



## **Operation & Maintenance Manual**

**Rectangular Section  
Electrically Heated  
Priorclaves**





## INTRODUCTION

Priorclave autoclaves are a range of general-purpose laboratory autoclaves intended primarily for media preparation, the making safe of ordinary laboratory and pathological waste and other apparatus sterilisation purposes. The autoclaves are manufactured to a high standard and feature a number of patented innovative design features. The sophisticated **TACTROL** microprocessor control system provides a very simple method of setting even the most complex cycles. The machines have been designed from the outset for easy and safe operation and maintenance.

Properly looked after your autoclave should give years of valuable and trouble free service.

## PRIORCLAVE SERVICE

**Serial Number:**

**Date of Manufacture:**

**Software Version:**

Please quote the above when asking for parts or service:

### PRIORCLAVE LIMITED

129 /131 Nathan Way  
West Thamesmead Business Park  
London  
SE28 0AB

**Telephone:** +44 (0)208-316-6620

**Fax:** +44 (0)208-855-0616

**E-mail:** sales@priorclave.co.uk

**Website:** www.priorclave.co.uk

or your local agent:

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## IMPORTANT NOTICES

- Priorclave Pressure Vessels and Autoclaves are manufactured according to BS2646 Part 1 (1993). It is recommended that the user/operator ensures that the autoclave is installed, operated, maintained and tested according to parts 2,3,4 & 5 of this standard for safe and effective use and that an adequate logging record of operation and maintenance be established.
- Before despatch from our works all Priorclaves are subjected to rigorous electrical safety tests to the appropriate standards. Should you or your contractors carry out further insulation and flash tests as part of your internal procedures please disconnect the switch mode power supply before testing. Failure to do so will result in a test failure and may lead to corruption of the microprocessor memory which cannot be covered by our warranty.

### Safety

- If you are unclear about any aspects of this manual, the use and operation of the autoclave or your autoclave process please contact Priorclave or your authorised Priorclave dealer before proceeding.
- Always wear gloves a facemask and adequate protective clothing when unloading an autoclave and ensure that the workload does not exceed safe limits.
- Priorclave are pleased provide training for operators in the use of their autoclaves at a small extra charge.

### Thermal Lock

- The safety Thermal Lock (80°C door retention device) has been set in accordance with the load and procedure defined in paras. 3.3.3.2.3 and 3.3.3.3 of BS2646 Part 5:1993.
- The relatively light load defined under this procedure may not be appropriate to the load to be autoclaved in your Priorclave. Therefore, to ensure compliance with Health & Safety Executive Guidance Note PM73 'Safety at Autoclaves' and to avoid possible injury you are strongly advised to have your autoclave with its normal working load formally validated, and the thermal lock set up accordingly by properly trained personnel.

### Stainless Steel Pressure Vessels.

- Vessels are manufactured from grade 316 stabilised stainless steel, designed built and tested in accordance with BS5500 category 3 as required by BS2646 Part 1. Grade 316 stainless steel is employed to reduce the corrosive effects of substances such as hydroxides and chlorine. However we recommend that the interior of the vessel is kept free of such potentially harmful substances and is regularly cleaned out with soft water. The use of chlorine based or other aggressive cleaners is not recommended. Exposure to such chemicals could damage the surface finish and the integrity of the pressure vessel and door. Care should also be taken not to routinely introduce such chemicals where they are used to pre-wash items that form part of the load. In such cases the items should be thoroughly rinsed before autoclaving.

### Product Life

- Due to fatigue occurring in normal use the life of all pressure vessels is finite regardless of corrosion, erosion or other damage. Using a calculation from BS3970, and assuming an average autoclaving cycle time of 2.5 hours this gives the autoclave vessel a projected fatigue life of 10,000 operating cycles. The lifespan of the autoclave will obviously depend upon frequency of use, but for example (based on a 365 day working year) if the autoclave is used two or four times per day this gives a working life of 13.6 to 6.8 years respectively. Your own usage of the autoclave should be considered to determine the actual lifespan of the autoclave.

## Cleaning

- This equipment contains sensitive electrical equipment. Although designed to withstand laboratory conditions it is not designed for wet cleaning. Cleaning this equipment by hosing down may cause damage, invalidating the warranty, and may cause an electrocution hazard.
- External cleaning should be carried out with a damp cloth or with proprietary, non-abrasive cleaners.

## Servicing and Maintenance of Priorclave Autoclaves

- Priorclave Laboratory Autoclaves are complex pressure systems designed and built to special regulations and as such should only be serviced or maintained by properly trained personnel. Priorclave Ltd. cannot be held responsible for hazards or damage resulting from work carried out on the pressure system by untrained or unauthorised personnel. If in doubt please contact Priorclave Service or your nearest authorised dealership.

## CE Marking

The CE mark applied to this autoclave is applied in relation to the EMC (Electromagnetic Compatibility) directive and the Low Voltage directive of the European Community. This indicates that this Priorclave autoclave meets the following technical standards :

- **EN50081-1**  
Electromagnetic Compatibility. Generic Emission Standard. Residential, Commercial & Light Industry.
- **EN50082-1**  
Electromagnetic Compatibility. Generic Immunity Standard. Residential, Commercial & Light Industry.
- **BS EN 61010-1: 1993**  
Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use.
- **BS EN 61010-2-041: 1996**  
Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use; Part 2-041, Particular Requirements for Autoclaves using Steam for the treatment of Medical Materials and for Laboratory Processes.
- **EN 46001: 1997**  
If used for the sterilisation of medical equipment within the scope of the Medical Devices Directive the CE mark is applicable to this directive. If using this equipment for the sterilisation of medical equipment your attention is drawn to the need for the consideration of the standards that may be applicable to the type of equipment to be sterilised. If in doubt consult the manufacturer. In all cases autoclaves used for the sterilisation of medical devices must be validated in accordance with EN554 before use. This product is manufactured in accordance with EN46001.

A "Declaration of Conformity" in accordance with the above standards has been made and is on file at:

**Priorclave Ltd.**  
**129 /131 Nathan Way**  
**West Thamesmead Business Park**  
**London SE28 0AB**

## Environmental Conditions

This equipment has been designed for safe operation within the following environmental conditions:

- Indoor Use.
- Altitude up to 2,000 M. (See Appendix B - Steam Table for special conditions affecting calibration for operation at elevated altitudes).
- Temperatures between 5°C and 40°C.

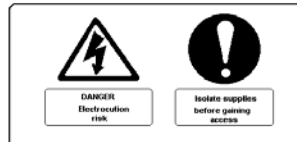
- Maximum Relative Humidity of 85% at any temperature between 5°C and 40°C.
- Mains Supply Voltage Variations not exceeding  $\pm 10\%$  of that shown on the Serial Plate.

- **Electromagnetic Interference**

This equipment has been designed to comply with the requirements for immunity from electromagnetic interference under normal conditions of use. Care should be taken when siting the equipment however, to avoid interference from potential extreme sources of interference such as MR scanners or x-ray equipment.

## Hazard Statement

### Electrical Hazard Stickers



When this sticker has been placed on a removable panel the power must be switched off before the panel is removed. There may be a number of areas behind the labelled panel that constitute an electrical shock hazard. All such panels are service access panels only and should not be removed unless there is a full understanding of the equipment.

# CONTENTS

<b>INTRODUCTION.....</b>	<b>1</b>
<b>IMPORTANT NOTICES.....</b>	<b>3</b>
<b>CONTENTS .....</b>	<b>6</b>
<b>OPERATING SUMMARY .....</b>	<b>7</b>
<b>LAYOUT DIAGRAM .....</b>	<b>8</b>
<b>CONTROL PANEL LAYOUT .....</b>	<b>9</b>
<b>PREPARING YOUR PRIORCLAVE FOR USE FOR THE FIRST TIME .....</b>	<b>10</b>
Positioning .....	10
Installation.....	10
Electrical .....	10
Drainage .....	11
Commissioning .....	12
Full Commissioning and Performance Testing .....	13
<b>OPERATION.....</b>	<b>14</b>
Rapid Cooling .....	16
Automatic Free-Steamng .....	16
Pulsed Freesteaming.....	17
Load Sensed Process Timing.....	17
Media Warming.....	17
Starting the Cycle .....	18
<b>ABORTING THE CYCLE .....</b>	<b>20</b>
<b>CHANGING DATE &amp; TIME.....</b>	<b>21</b>
<b>OPERATION WITH OPTIONS &amp; ACCESSORIES.....</b>	<b>22</b>
Multi Program Memory Options .....	22
Setting Lock Keyswitch Option .....	22
Printer .....	22
Chart Recorder .....	23
Heater Over Temperature Protection .....	24
Automatic Waterfill Option .....	24
Internal Validation System .....	24
Air Intake Filter.....	24
Vent Filter .....	24
Loading Trolley .....	24
<b>VACUUM OPTIONS .....</b>	<b>25</b>
Pre-Cycle Vacuum.....	25
Drying Cycle - Suitable for Non Media Loads Only .....	25
Vacuum Cooling - Suitable for Non Media Loads Only .....	25
<b>WARNING INDICATORS AND FAULT CODES.....</b>	<b>26</b>
<b>MAINTENANCE .....</b>	<b>28</b>
Weekly Maintenance .....	28
Monthly Maintenance.....	30
Quarterly Maintenance .....	30
General Maintenance .....	31
<b>SPECIFICATION TABLE .....</b>	<b>33</b>
<b>SPARES LIST. ....</b>	<b>35</b>
<b>NOTES.....</b>	<b>39</b>
<b>APPENDIX A - FAULT FINDING &amp; RECTIFICATION GUIDE.....</b>	<b>41</b>
<b>APPENDIX B - STEAM TABLE .....</b>	<b>43</b>
<b>APPENDIX C - WIRING DIAGRAMS .....</b>	<b>45</b>
Output Board Designations.....	45
<b>APPENDIX D - OTHER OPTIONS FITTED.....</b>	<b>49</b>
<b>PIPEWORK SCHEMATIC (VACUUM OPTIONS ONLY).....</b>	<b>75</b>



## OPERATING SUMMARY

**N.B. Before proceeding please check the specification sheet at the front of this manual to establish which options and accessories, if any, are fitted to your Priorclave. This will determine whether you will need to read the instructions for these options later in this manual or in Appendix D.**

1. Check electricity and, if applicable, water supply is **ON**.
2. Press the '**door**' button on the control panel there will be a bleep and the message '**hoLd**' will be displayed in the timer display. Wait for a short time until the timer display returns to normal, there is another bleep and the '**door**' indicator illuminates. The '**door**' button can now be pressed again to release the lock. When the lock is released a green indicator lamp below the lower handwheel will illuminate.
3. Open the door by undoing the lower black handwheel first followed by the centre black handwheel and finally the red safety handwheel. With the door free, carefully pull open.
4. Top up with water if necessary to just below the level of the weir or if an automatic waterfill system is fitted, allow the autoclave to fill automatically to this level.
5. Load the autoclave directly onto the shelves or with baskets or containers.
6. Set the temperature as required using the up/down keys.
7. Set the process time as required using the up/down keys.
8. Set / select other functions i.e. free-steam, rapid cooling etc., as required and if fitted.
9. Carefully close the pressure door and fully wind in the safety handwheel followed by the centre black handwheel.
10. Press and release the '**door**' button to release the door lock. There will be a bleep and the lock will immediately withdraw. The green indicator lamp below the lower handwheel will illuminate whilst the lock is withdrawn. Secure by fully tightening the lower handwheel. If any difficulty is encountered, open the door and check for obstruction.
11. Wait a few seconds for the '**start**' indicator to illuminate, and press the '**start**' button to begin the cycle.

