Excellent Minerals Solutions

WEIR MINERALS EUROPE LIMITED

INSTALLATION, OPERATION & MAINTENANCE MANUAL

PUMP TYPE: 300PG-PC

Client:	
Warman Ref:	
Customer PO No:	
Serial No/s:	
Tag No/s:	
Manual Ref:	
Date:	**16/07/2015**

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Original Instructions

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INSTALLATION AND MAINTENANCE MANUAL

WARMAN SLURRY PUMP PROCESS CHEMICAL

300 PG-PC

GLAND SEALED VALUE ENGINEERED

NOTE:
This manual has been compiled to suit a particular range of pumps.
Additional copies are readily available, however, regrettably a nominal charge is made for the extra copies to cover printing and administrative costs. The policy of continuous improvement may mean that replacement parts may differ from original parts fitted. All information in this manual is based on the latest information available, but the right is reserved to introduce modifications which may affect this information.

PUMP IDENTIFICATION

To ensure long trouble-free service from a Warman pump, the instructions contained in this manual must be carefully applied.

Every Warman pump has a nameplate attached to the frame. The pump serial number and identification code is stamped on the nameplate.

The pump identification code is made up of digits and letters arranged as follows:

DIGITS	LETTERS	LETTERS
A	B	C
PUMP SIZE	FRAME SIZE	WET END TYPE

(a) The pump size is taken to be the discharge diameter. It is given in millimetres; it is expressed by a number such as 100, 150, 200, and 250.

(b) The frame size of the pump is identified by letters such as PD, PE, PF, and PG.

(c) The wet end is identified by letters ‘PC’ for Process Chemical. Where the letter ‘H’ is added it denotes High Head.

On ‘PC’ pumps the diameters of the intake and discharge are the same; on ‘PCH’ pumps they can be different.

Examples:

200 PF PC 200mm intake + 200mm discharge diameter

PF – Frame Size

PC – Process Chemical

200 PG PCH 250mm intake + 200mm discharge diameter

PG – Frame Size

PCH – Process Chemical High Head

This manual highlights danger areas during assembly. These must also be observed during dismantling. Read the manual and for strict safety note the danger areas.

WARNINGS:

The following warnings provide important safety information and are relevant to all Warman pumps. Some of the warnings are repeated in the text throughout the manual.

1. **THE WARMAN PUMP IS BOTH A PRESSURE VESSEL AND A PIECE OF ROTATING EQUIPMENT. ALL STANDARD SAFETY PRECAUTIONS FOR SUCH EQUIPMENT SHOULD BE FOLLOWED BEFORE AND DURING INSTALLATION, OPERATION AND MAINTENANCE.**

2. **FOR AUXILIARY EQUIPMENT (MOTORS, BELT DRIVES, COUPLINGS, GEAR REDUCERS, VARIABLE SPEED DRIVES, ETC.) STANDARD SAFETY PRECAUTIONS SHOULD BE FOLLOWED AND APPROPRIATE INSTRUCTION MANUALS CONSULTED BEFORE AND DURING INSTALLATION, OPERATION AND MAINTENANCE.**

3. **DRIVER ROTATION MUST BE CHECKED BEFORE BELTS OR COUPLINGS ARE CONNECTED. PERSONAL INJURY AND DAMAGE TO EQUIPMENT COULD RESULT FROM OPERATING THE PUMP IN THE WRONG DIRECTION.**

4. **DO NOT OPERATE THE PUMP AT LOW OR ZERO FLOW CONDITIONS FOR PROLONGED PERIODS, OR UNDER ANY CIRCUMSTANCES, WHICH COULD CAUSE THE PUMPING LIQUID TO VAPORISE. PERSONAL INJURY AND EQUIPMENT DAMAGE COULD RESULT FROM THE PRESSURE CREATED.**

5. **DO NOT APPLY HEAT TO IMPELLER BOSS OR NOSE FOR ANY REASON. PERSONAL INJURY AND EQUIPMENT DAMAGE COULD RESULT FROM THE IMPELLER SHATTERING OR EXPLODING WHEN HEAT IS APPLIED.**

6. **WHEN DISMANTLING THE PUMP ENSURE THAT THE CASING IS ADEQUATELY SUPPORTED BEFORE REMOVING THE CLAMP RING.**

7. **SHOULD ANY DIFFICULTIES ARISE DURING DISMANTLING CONTACT WEIR MINERALS EUROPE LIMITED FOR ADVICE.**

INSTALLATION OF PUMP UNITS

Bedplates:
Before dispatch from the factory the pump and its driving unit are erected on a common bedplate which in turn is supported on a level assembly bed. Pump and driving units, which share the same bedplate, have their driving and driven shafts aligned while the set is mounted on the assembly bed.

Uneven foundations on site such as concrete plinths can cause the bedplate to distort. To alleviate distortion, the foundation surface should be levelled as described in **'Levelling a Common Bedplate'.**

Foundations:
Efficient pump service can only be obtained by installing the pump on steel and concrete foundations designed to take all loads from the pump and motor and to absorb any vibrations.

During the preparation of the foundation block, holes should be cast into the concrete to accommodate the pump securing bolts. Refer to general arrangement drawing for foundation centres.

The top surface of the block should be left rough for keying the final grout.

Depth of foundations should be designed to suit nature of ground.

Where a pump base is mounted directly onto a steel framework this should be designed with sufficient strength to withstand normal pumping operational stress and to ensure that there is no distortion to the basic frame when the pump and pump base is installed.

Levelling a Common Bedplate:
Position the securing bolts through the holes in the bedplate and adjust the nuts to a full nut depth.

Mount the bedplate complete with pump and driving unit, onto the foundation block.

For large pump units i.e.; Pump, Gearbox, Variable speed Drive and Electric Motor it is strongly recommended that all items are removed from the bedplate prior to mounting.

Support with iron or steel packing pieces placed at frequent intervals between the underside of the bedplate and the top surface of the foundation block. Sufficient pieces must be used to support the bedplate without distortion. In addition at least one piece must be placed each side of each securing bolt. Check the bedplate level using an engineer's level and adjust to within 0/5mm in 254mm. This is achieved by shimming the gap with packing pieces. Ensure that each packing piece is supporting the bedplate.

When the bedplate is level, grout in the securing bolts.

When the grout has set, gently but firmly tighten the securing bolts. Care must be taken not to distort the bedplate or loosen the securing bolts in the grout by excessive tightening.

If previously removed mount all items onto the bedplate.

Check the alignment of the pump and its driving unit. See Section WP2 'ALIGNMENT'.

When both the bedplate level and the shaft alignment are satisfactory the final finishing grout can be run-in and the concrete plinth finished off.

ALIGNMENT AND TENSIONING - BELT DRIVE

General:

When belt driven, the pump and motor shafts should be accurately aligned. In belt drives, non-parallel shafts cause excessive belt wear.

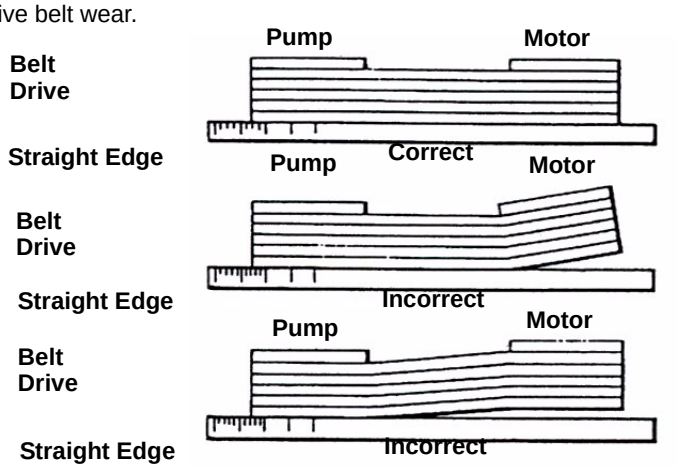


Fig 1. Belt Alignment

Alignment:

Before fitting the drive belt, ensure the following details are adhered to. Clean any oil or grease from the pulleys. Remove any rust or burrs from the grooves. Reduce the centre distance by jacking the motor towards the pump using the jacking bolts supplied, until the drive belt can be put onto the pulley grooves without forcing. Use a good straight edge across both motor and pump pulley faces. It is important to align the two pulleys to a tolerance whereby daylight is non-existent or at a minimum between the pulleys and the straight edge. Refer to Fig.1 above.

Tensioning:

Proper tensioning of the belt drive ensures a longer life for both the belt and the roller bearings.
Rotate the drive while tightening the belt in order to equalise the tension.
The high performance required from a modern belt drive cannot be achieved without the correct tensioning. To check the belt for correct tensioning refer to Fig. 2 above and proceed as follows:-

- Measure the centre distance. (M)
- Apply a force at right angles to the belt at the mid point of the centre distance to deflect one belt by the required deflection.
  Deflection (mm) = Centre distance (M) x 16
- Compare the force required with the value stated in the table.

If the measured force is within values stated in the table the belt tensioning should be satisfactory. If the force measured is below or above the value stated the belt should be tightened or slackened respectively.

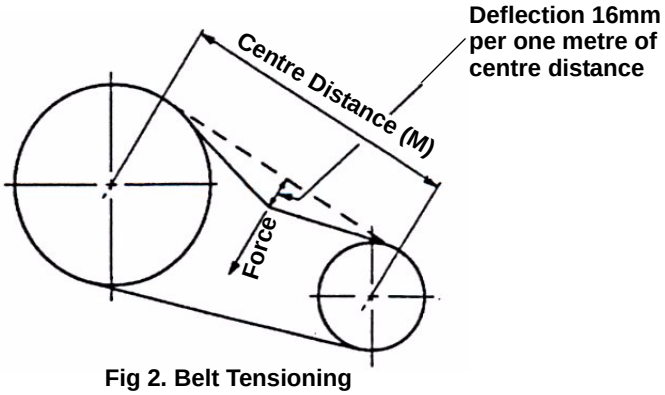


Fig 2. Belt Tensioning

A new belt drive should be tensioned to the higher value stated (1.25 x setting forces) to allow for the normal drop in tension during the running in period. After the drive has been running for thirty minutes, the tension should be rechecked and readjusted to the higher value.

Tensioning Forces:

Belt Section	Setting force to deflect belt 16mm per metre of span				
	Small Pulley Diameter (mm)	Basic setting forces Newton (N)	Kilograms (kg)	1.25 x setting forces Newtons (N)	Kilograms (Kg)
SPZ	56 to 71	16	1.6	20	2.0
	75 to 90	18	1.8	22	2.2
	95 to 125	20	2.0	25	2.5
XPZ & QXPZ	over 125	22	2.2	28	2.8
SPA	80 to 100	22	2.2	28	2.8
	106 to 140	30	3.0	38	3.9
	150 to 200	36	3.7	45	4.6
XPA & QXPA	over 200	40	4.0	50	5.1
SPB	112 to 160	40	4.0	50	5.1
	170 to 224	50	5.1	62	6.3
	236 to 355	62	6.3	77	7.9
XPB & QXPB	over 355	65	6.6	81	8.3
SPC	224 to 250	70	7.1	87	8.9
	265 to 355	92	9.4	115	12.0
QXPC	over 375	115	12.0	144	15.0

Under Tensioning:
Under tensioning of the drive belt can cause vibration resulting in damage to the bearing cartridge, as well as the loss of transmission efficiency. Under tensioning also causes the drive belt to slip and overheat, resulting in belt fatigue and subsequently a shortening of the belt life.

Over Tensioning:
Over tensioning of the drive belt can shorten the drive belt life. Furthermore bearings will overheat due to excessive radial forces on the rolling elements and this will lead to premature bearing failure.

Adjustment:
After the drive has been running for thirty minutes, the tension should be rechecked and readjusted to the higher value. The drive should then be subsequently checked at regular maintenance periods.

ALIGNMENT – DIRECT COUPLED DRIVE

General:
In direct coupled drive, misalignment causes unnecessary vibration and wear on the bearings. Rigid couplings should be avoided and must not be used without consultation with Weir Minerals Europe Limited.

