Installation, Operating, Maintenance & Safety Instruction For

WARRENDER Series WMCA

Heavy Duty Alloy Centrifugal

ISO 2858 - DIN 24256 - NFE 44121 - ANSI B 73.1 - API 685

Sealless Mag-Drive Pumps

This manual presents installation, servicing, troubleshooting, and maintenance for **WARRENDER WMCA SERIES PUMPS**

Information that may be required regarding performance, alterations or detailed technical data which is not included here may be obtained from your representative.

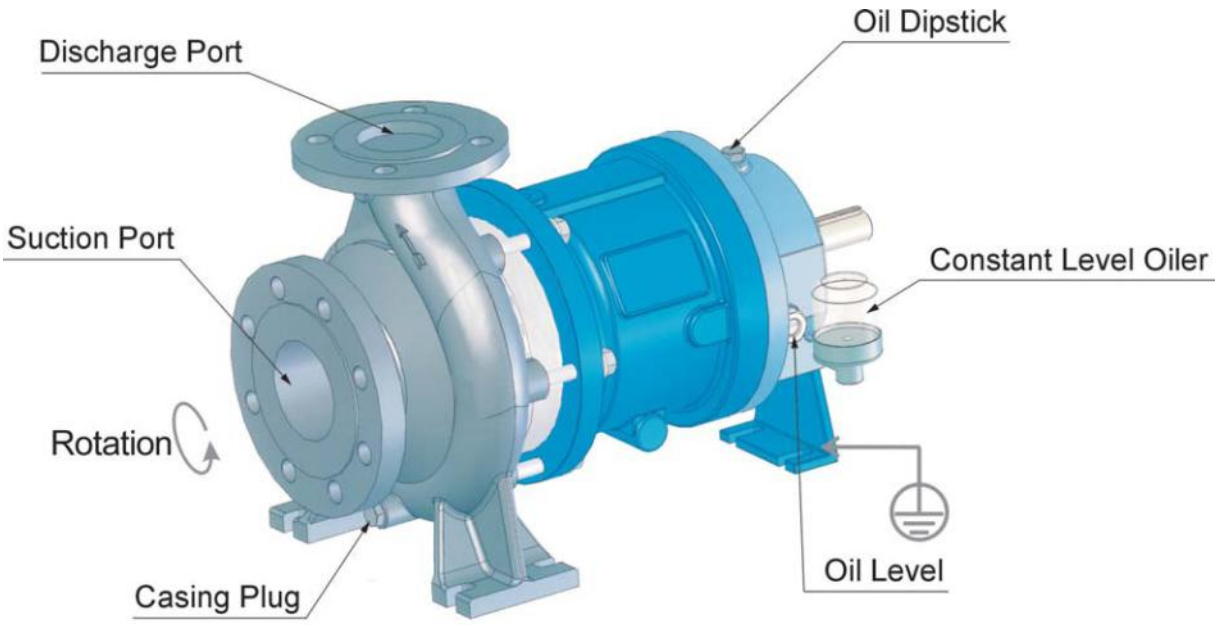
THIS INSTRUCTION MANUAL is intended to guide those responsible for the installation, operation and maintenance of WARRENDER SERIES WMCA Heavy Duty Alloy Centrifugal seal-less magnetic drive pumps. Please read it carefully, before you install and operate your WARRENDER pump. Useful information can also be obtained from: - Hydraulic Institute Standards (USA) regarding pump installation.

INDEX

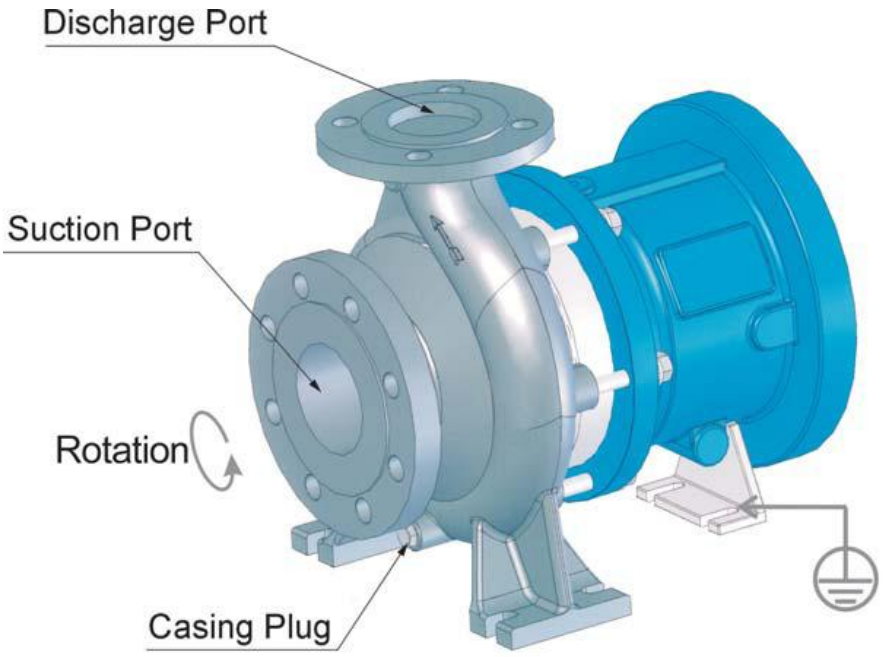
To obtain the best performance from your WARRENDER pump, please read these instructions carefully. Failure to observe the recommended procedures may result in damage to your WARRENDER pump, and may also invalidate the supplier's guarantee.

1 The Pump

Long coupled version



Close coupled version



2 SAFETY

INSTALLATION, OPERATION AND MAINTENANCE MUST BE DONE BY THOROUGHLY QUALIFIED PERSONNEL IN STRICT ACCORDANCE WITH THIS MANUAL AND MUST COMPLY WITH ALL LOCAL, STATE AND FEDERAL CODES.
For your protection and the protection of others, learn and always follow the safety rules outlined in this booklet.
Observe warning signs on machines and act accordingly. Form safe working habits by reading the rules and abiding by them.
Keep this booklet handy and review it from time to time to refresh your understanding of the rules.

DANGER

The use of the word “DANGER” always signifies an immediate hazard with a high likelihood of severe personal injury or death if instructions, including recommended precautions, are not followed.

WARNING

The use of the word “WARNING” signifies the presence of hazard or unsafe practices which could result in severe personal injury or death if instructions, including recommended precautions, are not followed.

CAUTION

The use of the word “CAUTION” signifies possible hazards or unsafe practices which could not result in minor injury, product or property damage if instructions and recommended precautions are not followed.

MAGNETIC

WMCA Series are magnetic driven pumps. The use of the word “Magnetic” indicates the persistent presence of a magnetic field. Please follow the prescriptions below:

a) Magnets can produce strong mechanical forces.

b) There is a danger of injury when two magnets are brought together by hand.

c) Magnets are brittle and are easily damaged. Breakage can occur when a magnet is placed near another magnet or iron object without mechanical guidance and special care.

d) If magnetic particles get into the eyes, get medical help immediately.

e) Heart pacemakers can be damaged. Magnetic fields present immediate danger to individuals having electronic medical devices, metallic heart valves, metallic prosthetics or metallic surgical clips.

f) Tools or other iron objects can be attracted suddenly.

g) Credit cards etc with magnetically-stored information can be damaged.

h) Watches can be damaged.