### **Cycle Abort and Thermal Lock Override**

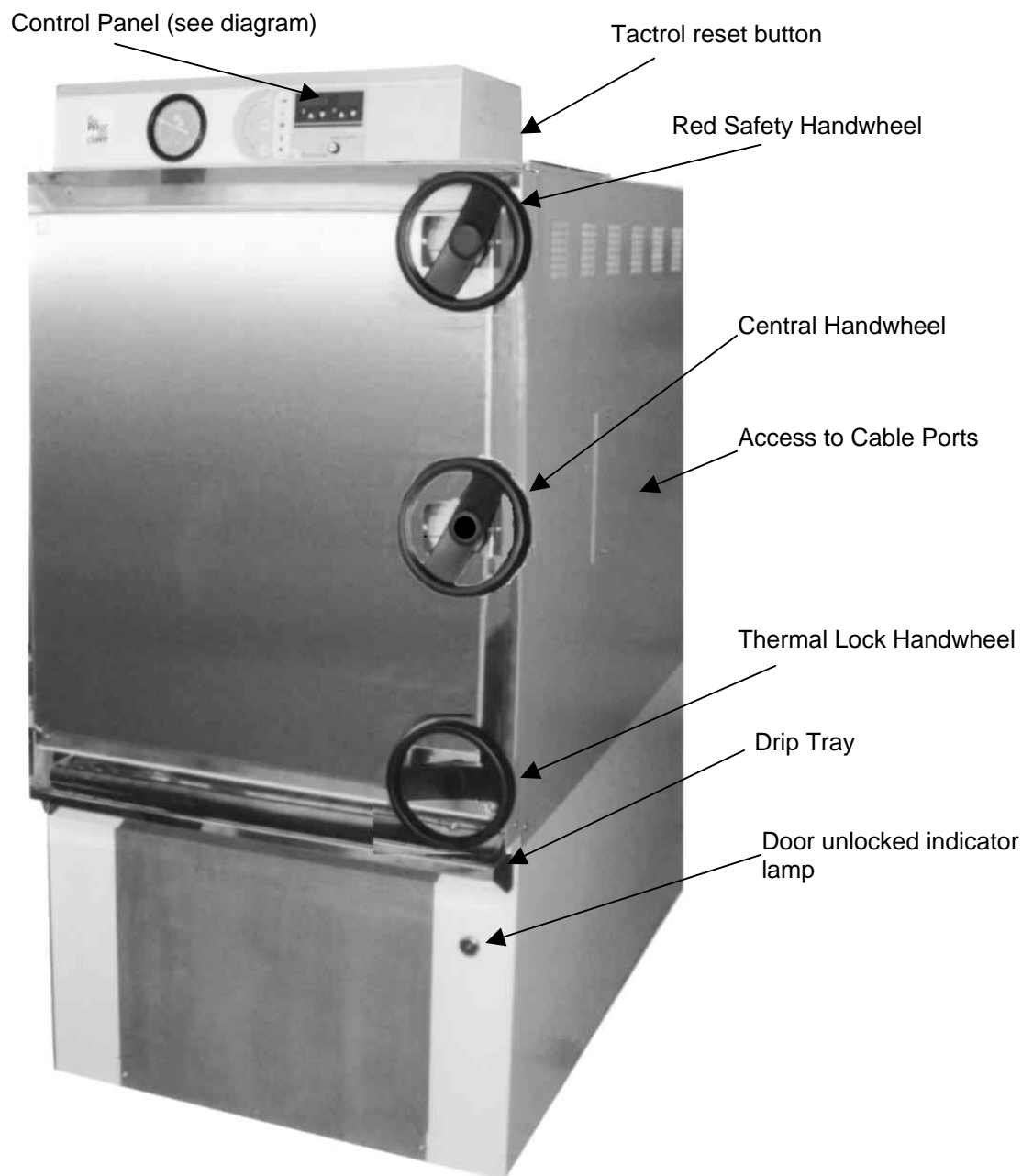
#### **Aborting a cycle**

To abort the cycle at any stage press the '**start**' Button.

#### **Thermal Lock Override**

First abort the cycle as above. After checking that there is no pressure within the autoclave turn the thermal lock key to the right and hold it there. Then press the '**door**' button once, keeping the thermal lock key held over. Wait during the '**hoLd**' display until the '**door**' indicator illuminates. Keep the key held and press the '**Door**' button to unlock the door. The keyswitch can now be released. If the key is released at any stage the procedure must be repeated to open the door and reset the display.

## LAYOUT DIAGRAM





# PREPARING YOUR PRIORCLAVE FOR USE FOR THE FIRST TIME

## **Positioning**

Unpack the autoclave and check against the delivery note that all items ordered have been delivered.

Any shortages or damage must be reported to Priorclave Limited within 7 days of delivery.

### Positioning

The autoclave may be positioned flush to units, walls etc. on both sides, but a gap of at least (305mm) 12" must be left at the back of the machine to ensure the circulation of air. This will also provide a space for pipework and electrical connections. Sufficient space should also be allowed for the pressure door to fully open.

The autoclave has castors fitted to allow positioning and should ideally be positioned within easy reach of a suitable isolatable electrical supply and drain. See Installation.

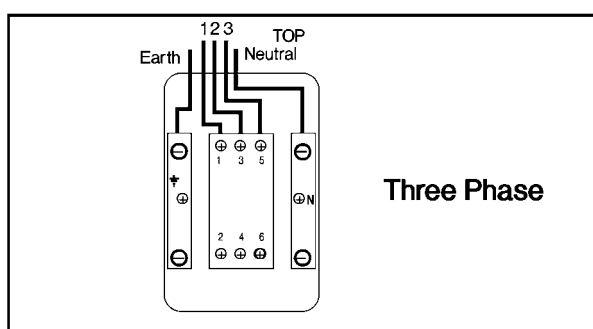
All autoclaves during their process cycle will release steam (unless plumbed into a drain) and heat, and this should be taken into consideration when choosing a site in your laboratory in which to install your autoclave.

## **Installation**

### **Electrical**

To connect your Priorclave to the power supply simply connect a suitable cable from your isolator to the isolator at the rear of the unit. Wiring is as shown in the diagram.

The power supply should be a 3 phase and neutral isolated supply, rated at 45 Amps per phase for 31.5 kW heating or 60 Amps per phase for 42 kW heating and connected to the isolator as in diagram (B). Sufficient length of cable should be used to allow the autoclave to be pulled out and worked on from the back. The cable used to the earth line and neutral feeds should be capable of carrying the per phase amperage of the supply. The neutral line must be nominally at earth potential and must **NOT** be fused. This equipment must be earthed.



### **Electrical - General**

Heating is by 9 or 12, 3.5 kW immersion elements.

The main circuit breakers are located at the front of the autoclave below the lower panel.

The main processor control board is independently fused at its power supply.

See Wiring Diagram - Appendix C - for more details.



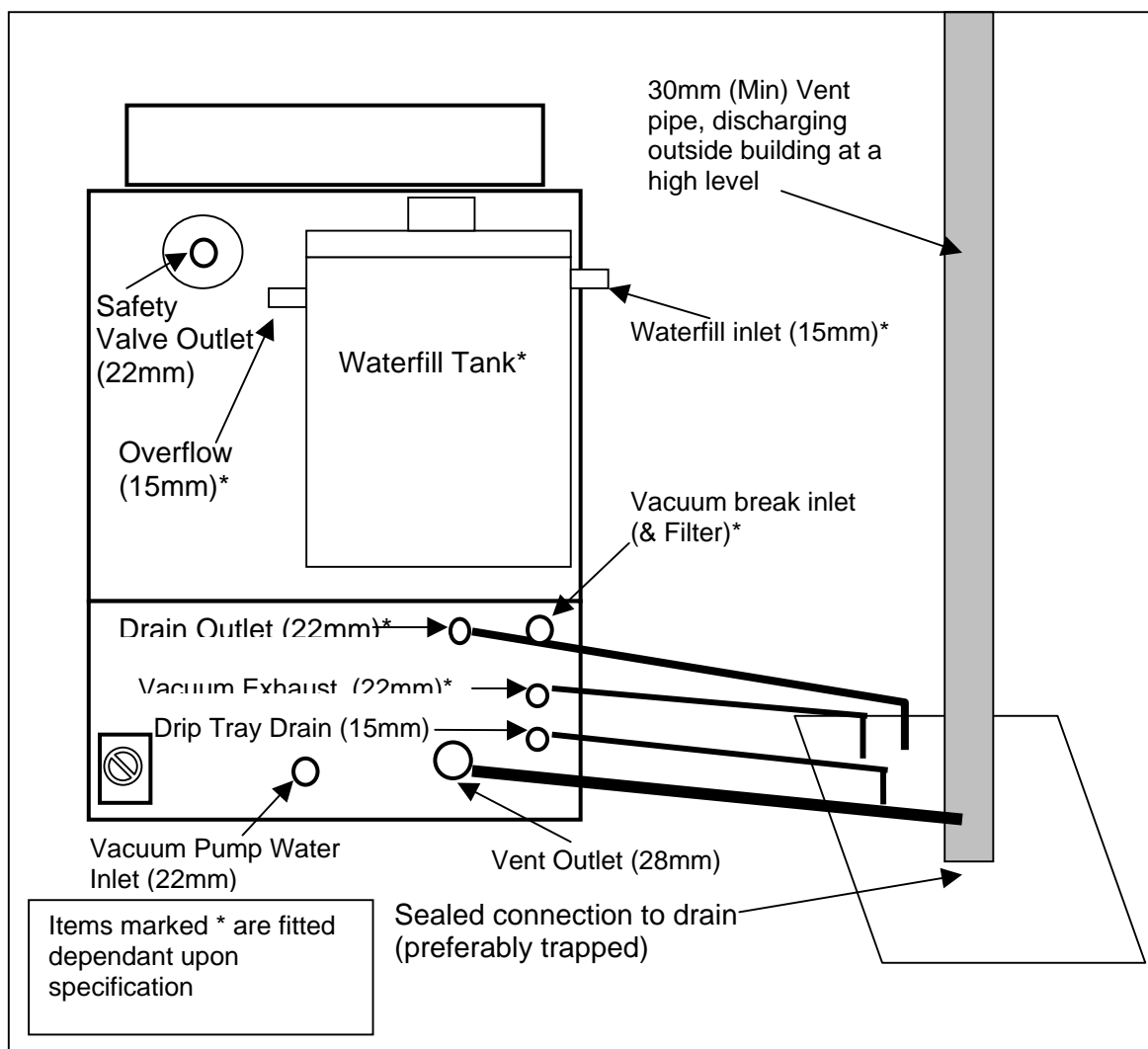
Depending on the model and the options fitted to the autoclave one or two 3 pin 230V power sockets may be fitted to the back of the autoclave. These are marked with the symbol shown above are intended for use only with the Priorclave accessory supplied for use with them which is fitted with the appropriate plug.

