 pump set 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.

8.1 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 performance at 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 be driven by a frequency converter, this might influence the motor selection. Strictly follow the Frequency converter manufacturer instructions. The minimum rotation speed of the pump should never go below 40% of the nominal speed.

9. 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, startup. Refer to motor & electrical panel instruction manuals for electrical safety & control devices information.

MARNING! Danger of pump damage!

Do not operate the pump away from specified operating range. Operating beyond duty point may not only 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.

9.1 List of Essentials to made available at site prior to start commissioning

- Set of I-Beams of erection.
- Set of Slings, Shackles, wire ropes, eye bolts, wrenches.
- Set of spanners, Allen keys, hammer, scrapper, screw drivers.
- Skilled manpower, ladder, sufficient lighting, Helmet, Safety jacket, Safety Shoes etc.

9.2 Pre-starting checks

Prior to starting the pump, it is essential that the following checks be made.

- Motor properly secured to the motor stool
- All fasteners are tightened correctly
- Check that coupling guard in place
- Check bearing lubrication
- Ensure free rotation of shaft by hand when coupled
- Sufficient submergence level is maintained.
- No blockage in the strainer at the suction end.
- Check that delivery pressure gauge is connected.
- Discharge line is having non return valve & get valve installed.
- Test and make available all protection devices like alarm, signals, interlock systems 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 cooling water arrangement is provided bearing cooling and stuffing box.

9.3 Bearing Lubrication

Two types of bearings are used in vertical sump pumps. Line shaft bearings are used to support pump shaft within the column. These plain bearings are lubricated by external flush, product lubrication or grease.

Thrust bearings: Double row angular contact bearings are used to support the coupling end of the shaft. These ball bearings support coupling ends and take pump thrust. They are lubricated by bearing grease or oil.

Operation of the unit without proper lubrication can result in bearing failures, pump seizures and pump failure.

9.3.1 Line Shaft Bearings

Check to see that no damage has occurred to any lubrication lines above the mounting plate during shipment or installation. Check that connections are made to lubrication fittings at pump manifold on mounting plate.

9.3.1.1 External flush lubrication (Ref. fig.3; Page No. 5) a) Clean liquid from an external source must be used when pumps are furnished with external flush lubrication connections. Liquid is typically supplied continuously during operation. Lubrication is needed to dissipate heat and abrasives.

b) It is always absolutely necessary that rubber bearings be wet during operation.

Source	Capacity per Bush	Pressure	Connection tapping size
External clear water	0.3 to 0.5 m³/hr.	Delivery pressure*0.4 + 1 kg/cm²	At mounting plate ½" NPT

9.3.1.2 Internal flush lubrication (Ref. fig.2; Page No. 4) When conditions warrant, the pump can be furnished with provisions for pumped product bearing lubrication. This is accomplished by means of a lubrication line from the discharge flange of the pump casing to the line shaft bearings

Changes in noise and vibration may indicate insufficient lubrication.

9.3.1.3 Grease lubrication (Ref. fig.4; Page No. 6)

Pumps furnished with grease-lubricated line shaft bearings will leave the factory with lube lines and bearings already packed with grease. The grease used will be of a water-resistant nature. Each bearing should be re-greased prior to start-up through the grease fittings located in the manifold on the pump mounting plate. Grease must be insoluble in the liquid being pumped. The recommended grease to be used which are mentioned in section 9.4.1 or equivalent. Consult local lubricant suppliers for the type of grease most compatible with the liquid being pumped. The grease lubrication system is the same as the external flush system with the exception of the manifold. For grease lubrication the manifold contains grease fittings while the external flush manifold contains fluid line taps.

9.3.2 Thrust bearing lubrication

Grease lubricated double row angular contact thrust bearings are used as standard. The bearing will leave the factory with grease already packed.

The replacement interval of the grease for these bearings is mentioned in the section 9.4.2

Oil lubricated bearings are used for the designs such as **AOP** & **EOP** types (Ref. fig. 5 & 6, Page No. 7). In these pumps the pumped oil is used for the lubrication of bearings. (Ref. fig. 12, Page No. 11)

9.4 Cleaning of Bearings

Vertical sump pumps are supplied with oil or grease lubricated bearing depending upon the suitability. 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 oil/paraffin & used cotton cloth 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.