The following procedures outline the recommended practice given in BS 3170 1972 (Appendix) for checking shaft alignment. This method is independent of the truth of the coupling or shaft and is therefore not affected by canted coupling faces or eccentricity of the outside diameter of the coupling.

CAUTION: CHECK THAT NO DAMAGE CAN BE CAUSED WHEN THE SHAFT OF THE DRIVE UNIT IS TURNED.

Before commencing alignment rotate each shaft independently to check that the shaft and bearings turn without undue friction and that the shaft is true to within 0.04mm or better as measured on a Dial Test Indicator (DTI).

Couplings should be loosely coupled, each half must be free to move relative to the other or the resulting DTI readings can be incorrect. Where tightly fitting pins or springs prevent loose coupling, the pins or springs should be removed, a line scribed across both half couplings and readings taken only when the two are aligned. On couplings with a serrated rim, ensure that as the couplings are rotated, the gauge plungers do not fall into a groove and become entangled.

Angular Shaft Alignment
To ensure correct Angular Shaft alignment proceed as follows:

Isolate the driving unit from the power supply.
Refer to Fig. 3 and clamp two Dial Test indicators (DTI) at diametrically opposite points (180°) on one half coupling, with the plungers resting on the back of the other half coupling.

Rotate the couplings until the gauges are in line vertically, and set the gauges to read zero.

Rotate the couplings through a half (180°) revolution and record the reading on each DTI. The reading should be identical though not necessarily zero because of possible end float. Either positive or negative readings are acceptable provided that they are equally positive or negative. Refer to paragraphs headed **“Tolerances”** for the maximum allowable tolerance and adjust the position of one of the units if necessary.

Rotate the couplings until the gauges are in line horizontally and reset the gauges to read zero.

Repeat operation and adjust the unit position until the correct tolerance is achieved and no further adjustment is necessary.

Radial Shaft Alignment
To ensure correct Radial Shaft Alignment proceed as follows:
Isolate the driving unit from the power supply.

Refer to Fig. 4 and clamp one DTI on one half coupling, with the plunger resting on the rim of the other half coupling.

Set the gauge to read zero.

Rotate the couplings through a quarter (90°) revolution and record the reading on the DTI. Repeat for each quarter (90°) revolution. Any variation in the readings indicates a 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. Refer to paragraphs headed **“Tolerances”.**

NOTE: Provisional alignment can be carried out with the unit cold however, where the working temperature of the pump has the effect of raising the centre line of one machine relative to the other, allowances must be made. The units should then be realigned when each has attained their correct operating temperature.

Tolerances:
The limits of accuracy within which adjustments must be made cannot be specifically defined because of differences in the size and speed of units, but the following variations which can be tolerated when checking alignment, are suggested.

Semi Rigid Couplings

1. Angular Alignment:
Couplings up to 300mm dia……0.05mm
Couplings more than 300mm……0.07mm

2. Radial Alignment:
Not to exceed 0.1mm on micrometer dial gauge
(I.e. 0.05mm eccentricity).

Flexible Couplings
Consult manufacturer literature.

INSTALLATION OF PIPEWORK

Pipework:
No strain should be imposed on the pump casing either by the weight of pipes or by tightening badly fitted pipes. Experience has shown that such strain can seriously affect the alignment of the pumping unit. All pipework attached to the pump must be the correct size and fully supported. The mating faces of the pipe flanges must abut squarely, with all bolt holes in line. In joining the pipework to the pump on no account should excessive force be used as this could result in damaged castings and flange damage.

A removable piece of pipe (preferably flexible on the intake side) should be fitted to the intake and discharge pipework. The removable intake/discharge pipes should be of sufficient length to allow removal of the casing for easy access when renewing worn parts.

Intake Conditions:
Suitable isolation should be fitted in the intake pipe as near to the pump as possible.

THE INTAKE PIPE MUST BE FULLY SUPPORTED.

The intake pipe should be as short as possible.
An arrangement of intake pipework, which is common to two or more pumps operating on suction lift, is not recommended. If such an arrangement is unavoidable any points of possible air ingress, such as valve glands, should be liquid sealed and isolating valves should be fitted at appropriate points.
The diameter of the intake pipe required depends upon its length and bears no fixed relationship to the diameter of the intake branch of the pump. The size of the pipe must be such that the velocity is kept to a minimum, but above the solids particle critical settling velocity to reduce friction losses i.e. a long intake pipe, (or one with numerous bends) which passes a given quantity of liquid must be of larger bore than a short straight one passing the same quantity of liquid.
When the bore in intake pipe is increased to a size larger than that of the pump intake branch, the form of taper pipe used must not allow the formation of air pockets.
To avoid the formation of air pockets, the installation of intake pipework must be arranged under the following conditions:

a. With as few bends as possible.

b. Completely airtight

c. Taper at the bottom

Delivery Conditions:
Suitable isolation should be fitted in the delivery pipe as near to the pump as possible.

THE DISCHARGE PIPE MUST BE FULLY SUPPORTED.

IMPORTANT: WHEN PIPING UP THE INTAKE AND DISCHARGE FLANGES OF THE PUMP IT IS IMPERATIVE THAT THE IMPERATIVE THAT THE APPROPRIATE WARMAN JOINT RINGS BE USED. THE JOINT RINGS FORM AN EFFECTIVE SEAL BETWEEN PIPEWORK AND PUMP FLANGES.

IMPORTANT: CARE SHOULD BE TAKEN NOT TO OVERTIGHTEN THE FLANGE BOLTS THUS PREVENTING DAMAGE TO THE JOINT RINGS.

COMMISSIONING CHECKS

Before any pump is brought into service during initial commissioning or re-commissioning after overhaul, all pipework associated with the pump should be flushed through. The following set procedure should then be carried out:

Motor Rotation Check:
REMOVE ALL BELTS
DISCONNECT SHAFT COUPLING

WARNING: ROTATION IN DIRECTION OPPOSITE TO THE ARROW ON THE PUMP WILL UNSCREW THE IMPELLER FROM THE SHAFT CAUSING SERIOUS DAMAGE TO THE PUMP.

Start motor, check rotation and correct if necessary to produce pump shaft rotation indicated by arrow on pump casing or bearing cartridge. Refits belts. When tensioning belts maintain shaft alignment. See Section WP2 'ALIGNMENT'. Reconnect shaft coupling.

Shaft Rotation:
The shaft should be rotated by hand to ensure that the impeller turns freely within the pump. At any indication of fouling, the impeller must be adjusted. See Section WP3 'FRONT IMPELLER CLEARANCE ADJUSTMENT'.

Shaft seal check: Gland Seal
Full Flow: Restricted Flow: Low Flow
See Section WP6 'PUMP ASSEMBLY'
Check gland seal water is available and that it is of sufficient quantity and at the correct pressure. In solids handling pumps, gland water pressure would be approximately 5 p.s.i (0.35 kg/cm²) above pump discharge pressure. The following flow rate should be provided at the tapping in the stuffing box.

FLOW RATE

Frame	Full (Litre/ second)	Restricted (Litre/ second)	Low (Litre/ minute)
PD	0.15	0.07	0.8
PE	0.20	0.10	1.0
PF	0.35	0.12	1.5
PG	0.75	0.15	2

Slacken off gland and adjust it so that a small flow is obtained along the shaft. Note that pumps supplied by Weir Minerals Europe Limited Factories usually have tight glands to minimise shaft vibration during transport. It is therefore necessary to slacken off the gland bolts prior to starting the pump.

Gland sealing water must be left on during all operations. Including pump start up, and running.

NOTE: With the aging and deterioration of a pump gland, the required GSW Flowrate can be up to three times (3x) higher than listed above. Any design of a GSW supply system should take this higher flowrate into account.

Shaft Seal Check: Centrifugal Seal
See Section WP6 'PUMP ASSEMBLY'

Centrifugal sealed pumps fitted with metal expeller ring, lubricate the static seal chamber. Two complete turns of the grease cup is recommended.

Priming Procedure – Caution
A centrifugal pump is not self-priming and if it fails to generate its rated delivery head on starting, it must be stopped immediately, the fault rectified, and the pump re-primed before re-starting.

Pumps Operating on Positive Inlet Head:
To prime the pump, fully open the inlet-isolating valve.

Pumps Operating on Negative Inlet Head:
To prime the pump, see supplement accompanying this manual which gives details of the various priming methods recommended.

STARTING PROCEDURE

Normal practice whenever possible is to allow pumps to operate on water only for a short period before introducing solids or slurry into the system.

Before attempting to start up the pump carry out the checklist below:

Test and make available any alarm signals, interlock systems, and any other protective devices incorporated in the pumping system.

Open all ancillary inlet and outlet isolating valves to cooling systems.

Ensure that the shaft seal is serviceable.

Ensure that sufficient fluid is available at the inlet pipe to satisfactorily prime the pump.

Ensure that the inlet-isolating valve is fully open.

WARNING: PUMPS FITTED WITH MECHANICAL SEALS MUST HAVE THE SEAL CHAMBER VENTED TO ENSURE AIR IS NOT TRAPPED IN THE VICINITY OF THE SEAL FACES. DRY RUNNING WILL CAUSE SERIOUS DAMAGE TO THE SEAL FACES.

Ensure that the delivery valve is approximately 10% open. This reduces the load on the shaft seal.

PUMP START UP
When all foregoing procedure checks are satisfactory, depress the appropriate ‘START PUMP’ push button on the control panel and run the pump up to its rated speed.

OPERATIONAL CHECKS

Running:
When the pump has attained its full operating speed the following checks must be made:
That the pump is rotating in the correct direction as indicated by the directional arrow.
That the pump is generating not less than its rated delivery head.
If the pump fails to generate at least its rated delivery head it must be stopped immediately, the cause ascertained the fault rectified and the pump re-primed before re-staring. See Section WP3 'FAULT FINDING CHART'.
If the foregoing checks are proved to be satisfactory, open the delivery valves slowly and bring the pump gradually up to load.

WARNING: PUMPS THAT ARE NOT FITTED WITH A LEAK-OFF DEVICE SHOULD NOT BE RUN FOR A LONG PERIOD AGAINST A CLOSED DISCHARGE VALVE.
CHECK THAT THE DRIVING UNIT IS NOT BEING OVERLOADED.

Overloading may occur when the pump is discharging into an empty system when the delivery head will be temporarily lower and the throughput in excess of that for which the pump is designed. Careful regulation of the delivery valve until the system is fully charged will prevent this.
Ensure that the bearings are not overheating. The ideal running temperature of a bearing is between 40°C and 90°C.
However, this figure may be slightly increased as long as the reading is constant. A constant reading of 90°C and sill rising should be investigated.

Gland Leakage Check: Gland Sealed.
If leakage is excessive tighten gland nuts until flow is reduced to required level. If leakage is insufficient and gland shows signs of heating, then loosen the gland nuts. If this is ineffective and the gland continues to heat up, the pump should be stopped and the gland allowed to cool. Gland nuts may be loosened to such an extent that the gland follower is allowed to disengage form the stuffing box.
At low pressure (single stage operation) very little leakage is required and it is possible to operate with only a small amount of water issuing from the gland.
At high pressure (multi-stage operation) allow sufficient leakage to keep the glands cool. A trickle of water should be sufficient.

Note: It is normal for gland leakage water to be hotter than the supply because it is conducting away the heat generated by friction in the gland.
It is not essential to stop a pump because of gland heating unless steam or smoke is produced.

When initial heat up of the gland is encountered it is usually only necessary to stop the pump for a short time and allow the gland to cool. This may have to be carried out several times before the packing beds in correctly.

It is preferable at start up to have too much leakage than not enough.

During the first 8 hours running, gland bolts should be adjusted to give optimum leakage.

High-pressure operation may require a longer period of time before optimum leakage is achieved.

It is recommended that the gland follower nuts are tightened by a ¼ TURN each hour to achieve optimum and maximum packing life.