3 INSPECTION

All WARRENDER pumps are inspected prior to shipping and prepared for safe transportation. Upon receipt of WMCA Series pump, check for any damage which may have occurred during shipment.
Notify the courier and WARRENDER promptly if damage has occurred.

4 STORAGE

If the pump is not installed immediately, it should be protected from exposure to moisture and dust.
Shipping protections of the ports installed at the factory, must be kept securely in place.
Storage instruction provided by the driver manufacturer should be observed.

5 ON RECEIVING YOUR PUMP

5.1 Check the nameplate on the pump against the receiving and purchase order documents to be sure that the correct size of pump and materials of construction have been supplied. If a motor has been supplied, check that the power, speed, and voltage are correct.

5.2 Prior to unpacking, check for physical damage to the packing and the pump, notify the forwarding agent **IMMEDIATELY** if any damage is found.

5.3 Check that the port covers are intact. If not, check whether foreign objects may have found their way into the pump casing through the ports. Remove the port covers only when you are ready to connect the pipes to the pump. When shipped, the pumps are suitable for short term storage only. If long term storage is necessary before the pump will be put into operation, we suggest that you contact your pump supplier for long term storage recommendations.

5.4 Check for free rotation of the pump. If the pump is close-coupled to the motor, remove the fan cover from the motor and rotate the fan by hand. To check long coupled pumps for free rotation, remove the coupling guard and rotate the pump and motor shafts at the flexible coupling.

6 PUMP IDENTIFICATION

Every WARRENDER pump has a nameplate located on the side of the casing. It is recommended that the purchaser record the serial number and reference it when requesting information or service parts from WARRENDER. The serial number, must be used for all correspondence and spare parts order.
Standard nameplate

7 PREPARING THE FOUNDATION

The foundation should be substantial in order to reduce vibrations, and rigid enough to prevent flexing which can result in miss-alignment. Foundation bolts of the correct size should be located by reference to certified drawings if the base plate is supplied with the pump.

7.1 The pump must be mounted horizontally on a level foundation, with the discharge port vertically upwards.

7.2 Close-coupled motor-pump units without base plates Level the pump base accurately, using shims under the pump feet. The pump must sit firmly and evenly on its foundation. It must not be distorted by bolting to an uneven surface.

7.3 Motor-pump units on base plates Level the base plate accurately, using shims under the base-plate next to the foundation bolts. The base plate must sit firmly and evenly on its foundation: it must not be distorted by bolting to an uneven surface, which will throw the pump and motor out of alignment.

8 PUMP AND MOTOR ALIGNMENT

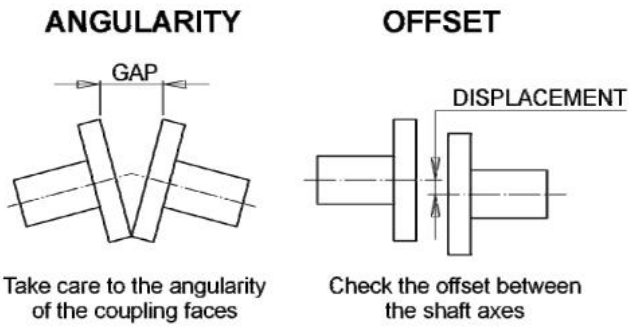
8.1 Close-coupled pumps have been aligned prior to shipment and if they turn freely by hand, no further adjustments are necessary.

8.2 Long-coupled pumps have been pre-aligned with the motor prior to shipment. If pump units receive rough treatment during shipment, they can become miss-aligned. The flexible coupling is not designed to compensate for miss-alignment. Improper alignment will cause vibration and premature bearing failure.

CAUTION

CHECK THE ALIGNMENT OF PUMP AND MOTOR BEFORE START-UP.

A final alignment check should be made after the base plate has been grouted and set, and the foundation bolts have been tightened.

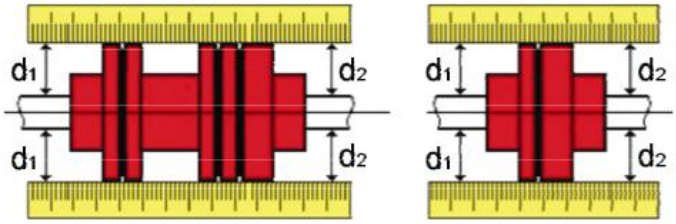


Couplings should be aligned within the following limits:

COUPLING TYPE	OFFSET	ANGULARITY
	Displacement	Gap
Short flexible coupling (3000 rpm)	0.002 inch	0.0016 inch per 3.94 inches coupling diameter.
Flexible spacer coupling (3000 rpm)	0.0028 inch per (3.94 inches) spacer length.	0.0016 inch per 3.94 inches coupling diameter.

HOW TO check the alignment

a. Straight edge
Using a straight edge, check the distance from the shaft at several points on the circumference of the coupling. The distances d1 and d2 should each remain constant.



NOTE: The straight edge method checks static coupling alignment, not shaft alignment. It relies for its accuracy on the accurate alignment of each coupling half on its shaft. The straight edge method is a useful preliminary check, but should not be seen as an effective final alignment method.

b. Dial gauge ("clocking")
There are several methods, using one or two dial gauges. The less accurate is the reverse indicator method, using two gauges, which overcomes errors due to `sag' of the gauge bars.

c. Optical methods
Several proprietary systems are available, such as the OPTALIGN system. Mechanical errors are eliminated by optical alignment techniques.
On request, your pump supplier can provide further information about suitable alignment methods, including allowances for THERMAL EXPANSION in high temperature duties.

9 LOCATION AND PIPING

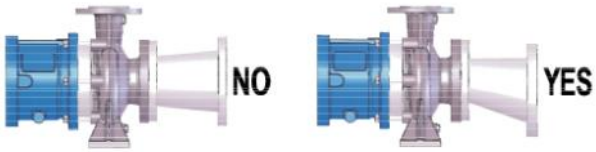
9.1 The correct pipe work sizes should be selected according to the allowable limits of liquid velocity and pressure drop at the required flow rate. Check the NPSH required by the pump at its specified duty point, and ensure that the minimum NPSH available exceeds that required. This is particularly important for liquids near their boiling temperature (or bubble point).

9.2 Check that the pipe work is THOROUGHLY CLEAN before the pump is installed.

9.3 Pipe work connections must be accurately aligned with the pump ports, so that they can be connected to the pump without forcing. Maximum allowable bending moments are set out in the Tables on pages 10/11. These moments must not be exceeded, otherwise the pump may distort internally, or the pump and motor may become miss-aligned. Pipe work must Be fully and independently supported as close as practicable to the pump.