Bearings are given an initial charge of grease before leaving WILO Mather & Platt works and do not require any attention beyond the normal greasing routine before the first servicing period. Only greases recommended by pump manufacturer or their equivalent should be used. Bearings should never be over greased.

Do not overfill the thrust bearings with grease.

If too much grease is filled into the bearings, they can overheat.

9.4.1 Recommended Grease brands

Manufacturer	Grease type
Hindustan Oil Corporation	Servogem-2/3
Hindustan Petroleum	Lithon-2/3
Bharat Petroleum	Multipurpose grease- 3

NOTE:

^{1.} Only lithium base Grease to be used.

^{2.} Numbers mentioned stands for consistency.

^{3.} Grease of two different grades should not be used.

	PNV Pump Technical Data										
Ритр Туре	O' Ring Size *	Bearing Details	Brg. Lubricating Interval (Operating Hrs.)		Bearing Grease Qty. (gm)	Neck Ring & Impeller Clearances (mm)		Pump Bearing Bush & Sleeve Clearances (mm)		Intermediate Bearing Bush & Sleeve Clearances (mm)	
			1450 rpm	2900 rpm		Max.	Min.	Max.	Min.	Max.	Min.
PNV 25-125		3306	1200	500	15	0.359	0.289	0.748	0.638	0.570	0.480
PNV 32-125		3306	1200	500	15	0.359	0.289	0.748	0.638	0.570	0.480
PNV 50-125	ID 132.2 X DIA 4.75	3306	1200	500	15	0.379	0.309	0.748	0.638	0.570	0.480
PNV 65-125		3306	1200	500	15	0.438	0.363	0.748	0.638	0.570	0.480
PNV 25-160		3306	1200	500	15	0.359	0.289	0.748	0.638	0.570	0.480
PNV 32-160		3306	1200	500	15	0.359	0.289	0.748	0.638	0.570	0.480
PNV 50-160	ID 187.2 X DIA 4.75	3306	1200	500	15	0.379	0.309	0.748	0.638	0.570	0.480
PNV 65-160		3306	1200	500	15	0.438	0.368	0.748	0.638	0.570	0.480
PNV 32-200		3306	1200	500	15	0.359	0.289	0.748	0.638	0.570	0.480
PNV 40-200		3306	1200	500	15	0.379	0.309	0.748	0.638	0.570	0.480
PNV 50-200		3306	1200	500	15	0.438	0.368	0.748	0.638	0.570	0.480
PNV 65-200	ID 234.2 x DIA 4.75	3310	1100	400	20	0.478	0.398	0.818	0.688	0.828	0.698
PNV 100-200		3310	1100	400	20	0.539	0.469	0.818	0.688	0.828	0.698
PNV 150-200		3310	900	300	20	0.571	0.479	0.818	0.688	0.828	0.698
PNV 32-250		3310	1100	400	20	0.359	0.289	0.818	0.688	0.828	0.698
PNV 40-250		3310	1100	400	20	0.379	0.309	0.818	0.688	0.828	0.698
PNV 50-250		3310	1100	400	20	0.438	0.368	0.818	0.688	0.828	0.698
PNV 65-250	ID 282.5 x DIA 4.75	3310	1100	400	20	0.478	0.398	0.818	0.688	0.828	0.698
PNV 100-250		3310	900	300	20	0.539	0.469	0.818	0.688	0.828	0.698
PNV 125-250		3310	900	300	20	0.571	0.479	0.818	0.688	0.828	0.698
PNV 150-250		3310	900	300	20	0.630	0.538	0.818	0.688	0.828	0.698
PNV 40-315		3310	1100	400	20	0.379	0.309	0.818	0.688	0.828	0.698
PNV 50-315		3310	1100	400	20	0.438	0.368	0.818	0.688	0.828	0.698
PNV 65-315		3310	900	300	20	0.478	0.398	0.818	0.688	0.828	0.698
PNV 100-315	ID 344 x DIA 6.35	3310	900	300	20	0.539	0.469	0.818	0.688	0.828	0.698
PNV 125-315		3310	900	300	20	0.571	0.479	0.818	0.688	0.828	0.698
PNV 150-315		3313	800	250	25	0.630	0.538	0.690	0.570	0.718	0.658
PNV 200-315		3313	800	250	25	0.686	0.588	0.690	0.570	0.718	0.658
PNV 100-400		3310	900	300	20	0.539	0.469	0.818	0.688	0.828	0.698
PNV 125-400	ID 441 x DIA 6.35	3310	900	300	20	0.571	0.479	0.818	0.688	0.828	0.698
PNV 150-400		3313	800	250	25	0.630	0.538	0.690	0.570	0.718	0.658
PNV 100-500		3313	800	250	25	0.539	0.459	0.690	0.570	0.718	0.658
PNV 125-500	ID 548 x DIA 6.35	3313	800	250	25	0.571	0.479	0.690	0.570	0.718	0.658
PNV 150-500		3313	800	250	25	0.630	0.538	0,690	0.570	0.718	0.658
4/5 TYPF 12				250		0.050	0.550	0.000	0.570	010	0.050
MODEL 70	NA	6308				0.435	0.300	0.375	0.300	-	-
8/8 SERIES 6		2215	Oil I	_ubricated Be	arings	0.000	0.540	0.200	0.200		
MODEL 60	NA	3315		en zaonearoa obannigo		0.600 0.	0.540	0.380	0.300	-	-
5/6 EHLG	ID 284.2 x DIA 4.75	3311				0.571	0.479	0.380	0.300	-	-
* Refer. 'O'-RING	(CASING/BACK COVER)									