Gland Leakage Check: Centrifugal Seal
During operation no gland leakage should occur to a centrifugal sealed pump. If leakage is occurring and persistent, consult Weir Minerals Europe Limited. A slight drip will occur from the gland during normal shutdown. Should the leakage be excessive during the shutdown period, first lubricate the gland by rotation of the grease cup. Two complete turns are recommended. If the gland still leaks adjust the gland nuts to the required tightness. If the gland leakage still persists repack the complete stuffing box.

Weir Minerals Europe **Limited can supply all recommended packings in individual blocked rings, cut to length and moulded to the correct size for each type of pump.**

OPERATIONAL FAULTS

START UP

Priming:
If the pump fails to prime, one or more of the following faults may be the cause.

Blocked Intake Pipe:
When the pump has been inoperative for some time it is possible for slurry to settle in or around the intake pipe. This prevents the liquid rising to the pump impeller.

Faulty Inlet Valve:
Check valve is fully open.

Air Entering Gland:
Air may be induced into the pump through the gland for one or more of the reasons listed below. This may prevent the pump “picking up” it’s prime or cause it to lose its prime during operation.

(a) Sealing water pressure low.
(b) Sealing water quantity low.
(c) Gland sealing water connection into stuffing box is blocked.
(d) Packing is excessively worn.
(e) Shaft sleeve is excessively worn.

RUNNING

WARNING; PUMPS THAT ARE NOT FITTED WITH A LEAK-OFF DEVICE SHOULD NOT BE RUN FOR A LONG PERIOD AGAINST A CLOSED DISCHARGE VALVE.

CHECK THAT THE DRIVING UNIT IS NOT BEING OVERLOADED.
Overloading may occur when the pump is discharging into an empty system when the delivery head will be temporarily lower and the throughput in excess of that for which the pump is designed. Careful regulation of the delivery valve until the system is fully charged will prevent his.

Blocked Intake Pipe:
It is possible during operations for foreign matter to be drawn across the bottom of the intake pipe thereby causing a partial obstruction.

Such an obstruction may not be sufficient to stop operation completely but will result in a reduced output from the pump. It will also cause a drop in discharge pressure and will increase the vacuum reading on the pump intake. Rough running and vibration of the pump may also occur due to the high-induced suction causing cavitation within the pump.

Blocked Impeller:
Impellers are capable of passing certain size particles. If a particle larger in size enters the intake pipe it may become lodged in the eye of the impeller thereby restricting the output of the pump. Such an obstruction will usually result in a drop of motor current and a drop in both discharge pressure and suction vacuum readings. Pump vibration may also occur due to the out of balance effects.

Blocked Discharge Pipe:
Blocked discharge pipe may be caused by abnormally high concentration of coarse particles in the pump discharge pipe or by the velocity in the discharge pipe being too low to adequately transport the solids. Such a blockage will be shown up by a rise in discharge pressure and a drop in both motor current and suction vacuum readings.

SHUT DOWN PROCEDURE

Normal practice whenever possible is to allow pumps to operate on water only for a short period to ensure the system is clear before shut down.

SHUT DOWN

Close the delivery valve to reduce the load on the driving unit.

Depress the appropriate ‘STOP PUMP’ push-button on the control panel.

Gland sealing water must be left on during all operations, including shutdown and run back.

Close all ancillary inlet and outlet isolating valves to cooling systems.

When all ancillary supplies have been isolated it is advisable to close the inlet-isolating valve.

EMERGENCY SHUT DOWN

Depress ‘STOP PUMP’ push-button.

MAINTENANCE PROCEDURES

Warman pumps are of sturdy construction and when correctly assembled and installed, they will give long trouble-free service with a minimum amount of maintenance. However, regular observation checks by the operator can minimise the risk of costly stoppages.

Bearings
Maintenance personnel should open bearing housings at regular intervals (not longer than twelve months) to inspect bearings, lubricant and to determine each time the course of action and the period for the next inspection.

Front Impeller Clearance
Warman pump performance is inversely proportional to clearance between the impeller and the casing.

With wear the clearance increases and the pump efficiency drops. For best performance it is necessary, therefore, to stop the pump occasionally and adjust the forward impeller clearance.

This adjustment can be carried out without any dismantling of the pump.

To move the impeller forward, slacken the drive end cover set screws. Insert two set screws into the two jacking screw holes and alternately tighten each set screw to separate the assembly from the frame until the gap is sufficient to allow the removal of a shim from the shim set positioned between the bearing carrier and the frame.

Remove a shim the thickness of which is estimated to be the equivalent of the gap between the impeller and the casing.

Remove the jacking-screws and tighten the end cover set screws. This automatically advances the impeller rotating assembly.

Rotate the impeller by hand to ensure that it does not foul the casing. The clearance between the impeller and casing should be at a minimum; a greater gap will impair pump efficiency.

If the impeller fouls the casing, replace the removed shim and take out a thinner one. Repeat the adjustment sequence.

If the rotation is considered to be too free, i.e. the clearance between the impeller and casing is too great, replace the removed shim and take out a thicker one. Repeat the adjustment sequence.

When the exact clearance can no longer be achieved by shim removal the complete wet-end assembly should be inspected and worn parts replaced as necessary.

Wearing Parts Replacement
The wear rate of a solid handling pump is dependent on the severity of the pumping duty and of the abrasive properties of the material handled. Therefore, the life of wearing parts, such as impellers and liners, varies from pump to pump and from one installation to another.

Wearing parts must be replaced when the performance of a given pump no longer satisfies the requirements of a particular installation.

Where a pump is used on a particular duty for the first time and especially where failure of a wearing part during service could have serious consequences, it is recommended that the pump be opened at regular intervals, parts be inspected and their wear rate estimated so that the remaining life of the parts may be established.

For installation of new wearing parts see appropriate sections of this manual.

Stand-by Pumps
Where stand-by pumps are standing idle for long periods, it is advisable to turn their shafts a quarter of a turn by hand once a week. In this way all the bearing rollers in turn are made to carry static loads and external vibrations. Alternatively run all pumps at weekly intervals.

Shaft Seal Care

Gland Sealed Pumps:
Check periodically gland seal water supply and discharge. Always maintain a very small amount of clean water leakage along the shaft by regularly adjusting gland. When gland adjustment is no longer possible, replace complete gland pack.

Maintenance personnel should inspect gland packings at regular intervals, not longer than six months (1800 hours) to determine when packings need to be changed.

Weir Minerals Europe Limited can supply all recommended packings in individual blocked rings, cut to length and moulded to the correct size for each type of pump.

Centrifugal Sealed Pumps:
Fitted with metal expeller ring, lubricate the static seal chamber. Two complete turns of the grease cup per 12 hours running time is recommended.

Maintenance personnel should inspect gland packings at regular intervals, not longer than six months (1800 hours) to determine when packings need to be changed.

Weir Minerals Europe Limited can supply all recommended packings in individual blocked rings, cut to length and moulded to the correct size for each type of pump.

PERIODIC LUBRICATION

Bearing Lubrication
A correctly assembled and lubricated bearing assembly will have a long trouble-free life, provided it is protected against ingress of water or other foreign matter and that it is adequately maintained.

Maintenance personnel should open bearing housings at regular intervals (not longer than twelve months) to inspect bearings, lubricant and to determine each time the course of action and the period for the next inspection.

Check the lubricating oil level daily. To replenish lost oil, withdraw constant level oiler from the holder. Invert the oiler and refill with clean lubricant. See Section WP3 ‘LUBRICANTS’. Replace the oiler in the holder and check that there is no leakage from the seal around the neck of the oiler.

Maintaining the oil level in the oiler will ensure adequate and constant lubrication of the bearings.

Recommendations
Weir Minerals Europe Limited recommend that a full oil change is carried out every six months or 4000 hours which ever is the sooner.

Gland Lubrication (Centrifugal Seal)
A correctly packed gland will have a long, trouble-free life, provided it is adequately maintained.

Check the grease staufer daily and top up as necessary.

Lubricate the static seal chamber. Two complete turns of the grease cup per 12 hours running time is recommended to enable the grease to form an adequate seal at the packing rings.

Use only recommended clean lubricant. See Section WP3 ‘LUBRICANTS’.

LUBRICANTS

(a) Bearings
The recommended initial quantity of oil to be filled for each frame is as follows:

Pump	Capacity (litres)
65 : PD PCH	0.9
100 : PD PC	0.9
100 : PE PCH	1.8
150 : PE PC	1.8
150 : PF PCH	2.5
200 : PF PC	2.5
200 : PG PCH	6.0
250 : PG PC	6.0
300 : PG PC	6.0

It is recommended that lubricating oil used in rolling bearings should have the following characteristics:
Lubricating oil which inhibits rust and oxidation, and which will separate readily from water. Low foaming tendency.

VISCOSITY INDEX, IP226			100
VISCOSITY, KINEMATIC, CST	@	40°C	150
	@	100°C	15
FLASH-POINT OPEN	@	0°C	237
DENSITY	@	15°C	0.887

PRE-FILLED BEFORE DESPATCH WITH: Mobil Gear 600 XP 150

The grade of oil recommended has been selected to suit a wide range of operating conditions. Under certain conditions a lighter grade may prove to be satisfactory and users of existing pumps may prefer to select oils based on their own operating experience.

(b) Centrifugal Seal
It is recommended that the lubricating grease used in the centrifugal seal chamber should have the following characteristics:

Calcium based soap in a mineral oil with oxidation inhibitor and rust preventative.

N.L.G.I. Consistency No.	3
Drop Point, IP132 °C min	120
IP Penetration, worked, IP150	220-250

PRE-PACKED BEFORE DESPATCH WITH:- Mobilux EP 3

EXAMPLES OF PROPRIETARY BRANDS OF LUBRICANTS
RECOMMENDED BY WEIR MINERALS EUROPE LIMITED

THE ORDER OF MENTION HAS NO PREFERENTIAL CONNECTION
(The correct amount of lubricant detailed above is filled in the bearing housing prior to despatch from the factory)

SUPPLIER	OIL (BEARINGS)	GREASE (CENTRIFUGAL SEAL)
Burmah Oil (Castrol)	HYSPIN AWS 150	Castrol Spheerol LG.
Esso Petroleum Co Ltd	NUTO H150	R111
British Petroleum	BARTRAN 150	Energrease C3-G
Texaco Ltd	RANDO HD 150	Cup Grease 3
Shell UK Ltd	TELLUS 150	Shell Barbatia 4 or Shell Alvania R3
Century Oil	PWLM	Centaurus 4

It is recommended that before one of the above lubricants is used as an alternative, the associated housing should be flushed out prior to filling with new oil.