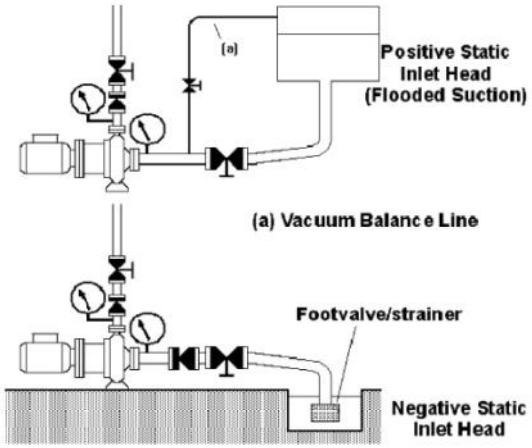
9.4 Locate the pump as close as possible to the liquid source.

9.5 The suction line should be as short and straight as possible, with a minimum number of bends. Bends should be radiuses: avoid sharp elbows. Bends and fittings should be no closer than 20 pipe diameters to the pump suction, to allow undisturbed flow to the pump impeller. Liquid velocity in the suction line should normally be between 2.3 ft. and 6.6 ft/sec. If the liquid is near its boiling temperature (or bubble point), its velocity may need to reduced to 1.6-3.3 ft/sec. If the suction line is oversized, the reducer at the pump inlet port should be **ECCENTRIC**, not concentric.



9.6 Generally, suction piping should be one or two sizes larger than the inlet bore of the pump, to keep liquid velocity low and friction losses to a minimum. This becomes more important as the distance between the pump and the liquid supply increases.

9.7 The suction line should slope so as to avoid air pockets. Valves on the suction side should be mounted with stems horizontal, or vertically downwards. All joints in the suction line must be tight, to prevent air from entering into the system, with the risk of vapor locking. If the pump is installed with a negative static inlet head (lower diagram), the foot valve/ strainer must always be immersed at a sufficient depth to avoid entry of air into the pump.



Take suitable precautions to prevent vortexing in the supply vessel A pressure gauge should be installed in the suction line, as close as possible to the pump.

9.8 If the supply vessel is under vacuum, a pressure balancing line should connect the supply vessel and the pump inlet port.

9.9 The discharge line should be as short and direct as possible to minimize friction losses. An air vent (if permissible) should be installed at the first high point in the discharge line.
A check valve and gate valve should be installed as close as possible to the pump discharge nozzle. The check valve is installed to protect the pump from excessive back pressure or reverse flow rotation, and to prevent back flow into the pump during shut down. The discharge (gate) valve is used to regulate the flow. The check valve should be installed between the pump and the discharge valve to allow the pump to be removed from service without emptying the discharge line.
A pressure gauge should be installed on the discharge side of the pump as close as possible to the discharge nozzle.

9.10 If the pump is fitted with a STEAM HEATING JACKET, the steam must flow into the upper connection and out of the lower connection. The heating fluid may be water with a maximum temperature of 338°F or saturated steam with a maximum pressure of 100psi.

9.11 Prior to starting the pump it is important to flush the piping to make sure that the system is free of solids such as pipe scale, welding beads, and dirt. If possible a TEMPORARY START-UP STRAINER with a 40 mesh screen 420 Micron should be installed in the suction line.

BE VERY CAREFUL not to allow the temporary strainer to become plugged, causing low inlet pressure with cavitation or dry running. A pressure gauge should be installed on either side of the temporary strainer to measure the pressure drop across it. If there is any risk of ingestion of solids during normal operation, once the pump has been successfully commissioned, a PERMANENT INLET STRAINER should be fitted in the inlet line.

AVOID PUMPING LIQUIDS CONTAINING SUSPENDED SOLIDS

Standard WARRENDER pumps are designed to handle clean liquids. Unless specifically agreed prior to purchase of the pump from your supplier, suspended solid matter must be kept out of the pump by a suitable inlet strainer. The strainer mesh size should be less than (0.0197”), with an open surface area at least 2.5 x nominal cross-sectional area of pump inlet bore. The strainer must be inspected regularly and cleaned when necessary.

DO NOT PUMP LIQUIDS CONTAINING IRON OXIDES OR FERROMAGNETIC PARTICLES, HOWEVER SMALL. THESE MAY ADHERE TO THE INTERNAL MAGNET AND CAN EVENTUALLY BUILD UP INTO DAMAGING DEPOSITS.

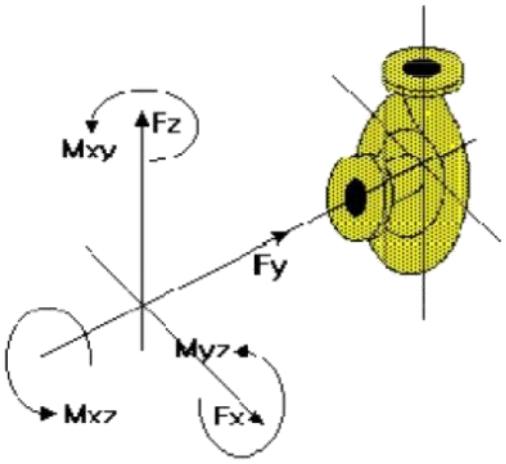
9.12 Protecting the pump against DRY RUNNING The pump must not be allowed to run dry. Dry running will result in loss of liquid film to the bearings, causing overheating and eventual bearing failure,
leading to seizure of the pump.
Avoid the following conditions:

a. Loss of liquid supply. Ensure that an adequate supply of liquid is available at the pump inlet at all times. Pressure and/or flow sensors should be installed if necessary, to monitor the hydraulic conditions in the inlet pipe work.

b. Low inlet pressure due to restriction or blockage of the inlet pipe work, causing liquid vaporization and cavitation in the pump, with the risk of loss of liquid film in the bearings.

c. "Dead-heading" If the pump is permitted to run against a closed discharge for more than a short time (depending on the liquid, the duty, and the pump model and power), the liquid in the pump casing will heat up and evaporate with consequences as in b. above.

9.13 Electronic dry-running protection
A rapid and reliable method of stopping a centrifugal pump, in the event of loss of liquid supply or interruption of flow, is to monitor the power output of the motor. The Lineman Power monitors both current and phase angle, providing pump protection without pipe work sensors or attachments. Lineman Power Monitor is easily fitted in the power supply to the motor, in place of a normal starter. Details of Lineman Power Monitors are available on request from your pump supplier.