9.5 Availability of liquid

Efficient operation of the pump depends upon the fine running clearances of internal hydraulic components which are lubricated by pumped fluid. Sufficient fluid must be available to ensure that the pump is flooded at all times to prevent seizure of the internal components. Wherever external flushing/lubrication is provided it should be available before starting the pump.

If on starting, a pump fails to generate its rated delivery head, as indicated on the pump nameplate, it must be stopped immediately; the cause must be ascertained and rectified, before re-starting.

Ensure that minimum submergence is available as recommended. Open all ancillary inlet and outlet isolating valves such as air vents, leak-off connections etc.

CAUTION! Danger of Dry Run !

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

9.6 Direction of rotation

It is absolutely essential that the rotation of the motor be checked before installing the coupling drive element. Incorrect rotation of the pump, for even a short time, can damage the impeller, casing, shaft and shaft seal. Always check the direction arrow which is cast on the motor stool.

9.7 Coupling Installation (Ref. fig. 13 & 14; Pg. No. 12)

Turn off the driver power and lock it out so that the driver cannot be started during the coupling assembly. Non-spacer couplings are used. Mount coupling hubs/sheaves on pump and motor shafts prior to attaching motor to the motor stool. The coupling should be installed as advised by the coupling

manufacturer. Remove all protective material from the coupling and shaft before installing the coupling.

9.8 Starting the pump & running checks

To avoid pump damage or injury to operating personnel during start-up and operation,

- **DO NOT** operates the pump outside of design parameters.
- DO NOT run with a closed discharge
- **DO NOT** operate with safety devices removed (such as coupling guard)
- DO NOT run the pump dry.
- Minimum submergence level should be as per recommended.
- All flush lines must be started & regulated
- 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 motor stool) otherwise stop the pump immediately for correction of direction of rotation.

- 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 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 spherical roller bearings. The temperature should never exceed 85°C for bearings. If the bearings are overheating its cause should be investigated immediately.
- Check vibration of pump set and ensure that vibration level is within limits specified as per HIS standard (see page no. 26 for reference)
- 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 if applicable.

If pumps fail to generate its rated delivery pressure as indicated on the pump nameplate. It must be stopped immediately, the cause ascertained, the fault rectified and then restart. (Refer point no. 12 Page No. 30 for detail information)

9.9 Normal Shutdown

WARNING! Risk of Burns!

If the fluid temperature and system pressure is high, close the isolation valves upstream (in case of barrel pumps) and downstream of the pump. Initially let the pump cool.

Stop the driver of the pump. When the pump has come to rest, close the delivery valve. Isolate any ancillary supplies.

9.10 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 discharge valves, isolate the driving unit power supply & rectify the fault.

Hydraulic Institute Standard (ANSI/HI 9.6.4–2016) Acceptable field vibration limit chart (9.6.4.2.5.1b)



10. 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 de-pressurize the system.

10.1 Routine maintenance and frequency of inspection

Vertical sump 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 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.
- Vibration & sound level readings should be taken once in a fortnight and values compared with that of previous records.

- For any abnormality observed from the visual/ manual inspection and through maintenance and 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 Faults, causes and remedies.