SectionWP3
Fault Finding Chart

FAULTS	SYMPTOMS	Discharge failure	Reduced discharge delivery	Insufficient pressure	Pump loses prime	Excessive horsepower required	Leakage from stuffing box	Packing has short life	Vibration and noise from pump	Short life of bearings	Overheating or seizure of pump	Hopper Overflows
INTAKE FAULTS	Pump not primed.	■									■	■
	Pump or intake pipe not completely filled with liquid.	■	■		■				■			
	Suction lift too high.	■	■		■				■			
	Insufficient margin between intake pressure and vapour pressure.	■	■						■		■	
	Excessive amount of air or gas in liquid.		■	■	■							■
	Air pocket in intake line.	■	■		■							
	Air leaks into intake line.		■		■							
	Air leaks into pump through stuffing box.		■		■							
	Foot valve to small.		■						■			
	Foot valve partially clogged.		■						■			
	Intake pipe insufficiently submerged.	■	■		■				■			■
	Blocked intake.	■	■		■							■
	Intake pipe diameter too small or length of intake too long.	■	■		■							■
SYSTEM FAULTS	Speed to low.	■	■	■								■
	Speed to high.		■			■						
	Wrong direction of rotation.	■	■	■		■						■
	Total head of system higher than design head.	■	■	■		■						■
	Total head of system lower than design head.					■						
	Specific gravity of liquid different from design.					■						■
	Viscosity of liquid differs from that for which designed.		■	■		■						
	Operation at very low capacity.								■		■	
	Entrained air in pump. Pump hopper requires baffles.	■	■	■	■							■
	Badly installed pipe line or gaskets partly blocking pipe.	■	■	■	■				■			■
MECHANICAL FAULTS	Misalignment.					■	■	■	■	■	■	
	Foundations not rigid.								■			
	Shaft bent.					■	■	■	■	■		
	Rotating part rubbing on stationary part.					■			■	■	■	
	Bearings worn.							■	■	■	■	
	Impeller damaged or worn.	■	■	■					■			
	Casing gasket defective, permitting internal leakage.	■	■	■								■
	Shaft or shaft sleeves worn or scored at the packing.						■	■				
	Packing improperly installed.					■	■	■				
	Incorrect type of packing for operating conditions.					■	■					
	Shaft running off-centre because of worn bearings or misalignment.						■	■	■	■	■	
	Impeller out of balance, resulting in vibration.						■	■	■	■	■	
	Gland to tight, resulting in no flow of liquid to lubricate packing.					■		■				
	Foreign matter in impeller.	■	■	■	■				■			■
	Dirt or grit in sealing liquid, leading to scoring shaft sleeve.						■	■				
	Excessive thrust caused by mechanical failure inside the pump.								■	■	■	
	Excessive amount of lubricant in bearing housing causing high bearing temperature.								■	■	■	
	Lack of lubrication.								■	■	■	
	Improper installation of bearings.								■	■	■	
	Dirt getting into bearings.								■	■		
	Rusting of bearings due to water getting into housing.								■	■		
	Expeller worn or blocked.						■	■				
	Excessive clearance at bottom of stuffing bo, forcing packing into Pump.						■	■				

■ **PROBABLE FAULT**

DISMANTLING

Casing
Clean the pump before starting dismantling procedure and refer to the component drawing.

Remove drain plug and drain oil from the frame.

Remove breather and constant level oiler. Keep in a clean place. Plug the holes to prevent the entry of dirt.

Lift off gland splashguard.

Remove the 8 clamp bolts, which locate the casing to the frame.

Insert the bolts into the two jacking screw holes and alternately screw in each bolt to withdraw the casing.

Note: Before withdrawing, ensure that the casing is adequately supported and cannot fall.

If the casing is to be replaced, remove flanges from casing suction and discharge nozzles.

Remove the jacking bolts from the frame.

Removal of the impeller
Insert a substantial bar between the vanes of the impeller and locate the other end against a stop, i.e. the floor.

With the aid of a shaft wrench (assembly aid), rotate the shaft anti-clockwise when viewed from the drive end. This will unscrew the impeller, which is then withdrawn.

Note: Some force may be necessary.

Unbolt the four back liner studs and remove the back liner.

Take out casing frame seal and seal ring.

Remove shaft sleeve ‘O’ ring.

GLAND SEAL

1. Remove the stuffing box assembly by tapping it out with a nylon hammer.
2. Unscrew gland nuts and separate the gland from the gland ring.
3. Remove gland packing pieces.
4. Remove lantern restrictor.
5. Withdraw shaft sleeve spacer and shaft sleeve spacer ‘O’ ring.
6. Withdraw shaft sleeve and shaft sleeve ‘O’ ring.
7. Push the flinger off the shaft sleeve.

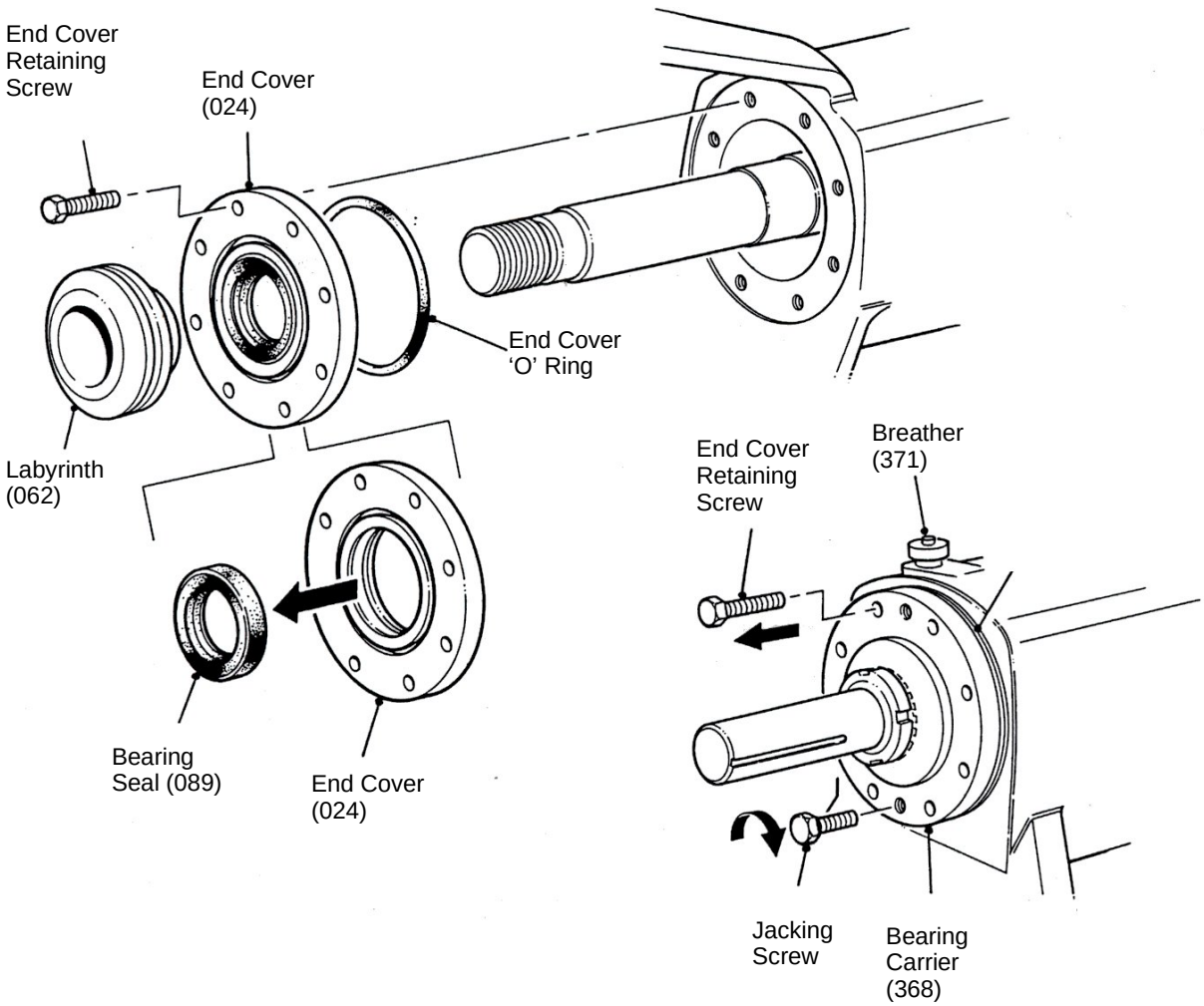
SHAFT AND BEARING ASSEMBLY FROM FRAME

From the Impeller End

1. Slide labyrinth off the shaft.
2. Make alignment marks on the end cover and frame. This will aid re-assembly.
3. Unscrew end cover retaining screws and remove the end cover.
4. Remove end cover 'O' ring.
5. Carefully tap out the bearing seal from the end cover, excessive-force could damage the seal.

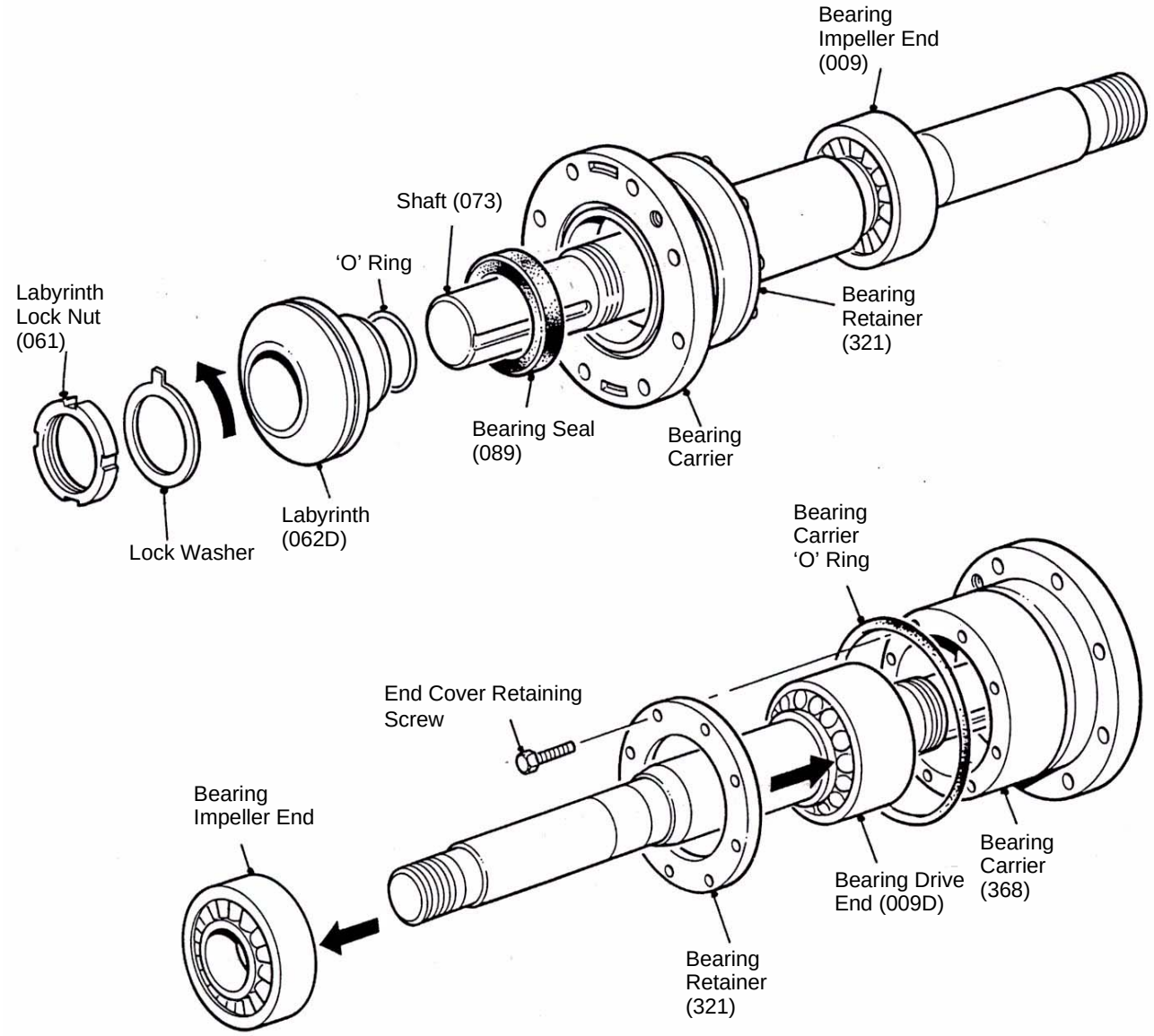
From the Drive End

1. Unscrew end cover retaining screws.
2. Make alignment marks on the bearing carrier and frame.
3. Insert screws into the two jacking-screw holes in the bearing carrier and alternately tighten each screw to withdraw the complete shaft and bearing assembly from the frame. In order to free the assembly it may be necessary to tap the shaft from the impeller end using a nylon hammer. Some force may be necessary.
4. Retain the shim set.
5. Place the assembly on a clean work surface.



REMOVAL OF BEARINGS

1. Straighten labyrinth lockwasher and unscrew labyrinth locknut by turning it in an anti-clockwise direction.
2. Remove drive end labyrinth and ‘O’ ring.
3. Unscrew bearing retainer screws and remove bearing retainer.
4. Slide bearing carrier ‘O’ ring off the carrier.
5. Press the bearing carrier off the bearing.
6. Withdraw bearing seal.
7. Press bearing-drive end off the shaft.
8. Press bearing-impeller end off the shaft.
9. Pump is now dismantled.