PERMISSIBLE PIPEWORK LOADS: FORCES AND MOMENTS

PUMP TYPE	Fx;Kg		Fy;Kg		Fz; Kg		Bending moment; Kg. m		
	Suct.	Disch.	Suct.	Disch.	Suct.	Disch.	Myz	Mxy	Mxz
32-125	120	75	120	75	250	160	65	65	68
32-160	120	75	120	75	250	160	65	65	68
32-200	120	75	120	75	250	160	65	65	68
32-250	120	75	120	75	250	160	65	65	68
40-125	130	80	130	80	270	180	78	78	80
40-160	130	80	130	80	270	180	78	78	80
40-200	130	80	130	80	270	180	78	78	80
40-250	130	80	130	80	270	180	78	78	80
50-125	165	115	165	115	320	220	95	95	100
50-160	165	115	165	115	320	220	95	95	100
50-200	165	115	165	115	320	220	95	95	100
50-250	165	115	165	115	320	220	95	95	100
50-315	165	115	165	115	320	220	95	95	100
65-125	215	135	215	135	440	275	100	110	115
65-160	215	135	215	135	440	275	100	110	115
65-200	215	135	215	135	440	275	100	110	115
65-250	215	135	215	135	440	275	100	110	115

65-315	215	135	215	135	440	275	100	110	115
80-160	260	165	260	165	510	320	120	130	140
80-200	260	165	260	165	510	320	120	130	140
80-250	260	165	260	165	510	320	120	130	140
80-315	260	165	260	165	510	320	120	130	140
80-400	260	165	260	165	510	320	120	130	140
100-200	260	215	260	215	510	430	125	137	150
100-250	260	215	260	215	510	430	125	137	150
100-315	260	215	260	215	510	430	125	137	150
100-400	260	215	260	215	510	430	125	137	150
125-250	290	270	290	270	580	550	137	145	155
125-315	290	270	290	270	580	550	137	145	155
125-400	290	270	290	270	580	550	137	145	155
150-250	350	290	350	290	650	580	145	160	163
150-315	350	290	350	290	650	580	145	160	163
150-400	350	290	350	290	650	580	145	160	163
150-500	350	290	350	290	650	580	145	160	163
200-315	400	350	400	350	750	650	150	165	170
200-400	400	350	400	350	750	650	150	165	170
250-315	440	380	440	380	780	670	160	180	190

10 ELECTRICAL CONNECTION

The electrical connection to the motor should be carried out by a properly qualified electrician, using cable, cable glands and connection procedures suitable for the electrical load and for the location of the installation.
All regulations governing electrical installations in HAZARDOUS AREAS must be strictly followed. It is the responsibility of the pump user to ensure that a safe electrical installation is made and maintained.

10.1 Connecting the electric motor

10.1.1 Isolate the electric supply cable from the power supply.

10.1.2 Bring the cable end into the terminal box through a suitable cable gland.

10.1.3 Follow the motor manufacturer's instructions for electrical connection. These will normally be found inside the terminal box, either on a separate instruction sheet or attached to the inside of the terminal box cover.
Check that the terminal links are correctly positioned for the supply voltage.
Ensure that the earth connection is properly and securely made.
5.1.4 Before replacing the terminal box lid, check that the sealing surfaces and the gasket or 0-ring seal are clean and in good condition. With flameproof electric motors, the opposing metal surfaces of the terminal box seal should be lightly greased to keep out condensation and prevent corrosion.

10.2 A proper electrical starter must be used. A starter will:
a. prevent accidental restarts after power Failure
b. provide a safe, waterproof switch enclosure (e.g. to IP55 ` hose-protected' specification)
c. protect the motor with a correctly set thermal overload cut-out: a fuse protects only the wiring
d. withstand the heavy starting current of the motor, preventing arcing and rapid contact wear.

10.3 Electronic dry-running protection:
see **9.13.**

11 ROTATION CHECK AND PREPARATION FOR START-UP

WARNING

DON'T RUN THE PUMP DRY

11.1 Long-coupled pumps only

Prior to starting the pump the bearing housing should be filled with one of the following oils:

Texaco Regal Oil R & O 32
Shell Turbo T32 Turbine Oil
Mobil DTE Heavy Medium ISO 68
Exxon Teresso 68 ISO 68

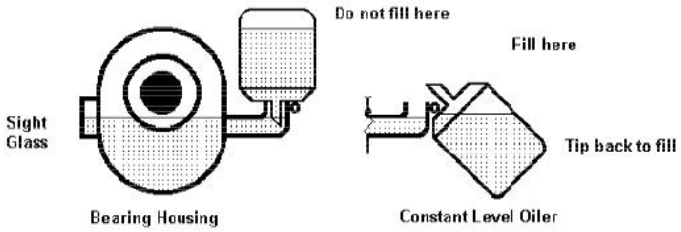
or equivalent. If the pump is to operate at an ambient temperature of more than 40°C (104°F) a more viscous oil (about SAE 40) is recommended.
Fill to the middle of the sight glass, using the following procedure:

i) pour oil into the bearing housing, through the filler cap on top of it, until oil is just visible at the bottom of the sight glass.

ii) tip back the transparent bulb of the constant level oiler, and fill it with oil.

iii) allow the bulb to return to its normal position. Wait for the oil to flow into the bearing housing.

iv) repeat the operation until oil no longer flows out of the bulb.



If there is a toothed spacer coupling between the pump and the motor, check whether it needs to be filled with oil. Follow the coupling manufacturer' s instructions as required.

11.2 Direction of rotation

WARRENDER WMCA series pumps rotate counter clockwise when viewed from in front of the pump inlet port (clockwise from the motor fan).
To confirm the direction of rotation (refer to the rotational arrow on the pump casing) use the following procedure:
a. Open the suction and discharge valves, allowing the pump to fill with liquid.
b. Remove the coupling guard of a long coupled
pump, or the motor fan cover of a close-coupled pump.
c. "Bump" the motor by pressing the motor start and stop buttons in quick succession. If the direction of rotation is incorrect, reverse any two of the three-phase power leads to the motor.
d. After confirming correct rotation, replace the coupling guard or motor fan cover.

12 PRIMING THE PUMP

WARNING

DO NOT RUN THE PUMP DRY

12.1 Check that the liquid supply is at the correct temperature, with any necessary heating/cooling in operation.

Open the suction and discharge valves, allowing the pump to fill with liquid.
NOTE: If the direction of rotation has not been checked, this must be done before proceeding (see 11.2 above).

12.2 Open the discharge valve to 1/4 open.

12.3 Start the motor and immediately check the discharge pressure gauge. The pressure should rise quickly and hold steady. If the pressure rises and then falls back, there is air or vapor in the system.

STOP THE PUMP IMMEDIATELY.
Wait a few seconds before restarting the pump.

12.4 If the pressure gauge does not hold steady after repeating step 7.3 several times, shut the pump down, open the discharge vent (if permissible) and check that all vapor or air is purged from the system.

12.5 Once the pump is fully primed and a steady discharge pressure is established, slowly open the discharge valve until the desired operating point is reached. Check that the electric motor current does not exceed the rated full load current shown on the motor plate.

12.6 If the pump starts to vibrate, rattle or run noisily, the flow rate has become excessive. Close the discharge valve IMMEDIATELY until the pump runs smoothly again. Vibration and noise are an indication of cavitation, which can cause rapid and severe damage if permitted to continue. If the flow rate needs to be permanently restricted, a permanent orifice in the discharge line is more secure than an adjustable valve. Your pump supplier will advise on a suitable orifice size if necessary.

13 PUMP OPERATION

13.1 Operators should make frequent visual inspections to check that the pump is running smoothly without noise or vibration, and that the discharge pressure is holding steady, without fluctuation, at the correct figure. Over-heating of the pump or motor bearings is cause for alarm. The bearing housing should not be more than 50°C (122°F) above ambient temperature, nor should it exceed 80°C (176°F) (too hot to touch) in any event. If the bearings overheat, shut the pump down immediately, investigate the cause, and take corrective action.