	Routine maintenance						
Parts	Action	Period	Remarks				
Bearings	Check temperature	Weekly	If Bearing temperature exceeds 80 ⁰ C, the fault needs to be rectified.				
Oil / Grease @ Bearing	Replenish		Refer 9.4.2 / Tech Data Pg. No. 24				
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. 26				
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. Tech Data Pg. 24)				
Alignment	Check the alignment of pump with motor	Half yearly	Refer 9.7, Tech. Data Pg. No. 24				

• Check dirt and dust is removed from areas around close clearances, bearing housing and motors.

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

Recommended Tightening Torques for fasteners (Nm)						
Thread Size	Material Class 8.8	Material Class 10.9				
M4	3	4.3				
M5	6	8.9				
M6	10.3	15.1				
M8	25	37				
M10	50	74				
M12	67	128				
M14	139	205				
M16	214	316				
M20	431	615				
M22	586	835				
M24	745	1060				
M27	1090	1560				
M30	1480	2105				
M33	2013	2865				
M36	2586	3680				
M39	3348	4760				

10.2 Overhaul maintenance

- 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.
- 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 Platt. Such requests must quote name plate number and type of the pump in question.

The parts most likely to be affected are:

- Impeller
- Neck Rings
- Sleeves
- Stuffing Box Bush
- Bearings
- Coupling Bushes

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.
- Installation and operating instructions WILO Mather and Platt Sump Pumps

- 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, screw 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

10.3 Disassembling the Pump

10.3.1 Disassembling the top Motor

- Isolate the pump motor electrically
- Isolate the pump system hydraulically
- Clear the area of any equipment that might impede the free lifting of the pump
- Disconnect and remove the driving coupling
- Disconnect the electrical supply cables from the motor terminal block
- Attach slings and lifting apparatus to the motor lifting attachments
- Remove the screws / bolts, or nuts, from the motor flange and lift the motor off from the motor stool.
- Support the motor on timber packing blocks with the coupling hub clear off the ground

10.3.2 Removing pump from pit

- Dismantle the discharge pipeline, delivery valves and nonreturn valve from the delivery pipe.
- Then remove the complete pump assembly along with mounting plate away from the sump.

10.3.3 Disassembling of pump parts

- Remove the coupling key & take off the coupling half from top pump shaft.
- Remove Adjusting ring from the shaft.
- Dismantle the delivery pipe (TOP) from the casing.
- Remove bearing cover, unscrew lock washer and remove bearing cartridge along with bearing from top shaft.
- Unscrew the fasteners and remove the motor stool
- Remove casing from the bottom support pipe along with the strainer.
- No need to remove the strainer from casing unless it is to be cleaned or replaced.
- Remove the locking screw and unscrew the impeller nut
- Remove the impeller
- Unscrew the fasteners and remove the back cover along with the bush bearing
- Remove shaft sleeve from the shaft.
- Remove intermediate assembly consists of the support pipes and intermediate shafts and bearing brackets.
- Remove muff coupling assembly
- Remove the intermediate bracket/support pipe assembly fasteners and remove top support pipe.

10.4 Examination of Internal Components

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

10.4.1 Casing neck ring

Use an internal micrometer to measure the bore of casing 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 neck ring should be replaced. **Refer Pump Technical Data for Details (Pg. No. 24)**

The impeller-wearing ring to casing neck ring clearance must be restored to the original design value by fitting small in-bore neck rings, bored out to suit the diameter of the impeller.

10.4.2 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 stuffing box bush 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 limits.

10.4.3 Impeller

Inspect the impeller as follows:

- Inspect the impeller for mechanical damage, corrosive pitting, cavitation etc. If damage is extensive, the impeller may need replacement.
- Examine around the eye at neck portion for grooving; slight grooving is acceptable, but deep or profuse grooving must be remedied by machining the impeller and fitting small-in-bore neck ring.

To check wear around eye, use precision tools such as outside micrometer to accurately measure outside diameter of impeller. When this diameter is subtracted from internal diameter of neck ring, which is measured in sequence 2.1, clearance obtained should not be more than 150% of maximum designed clearance. **Refer Pump Technical Data for Details (Pg. No. 24)**

10.4.4 Shaft & keys

Shaft should be checked for the trueness, or any other mechanical damage and corrosion. If the shaft is not true within 0.1 mm TIR (Total Indicated Reading), it should be replaced / repaired. Examine the shaft keys and keyways. Remove damaged or worn out keys.