DISMANTLING, BACK PULL OUT METHOD

This method allows the pump to be withdrawn from the pipework without disconnecting the intake/discharge pipework from the pump casing.

Before starting, ensure that there is space greater than the length of the pump behind the drive end to allow backward and upward movement of the pump away from the pipework.

Ensure that the pump casing is adequatly wedged and supported.

Refer to component drawing.

Remove drive and guard.

Remove the 8 clamp bolts which locate the casing to the frame.

Slacken the 4 bolts securing the frame to the bedplate.

Attach ropes around the frame legs.

Insert bolts into the two jacking screw holes and alternately screw in each bolt to withdraw the pump from the casing.

Note: Before withdrawing, ensure that the casing is still adequately wedged and supported.

Slowly and smoothly pull on the ropes to ease the complete assembly backwards and away from the casing.

Remove pump to workshops.

Carry out work detailed on pages WP4.500-1 to WP4.504.

BEARINGS

Bearings and shaft should be kept clean at all times. Mild steel drifts only should be used when tapping bearings into position. Brass or copper drifts should NOT be used.

Check that shaft and shoulders are clean and free from burrs.

Before fitting the bearings apply a smear of clean light lubricating-oil to the bearing landings on the shaft.

Weir Minerals Europe Limited and related companies recommend the use of an induction heater to shrink bearings on to the shaft. The temperature for the heater should be 100°C.

For companies without an induction heater the following process should be used.

Pre-heat both bearings by immersion in clean oil at a temperature of approximately 100°C. Ensure that the bearings do not touch the bottom of the container.

Note: The bearing fitted at the drive end is provided with spacers and as such is a pre-set assembly. The spacers are finished to size for each bearing assembly and component parts from one assembly are NOT interchangeable with those of a similar assembly. Because the component parts of both large and small bearing assemblies are matched to each other, they cannot be interchanged with similar components from other assemblies and should be kept in sets and assembled as received. Large bearing assemblies have an identifying serial number marked on each cup, cone and spacer.

Replacement of Drive End Bearing

1. Remove assembled bearing from packaging, separate into individual components and heat both cones using either of the methods described opposite. After heating, shrink one cone onto the shaft together with a cone spacer and the cup. Repeat the procedure and shrink the second cone onto the shaft. It is important that the cones and the spacer are located firmly against each other and that the complete assembly is hard against the shaft shoulder. When the assembly is cool tap it with a mild steel drift to ensure that it is tight against the shoulder.

2. Position the bearing carrier against the bearing and ease it over the outer race.

3. Fit the bearing retainer.

4. Press the bearing carrier 'O' ring into the groove on the bearing carrier.

5. Press the bearing oil seal in to position against the lip on the carrier ring. It is important that the seal is fitted the correct way round, i.e. with the pressure side (spring side) on the inside of the assembly.

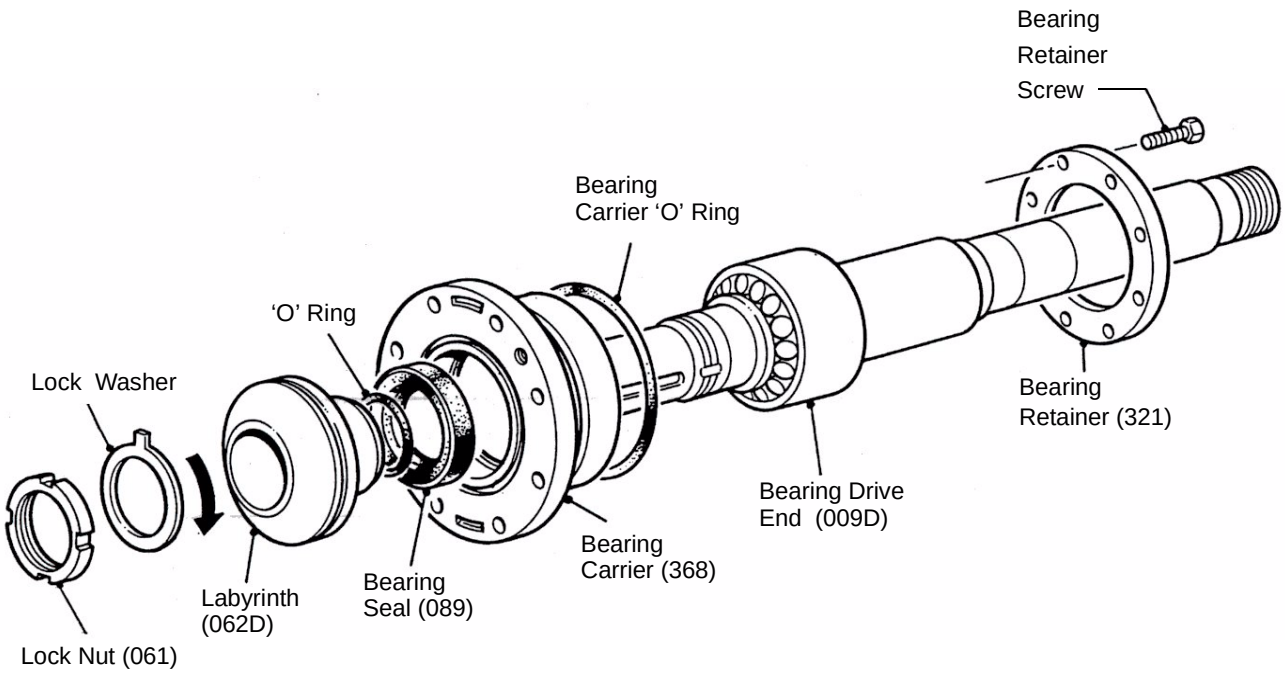
6. Slide the 'O' ring along the shaft and position against the bearing.

7. Push drive-end labyrinth onto shaft until it is firmly against 'O' ring and within groove on face of bearing carrier. Take care not to damage the oil seal.

8. Secure labyrinth in position using lockwasher and by tightening the labyrinth locknut. After tightening the locknut, bend the tab of the lockwasher over the locknut.

Replacement of Impeller End Bearing

After heating, shrink the impeller end bearing onto the shaft and tight against the shaft shoulder. Use the mild steel drift to drive the bearing against the shoulder.


Bearing
Retainer
Screw
Bearing
Carrier 'O' Ring
'O' Ring
Lock Washer
Bearing
Retainer (321)
Bearing Drive
End (009D)
Bearing
Carrier (368)
Labyrinth
(062D)
Bearing
Seal (089)
Lock Nut (061)

SHAFT AND BEARING ASSEMBLY IN FRAME

Inspect the bore of the frame for radial score marks and cleanliness. Apply clean lubricating oil to the bore at each end of the frame. Check the condition of all 'O' rings and seals. If in doubt they must be replaced.

From the Drive End.
1. Align the assembly marks on the bearing carrier and frame.

2. Insert the shaft and bearing assembly into the frame. It may be necessary to gently tap the shaft with a nylon hammer to ease the assembly into position.

3. When partially installed retain the assembly in place by inserting the end cover retaining screws. Move to the impeller end of the casing and view the shaft and bearing carrier end-on to determine their alignment with the bore.

4. Check that the bearing is square within the frame by rotating the shaft.

5. When alignment is satisfactory, move to the impeller end of the assembly. Do not fully tighten the end cover retaining screws.

Alternative method using Shaft Fitting Tube
1. Fit the drive end bearing assembly to the shaft, see page WP5.500.

2. Fit the impeller end bearing assembly to the shaft, see page WP5.500.

3. Screw the shaft fitting tube (assembly aid) on to the impeller end of the shaft.

4. From the drive end, insert the assembly into the frame until the bearing carrier shoulder is almost touching the frame face.

5. Remove the shaft fitting tube.

From the Impeller End
1. Remove all traces of sealant, grease, oil, etc. from the oil seal seating in the bearing carrier and apply a light coating of RTV silicone sealant to the sealing diameter and face. Carefully press the oil seal into the recess fully, ensuring that the seal is the correct way round - see diagram. Note that on PF size frames only an 'oil et stream breaker' is fitted into recess, plain face towards the bearing, before the oil seal.

2. Fit the End Cover 'O' Ring into the groove.

3. Align the assembly marks on the end cover and frame.

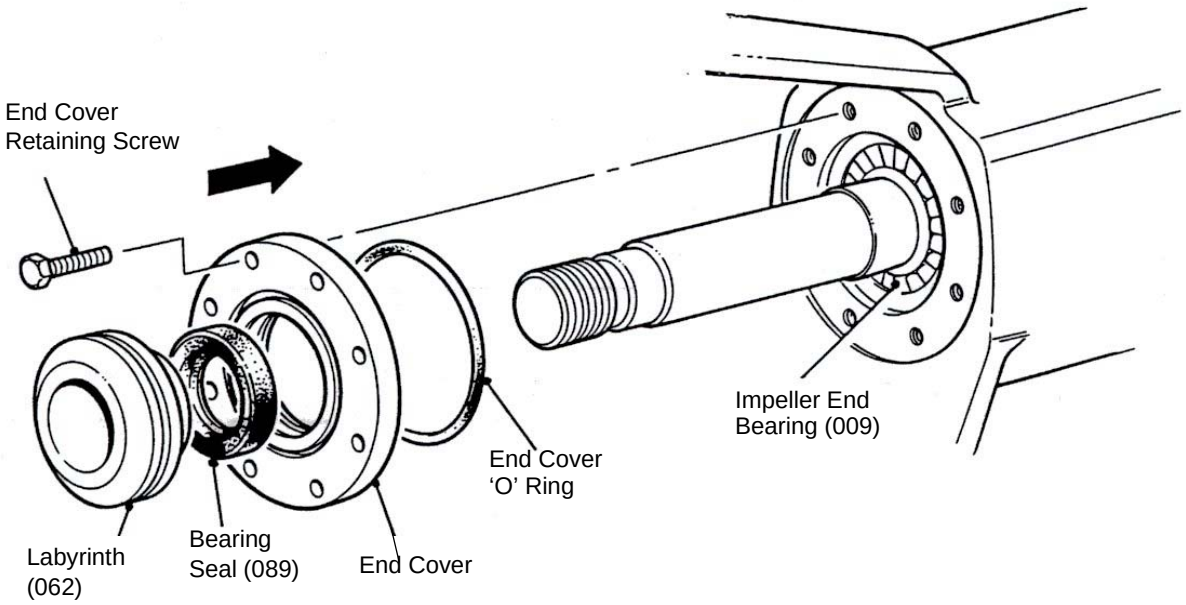
4. Position the end cover against the frame and secure with the end cover screws. Do not fully tighten the screws.

5. Oil lightly the oil seal lips and the outside diameter of the labyrinth sleeve onto the shaft 'O' ring recess away from the oil seal. Push gently and with a twisting motion, the labyrinth sleeve through the oil seal until it is firmly against the bearing.