13.2 Care must be taken to make sure that the sleeve bearings in the pump are replaced in sufficient time to prevent mechanical rubbing between the inner magnet and the rear casing of the pump. This condition can be detected by an increase in power consumption and loss of pump performance. In addition the pump may vibrate or operate noisily.

IF LEFT UNATTENDED, THE RUBBING WILL EVENTUALLY BREAK THE REAR CASING CAUSING LEAKAGE OF THE LIQUID INTO THE ENVIRONMENT.

Be sure to maintain properly the ball bearings supporting the outer magnet in the external bearing housing (or the motor bearings in the case of close-coupled pumps).

BEARING FAILURE WILL RESULT IN THE OUTER MAGNET MECHANICALLY RUBBING ON THE OUTSIDE OF THE REAR CASING, WHICH IF LEFT UNATTENDED WILL CAUSE THE REAR CASING TO FAIL, WITH LIQUID LEAKAGE INTO THE ENVIRONMENT.

Follow the motor manufacturer' s recommendations and keep the motor bearings maintained.

WARNING

Never throttle the pump by closing a valve in the suction line. **Throttling the suction line can cause serious damage to the pump.**

WARNING

Do not allow the pump to run against a closed discharge valve for more than a few seconds. This will cause rapid heating of the liquid in the pump casing, with vaporization and dry running of the bearings, risking serious damage to the pump.

13.3 WARRENDER pumps are dynamically balanced during manufacture and are tested prior to dispatch to ensure that they run smoothly and without vibration. Replacement impellers are also balanced prior to dispatch.
Vibration monitoring in service can detect poor hydraulic conditions, bearing wear, internal erosion or chemical attack before it seriously damages the pump. Vibration may be monitored on the internal pump bearings and/or the external bearing housing and/or the motor bearings. Your supplier will advise you on vibration monitoring on request.
13.4 If a temperature sensor is fitted to the pump, check regularly to ensure that it is working properly.
13.5 IMPORTANT SAFETY NOTE: When the pump is stopped, unless a non-return valve is fitted in the discharge line, liquid will drain back through the pump, causing it to rotate in reverse. Do not start the pump while it is turning backwards, as this can result in immediate and severe damage. Allow ample time for complete drainage of the discharge line before the pump is restarted.

14. MAINTENANCE SCHEDULE

Provided the pumped liquid is clean and free of suspended solids, and the pump is operated within the manufacturer' s stated performance limits and is not allowed to run dry, your WMCA Series pump is capable of running for very long periods with minimal attention. Please read paragraph 13.1.

PART TO BE INSPECTED	ACTION TO BE TAKEN	FREQUENCY
External Bearing Housing (Long-coupled units)	Fill with appropriate oil to the mid-dle of the sight glass	Weekly. Change the oil every 5000 hours
Internal Bearing system	Check thrust bearings and sleeve bearings for wear. On reassembly use new gaskets and O-rings	After 2500 hours of operation, check for premature wear. Thereafter, check every 5000 hours or once a year, whichever is short-er.

Casing Wear Ring	Check wear ring clearance (See paragraph 12.1)	After 2500 hours of operation, check for premature wear. Thereafter, check every 5000 hours or once a year, whichever is shorter
Motor bearings	Unless otherwise specifically stated in the pump instructions, motor bearings are grease-filled and sealed for life. We recommend regular checks on motor bearing condition, and replacement when necessary.	

15 DECOMMISSIONING THE PUMP

WARNING
MAGNETIC

Before the pump is decommissioned, it should be flushed out with clean water or another suitable liquid.
Thorough flushing out will help to ensure that:

a) if the pump stands idle for an extended period, it is not damaged by precipitation or encrustation of solids.

b) the pump does not contain dangerous amounts of corrosive, toxic or otherwise hazardous liquids when dismantled.
If there is any risk of FREEZING in cold weather, the pump and pipe work should be drained down via the drain port in the base of the pump casing.

It is the pump user's responsibility to ensure that the pump is in a safe condition before it is opened or worked on. If the pump is removed and stored, or returned to its supplier or to a third party for repair or overhaul, it must be clearly LABELED, stating what substances or residues it may contain, warning the recipient of any possible hazard to health.

16 DISASSEMBLING THE PUMP

These operations should be carried out only by skilled personnel. Damage caused by careless or improper disassembly or reassembly is excluded from the supplier's guarantee.

CAUTION

WORK IN A CLEAN AREA!
DO NOT ALLOW MAGNETIC MATERIALS TO CLING TO THE PUMP MAGNETS.
DO NOT USE FORCE!

The pump should be taken apart with the help of the labeled sectional drawing's supplied with it.

If necessary the internal assembly of the pump can be removed from the pump casing without disturbing the pipe work. If a spacer coupling is fitted between pump and

motor, the pump can be dismantled without disturbing the motor.

16.1 Check that the pump has been fully drained and flushed out, before you start work on it.

16.2 Isolate the motor from its electrical supply.

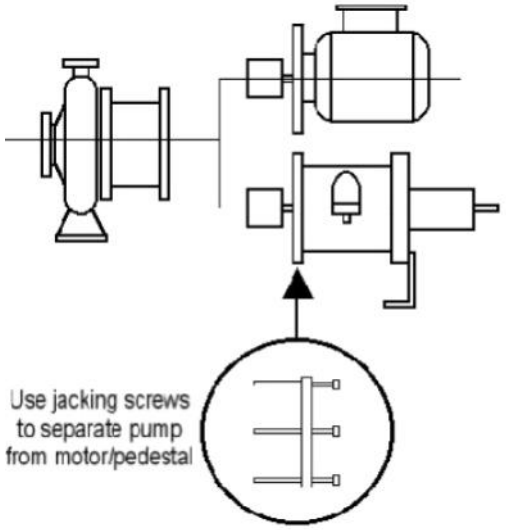
16.3 Isolate the pump from the rest of the hydraulic system. Isolate and disconnect any jacketing or other auxiliary pipe work from the pump.

16.4 Discharge the oil from the bearing housing. Replace the oil chamber plugs.

16.5 Remove the spacer element of the coupling, or if no spacer is present, remove the motor.
With close-coupled pumps, the motor and external magnet assembly must be removed carefully, without damaging the magnet. See 16.7.2 below.

16.6 Remove the external cooling/recirculation pipe by disconnecting the pipe unions at each end.

16.7 Dismantling the magnetic drive



WARNING

SAFETY NOTE
See PRECAUTIONS on page 12.
Take care not to trap your fingers as the two halves of the magnetic coupling are separated.

16.7.1 Long-coupled units
Remove the bolts securing the bearing housing to the bracket and carefully withdraw the
external bearing housing with the external magnet attached.
You are strongly recommended to use three JACKING SCREWS in the tapped holes provided. JACKING SCREW sizes are:

WMCA series range I pumps: M10 x 145mm
WMCA series range II pumps: M12 x 180mm
WMCA series range III pumps: M16 x 250mm

Withdraw the external bearing housing and external magnet slowly and progressively, taking care to avoid damaging the brittle magnetic elements inside the external magnet.