10.4.5 Bearings

- Visually inspect the bearings. The balls, the inner and outer tracks must all be free from chipping, cracks, abrasion or discoloration.
- Inspect the bore for any sign of damage. The burrs of any scratches caused during bearing withdrawal should be carefully removed by the hand application of a fine oil stone, 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.

10.4.6 Bearing Cartridge

- 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 cartridge should be cleaned, and trial assembled. Bearing should be transitional fit.

10.5 Reassembling the Pump

Follow the procedure given below in case of pumps to be erected for the first time or pumps to be assembled after dismantling for overhauling. Clean all the parts thoroughly with kerosene, petrol to remove dust, dirt etc. Check the sleeves bore and shaft outside diameter which is free from burs and scratches. Deburr if required. Replace the parts with a new one if found damaged. Use new gaskets and O rings at the time of reassembling.

a) Fit the bearing bush (pump end) in the back cover. Mount the support pipe (Bottom) on the back cover. Fix the screws between support pipe and back cover.

b) Insert the shaft sleeve on pump shaft (Impeller end) with key and insert the intermediate sleeve at the other end (muff coupling) and tighten the grub screw with the shaft. Insert the pump shaft through the back cover.

c) Place the key in position and mount the Impeller. Place the lock washer, take care that the pinch projection in washer should lock with the hole provided in the Impeller face and screw the Impeller nut. Tighten the Impeller nut along with lock washer and fold it along with the impeller nut for securing the nut from unscrew.

d) Insert the assembly so far completed into the pump casing with O ring (in between back cover and casing) in proper position. Tighten the hex. nuts on pump casing studs diametrically opposite evenly.

e) Fit the bearing bush (Intermediate) in the Intermediate bearing bracket and mount it on the support pipe (bottom) top face.

This completes the casing assembly. At this stage the pump shaft will be projected above the Intermediate bearing assembly.

f) Insert the intermediate shaft sleeves on the Intermediate shaft both ends and tighten the grub screw.

g) Connect the Intermediate shaft to the pump shaft by means of muff coupling. The muff coupling sleeve first be slide on the intermediate shaft. Put the keys on both ends of the shafts and bring both the shaft ends close together in line. With slight adjustments of shaft fit the split collars on the both ends of the shafts and slide the muff coupling on the pump shaft till it rests on the shaft step. Ensure proper fitting of the muff coupling with both the shafts and tight the grub screws provided on the muff coupling.

h) Lower the intermediate support pipe and connect it to the bottom support pipe. Tighten diametrically opposite bolts evenly.

i) Repeat the same procedure till top shaft. (Ref. fig. 15; Page No. 12)

At this stage the top shaft will be projected outside, above the support pipe (top).

j) Fit the motor stool on the mounting plate.

k) Fit the top pipe assembly to motor stool by fasteners with top shaft passing through the motor stool.

I) Mount the bearing in the bearing cartridge.

m) Slide the bearing spacer over the top shaft and insert the cartridge assembly through the shaft.

n) Now the total bearing cartridge assembly will rest on the stuffing box stool and fasten it.

o) Insert the bearing lock washer over the shaft and place the lock nut. Firmly tight the lock nut along with the shaft. Fold the lock washer arm into the bearing lock nut slot.

p) Place the bearing cover over the bearing cartridge and fix it by means of screws.

q) Check the freeness of pump in horizontal condition.

r) Mount the delivery pipe to the casing with gasket.

s) Fix the delivery pipe to the mounting plate by means of clamping plate which is already welded to the delivery pipe and It prevents direct load acts to the casing.

t) Make all the connections like delivery bend, valves, and nonreturn valve above the mounting plate. Precaution should be taken that no direct load will act on the delivery pipe, such a way that the pipe extension and valve assembly should be supported.

CAUTION! Ensure that the pump shaft rotates freely.

u) Mount the pump half coupling and tighten the lock screw.

v) Make the motor electric connections. Mount the motor half coupling and tighten the screw of the coupling. Make sure the direction of rotation before mounting the motor on the motor stool. The direction of rotation should be clockwise when viewed from the top i.e. Non-driving end of the motor.



Direction of rotation of pump should be clockwise when viewed from the top.

w) Mount the motor on the motor stool. Check the angular alignment with the help of filler gauge and parallel alignment with the help of straight edge and filler gauge. Alignment should be within 0.05mm.

x) Grease the bearing with the help of grease gun. For further greasing the bearing a separate grease feeder is supplied along with the pump, which is mounted side of the motor stool.