6. Slide the shaft sleeve 'O' ring along the shaft and into it's groove.

7. Slide the flinger along the shaft and seat it firmly.

8. When alignment is satisfactory, gradually and evenly tighten the impeller end cover screws


End Cover
Retaining Screw
Impeller End
Bearing (009)
End Cover
'O' Ring
Labyrinth
(062)
Bearing
Seal (089)
End Cover

GLAND SEAL

1. Fit shaft sleeve ‘O’ ring over shaft and position against the labyrinth.

2. Place the stuffing box on a flat surface with packing entry face uppermost.

3. Fit the lantern restrictor into the stuffing box.

4. Insert shaft sleeve through the assembly.

5. Fit packing rings into the stuffing box.

6. Interlock gland and gland ring and secure to the stuffing box using gland studs.

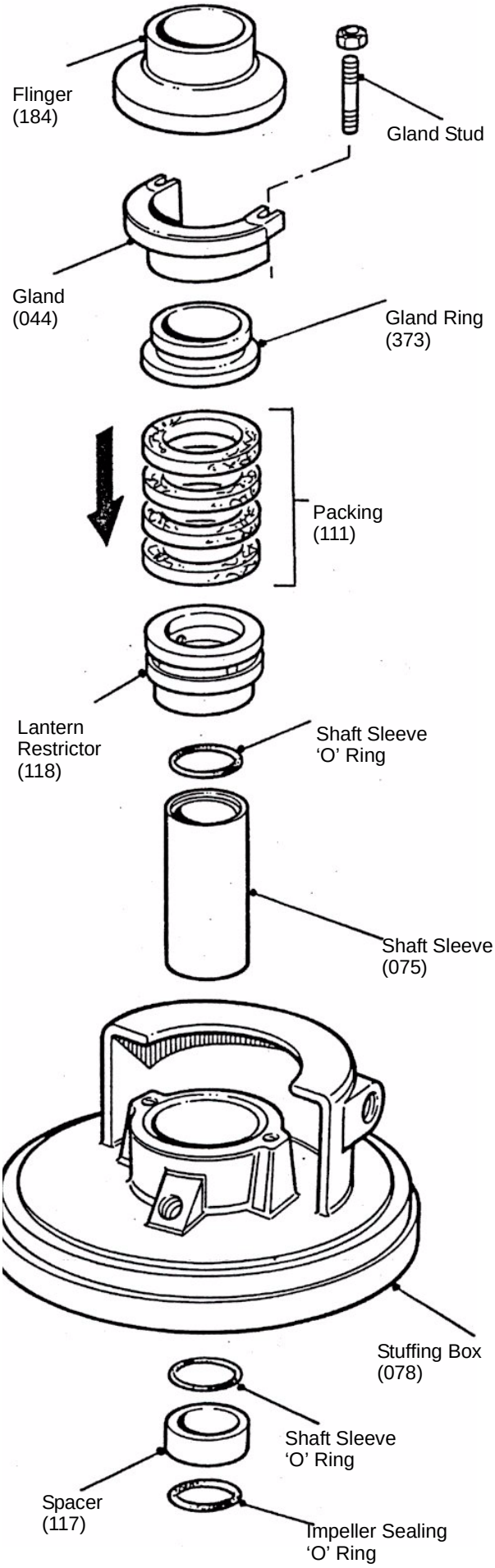
7. Place the flinger on the shaft sleeve with large diameter facing the gland.

8. Slide the stuffing box assembly, gland first, over the shaft until the face of the flinger is against the labyrinth and the shaft sleeve against the ‘O’ ring adjacent to the labyrinth.

9. Move to impeller end of shaft and fit ‘O’ ring.

10. Push the shaft sleeve spacer along the shaft until it touches the shaft sleeve. The grooved face of the spacer should be towards the impeller.

11. Fit impeller sealing ‘O’ ring into the groove.



BACKLINER AND IMPELLER

Insert seal ring and casing frame seal. Ensure flat face of casing frame seal is against the frame.

Position the backliner and Secure with backliner studs.

Attach shaft wrench (assembly aid) to the shaft.

Screw Impeller on to the shaft, lock as tight as possible.

Casing

Position the casing against the frame so that the 8 bolt slots are in line. Ensure that the orientation of the casing matches the position of the existing pipework.

Bolt two halves of the discharge flange onto the casing to enable the assembly to be lifted.

Fit the 8 clamp bolts and fully tighten.

RE-ASSEMBLY - BACK PULLOUT METHOD

Approximately align the complete frame assembly with the casing.

Attach ropes around the main frame and secure to a crane.

Slowly and smoothly pull on the ropes to ease the complete assembly forward and into the casing.

When the frame and bedplate holes are aligned, insert the securing bolts but do not fully tighten.

Position the frame against the casing so that the 8 bolt slots are in line.

Fit the 8 clamp bolts and tighten

Fully tighten the frame/bed plate securing bolts.

Front Impeller clearance, see page WP6.504-1, items 1 - 9.

Remove wedges from underneath pump casing.

Check tightness of bolts between pipework and pump flanges.

Push splashguard into position.

Pour correct grade and amount of oil. See section WP3 ‘LUBRICANTS’,through the constant level oiler hole until the oil overflows.

Screw on fittings.

Fill the constant level oiler with the correct grade of oil. See section WP3 ‘LUBRICANTS’ and refit.

Refit the breather.

Replace drive and guard.

The pump is now ready for operation.

FRONT IMPELLER CLEARANCE

When installed in the casing the impeller should be free to rotate but with the minimum clearance against the casing wall. Adjustment is as follows:

Gradually and evenly tighten the drive end - end cover set screws. This advances the impeller assembly.

Rotate the shaft by hand using shaft wrench (assembly aid) to check the impeller clearance.

Continue to tighten the set screws and rotate the shaft until the impeller touches the casing.

Insert set screws into the jacking-screw holes in the bearing carrier. Gradually and evenly tighten them. This will ease the shaft assembly away from the casing and allow the impeller to rotate once more.

Continue until the impeller freely rotates but with the minimum clearance.

Measure the gap between the bearing carrier and the frame and compare this measurement with the dimension of the original shim set.

Insert the shim set into the gap and add or remove shims as required.

When shim adjustment is satisfactory, remove the jacking-screws and continue to evenly tighten the end cover set screws until the assembly is fully secure.

Rotate the shaft, if the impeller fouls the casing, repeat the complete adjustment sequence.

Refit the suction and discharge nozzle flanges.

Push splashguard into position.

Pour the correct amount and grade of oil. See section WP3 'LUBRICANTS' through the constant level oiler hole until oil overflows.

Screw on fittings.

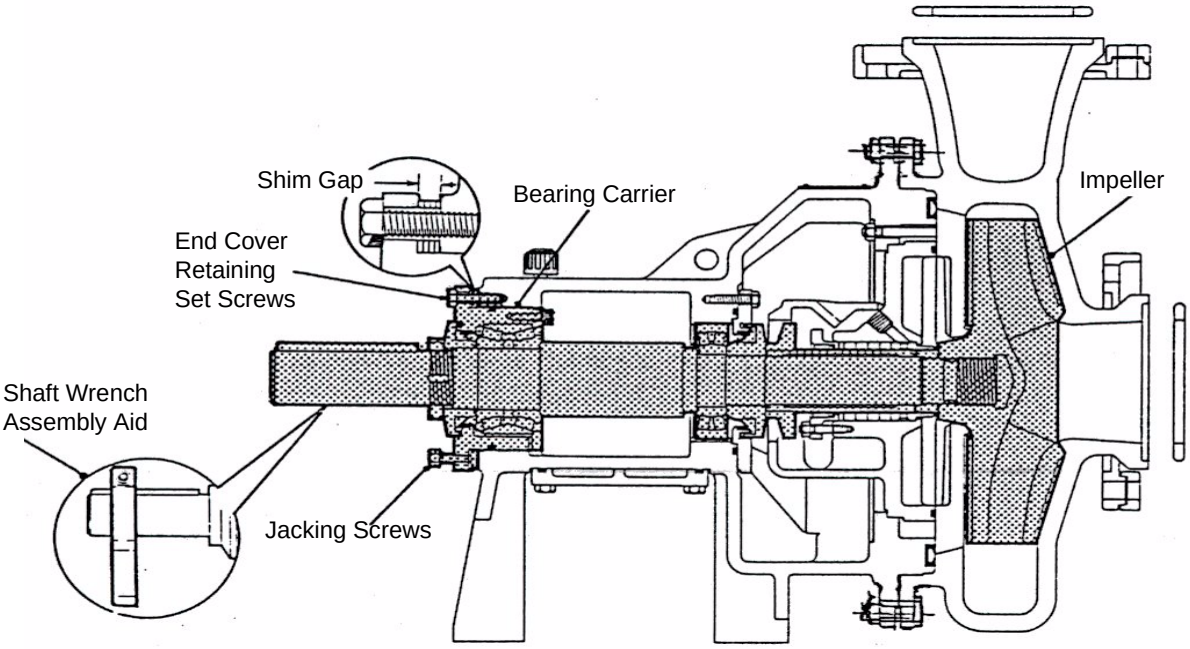
Fill the constant level oiler with the correct grade of oil. See section WP3 'LUBRICANTS' and refit.

Refit the breather.

Place the suction and discharge joint rings in to the lips on the casing faces. Ensure that they remain flat and in position.

The pump is now complete.

IMPORTANT: WHEN CONNECTING THE SUCTION (INTAKE) AND DISCHARGE FLANGES OF THE PUMP IT IS ESSENTIAL TO USE THE APPROPRIATE WARMAN JOINT RING TO ENSURE AN EFFECTIVE SEAL BETWEEN PIPEWORK AND PUMP CASING.


Shim Gap
Bearing Carrier
Impeller
End Cover
Retaining
Set Screws
Shaft Wrench
Assembly Aid
Jacking Screws

SPARE PARTS

Spare parts for Warman pumps consist in the main of liners, impellers, bearings, shaft sleeves, seals, and shaft seal parts.

Depending on the expected life of each part, a number of spares of each should be kept in stock by the user to ensure maximum use of the pump.

In this way, damage is prevented, and all pumps are always kept in optimum condition with a minimum of downtime.

Pump Parts Identification:

Every Warman pump part has a name and a three digit basic number. Parts with the same name, irrespective of size or material, have the same basic number. Thus the SHAFT of every Warman pump has the basic number 073.

Additional letters and digits are added to a given basic number to identify a specific component part of a particular pump and the material in which it is manufactured.

Example: PD10222-AOS

P - Process Chemical Slurry Pump.

D - Frame size.

10 - Intake/Discharge diameter.

122 - Basic number for casing.

\- - Separator before material code.

A05 - Material code for High Chrome.

Some of the letters or digits are omitted in some pump parts where the information is not needed.

Example: PE009

P - Process Chemical Slurry Pump.

E - Frame Size.

009 - Basic number for bearing.

In all correspondence with Weir Minerals Europe Limited or their representatives, and especially when ordering spare parts, it is advisable to use correct names as well as full part numbers to prevent misunderstandings or wrong deliveries. When in doubt the pump serial number should be quoted as well. This can be found on the nameplate located on the pump frame.

For a list of common basic numbers and material codes see sheet WP7.02 SERVICE

Weir Minerals Europe Limited is in a unique position to offer you the very best pump servicing facilities at unbeatable prices. It is our interest to offer the product and back up service that gives the user the lowest possible ownership costs.

At our Todmorden manufacturing centre we can offer you the wealth of experience and skills born from over fifty years of slurry pump manufacture.

We offer various levels of service depending on your particular needs.

24 Hour on site breakdown service.
We can respond to breakdowns on a 24-hour basis subject to the availability of spare parts and fitters.

Workshop overhaul.
Here we can completely refurbish pumps to the standard originally manufactured. We have ready availability of components and other services required for fast turn around

Service exchange.
On a large number of our pumps, we are able to offer service exchange units. Requirements can be discussed with our service department.

Contract maintenance.
Contract maintenance is available and requirements should be discussed with our service department.

Using Weir Minerals Europe Limited's service facilities gives you the secure knowledge that your Warman pump is fully guaranteed and incorporates all the latest modifications.

For further details please contact:

Contracts Supervisor.
Weir Minerals Europe Limited.
Halifax Road,
Todmorden.
Lancs.
OL14 5RT
Telephone: (01706) 814251

BASIC NUMBERS

Every Warman pump part has a name and a three digit basic number. Parts with the same name, irrespective of size or material have the same basic number.

There are over three hundred different basic numbers, most of which do not refer to wearing parts. The following list gives the correct names and basic numbers of the parts most likely to be ordered as spare parts.