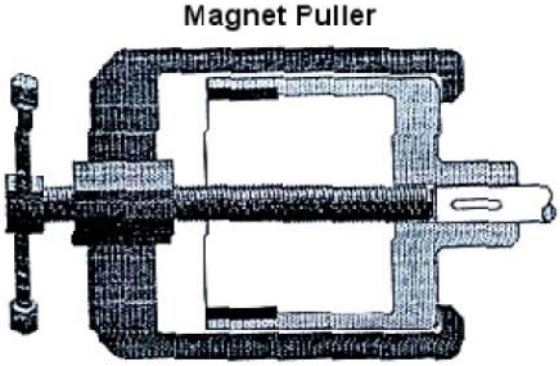
16.7.2 Close-coupled units
Remove the bolts securing the motor to bracket, and carefully withdraw the motor with the external magnet attached.
You are strongly recommended to use three JACKING SCREWS in the tapped holes provided. JACKING SCREW sizes are:

WMCA series range I pumps: M10 x 145mm
WMCA series range II pumps: M12 x 180mm
WMCA series range III pumps: M16 x 250mm

Withdraw the external bearing housing and external magnet slowly and progressively, taking care to avoid damaging the brittle magnetic elements inside the external magnet.

16.8 Removing the external magnet from the motor shaft or the external bearing shaft
First loosen the grub screws securing the external magnet. Then use a puller to

extract the magnet slowly and progressively from the shaft. If a suitable puller is not available, use wooden levers.



DO NOT STRIKE THE MAGNET! The magnetic elements are brittle and are easily damaged.

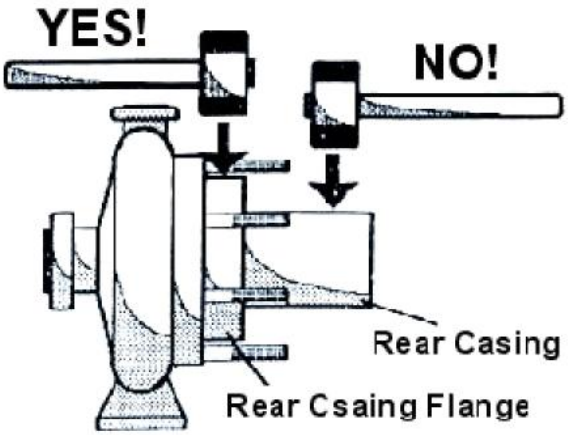
DO NOT ALLOW THE MAGNET TO FALL TO THE FLOOR!

16.9 Disassembly of external bearing housing See 16.15, page 18.

16.10 Removing the internal pump assembly
Remove the nuts securing the bracket to the pump head. Carefully withdraw the internal pump assembly from the pump head. If the internal pump assembly does not move easily, DO NOT LEVER, but gently tap the flange of the rear casing on alternate sides with a soft-headed mallet, to free the internal assembly.

DO NOT STRIKE THE 'CAN' OF THE REAR CASING!

This thin walled component must not be distorted or damaged



16.11 Removing the impeller
Place the internal assembly on a clean surface, impeller upwards. Flatten the impeller lock washer. Holding the impeller firmly around its circumference, loosen and remove the impeller nut. Remove the impeller and its key. Remove the front thrust
bearing.

16.12 Stripping the internal pump assembly
Remove the countersunk screws securing the internal bearing housing assembly in the rear casing.
You are strongly recommended to use JACKING SCREWS in the tapped holes provided.
The countersunk screws can be used for this purpose.
Remove the shaft/internal magnet/thrust bearing sub-assembly slowly and carefully from the internal bearing housing. Take great care not to chip the brittle silicon carbide shaft sleeve bearings.

16.13 Stripping the shaft/internal magnet/thrust bearing sub-assembly
Remove the bolts from the assembly, and remove the internal magnet. Take care to catch the thrust bearing as the last bolt is removed. The silicon carbide bearing sleeves may now be removed from the shaft by removing the grub screws that

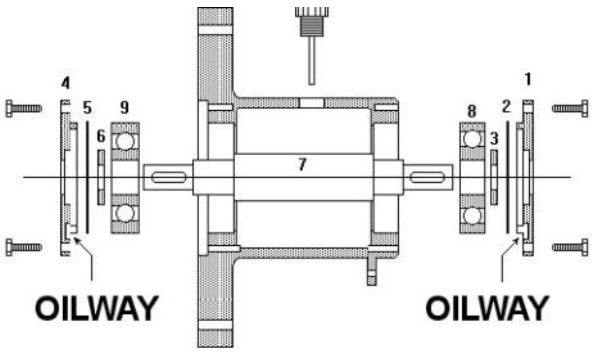
locate them, and sliding the sleeves off their tolerance rings. Remove the metal spacer separating the two sleeves on the shaft.

16.14 Stripping the internal bearing housing

Remove the silicon carbide bearing sleeves in their metal supports by removing the screws that secure them. Use bolts as JACKING SCREWS if necessary.
Remove the silicon carbide sleeves from their metal housings by removing the grub screws that locate them.

16.15 Disassembly and re-assembly of the EXTERNAL BEARING HOUSING (long-coupled units only)

Drain oil from the pedestal housing. Loosen the grub screw and remove the external magnet from the shaft using a suitable extractor tool.
Undo bolts and remove bearing covers, together with gaskets and lip seals (items 1-6). Using a bench press, press out shaft (7) together with outer bearing (8). Press out the inner bearing (9). Inspect bearings for wear and replace if necessary. Remove any burrs from shaft keyway.

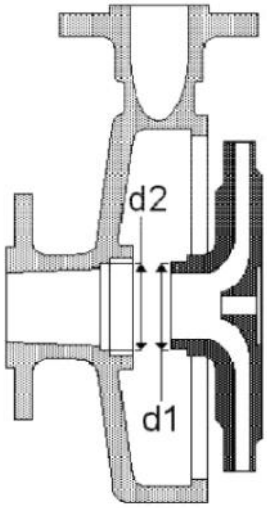


Re-assembly

Using a bench press, insert inner bearing (9) into pedestal housing. Assemble outer bearing (8) and shaft (7). Press shaft and bearing assembly into pedestal housing. Insert lip seals (3,6) in bearing covers (1,4), and fit new gaskets. Locate bearing covers onto pedestal housing, ensuring the oil ways are at the bottom. Replace and tighten bolts.

17. INSPECTION PRIOR TO REASSEMBLY

Clean all the parts carefully. Ball bearings should be washed in a clean solvent and allowed to dry, then oiled. Check all pump parts and replace worn ones.
17.1 Check the clearances between the collar of the impeller and the wear ring in the pump casing.



Pump Size	Diameter Clearance for Stainless steel.		Diameter Clearance for other alloys	
Discharge Nominal Bore, mm	mm	in	mm	in
32,40	0.45-0.55	0.018-0.022	0.25-0.35	0.010-0.014
50,65,80,100	0.50-0.60	0.020-0.024	0.30-0.40	0.012-0.016
125,150	0.55-0.65	0.022-0.026	0.35-0.45	0.014-0.018

All WMCA pumps are equipped with silicon carbide sleeve bearings and thrust bearings.