## Drainage

BS2646 Part 2 states that autoclaves used for processing laboratory waste should always be connected to a drain to prevent contaminated steam and condensate from fouling the laboratory. The drainpipe should be connected to a sealed drain cover and a high-level vent pipe should be fitted discharging outside the laboratory as in diagram.

However, in the case of loads other than waste, if no suitable drainage point is available then an open tundish or other container placed behind the autoclave under the outlet pipe should be sufficient. During a normal cycle (without prolonged freesteaming) the Priorclave will not produce a large volume of steam and condensate. There should therefore be ample evaporation from the dish to compensate for the condensate generated.

If possible it is always advisable to connect the autoclave to a drain to cut down on the amount of steam discharged into the laboratory. A compression fitting should be incorporated in the drainpipe in an easily accessible location to enable easy disconnection for maintenance purposes.



An air gap must be left between the drain outlet pipe and drain water level to prevent possible 'suck back' of drain water when the autoclave cools.

All drain piping should head downward towards the drain to prevent water collecting in the pipe.

The drip tray drain and waterfill overflow outlets should not be directly connected into the same drain outlet as the vent and other outlets or blowback into the water tank and out of the drip tray at the front of the autoclave will result.

**THE SAFETY VALVE OUTLET (MARKED 'SAFETY') MUST NOT BE CONNECTED TO A DRAIN. IT IS A REQUIREMENT OF B.S. AND HEALTH AND SAFETY STANDARDS THAT A STEAM DISCHARGE MUST BE VISIBLE SHOULD THE SAFETY VALVE OPERATE.**

### **Automatic Waterfill Option (Standard on Priorclaves with Vacuum Drying)**

Installation is simply a matter of connecting the waterfill inlet pipe (labelled on the back of the autoclave) to a suitable water supply via the 15mm BSP check valve supplied with the autoclave. Provision should also be made for the overflow outlet. If your Priorclave is fitted with an external waterfill tank then connect to the labelled inlet and overflow on the side of the tank.

**N.B.** The waterfill system relies on a float switch fitted inside the autoclave to shut off the water flowing into the autoclave. This **MUST** be regularly inspected and cleaned to ensure its proper operation (see **Maintenance** section). Proper drainage provision should be made in the event of flooding from the front of the autoclave caused by failure of components of the system.

### **Drain Condensers**

If your Priorclave is fitted with a drain condenser system then this should be connected to a suitable cold water supply and the outlet of the condenser connected to the drain.

**Consideration should be given to the discharge from the Vent and Safety Valve outlets, which should be directed in such a way as to not cause a hazard. This will be determined by the location of the autoclave.**

**Once properly installed your Priorclave is now ready for use.**

### **Commissioning**

Priorclave Autoclaves are given a full operational test before leaving the factory and as such arrive ready for immediate use after initial installation. It is advisable however to run a simple cycle with the autoclave empty before processing a working load to check that no problems have arisen during transport.

If commissioning has been ordered with the autoclave this will be carried out by a Priorclave technician otherwise follow this simple procedure to check the operation of your Priorclave.

- 1) Check that the power is **ON** at the wall isolator and, if a vacuum pump is fitted that the water supply is switched on.
- 2) As you are powering up the autoclave for the first time, the autoclave will be in a low water condition and the error code **F004** will show in the temperature display. You may ignore this at this stage as opening the autoclave and filling it with water will reset this error.
- 3) Switch on the power at the isolator at the back of the autoclave (for position see diagrams above). All indicators will light momentarily and a sounder will bleep. This enables the indicators to be checked. The **low water** indicator should now be lit.
- 4) Press and release the **door** button, which will bleep, and wait for a short time (about 20 seconds) until the **door** indicator illuminates and the sounder beeps again. On pressing the **door** button a second time, you will hear the locking bolt withdraw and the green indicator lamp below the door will illuminate.
- 5) Open the door by undoing the lower black handwheel first followed by the centre black handwheel and finally the red safety handwheel. With the door free, carefully pull open.
- 6) The autoclave uses immersion heaters in a reservoir of water behind the weir at the bottom of the autoclave to raise steam. The heater is protected from boiling dry by a low water cutout. If the water level falls below the sensor the autoclave shuts down, the

**low water** warning indicator is lit and fault code **F004** is shown in the temperature display.

In hard water areas distilled water must be used to prevent scale from forming in the autoclave; when the autoclave is new, however, some tap water may need to be added until the **low water** lamp is extinguished as the low water cut out is operated by the water's conductivity.

- 7) The reservoir should be filled with water to a level just below the weir. If an automatic waterfill system is fitted to the autoclave this will activate once the door has been opened. Water will be allowed into the autoclave until the correct level is sensed by the float switch at the front of the autoclave.
- 8) Set the temperature to 121°C and the process time to 15 minutes using the arrows under the displays.
- 9) Carefully close the pressure door and fully wind in the safety handwheel followed by the centre black handwheel.
- 10) Press and release the '**door**' button to release the door lock. There will be a bleep and the lock will immediately withdraw. The green indicator lamp below the lower handwheel will illuminate whilst the lock is withdrawn. Secure by fully tightening the lower handwheel. If any difficulty is encountered, open the door and check for obstruction.
- 11) The **start** indicator should now be lit.
- 12) Press the **start** button to begin the cycle.
- 13) During the cycle, check that there are no problems during heat-up and process.

Following successful completion of the commissioning cycle your Priorclave is ready to process its first working load.

Please refer to the **Operation** section later in this manual before running your first working load as this gives further details on operation of the autoclave and on the control options which may be fitted

If you experience any problems during this procedure please contact Priorclave service or your local agent.

### ***Full Commissioning and Performance Testing***

If you are having the unit commissioned by a Priorclave technician this will be a simple matter of checking for correct installation, checking that all functions are operating correctly, and familiarising you with the autoclave. There are however some benefits that can be gained from having your Priorclave commissioned to suit your particular loads and requirements. Some examples of settings that can be optimised during commissioning, and the advantages these can provide are listed below.

- Establishing optimum freesteam temperatures for effective air displacement.
- Establishing optimum freesteam time for effective air displacement, whilst eliminating unnecessary time and energy consumption.
- Establishing optimum process time and temperature to ensure complete sterilisation, whilst maintaining minimum cycle time and energy consumption.
- Setting thermal lock release temperature to suit your particular load, to eliminate unnecessary cooling time whilst ensuring safety.

If you feel that any, or all of the above would be of use to you then please contact Priorclave Service.

# OPERATION

**BEFORE USING YOUR PRIORCLAVE FOR THE FIRST TIME CHECK THAT THE CIRCUIT BREAKERS AND ISOLATOR (AT THE BACK OF THE AUTOCLAVE) ARE SWITCHED ON. IF YOUR AUTOCLAVE IS FITTED WITH VACUUM OPTIONS ALSO ENSURE THAT THE WATER SUPPLY IS SWITCHED ON.**

**N.B.** Before proceeding please check the specification sheet at the front of this manual to establish which options and accessories, if any, are fitted to your Priorclave. This will determine whether you will need to read the instructions for these options later in this manual or in Appendix D.

1. **Opening the Pressure Door.** - Switch on the power at the isolator. All indicators will light momentarily and a sounder will bleep. This is to enable the indicators to be checked. The **start** and/or **low water** indicators should now be lit. Press and release the **door** button, which will bleep, and wait for a short time (about 20 seconds) until the **door** indicator illuminates and the sounder bleeps again. During the waiting time the temperature display will show **hoLd**, confirming that the autoclave is waiting during its safety delay. On pressing the **door** button a second time, you will hear the locking bolt withdraw. Check that the pressure gauge is reading zero and you may now fully unwind the black (Lower) handwheel. (The **vent** button will light when the **door** button is pressed and remain lit after the door is opened.)

**NOTE: Do not try to undo the handwheels against the lock before it has released or damage to the locking solenoid may result.**

**NB.** If you are powering up the autoclave for the first time, or if the autoclave is in a low water condition the error code **F004** will be showing in the temperature display. You may ignore this at this stage as opening the autoclave and filling it with water will reset this error.

2. Unwind the centre black handwheel followed by the red (Upper) safety handwheel. In the unlikely event of undetected residual pressure being present the red safety bolt prevents the lid from being blown open by breaking the gasket seal whilst retaining the lid, thus allowing the pressure to escape safely from around the edge of the lid. The autoclave is additionally fitted with a pressure switch, which prevents the solenoid lock from operating if pressure is detected within the autoclave.
3. Once all the bolts are fully released the lid can be carefully opened.