10.5.1 Adjusting the Impeller

Proper Impeller adjustment positions the Impeller inside the casing assembly for maximum performance.

The Impeller can be adjusted with complete rotor assembly by means of adjusting screw with locknuts provided in bearing cartridge.

To adjust the Impeller, release the locknuts in adjusting screw and unscrew all the fixing screws provided in bearing cartridge. By Unscrewing / screwing the adjusting screw in bearing cartridge the entire total rotor assembly moves up / down as decided.

After adjusting the Impeller make sure to lock the locknuts in adjusting screws. Tighten the screws with bearing cartridge. It is Important to position the Impeller correctly in relation to the casing. No rubbing can be allowed with sidewalls or front walls of the casing.

10.6 Recommended spare parts

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

		Under normal operation				
		For 2 Years	For 5 Years			
Part No.	Part Description	Qty./Pump	Qty./Pump			
1102	Neck Ring	1	2			
1700	Impeller Nut	1	2			
1500	Impeller	1	2			
4250	O–Ring (Casing/Back cover)	1	2			
2830	Pump Bearing Bush	1	2			
2832	Pump Bearing Sleeve	1	2			
1800	Pump Shaft	1	2			
1805	Intermediate Shaft	n-1	n-1			
1803	Top Shaft	1	2			
2801	Int. bearing Bush	n	n			
2050	Muff Coupling set	n	n			
2603	Thrust bearing	1	2			
2834	Int. bearing sleeve	n	n			
4080	Gasket	1	2			
n = No. o	n = No. of Intermediate bearing brackets					

For 2 & 5 years of normal operation:

	NOTE:
U	n= Nu

n= Number of Intermediate Bearing Brackets. Part numbers as applicable.

11. Decommissioning and recycling

The disposal of all material or debris must be done in order to protect the environment.

WILO Mather and Platt pumps do not contain any hazardous 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 the qualified personals. Cleaning and de-contamination must be achieved before any transportation or recycling.

12. Faults, Causes and Remedies (For Bare Pump Only)

	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 column pipe not completely filled with liquid	Check water level and blockages at strainer
3	Suction lift too high	Reduce by lowering pump elevation or increase Water level
4	Insufficient margin between pressure and vapor 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 that air release valve is open
7	Air leaks into suction line	Tighten pipe joints with solution
8	Air leaks into pump through stuffing boxes	Ensure stuffing box sealing
9	Strainer broken	Replace
10	Strainer partially clogged	Shut off the pump, strainer usually gets cleaned due reverse flow
11	Inlet of suction pipe insufficiently submerged recommendation	Ensure adequate submergence level as per pump manufacturers
12	Water seal pipe clogged	Clean or change
13	Logging ring is improperly located in stuffing box, preventing sealing fluid from entering to seal	Position logging ring centrally under sealing holes of stuffing box form
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 head of pump	Check the causes and refer to M&P. Measure with pressure gauge
18	Total head of system lower than pump design head	Check the causes and refer to M&P. Measure with pressure gauge
19	Specific gravity of liquid different from design	Refer to WILO Mather and Platt
20	Viscosity of liquid different from design	Refer to WILO Mather and Platt

	Causes	Remedies
21	Operation at very low capacity	Check the causes and refer to M&P, operate pump at rated Duty
22	Parallel operation of pumps unsuitable for such Operation	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 mount plate, 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 packing	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
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 bearings (damage, incorrect assembly of stacked bearings, use of unmatched bearings as a pair etc.)	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 bearing housing	Reduce cooling water flow e in

1 NOTE:

The above faults, causes and remedies are for pump only. Refer Motor / Engine manufacturers manual for the respective faults, causes and remedies.

Annexure-1

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		
	Installation of all instruments		
	Suction and delivery pressure gauges		
5	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		
10	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 I	Pumps)
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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 Vibration Measurement



Pump Set Details:

Date:

Pump Sr. No.	Motor Sr. No.:
Pump Type:	Make:
Project:	

Vibration Measurement: (Pk to Pk)

C	Position	V			Η	A	
Sr. No.		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
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Pump Set Details:

Date:

Pump Sr. No.	Motor Sr. No.:
Ритр Туре:	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

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