When new, diametrical clearances between the inner and outer silicon carbide sleeves are as follows:

WMCA SERIES RANGE I
0.025-0.0475mm / 0.0009-0.0018 inch

WMCA SERIES RANGE II
0.08 -0.13 mm / 0.003 - 0.005 inch

WMCA SERIES RANGE III
0.1 -02 mm / 0.0039 - 0.0078 inch

18 REASSEMBLING THE PUMP

WARNING
MAGNETIC

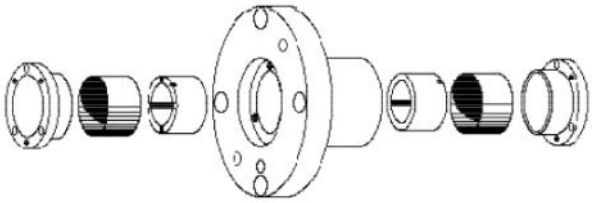
WORK IN A CLEAN AREA: DO NOT ALLOW MAGNETIC MATERIALS TO CLING TO THE PUMP MAGNETS.

SEE PAGE 5 FOR PRECAUTIONS WHEN WORKING WITH STRONG MAGNETS.

IF LUBRICANTS OR THREADLOCKING COMPOUNDS (e.g. LOCTITE) ARE USED ON ANY INTERNAL THREAD OR OTHER WETTED SURFACE IN THE PUMP, THEY MUST BE COMPATIBLE WITH THE PUMPED LIQUID. (If in doubt consult the manufacturer of the compound)

18.1 INTERNAL BEARING SUBASSEMBLY

18.1.1 Replace the silicon carbide sleeve bearings in their metal housings. Each silicon carbide bearing has a plain and a slotted end. The slotted ends face outwards.
Align the slots in the silicon carbide sleeves with the tapped holes in the metal housings, and replace the locating grub screws.



18.1.2 Fasten the sleeve bearing assemblies into the internal bearing housing.

18.2 SHAFT/MAGNET SUB-ASSEMBLY

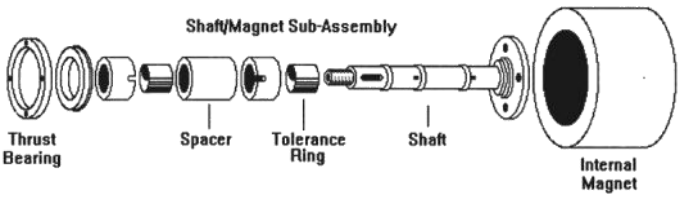
18.2.1 Fit the rear tolerance ring onto the shaft, aligning the gap in the tolerance ring with the tapped hole in the shaft.

18.2.2 Pinch the tolerance ring firmly on to the shaft, align the slot in the silicon carbide sleeve carefully with the gap in the tolerance ring, and slide the sleeve over the ring. Replace and tighten the locating grub screw. Replace the metal sleeve separating the front and rear silicon carbide sleeve bearings.

18.2.3 Repeat procedure 18.2.2 for the front silicon carbide sleeve bearing.

18.2.4 Secure the internal magnet and rear thrust bearing to the shaft, using bolts and lock washers. NOTE: The silicon carbide

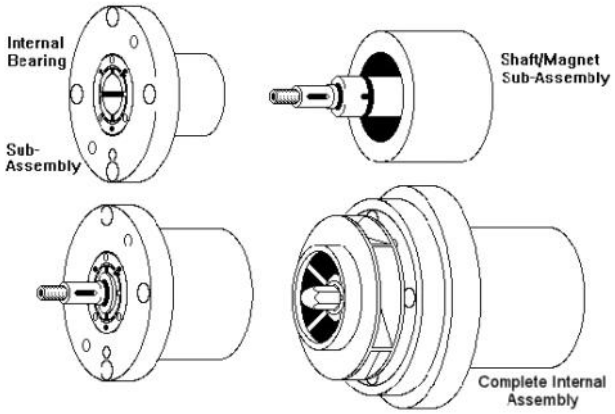
face of the rear thrust bearing must point forwards, towards the impeller.



18.3 INTERNAL PUMP ASSEMBLY

Rebuild the internal pump assembly with the internal bearing sub-assembly (18.1) and the shaft/magnet sub-assembly (18.2).

18.3.1 Slowly and carefully slide the shaft sub-assembly into the rear of the internal bearing subassembly.



Take great care not to damage the brittle silicon carbide bearings.

18.3.2 Stand the assembly with the free end of the shaft upwards. Slide the front thrust bearing on to the shaft, silicon carbide face downwards. Replace the shaft key. Slide the impeller on to the shaft.
Replace the impeller lock washer, locating its internal tab in the shaft keyway. Grip the impeller firmly around its circumference, replace and tighten the impeller nut. Bend up one edge of the impeller lock washer against a flat on the impeller nut.

Turn the impeller to check for free rotation.

18.3.3 Fit the internal pump assembly into the rear casing, aligning carefully the alignment marks on the internal bearing housing and the rear casing.

18.4 REASSEMBLY OF THE COMPLETE PUMP

18.4.1 Fit the external re-circulation/cooling pipe loosely to the union on the pump body, first making sure that both sealing surfaces are clean.

18.4.2 Inspect and carefully clean the main sealing surfaces on the rear casing and the pump body. Fit a new main gasket.

18.4.3 Offer up the internal pump assembly to the pump body, aligning it so that the pipe connection in the rear casing is correctly located to accept the pipe.
Slide the internal assembly into the pump body.
Connect the free end of the pipe loosely to the union on the rear casing, first making sure that the sealing surfaces are clean.

18.4.4 Align the bracket carefully with the locating dowel in the rear radial face of the flange of the rear casing.
Secure the bracket to the pump body, tightening the nuts progressively and evenly. The recommended torque on the nuts is 5.5kgm.
Secure the bracket foot to the base plate, making sure that the pump is properly leveled and supported under all its feet.
See ALIGNMENT instructions, section 3.

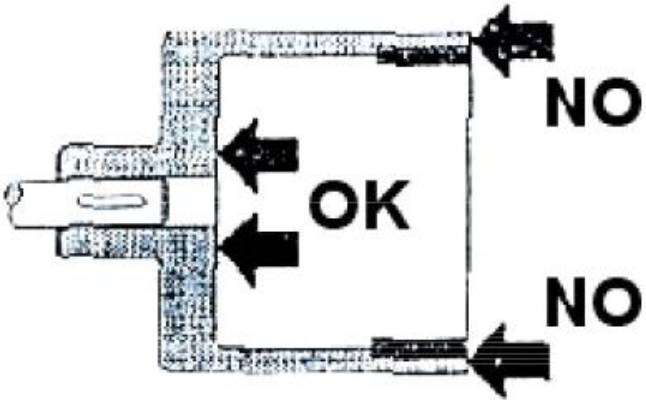
18.4.5 Tighten both joints on the external cooling/re-circulation pipe.

18.4.6 A hydrostatic pressure test may now be carried out with water, to test for leaks. The standard pump is suitable for use at system pressures up to 25 bar.