**NOTE: Care should be taken when opening the lid as it will be hot and steam may be released. Heatproof gloves and a faceshield should always be worn when unloading autoclaves.**

4. **Checking Water Level.** - The autoclave uses immersion heaters in a reservoir of water behind the pressure vessel weir to raise steam. The heaters are protected from boiling dry by a low water cut-out. If the water level falls below the sensor the autoclave shuts down, the **low water** warning indicator is lit and fault code **F004** is shown in the temperature display. The reservoir should be filled with water to a level just below the top of the weir. The autoclave is fitted with an automatic water filling system which will allow water into the autoclave whilst the door is open. On the first fill this takes a little time but between cycles a suitable level should be achieved during the time taken to unload and load the autoclave. A visual check of the water level is always recommended before commencing a cycle.

In hard water areas distilled water must be used to prevent scale from forming in the autoclave; when the autoclave is new, however, some tap water may need to be added until the **low water** lamp is extinguished as the low water cut out is operated by the water's conductivity.

**NOTE: Great care should be taken to ensure that the insulated part of the low water sensor and is clean (see diagram - Maintenance) as a build up of contamination here will prevent the low water cut-out from working and could lead to heater damage.**



5. **Loading.** - The autoclave can now be loaded with the items to be sterilised either directly onto the shelves, in baskets, or watertight discard containers in the case of waste loads which may leak liquids when autoclaved.

**The centre shelf is retained at the back to prevent tipping when extended and is prevented from being accidentally removed by pulling forwards. To remove this shelf lift it at the front and gently push it back until the anti-tip catches are released from the back of the runners.**

Care should be taken when loading the baskets or containers not to pack them too tightly with material. Ample room must be allowed for steam to penetrate the load properly or full sterilisation will not be achieved. When using autoclave bags these should be left open with the top of the bag rolled outwards, exposing the load to the steam inside the pressure vessel. Care should also be taken that the contents of bags and containers are not able to spill over into the body of the autoclave vessel. Any such spillage could block pipes and valves and will not be covered by the warranty.

Tests have shown that the depth of unperforated discard containers should be no greater than 180mm (7") for effective air displacement from the load. Suitable containers are available from Priorclave.

### Settings.

Once the autoclave has been satisfactorily loaded the controls should be set for the process cycle that you require.

If your autoclave has a setting lock fitted this must be set to **position 3**.

Sterilising Temperature & Time Settings.

The Medical Research Council has recommended the following temperatures and times as being sufficient for complete sterilisation in autoclaves:

**126°C for 10 minutes.**

**121°C for 15 minutes.**

**115°C for 30 minutes.**

These temperatures and times relate of course to load temperatures and the aim in setting a cycle should be to achieve one of the above criteria in the coldest part of the load. Some loads however are sensitive to elevated temperatures for prolonged periods, making full achievement of the above impractical. However the disinfection of such loads after a short cycle, without necessarily reaching full Sterilising Temperature, is usually sufficient for most purposes.

Should you require a more precise method then the optional **Load Sensed Process Timing** may be of assistance for certain load types. If your autoclave is fitted with this option please refer to section 6 of this manual.

Since there is a time and temperature 'lag' between the temperature controller probe and the load, this should be compensated for either by increasing temperature or process time, or by including in the cycle a period of free steaming with the vent open at 100°C. This can be achieved by pressing in the **vent** button manually and releasing it manually. Alternatively, the **Automatic Freesteaming** function can carry out this process automatically if the option is selected.

If you have an interest in any of the options mentioned above, which can quite easily be retrofitted; please contact Priorclave Technical Services Department.

In conclusion, when setting up the autoclaving cycle a large safety margin should be allowed within the settings.

Carrying out a 'worst load' test can assess more precise settings.

1. **Setting the process time.** - The process timer can be set to a time up to 999 minutes. Simply pressing the time up/down buttons sets the time required. The set time is displayed until the set temperature is reached, then the process time begins counting down to zero in increments



of one minute.

2. **Setting process temperature.** - Pressing either the up or down button momentarily causes the current set temperature to be displayed. Subsequent use of the up/down buttons changes the set temperature. If no keys are pressed for a short time, the display returns to showing the current chamber temperature.



3. **Selecting other functions.** - The function select keys may be used to switch the Media Warming Option, and optional functions such as **Rapid Cooling**, on or off at any time other than when a cycle is running. An indicator illuminates to show that a function has been selected. If **Automatic Timed Freesteaming** or **Load Sensed Process Timing** are not fitted pressing the appropriate key will result in a visual and audible fault being signalled and the function will not be selected.

Possible selections are:



### **Rapid Cooling**

A powerful fan is fitted to the autoclave to direct cool air over the autoclave vessel.

If selected by using the **cooling** button, the cooling fan will switch on automatically during the cooling stage of the cycle. There are three possible settings for rapid cooling, and these operate as follows:

- **Off** - No indicators lit.  
The cooling fan does not operate at all during the cycle.
- **Immediate start** - Left hand indicator lit. - 1 press of the **cooling** button.  
The cooling fan starts as soon as the cooling stage is reached.
- **Delayed start** - Both indicators lit. - 2 presses of the **cooling** button.  
The cooling fan starts after the autoclave chamber has cooled to 100°C.  
This setting is useful when autoclaving some fluid loads, as bringing the cooling fan on at temperatures above 100°C may reduce the chamber pressure too rapidly, causing the load to boil.

**In both cases the fan will switch off automatically when the cycle has reached the complete stage.**



### **Automatic Free-Steaming**

#### **What is freesteaming?**

Incorporating a period of freesteaming into a cycle can improve air removal in difficult loads and/or reduce temperature lag between the load and the autoclave, reducing process time at higher temperatures. Freesteaming introduces a stage during heating up to process temperature, when a solenoid valve at the rear of the autoclave is opened for a pre-set time. The valve opens at a factory set temperature of just above 100°C and is held open for the time set as detailed below. During this time steam is being generated in the chamber in large volumes and this creates turbulence as it passes through the load before escaping through the valve. It is this turbulence that can assist with air removal.

#### **Setting the freesteam time.**

If freesteaming is required this is selected by pressing the **freesteam** button. The indicator lights up to show that freesteaming is selected. The time display will now flash indicating that the freesteam time, not the process time, is currently being displayed. The freesteam time can now be set (in minutes) using the up/down buttons. If no further changes are made for a short time the display stops flashing, and reverts to showing process time. If you wish to check the freesteam time or make further changes then freesteaming should be deselected, then reselected.

#### **Freesteam temperature setting.**

If your autoclave is equipped with timed freesteaming, this will commence at a temperature slightly above 100°C, which has been set at the time of manufacture. If required qualified

personnel may increase this temperature, and the turbulence caused by the escaping steam pressure can further assist with air removal. It is desirable however to connect the autoclave to a drain and vent pipe (as described in Installation), as the release of pressurised steam into the laboratory should be avoided.



### ***Pulsed Freesteaming***

With certain loads and in certain situations the efficiency of the freesteaming process can be improved by pulsing. If this option is fitted to your autoclave then freesteaming commences as described above but at a higher temperature. Instead of remaining open for the entire freesteaming period the vent valve shuts off at a lower temperature (usually about 107°C). The autoclave then heats up again to the temperature at which the vent valve opens again. The autoclave will continue this cycle for the time set when selecting freesteaming. This continual pulsing of steam out of the autoclave creates considerable turbulence within the autoclave, helping to draw trapped air out of the load.

All Priorclaves fitted with freesteaming can be configured for pulsing by qualified personnel, however connection to a drain and vent pipe as described in Installation is essential.



### ***Load Sensed Process Timing***

#### **Function**

If this option is fitted, the autoclave will be provided with an additional thermocouple. This is a PTFE coated stainless steel armoured probe, which can be positioned in the load, ideally in the coolest part. When this option is selected, the autoclave will heat to the set chamber temperature as normal. However, when the set temperature is reached the process time will not begin to count down until the load temperature, as sensed by the additional thermocouple, reaches a temperature just below the set chamber temperature. The cycle will then proceed in the usual manner.

#### **Purpose**

The use of load sensed process timing can greatly assist with the sterilisation of certain types of difficult dense loads, such as large baskets of bottle caps, pipette tips or animal feed, by ensuring that the load reaches set temperature. The system is also very effective for bagged plastic waste loads, however as these tend to melt down around the probe, consumption of probes can be high. For this type of use load validation may prove to be more successful and economical in the long term.

#### **Load Sense Probe Positioning**

The probe should be positioned in what is anticipated to be the slowest part of the load to heat for example the centre of a large densely packed load, or the largest of a group of filled bottles. This is important, as there may be large variations in temperature distribution throughout the load.

**NOTE: Temperature variations can be reduced by the use of timed free steaming (see above).**

#### **Load Sense Thermocouples**

The load sensed process timing option utilises a thermocouple connected directly to the main processor board via a plug and socket connector for ease of replacement.

Replacement thermocouples are available from Priorclave.

See Maintenance for details on thermocouple replacement.



### ***Media Warming***

If this highly useful feature is selected the autoclave will cool to a factory pre-set temperature of 45°C. The temperature will then cycle between approximately 45° to 55°C until the door is opened. This allows, for example, nutrient media to be held as a liquid until it is needed.



## Vacuum Options

Please refer to the Vacuum Options section later in this manual if your autoclave is fitted with any of the vacuum options available for Priorclave autoclaves.