PART NAME	BASIC NUMBER
Bearing assembly	005
Bearing	009
Door	013
Cover plate liner	017
Cover plate	018
Impeller (2 vane chokeless)	021
Shim set	025
Expeller	028
Expeller Ring	029
Frame Plate Liner	036
Frame Plate Liner Insert	041
Frame Plate Liner (Half)	043
Gland	044
Impeller (3 vane open)	052
Intake Joint Ring	060
Labyrinth Locknut	061
Labyrinth	062
Lantern Ring	063
Impeller O-Ring	064
Neck Ring	067
Shaft	073
ShaftSleeve	075
Stuffing Box	078
Throatbush	083
Lip Seal	090
Casing	092
Piston Ring	108
Shaft O-Ring	109
Volute Liner	110
Packing	111
Cover Plate Liner Insert	112
Shaft Spacer	117
Lantern Restrictor	118
Seal Ring	122
Volute Liner Seal	124
Back Liner Seal	125
Impeller (5 vane open)	127
Bowl	131
Discharge Joint Ring	132
Impeller (5 vane open)	147
Back Liner	156
O-Ring	217
Casing	222
Release Collar	239
Shaft (Left hand)	254
Labyrinth (Right hand)	255

Note: Spare parts lists for specific Warman pumps showing the full Warman part number are available on request from Weir Minerals Europe Limited.

MATERIAL CODES

A material code is used on all parts, which are made from standard Warman materials and on parts, which can be supplied in a variety of materials.

All Warman material codes have one letter followed by two digits; some of the more common codes and their corresponding materials are as follows:

MATERIAL NAME	MATERIAL CODE
Nihard	A03
High Chrome	A05
Nihard Type 4	A06
Niresist	C02
EN56D Mild Steel	C21
316 Stainless Steel	C23
Ferralium	C55
SG Iron	D24
Cadmium Plated SG Iron	D70
Mild Steel	E05
Zinc coated Mild Steel	E62
Cast Iron	G02
Titanium	M01
Hastelloy C	L04
PTFE	P03
PVC	P30
Kevlar	Q21
Rubber	R26
Nordel	S01
Nitrile	S10
Butyl	S21
Hypalon	S31
Neoprene (liners & impellers)	S42
Neoprene (seals)	S43
Viton	S51
Ceramic coated EN56D	Z04

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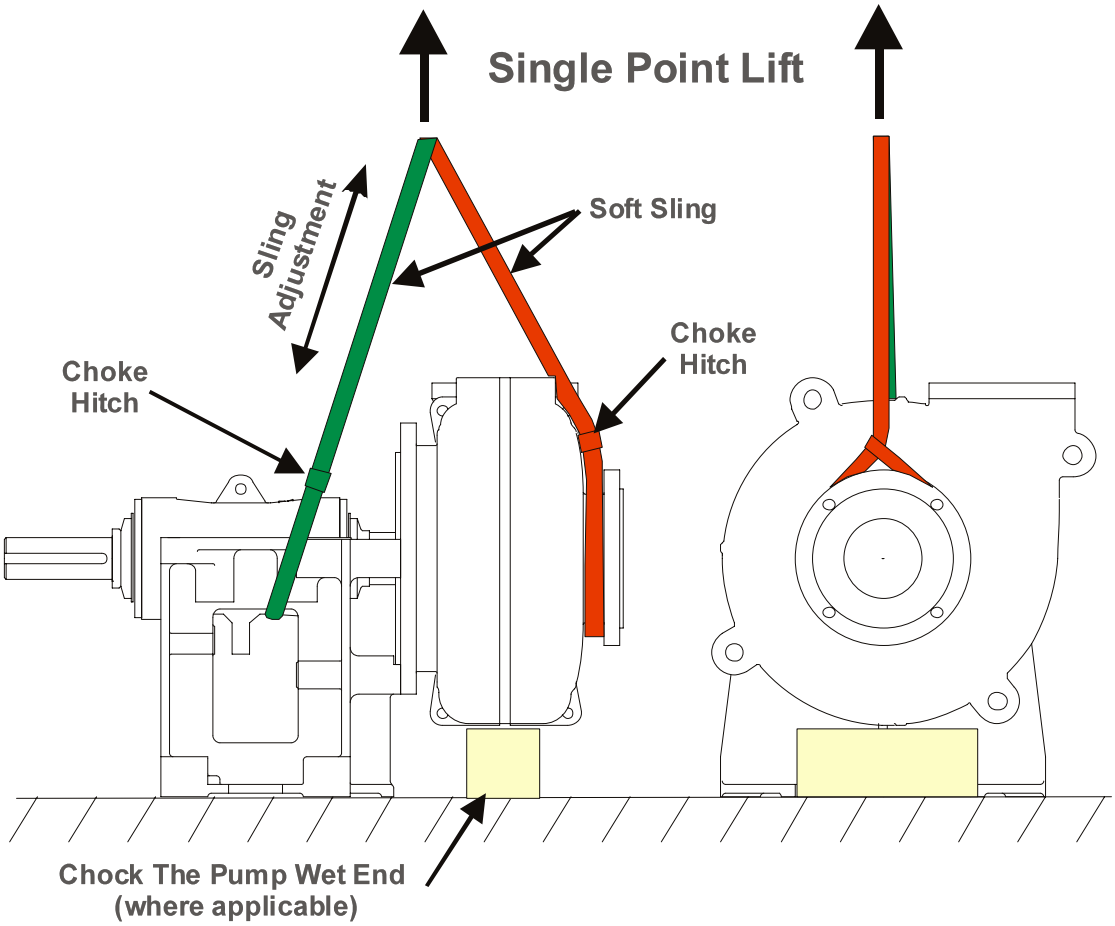
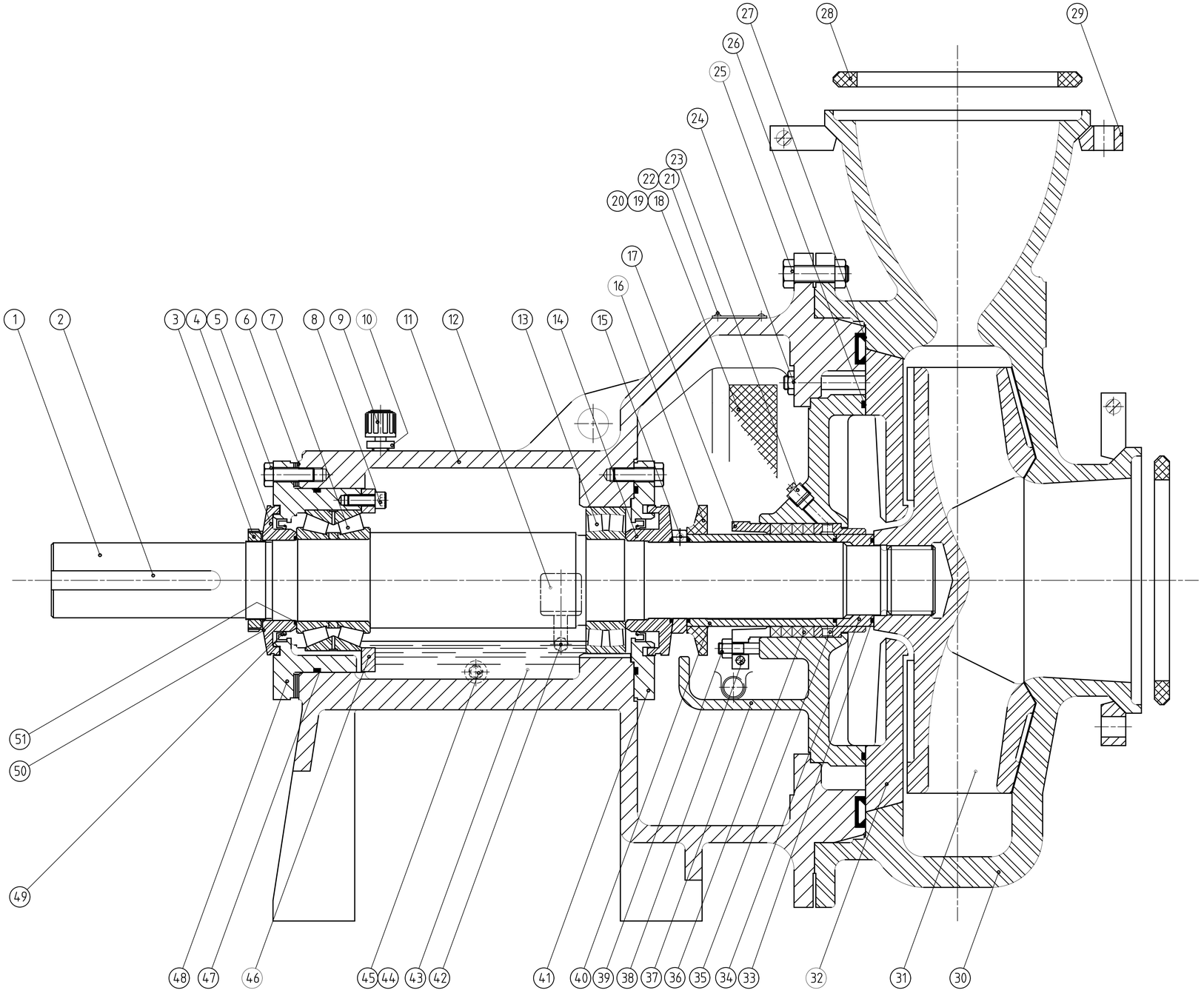
Slurry Equipment Solutions

Lifting Diagram: Bareshaft Pump



Safety Instructions

1. The illustration above shows a safe method of lifting the pump. However, the lifting of the pump should be undertaken by a competent person who is familiar with slinging safety legislation and practices. This person must be able to select suitable lifting equipment and then apply it safely.
2. The mass of the pump is given on its nameplate
3. The estimated centre of gravity for the pump is shown in the operation manual, the position of which will vary due to manufacturing variations.
4. The sling length may require adjusting to get a level lift.
5. Use a Choke Hitch where indicated to prevent the pump rotating during the lift.
6. Where indicated a soft sling must be used to protect the pump from damage.
7. Pumps with the wet end lower or higher than the bottom of the base will require a chock putting under the wet end to prevent it tipping over prior to it being secured to its foundations.
8. Lifting points on the individual pump component parts are for lifting of that part only and are not designed to take the full weight of the pump



ITEM	QTY	DESCRIPTION	PART NO
1	1	SHAFT	PG073X07
2	1	SHAFT KEY	PG070E05
3	1	LABYRINTH LOCKNUT	SV061E62
4	1	LABYRINTH	PG062DC21
5	12	END COVER SET SCREW	M20H2-65Z
6	1	SHIM SET	PG025E62
7	1	BEARING (DRIVE END)	PG009D
8	8	BEARING RETAINER SCREW	M16A4-50H
9	1	BREATHER	PD371-1
10	1	ADAPTOR BUSH	WP12P25-6G
11	1	FRAME	PG188-91D21
12	1	CONSTANT LEVEL OILER	PF370
13	1	BEARING	PG009
14	1	LABYRINTH	PG062C21
15	1	IMPELLER RELEASE COLLAR	FG239-1MC21H
16	1	FLINGER	PG184S44
17	1	GLAND (PAIR)	PG044C23
18	1	GLAND GUARD	PG186GGAE62
19	1	GLAND GUARD	PG186GGBE62
20	8	BOLT	M10H2-12ZW
21	1	NAMEPLATE	NP
22	4	NAMEPLATE RIVET	———
23	1	SQUARE HEAD PLUG	WP12P1-E
24	4	BACKLINER STUD	M20Z3-125ZL
25	8	CLAMP BOLT	M24H1-90HN
26	1	SEAL RING	69T507V469
27	1	CASING TO FRAME SEAL	SP25124S01
28	2	JOINT RING	PG30372S01
29	2	FLANGE ANSI=A2, DIN=D5, BS10=B5	PG30130D5E02
30	1	CASING	PG30222-9A05
31	1	IMPELLER	PG30145A05D
32	1	BACKLINER	PG041A05
33	4	SHAFT SLEEVE O-RING	53T111V348
34	1	SHAFT SPACER	PG117C21
35	1	LANTERN RESTRICTOR	PG118C02
36	4	PACKING	PG111Q21
37	1	STUFFING BOX	PG078D21
38	2	GLAND CLAMP BOLT	M12H1-80TN
39	2	GLAND BOLT	M16Z3-60SC
40	1	SHAFT SLEEVE	PG075C21
41	1	END COVER	PG024E62
42	1	REDUCING BUSH	WP8P25-4G
43	6 L	OIL	———
44	1	SQUARE HEAD PLUG	PD176K11
45	1	DRAIN PLUG O-RING	26T20V117
46	1	BEARING RETAINER	PG321E02
47	2	END COVER 'O' RING	69T254V449
48	1	BEARING CARRIER	PG368D21
49	2	BEARING SEAL	PG089S50
50	1	LABYRINTH LOCKWASHER	SV061LE62
51	1	LABYRINTH O-RING	53T117V350

CONTRACT REF:	SERIAL No:	TAG No:
257151-001	WP60129	-

REV	DESCRIPTION	DATE	REF NO	BY	CHK
-					
-					
-					
5	ITEM 41 MATERIAL CODE WAS D81	09JUN2015		J.G	KAB

FOR LIMITS OF UNTOLERANCED DIMENSIONS REFER TO DRG. A4-1589S.