18.5 REPLACING THE EXTERNAL MAGNET AND MOTOR OR BEARING HOUSING

18.5.1 Long-coupled units
Rebuild the external bearing housing if necessary: see 16.15.

18.5.2 Fit the external magnet on to the external bearing shaft or the motor shaft. First, clean the bore of the drive magnet hole and the surface of the shaft with fine emery paper, and lightly oil both surfaces. Fit the shaft key into the keyway. Push the magnet on to the shaft: it should be a smooth interference fit. If necessary, use a light hydraulic press to push the magnet into position, pressing on the inside base of the magnet hub. See Table below for correct positioning of the magnet on the shaft. - DO NOT STRIKE THE MAGNET! The magnetic elements are brittle and are easily damaged.



18.5.3 Refitting the external magnet (with its bearing housing or motor) to the pump
SAFETY NOTE - See PRECAUTIONS
Check the magnetic elements of the external magnet, and remove any loose metal particles attached to them. The magnet must be clean internally.
Fit the external magnet with its attached bearing housing or motor, into the pump bracket, using three JACKING BOLTS to bring the two magnets together progressively in a controlled manner.
JACKING BOLT sizes are:

WMCA series range I pumps: M10 x 145mm
WMCA series range II pumps: M12 x 180mm
WMCA series range III pumps: M16 x 250mm

Take care to avoid damaging the brittle magnetic elements inside the external magnet.
When the pump is fully assembled, turn it over by hand to check for free rotation. The pump should turn over evenly, with no noise or extra resistance at any point.

18.6 Refitting the coupling (long-coupled units only) Fit the two coupling halves to their shafts, checking that they run concentrically. Fit the spacer (if present). Check the coupling carefully for correct ALIGNMENT (see section 3).

19. PUMP OPERATING PROBLEMS: TROUBLESHOUTING

Provided your WMCA pump is correctly installed and is operated within its designed performance envelope, it is capable of running for very long periods with minimal attention. Regular inspection, and preventive maintenance when necessary, will help to prevent breakdowns. There are many possible reasons why a pump may not run properly. If your WMCA pump does not run satisfactorily, be prepared to look critically at the system as well as at the pump itself. This section lists some possible pumping problems and indicates how they may be overcome. Your pump supplier will do his best to assist you further if necessary.

19.1 INSUFFICIENT FLOW

	Causes	Remedies
19.1.1	Actual total discharge head exceeds rated head of pump.	Increase speed of rotation if possible. Fit larger diameter impeller. Reduce total head of system. Increase discharge pipe work size. Check that discharge valve is fully open. Replace pump: seek advice from your pump supplier.
19.1.2	Pump Rotating in reverse.	Check direction of rotation. Refer to section 11.2 of this manual.
19.1.3	Air or vapor trapped in inlet pipe work	Check for trapped air or vapor. Refer to section 9.4 of this manual.
19.1.4	Liquid contains entrained air or vapor. Liquid is foaming	Check for vortexing in the inlet line. Fit baffles in supply tank to prevent vortexing. Fit a settling tank in the inlet line to allow entrained gas to separate from the liquid.
19.1.5	Low inlet pressure, giving rise to cavitation and loss of efficiency.	Decrease suction lift (negative head). Increase static suction (positive head). Check for inlet obstructions or restrictions. Reduce liquid temperature. Increase inlet pipe work bore. Decrease length of inlet pipe work. Open inlet valve fully. Check for excessive liquid viscosity: increase liquid temperature if necessary.
19.1.6	Wear of impeller collar and/or wear ring.	Check condition of impeller collar and wear ring. Replace if excessively worn. Refer to section 17.1 of this manual.
19.1.7	Liquid temperature too close to boiling.	Reduce liquid temperature.

19.2 NO FLOW

	Causes	Remedies
19.2.1	See 19.1.1 to 19.1.7	As in 19.1.1 to 19.1.7
19.2.2	Pump has lost it's prime	Re-prime pump. Refer to section 12 of this manual. Check inlet line for air leaks. Check for loss of liquid supply.
19.2.3	Blocked inlet line.	Check for blocked pipe work or strainers, and closed valves.
19.2.4	Magnetic drive de-coupled.	Reduce flow rate: partly close discharge valve. Reduce liquid density. Reduce rated head of pump (check first with your supplier). Check for free rotation of pump: inspect pump internally if it does not rotate freely. Reduce motor power (check first with your pump supplier). Soft-start motor.

19.3 EXCESSIVE FLOW

	Causes	Remedies
19.3.1	Actual total discharge head is below rated head of pump	Reduce speed of rotation if possible. Fit smaller diameter impeller partly close discharge valve to restrict flow.

19.4 MOTOR OVERHEATS AND/OR CUTS OUT

	Causes	Remedies
19.4.1	See 19.3	As in 19.3
19.4.2	Excessive liquid density.	Reduce flow rate by partly closing discharge valve.
19.4.3	Pump has seized or is about to seize	Check pump for free rotation. Check pump internally for obstructions.
19.4.4	Motor and pump miss-aligned	Refer to section 8 (page 7) of this manual.
19.4.5	Motor bearings are failing	Replace motor bearings. Investigate cause of overload/failure.
19.4.6	Undersized motor.	Fit a larger motor: check first with your pump supplier.
19.4.7	Incorrectly set motor overload cut-out.	Check motor overload cut-out setting.
19.4.8	Electronic dry-running protector has tripped	Check for loss of flow or loss of liquid supply.

19.5 PUMP RUNS NOISILY AND/OR VIBRATES

	Causes	Remedies
19.5.1	Low inlet pressure, with cavitation, loss of efficiency, loss of liquid film in pump bearings (and mechanical damage if allowed to continue) **STOP THE PUMP IMMEDIATELY**	Refer to sections 19.1.5 and 19.1.7
19.5.2	Worn, eroded, fouled or damaged impeller or internal bearings	Check pump internally for wear, damage or obstruction.
19.5.3	Motor and pump mis-aligned	Refer to section 8 (page 7) of this manual.
19.5.4	Worn coupling.	Replace coupling. Check alignment of motor and pump
19.5.5	Worn external pump bearings or motor bearings	Check bearings and replace if necessary.
19.5.6	Pump feet or motor feet or base plate not firmly secured.	Check for “soft-foot”, refer to section 7 of this manual.
19.5.7	Miss-aligned or badly secured pipe work.	Check pipe work alignment and support. Refer to section 9 of this manual.
19.5.8	Pump started while rotating in reverse.	Stop pump immediately and allow discharge line to drain completely before re-starting.

19.6 OVERHEATED (EXTERNAL) PUMP BEARINGS (LONG-COUPLED UNITS ONLY)		
	Causes	**Remedies**
19.6.1	See 19.5.1 to 19.5.7	As in 19.5.1 to 19.5.7
19.6.2	Lack of oil, or incorrect oil in bearing housing.	Check oil level: refill, or drain and replace oil if necessary. Replace bearings.
19.6.3	Excessive temperature of pumped liquid	Refill bearing housing with the correct oil for the working temperature of the pump.

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