### Starting the Cycle

#### 1. Closing the pressure door.

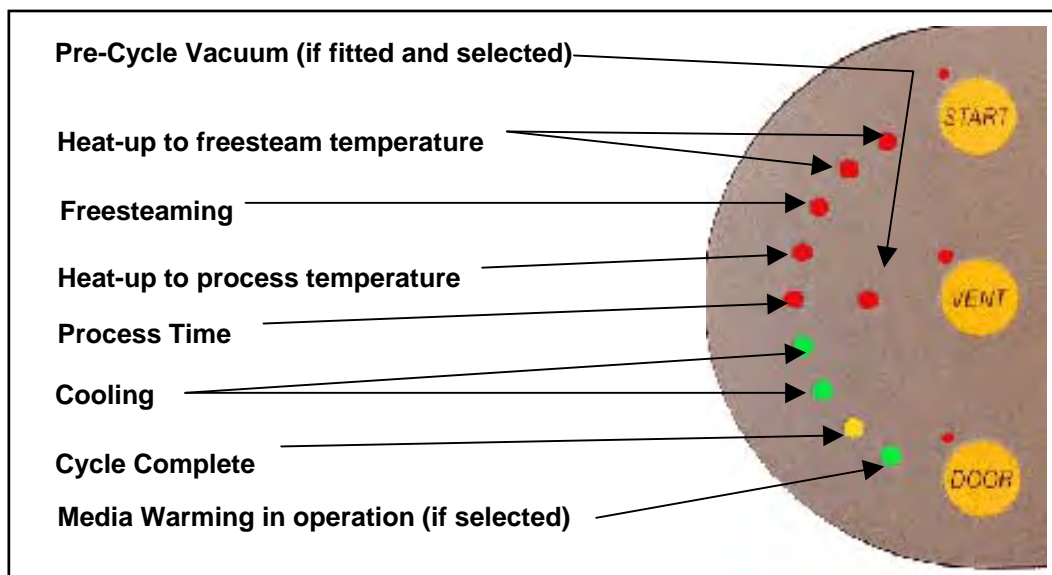
When you have set up the cycle parameters close the autoclave door, taking great care not to slam it shut as this will result in damage to the closure bolts, and secure it with the Upper safety handwheel. You may hear a clicking as the handwheel is turned down indicating that the microswitch under the handwheel has closed. Continue to turn the bolt until tight.

#### 2. Repeat with the centre handwheel.

#### 3. Next, press and release the **door** button to release the locking catch and turn down the Lower black handwheel fully. After a few seconds the locking catch will return, locking the door. The door will now be properly secured and the **start** indicator will illuminate.

**ATTEMPTING TO UNDO THE HANDWHEELS BEFORE PRESSING THE DOOR BUTTON AND RELEASING THE LOCKS IS NOT GOOD PRACTICE. THIS WILL LEAD TO EXCESSIVE STRAIN ON THE LOCKING SOLENOID, WHICH MAY CAUSE IT TO FAIL.**

#### 4. Starting a cycle. - Ensure the door is properly secured and the **start** indicator is illuminated. To start the cycle press the **start** button. The first segment of the cycle status indicator bar will illuminate and the autoclave will now gradually heat up to process temperature. The cycle status indicator will also advance through its stages to give 'at a glance' indication of the cycle's progress.



Once a cycle has been started the function selection settings cannot be changed; attempting to do so will cause a fault to be signalled. If changes are required the cycle should be aborted by pressing the **start** button again.

On Priorclaves not fitted with the setting lock keyswitch changes can be made to the process time and temperature settings once a cycle has started. At the end of the cycle the time setting will reset to its original setting.

#### 5. Vent button. -The **vent** button may be used at any stage during the cycle. When used it opens a large bore solenoid vent valve at the back of the machine. It may be left open for free steaming to achieve better steam penetration of the load if **Automatic Freesteaming** has not been selected. Care should be taken with this manual method however as failing to switch the **vent** off will eventually cause the autoclave to run dry, aborting the cycle. It may also be used with certain loads as a

means of rapidly venting the autoclave. If used for manual free steaming the **vent** button must be manually released before pressure will build up and process temperature can be achieved.

**CARE SHOULD BE TAKEN IF USING THE VENT BUTTON WHEN THE AUTOCLAVE IS PRESSURISED. VENTING OF THE AUTOCLAVE UNDER THESE CIRCUMSTANCES WITH A LIQUID LOAD MAY LEAD TO THE LOAD BOILING OVER AND GLASSWARE MAY BE BROKEN.**

6. **During the process time.** - Once set temperature is reached, the process time will begin to count down and the process indicator will illuminate. If the Load Sensed Process Timing Option is fitted and selected there may be a delay between the autoclave reaching set point and commencement of the process time whilst the load reaches set temperature.

During the process time a check should be made that there is correct correlation between temperature and pressure readings on the control panel. A steam table is included at the back of this manual for this purpose. The check should be made to ensure that air has been properly purged from the autoclave. Generally, a pressure reading higher than would be expected will indicate entrapped air in the autoclave.

If for any reason the temperature is forced outside of a pre-set band, or power to the autoclave is removed during the process time, the cycle will abort and the fault indicator will illuminate and a fault code of either **F005** or **F006** will be shown in the temperature indicator. This is to ensure that loads that have not been subjected to the required cycle parameters are not assumed to have been processed correctly. The fault condition is cancelled by:

**If no setting lock keyswitch is fitted:**

pressing the reset button on the top right hand side of the back of the autoclave,  
**or**

**If a setting lock is fitted:**

turning the setting lock key to the enable position and then to the disable position. If the lock was in the enable condition when the fault occurred, then it must first be turned to the disable position.

7. **Cooling.** - After completion of the process time the autoclave moves into the cooling part of its cycle, and this is shown on the cycle status indicator in green. If the **Air Cooling System** has been selected this will be switched on automatically according to the cooling strategy selected. Otherwise cooling will be by convection.
8. **Thermal lock.** - Under normal circumstances the autoclave cannot be opened until the temperature of the load simulator probe, which has a cooling rate assimilated to a bottle of fluid, has fallen below 80°C at which point the yellow bar on the cycle status indicator will illuminate. The temperature shown by the temperature indicator will be significantly below 80°C as this measures the temperature in the open chamber space. Pressing the door button before the thermal lock has released causes a fault to be signalled. The temperature at which the thermal lock operates is factory set. This can be reset but must only be done following commissioning by qualified personnel. The thermal lock can be overridden using the keyswitch on the control panel. The keys for this switch are provided in this manual.

**OVERRIDING THE THERMAL LOCK WILL CAUSE THE MAIN VENT TO OPEN. GREAT CARE SHOULD BE EXERCISED WHEN USING THE KEYSWITCH SINCE LIQUID LOADS COULD BOIL OVER IF VENTED AT ELEVATED PRESSURES.**

There are circumstances, however when quicker access to the load is required. When this is necessary, first abort the cycle by pressing the start button. Then turn the key into its horizontal position and holding it in this position, press the **door** button and wait while the **hoLd** message is displayed until the **door** lamp illuminates. Finally press the **door** button to release the door lock. The thermal lock key can now be released. If the key is released before this stage then the **hoLd** display will not reset and the autoclave cannot be opened. To reset the display, repeat the above procedure and open the autoclave.

Great care should be exercised when using the Thermal Lock Override, especially with liquid loads. Even at temperatures below 100°C a liquid load in sealable glass containers will not be safe. For the above reasons only responsible personnel should keep the Thermal Lock Override key in a safe place away from the autoclave.

Under certain cycle abort or failure conditions the thermal safety lock can latch in the locked condition. This is because the control system will always go to the safest condition if there is any uncertainty about the cycle end circumstances. To overcome this simply go through the door open or close procedure using the thermal lock override key. Operation will return to normal as soon as the next cycle is completed satisfactorily

9. **Cycle complete.** - When cooling to the 'thermal lock deactivation temperature' is complete, the **complete** indicator will illuminate, and the autoclave will emit a bleep for a short time (about 10 seconds). If the Air Cooling System is selected it will automatically switch off at this point. The autoclave is now ready to open and unload.
10. **Media Warming.** - If this has been selected, the autoclave will remain at the pre-set temperature after the cycle is complete, until the door is opened or the cycle otherwise aborted.
11. Opening the autoclave to unload and re-load for the next cycle is simply a repetition of steps 1,2 & 3.

### ***ABORTING THE CYCLE***

On occasions it may be necessary to abort a cycle before its completion. In order to do this simply press the start button.

## Changing Date & Time

A number of additional control system settings can be accessed via a "Hidden Menu".

To access these settings turn & hold the thermal lock key in the override position. Press the time up or down keys. Release the thermal lock key. **1** is displayed on the temperature display, by default **0** will be displayed on the time display. The temperature display now shows the number of a list of operating parameters, the value for the parameter is shown in the time display. Scroll through the list of available parameters using the temperature up/down keys.

After no keys are pressed for eight seconds the display returns to normal.

The function of these settings is as follows:

	Temp. Display	Time Display	Function	Action
			The autoclave can be set for the cycle to start after a pre-programmed delay, for example to allow a media preparation cycle to complete shortly prior to the start of the working day. Setting the value of parameter 1 to 1 in the time display switches delayed start on.	
	1	0-24	Delayed Start Time Hour <sup>+</sup>	Enter required Start time hour (24 hour clock)
	2	0-60	Delayed Start time Minute <sup>+</sup>	Enter required Start time minute
	3	0/1	Start Delay Select On/Off <sup>+</sup>	1= ON 0= OFF
*	4	0-999	Print Interval	Enter time (minutes) between printing during process time (0= printer disabled)
	5		Year Setting	Enter Year
	6		Month Setting	Enter Month
	7		Date Setting	Enter Day of month
	8		Hour Setting	Enter Hour (24 Hr Clock)
	9		Minute Setting	Enter Minute
	10		Second Setting	Enter Second.
			<b>Scroll back up to parameter 1 to confirm the new or current time settings.</b>	
#	11	1-999	Cycle Repeats	Enter Number of Cycles Required
<sup>+</sup> The time is set in real time, therefore the clock has to be correctly set for this to work properly. After one delayed start operation, delayed start automatically switches off, and the autoclave returns to normal operation.				
#	<b>Models fitted with optional Cycle Repeat Facility only</b>			
*	<b>Models fitted with 5 or 10 Program Memory</b> Setting marked * are program number related, and therefore should you wish to use different values for these in different programs this can be done by changing the value when the correct program is selected.			



# OPERATION WITH OPTIONS & ACCESSORIES

The following descriptions detail how to operate and gain maximum benefit from the options and accessories that may be fitted to your Priorclave.

## ***Multi Program Memory Options***

When this option is fitted, five program number keys are provided to the right of the control panel, each with two indicators. The indicators on the left are for programs 1 to 5 and those on the right for programs 6 to 10. If the Priorclave has been specified with a five program memory only the first five programs will be active. As each program number is selected, the indicator illuminates and the previously selected indicator is cancelled. Pressing the select button toggles between the two program numbers shown on the button.

When the program memory option is fitted a three-position setting lock keyswitch is fitted. These setting positions allow different levels of access to settings as follows.



- **Position 1.** Only the currently selected program can be run.  
Program settings cannot be changed.
- **Position 2.** All programs can be selected and run.  
Program settings cannot be changed.
- **Position 3.** All programs can be selected and run.  
Program settings can be changed freely.