OFFICE OF ORIGIN : TODMORDEN

SCALE: 1:3.33
APP: I.W
CHK: NPC
DRN: NPC
DATE: 04JUN2001
SHEET 1 OF 1

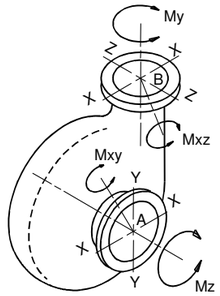
PRODUCT
WARMAN®
Centrifugal Slurry Pumps

WEIR MINERALS

TITLE
COMPONENTS DIAGRAM OF 300PG-PC PUMP WITH FULL FLOW GLAND SEAL
PART No: PC300PG-CCF-A1

SHEET SIZE	DRAWING No	SHEET GB	REVISION
A1	A805366		5

MAXIMUM CONCURRENT LOADS AND MOMENTS ON FLANGES



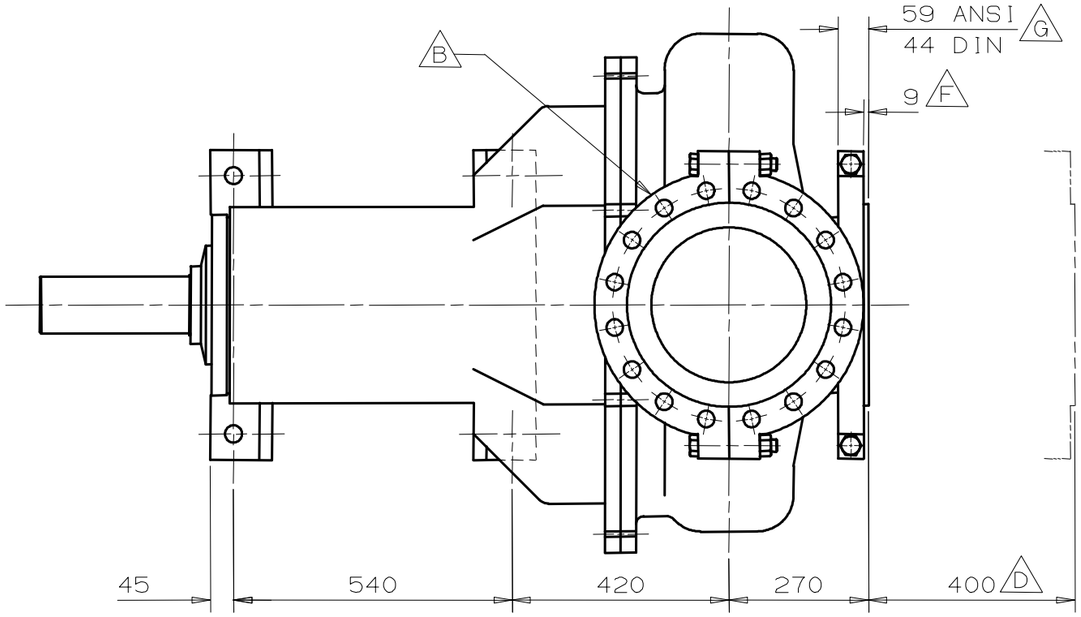
Intake Flange

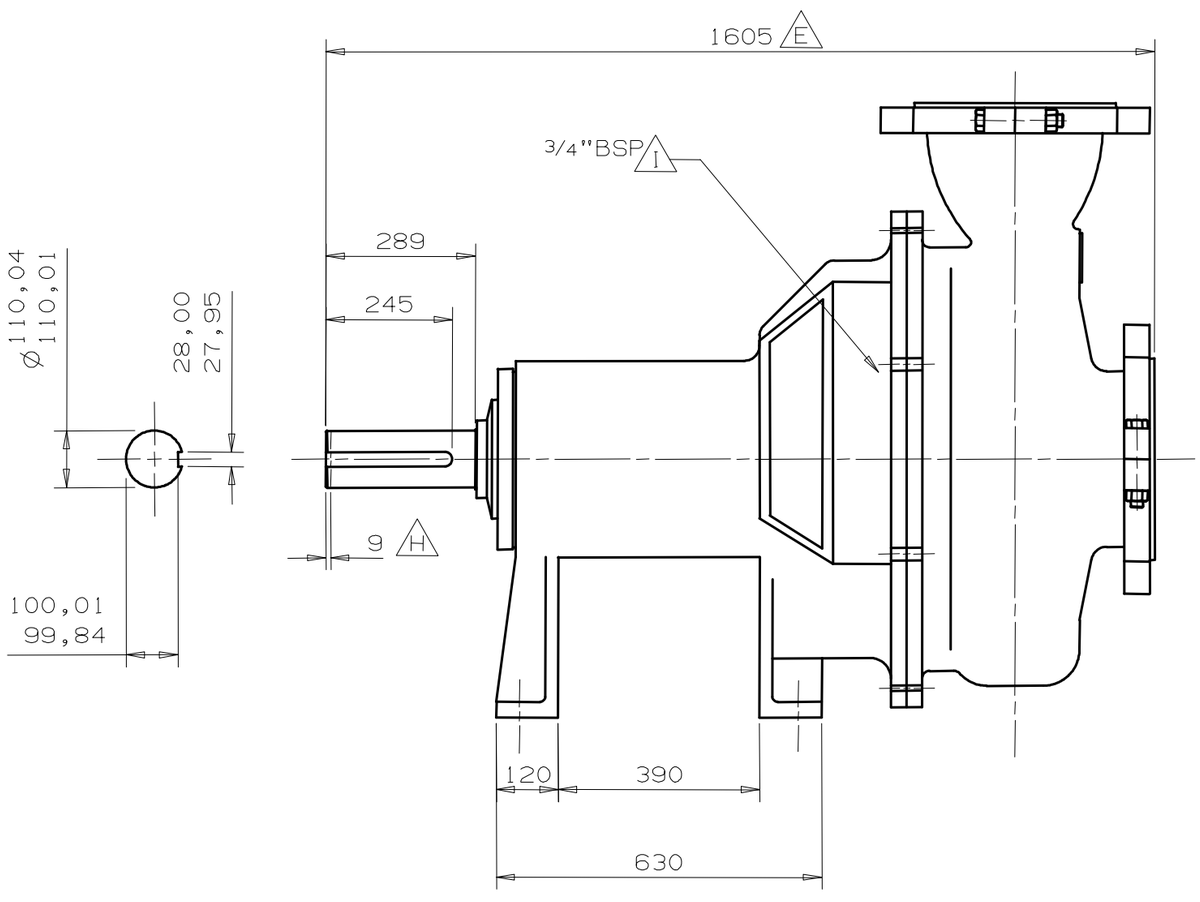
Fz	34800	N	Axial Load along Z-Z axis into or out of the pump through A
Fxy	17400	N	Force in the X-Y plane. Any direction through A.
Mz	3900	Nm	About Z-Z axis through A. Torsional moment on flange.
Mxy	7800	Nm	About any axis in X-Y plane through A.

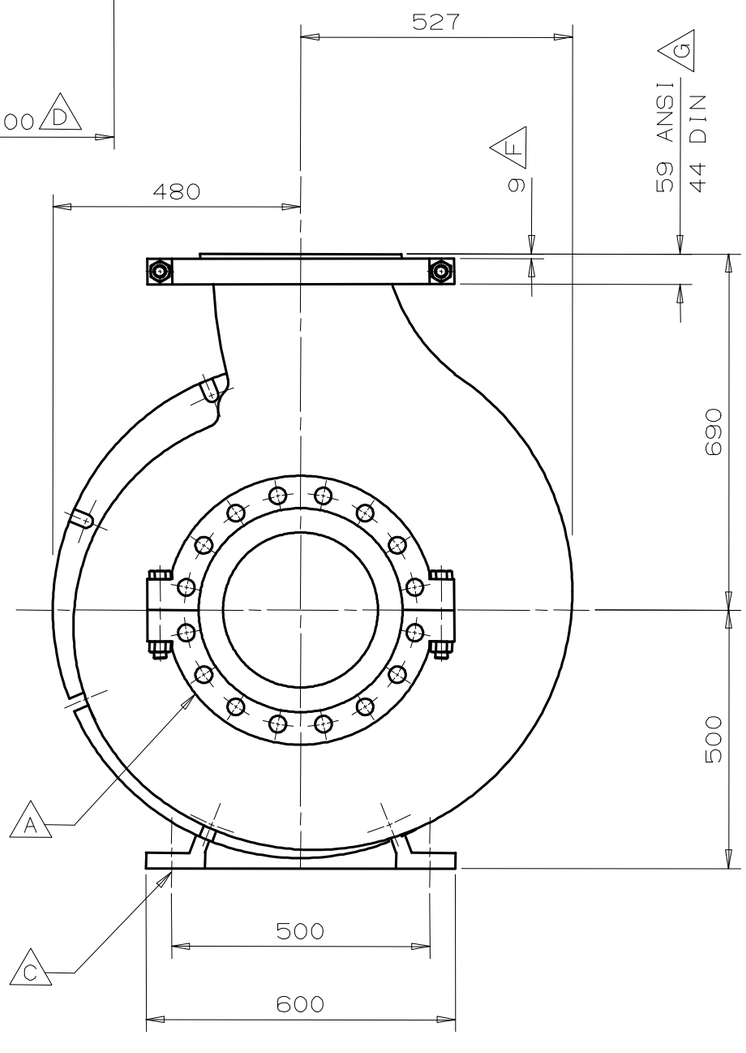
Discharge Flange

Fy	30400	N	Axial load along Y-Y axis into or out of the pump through B
Fxz	15200	N	Force in the X-Z plane. Any direction through B.
My	3450	Nm	About Y-Y axis through B. Torsional moment on flange.
Mxz	6900	Nm	About any axis in X-Z plane through B.

CERTIFIED DRAWING







PUMP DATA

Pump Nominal Mass = 1900 kg
Dynamic Loads are negligible

Pump Speed = 1200 Rpm

DRAWING NOTES

A **Intake Flange** — Drillings to Suit DIN PN25
Inner Diameter Ø300
Outer Diameter Ø485
16 Holes Ø30 Through
430 P.C.D. Off Centres

B **Discharge Flange** — Drillings to suit DIN PN25
Inner Diameter Ø300
Outer Diameter Ø485
16 Holes Ø30 Through
430 P.C.D. Off Centres

C **Fixing Bolts** — 4 Holes Ø33
For M30 Foundation Bolts

D Minimum distance to dismantle the Pump

E Maximum Dimension

F Includes compression of Rubber Joint

G DIN Flange selected

H Shaft Adjustment

I Gland Water Connection (if applicable).

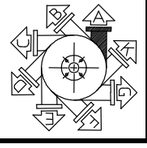
Pump Flanges drawn to ANSI, some dimensions may vary from the ANSI or DIN Standard

All dimensions in mm.

Contract Note
CONTRACT No: 257151-001
SERIAL No: WP60129

CONTRACT DISCHARGE POSITION A

Pump drawn in position A



Title: **300PG-PC UNLINED BARESHAFT PUMP**
Customer: **HERRENKNECHT AG**

WEIR MINERALS EUROPE LIMITED
OFFICE OF ORIGIN: TODMORDEN

Date	Drawing No	Issue
26/06/2015	**A805449**	**0**