**NOTE: The setting lock key can only be removed in positions 1 and 2.**

Programming of settings is the same as with the standard machine, but the required program number should be selected before setting. The settings entered can then be recalled for subsequent use by simply reselecting that program number.

## ***Setting Lock Keyswitch Option***

Fitted on Priorclaves without program memory to give an optional level of security this keyswitch has two settings only, which are equivalent to positions 1 & 3 above. The key can only be removed in position 1.

## ***Printer***

The printer if fitted is mounted on the right hand side of the control panel. This provides a useful record of the cycle as well as an indication if any faults have occurred. The information printed is as follows:

*USER NAME (if provided at time of ordering)*

*DEPARTMENT (if provided at time of ordering)*

*AUTOCLAVE SERIAL NUMBER*

*DATE*

*CYCLE NUMBER*

*PROGRAM NUMBER (if multi-program memory option fitted)*

*TEMPERATURE AND TIME AT CYCLE START (time is set to G.M.T)*

*TEMPERATURE AND TIME AT END OF FREESTEAMING*

*TEMPERATURE AND TIME AT START OF PROCESS TIME*

The temperature and time are then recorded at pre-set time intervals, until the end of the process time.

*TEMPERATURE AND TIME AT END OF PROCESS TIME*

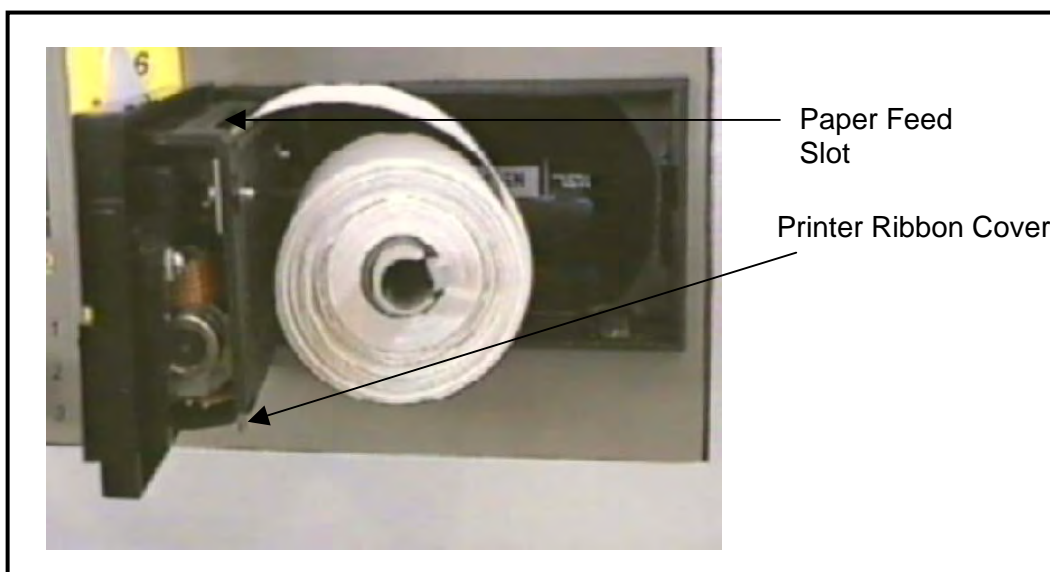
*TEMPERATURE AND TIME AT CYCLE COMPLETE.*



**CYCLE PASS/FAIL/ABORT**

(Fail means that a fault signal has occurred during the cycle or that the cycle was aborted. See - Warning Indicators)

The above information will be printed in the order listed, allowing the information to be read as it is printed.



At any time pressing the left-hand button on the lower right hand side of the printer can advance the paper.

**Replacing Printer Paper Roll**

Open the front of the printer by pushing the release catch on the far right of the printer unit to the left. The front of the printer unit will now swing open.. The empty roll can now be pulled from the spindle, and the new roll fitted in its place. The end of the roll should then be fed into the slot at the top of the printer mechanism as shown in the diagram.

Place the end of the paper roll into the entry slot. It may help to tear the corners off the end of the roll to form an inverted V shape. Next, press the paper feed key on the front of the door (to the left of the release catch) and the paper will be drawn through the printer head.

**Replacing The Printer Ribbon Cassette**

When the printing becomes faint the ribbon cassette will need to be replaced. To do this, open the door and withdraw the end of the paper from the print mechanism. Next hold onto the front of the printer door with one hand and with the other gently squeeze together the top and bottom of the printer mechanism cover. Then gently lift the cover while holding the door in place. The cover and the outside of the door should now separate giving access to the printer ribbon cassette. The used cassette can then be removed by pulling up evenly from both ends of the cassette. Before fitting the new cassette take up any slack in the ribbon by rotating the take up wheel in the direction indicated on the cassette. The cassette can then be clipped into place. Any further slack that has developed should now be taken up. Push the two parts of the door together ensuring that they are securely joined and re-fit the printer roll. With the paper re-threaded and the door closed the printer is ready for use.

**Chart Recorder**

If fitted, the recorder power input is connected directly to the autoclave in such a way that the recorder will only operate during the autoclave cycle, i.e. from the pressing of the start button to cycle complete. At this time power to the recorder is cut. Unless otherwise specified, single channel units record the temperature of a fixed thermocouple probe, and in the case of two channel units the second channel records the temperature of the load probe.

For more details on individual recorder function and operation please refer to the manufacturer's manual supplied with the autoclave.

### ***Heater Over Temperature Protection***

(Fitted as an optional extra in addition to the standard microprocessor based overheat function)

This device acts as secondary protection against the autoclave boiling dry and damaging the heating elements in the event of failure of the low water sensing system. Should the heater elements ever exceed a temperature of 150°C the heating circuit will be switched off and the **O/HEAT** warning indicator will illuminate. A fault code of **F003** will be shown in the temperature display.

Should this occur, then the autoclave should be switched off and allowed to cool to a safe temperature and pressure before opening for examination of the water level.

The fault indication can be cancelled as described in the Faults section. To re-run the autoclave it should be sufficient to top up with water to the correct level. However the low water system should be checked for faults as soon as possible and cleaned or repaired as necessary. (See Maintenance section.)

The overheat is activated by a thermocouple mounted on one of the heating elements inside the autoclave. This is coupled directly to the main processor board, and the overheat temperature is factory set.

### ***Automatic Waterfill Option***

Fitted as standard to Priorclaves with Vacuum Drying, and as an option on other models this option consists of a water tank mounted on the back of the autoclave. The water tank is fitted with a float valve to maintain maximum fill level. Whilst the autoclave door is open during loading and unloading a solenoid valve is opened and water flows into the autoclave vessel from the water tank until the level set by the float switch at the front of the autoclave is reached. During normal operation only small amounts of water will need to be replaced, however when first filling the autoclave, after a drying cycle or whilst filling after cleaning, more time may be required.

### ***Internal Validation System***

If fitted this system continuously monitors the performance of the temperature reading and control system with reference to an internal reference standard. If any problem is detected with the system the autoclave is stopped and a fault is signalled. (See Warning Indicators and Fault Codes for details.)

### ***Air Intake Filter***

When fitted to the autoclave this system ensures that air drawn into the autoclave during the cooling stage of the cycle is first passed through a bacteriological air filter. This filter is fitted at the back of the autoclave.

### ***Vent Filter***

When fitted to the autoclave this system passes all autoclave discharge through a filter fitted inside a pressurisable stainless steel housing. At the end of the cycle any unfiltered condensate from the filter housing is returned to the autoclave. The correct operation and effectiveness of the filter system should be regularly checked. Please refer to the manufacturers instructions enclosed with this manual.

### ***Loading Trolley***

When supplied and unless previously specified otherwise the loading trolley is manufactured for loading the lower shelf of the autoclave. The trolley is fitted with a safety catch, which latches automatically to the drip tray of the autoclave when the trolley is pushed into position for loading or unloading. This holds the trolley securely in place, preventing it from rolling backwards, especially when pulling heavy loads onto it during

unloading. To release the catch simply hold down the release arm at the front of the trolley whilst pulling the trolley away from the front of the autoclave.

## VACUUM OPTIONS

**N.B. It is strongly recommended that to achieve optimum performance from Priorclaves fitted with vacuum options that commissioning and/or load validation tests are carried out by a trained Priorclave engineer. If no particular programs have been specified your autoclave will be factory set with the following programs:**

**Program 1: Non vacuum Cycle**

**Program 2: Pre-Cycle Vacuum and Vacuum Cooling**

**Program 3: Pre-Cycle Vacuum and Vacuum Drying (if specified, otherwise as program 2 )**



### ***Pre-Cycle Vacuum***

The pre-cycle vacuum is selected using the lower function select key on the control panel. With the left-hand upper indicator lit the Pre-Cycle Vacuum is selected. With the Pre-Cycle Vacuum selected a vacuum pump will run at the beginning of the cycle, removing much of the air from the autoclave and load. At a pre-set level of vacuum the control system switches off the pump and the normal cycle begins. If set at commissioning a number of vacuum stages will be performed, with heating stages in between. Pre cycle vacuum is essential when autoclaving loads containing densely packed porous material.



### ***Drying Cycle - Suitable for Non Media Loads Only***

A drying cycle can be selected by means of the lower function select key. With the option selected the lower left-hand lamp will illuminate. When this option is fitted it can be run along with or separately from a Pre-Cycle Vacuum. With the option selected, at the end of the process dwell time the water charge is drained under pressure from the autoclave, and the autoclave cools to a pre-set temperature. If cooling has been selected the fan will operate at this stage. When this temperature is reached the fan switches off, a partial vacuum is drawn and heater mats attached to the outside of the vessel are switched on. This has the effect of evaporating liquid on the load. After a pre-set time air is admitted to the vessel and this process is repeated a number of times. At the end of this stage the autoclave passes immediately to cycle complete.

**Note: Post cycle drying must not be selected if the load contains bottled liquids, regardless of how these are contained. All liquids in the load will be evaporated. Sealed containers of liquid will explode. Unexploded containers will be in a dangerously unstable condition when removed.**



### ***Vacuum Cooling - Suitable for Non Media Loads Only***

**If fitted along with Vacuum Drying this option must be selected for attachment to a particular program in the control software during commissioning.**

A vacuum cooling cycle can be selected by means of the lower function select key. With the option selected the lower left-hand lamp will illuminate. When this option is fitted it can be run along with or separately from a Pre-Cycle Vacuum. With the option selected, at the end of the process dwell time autoclave vent is opened, and the autoclave cools to a pre-set temperature. If cooling has been selected the fan will operate at this stage. When this temperature is reached the fan continues to run and a partial vacuum is drawn. This has the effect of evaporating liquid on the load causing it to cool rapidly. After a pre-set time air is admitted to the vessel and this process is repeated a number of times. At the end of this stage the autoclave passes immediately to cycle complete.

**Note: Post cycle vacuum cooling must not be selected if the load contains bottled liquids, regardless of how these are contained. All liquids in the load will be evaporated. Sealed containers of liquid will explode. Unexploded containers will be in a dangerously unstable condition when removed.**

## **Warning Indicators and Fault Codes**

On the control panel there are a series of 'hidden until active' warning indicators. Some of these indicators will appear in conjunction with a fault code in the temperature display. The meaning of these warnings, why they appear, and what to do when they appear, is as follows.

### **SERVICE**

This means that 500 cycles, or six months have passed since the autoclave was last serviced. The engineer will cancel the message when the autoclave is serviced.

### **WATER + FAULT CODE F004**

The water level has fallen below the minimum level and must be topped up before the autoclave can be run. The warning will automatically cancel when the door is opened and the water level is topped up. The low water condition may have caused a running cycle to abort, and the load may need to be autoclaved again.

### **O/HEAT + FAULT CODE F003**

If fitted, the heater over-temperature protection thermocouple may have sensed that the heating element became too hot. This is probably due to a low water condition, which was not sensed by the low water probe. The water level and the condition of the probe (see Maintenance) should be checked before attempting to use the autoclave again.

If heater over protection is not fitted then the over heat cut out will only operate under extreme conditions, such as a failure of the temperature control system. The next attempt to run the autoclave should be closely observed and if problems persist contact Priorclave Service.

### **FAULT + FAULT CODES F000, F002, F005, F006, F007, F008, F009, F010 & F011**

The fault indicator illuminates under conditions that may invalidate the autoclaving process, and may result in the load requiring to be autoclaved again. The fault condition will be triggered by any of the following:

- F006** Power to the autoclave being interrupted when a cycle is in the heating or process dwell stage of the cycle.
- F005** The chamber temperature falling below the set temperature by more than 3°C during the process dwell time.
- F002** Failure of the temperature control, display, or load simulator thermocouple.
- F000** If your autoclave is fitted with the optional self-validation system, an error in the temperature measurement system is signalled by fault code **F000**. Usually this would mean that a critical error has developed in the temperature measurement system, however, as the detection system is extremely sensitive it is possible that it may be triggered by fluctuations in the electrical power supply. If fault code **F000** appears it may be cleared by the method described below. If the fault code will not clear, or continues to re-appear then the user cannot correct the fault. In such a case please contact Priorclave service or your local Priorclave approved service agent.
- F007** Vacuum stage timeout (loop break). The autoclave has not achieved the pre-set level of vacuum during the Pre-cycle vacuum stage during the pre-set time.
- F008** Heating stage timeout. The autoclave has not reached process temperature within the Pre-set time.
- F009** Vacuum cooling set-point not achieved. The autoclave has not achieved a low enough level of vacuum during the post cycle vacuum stage (Vacuum Cooling or Drying Cycle)
- F010** Air detector input activated. If fitted the air detector system has detected an over pressure condition symptomatic of excess air remaining in the load.
- F011** Printer Timeout / Malfunction. The control system has not received confirmation from the printer within its pre-set timeout.
- F012** Door micro-switch fault. If a door micro-switch opens during a cycle this fault code is displayed

- F013** Jacket Timeout - If a jacket is fitted it has not reached the required temperature within the Pre-set time. This would indicate a problem with steam supply or inlet or drain valve operation
- F014** Jacket Over temperature - If a jacket is fitted the temperature has exceeded the pre-set alarm temperature
- F015** Jacket under temperature - If a jacket is fitted the temperature has fallen below the pre-set operating temperature band.
- F016** Water Fill Timeout - The upper level water probe level has not been reached within the allowed time for filling and the filling operation has been stopped. This function prevents continuous unsupervised operation of the water fill, which could lead to flooding.
- F017** FreeSteam - During Pulsed Fresteaming operation the lower of the two set temperatures has not been achieved. The temperature has not fallen sufficiently following the opening of the vent valve.

### **LOCK**

This warning will light when the thermal lock keyswitch is in the override position.

### **LOAD + FAULT CODE F001**

This warning is activated in the event of the failure of the load sensing thermocouple. If the autoclave is fitted with load sensed process timing, this should be deselected to enable the autoclave to run without this feature. The thermocouple should be replaced as soon as possible. Great care should be taken to ensure that loads which would ordinarily be autoclaved with load sensed process timing are adequately sterilised.

### **CANCELLING FAULT MESSAGES**

The fault messages are cancelled by first correcting the source of the original fault, then turning the setting lock key switch to position 3. If a key-switch is not fitted they are cancelled by pressing the reset button.

If 2 or more faults occur at the same time, the one with the highest priority is displayed. (F000 is the highest priority and F012 is the lowest.) If a higher priority fault is cleared it will be replaced by the next active fault, unless this too is cleared by the same action.

# MAINTENANCE

**NOTE:** Before carrying out any maintenance work check the autoclave for any visual signs of materials which may be contaminated or damaged. Should any such matter be apparent contact the relevant person of authority before proceeding.

Do not carry out any work unless you are competent to do so. Items in this section marked with \* are those which require a level of competence as incorrect maintenance or fitting could lead to a safety hazard.

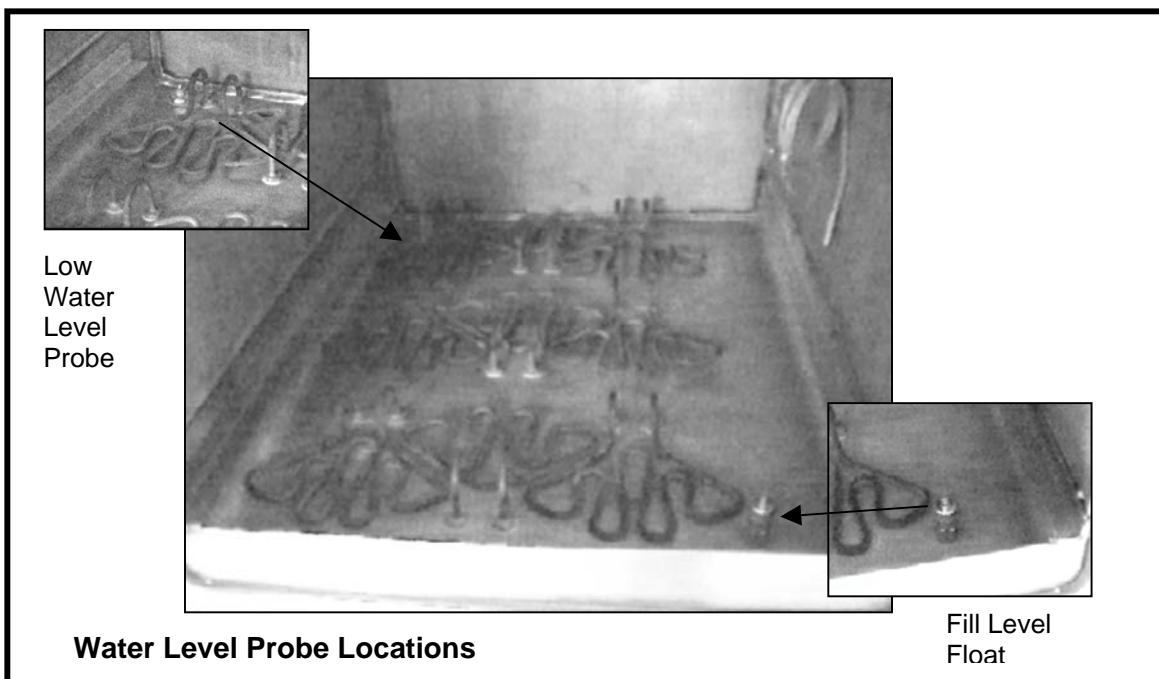
**DISCONNECT** or **ISOLATE** the machine from mains power supply before removing any panels or commencing any maintenance work.

**Ensure that any electrically locked doors or canopies are open before disconnecting power.**

**IN THE EVENT OF ANY DIFFICULTY** or doubt about any maintenance or service procedure contact Priorclave Limited or your nearest Priorclave approved agent or supplier immediately.

## *Weekly Maintenance*

- **Water Level Probes**

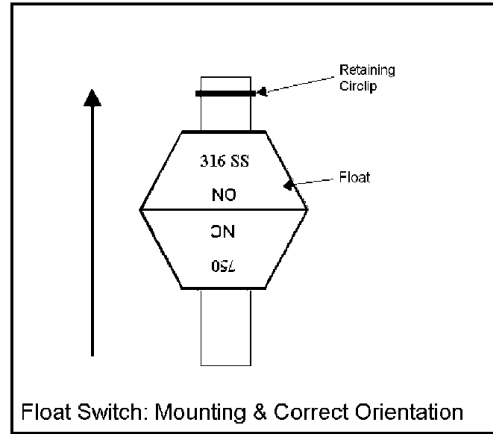
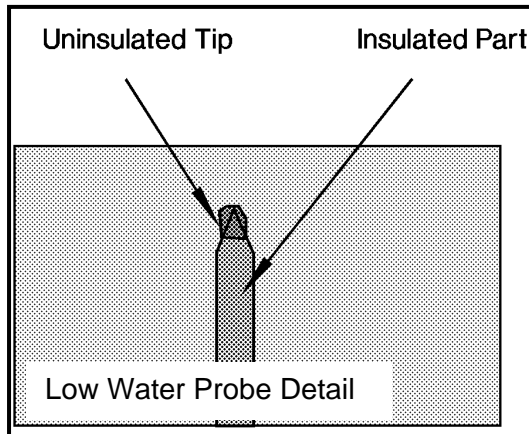


- **Low Water Probe**

To ensure protection from boiling dry the insulated section of the low water probe between the stainless steel tip and the pressure vessel wall should be scrubbed clean to prevent it from being short circuited (see diagram). The sensor tip should also be kept clean to ensure good contact.

- **Water Level Float Switch**

The condition of the column onto which the float is mounted should be regularly checked along with the operation and freedom of movement of the float. The float can be removed for cleaning by removing the circlip at the top of the shaft. Care must be taken to replace the float correctly with the legend 316 SS NO uppermost as shown in the diagram. Incorrect replacement of the probe could lead to flooding.



- **Vessel Water Charge**

The standing water within the vessel should be regularly removed, ideally with a wet/dry type vacuum cleaner to prevent the build up of spilled media and potentially corrosive chemicals. With the vessel empty the heating element(s) should be cleaned with a damp cloth to remove any build up of limescale.

If destruct type loads are regularly being processed consideration should be given to the use of suitable containers for such loads to minimise spillage. A range of such containers suitable for individual Priorclave models is available from Priorclave.

- **Vessel Cleaning**

Check exterior of machine and the inside walls of the pressure vessel for general cleanliness, particularly around operating parts and switchgear. Under no circumstances should an abrasive or chemically aggressive cleaner be used on the pressure vessel. The use of chlorine or hydroxide based cleaners is not recommended (see notices at the beginning of this manual).

- **Gasket**

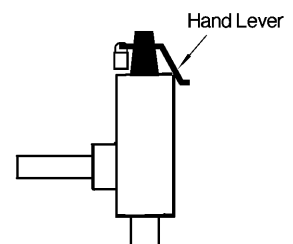
To prolong the life of the sealing gasket it is advisable to lubricate the sealing faces. This is carried out with the pressure lid in the open position by applying high melting point grease to the exposed surfaces of the gasket, after cleaning the gasket and inspecting for damage. A silicone grease such as high vacuum grease is ideal for this purpose.

- **Closure Bolts**

To ensure a free action of the closure bolts they should be kept lubricated and free from dirt. The threads of the bolts and the threaded holes in the header ring should be thoroughly cleaned and then lubricated with high melting point grease.

- **Safety Valve \***

The safety valve should be periodically checked for freedom of movement. This can be done without the need for removing panels from the machine, as the hand lever of the valve may be accessed from above the back panel of the autoclave. When the autoclave is at working pressure, keeping well clear of the safety valve outlet, lift the hand lever and check for a free flow of steam from the outlet pipe. If steam does not flow the valve should be replaced or serviced by a **qualified** person immediately. After releasing the lever ensure that the steam flow stops fully.



- **Drainage**

If the autoclave has been plumbed directly into a drain using flexible tubing, this should be checked for any signs of blockage, obstruction or damage. Also ensure that both ends of

the tube are connected as originally intended. Check for any obstruction to the safety valve outlet, which must remain exposed and unconnected to any form of drainage at all times.

If no external drainage is being used and the condensate is simply being collected in a tundish or other vessel at the rear of the machine, this should be emptied, cleaned and replaced.

### ***Monthly Maintenance***

To be carried out in addition to weekly maintenance programme.

- **Cleaning**

Check exterior of machine and inside pressure vessel for general cleanliness, particularly around operating parts and switchgear. Empty water reservoir using a vacuum water remover if available. In order to prolong the lifespan of the heating elements, water level probe, etc., it is advisable to wipe away any spilled media, chalk, limescale, etc. on these parts or in the reservoir area. This build up should be minimised by the use of distilled water and a discard load container. Under no circumstances should an abrasive cleaner be used on the pressure vessel. The use of chlorine or hydroxide based cleaners is not recommended (see notices at the beginning of this manual).

- **General Operation**

The general operation and performance of the autoclave should be observed frequently, and any fault or defect reported or rectified immediately, and entered into the notes section of the operating manual. (This will assist the service engineer in locating any persistent fault and reporting it to the manufacturer.)

- **Automatic Waterfill**

The condition of the float valve tank and its various connections should be periodically checked and cleaned if necessary. Particular attention should be paid to ensuring that there are no restrictions to the tank overflow. In hard water areas the function of any anti-scaling device fitted to the water supply should be tested and the heating elements checked for signs of scaling.

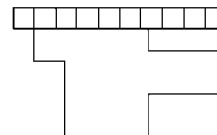
### ***Quarterly Maintenance***

- **Hinge**

With the pressure lid in the open position the hinge should be cleaned and lubricated with high melting point grease.

- **Automatic Air Purge Valve \***

It is advisable to replace the expanding switching element and other sealing parts contained in this unit on a regular basis, in order to prevent build up of foreign matter which may impair the operation of the unit. It is situated at the top of the vessel towards the rear. To remove the parts for replacement simply unscrew the top cap of the unit and remove. Re-assemble the unit as per the instructions in the repair kit (available from Priorclave or local agent). Should the top cap prove particularly tight the complete valve should be removed from the pressure vessel and the body gripped in a vice to remove the cap, as excessive localised pressure could damage the pressure vessel. Care should be taken when refitting the valve to the pressure vessel that all gaskets etc., are replaced in the correct position and the unit should be checked for leaks when first re-pressurised.



- **Microswitches \***

To ensure the reliable operation of the autoclave the internal microswitches, one located behind the red safety closure bolt and the others below the locking catch and behind the black closure bolts should be regularly cleaned and checked.



To gain access to these switches remove the right hand side panel. First, carefully clean around the microswitch under the locking catch and check this for damage and ease of operation. Repeat this process for the microswitches behind both locking bolts. Then screw down the safety bolt to its closed position and check the position in which it is operating the switch. Care should be taken to ensure that this switch is not operating too soon before the sealing gasket is effectively compressed and clamped. If so, adjust the position of the switch until correct operation is achieved. The switch should operate approximately 1/3 of a turn before the bolt is fully tight. Then, manually lifting the locking catch check the operation of the other two microswitches when the lower bolt is operated.

- **Locking Solenoid \***

With the right hand side panel removed, check the locking catch and solenoid for freedom of movement. If necessary the screws should be tightened and the solenoid re-aligned with the catch. A small amount of grease should be applied to the sliding parts if dry.

### **General Maintenance**

- **Removing Side Panels \***

Loosen the screws at the front of the panel then remove the screws holding the panel along the top and the top back corner. Then carefully remove the screw in the bottom corner and lift the panel off taking care that it does not drop to the floor.

### **Access to control components \***

To access the control components remove the top cover from the control box.

- **Checking Temperature Control And Pressure Gauge \***

Should a constant deviation from the values shown in the steam table (appendix B) be apparent in these instruments first follow the relevant procedures in the fault-finding table (appendix A). With all of these possible causes eliminated, proceed to check the gauges as follows:

First, place a thermocouple probe connected to a digital thermometer or chart recorder of known accuracy onto the Temperature Controller Probe. Then set the machine and run through a standard cycle. When the process time has commenced check the reading shown by the temperature display against that of the thermometer or recorder. Should there be a disparity of readings in the order of that previously noted then it is likely that the Temperature Controller is at fault and needs resetting.

If only negligible temperature disparity is apparent, however, and the steam pressure is still varying from the expected value by the amount noted previously, then the pressure gauge is probably faulty and in need of replacement.

**N.B. THE PRESSURE GAUGE AND CONTROL SYSTEM FITTED TO PRIORCLAVES ARE EXTREMELY RELIABLE INSTRUMENTS AND AS SUCH ARE UNLIKELY TO PRODUCE FALSE READINGS. THEREFORE IT IS MORE LIKELY THAT ANY DEVIATION FROM THE VALUES GIVEN IN THE STEAM TABLE IS CAUSED BY INCORRECT AIR PURGING ETC.**

- **Fitting A New Lid Gasket**

When it becomes necessary to replace the gasket, simply remove the old gasket by pulling it out of the groove in the pressure vessel body.

Using an abrasive pad clean out the groove and wipe away any residue with a cloth.

Locate the joint in the new gasket and press this part of the gasket firmly into the part of the groove closest to the hinge, marked A on the diagram.

Find the opposite centre line of the gasket and press firmly into the point marked B on the diagram, ensure that there is an even amount of gasket each side of points A and B. Press the gasket into the points marked C, again ensuring that there is an even amount of gasket between all 4 points.

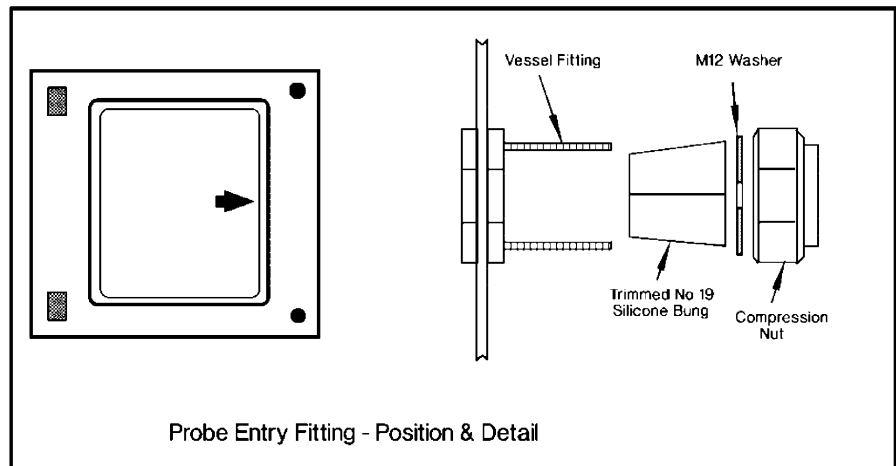
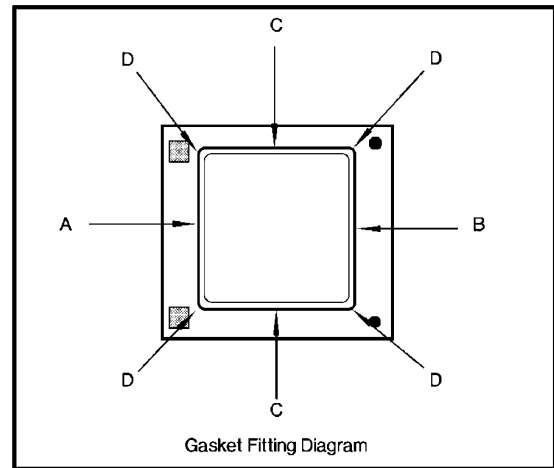
Press the gasket into the four points marked D. Finally press in the remaining points taking care not to cut the gasket on the header ring. Once the gasket is fully fitted smear the top surfaces with high temperature silicone grease if required, and smooth out any lumps, applying pressure in a circular motion around the gasket.

With the new gasket properly fitted, it may now be necessary to follow the lid adjustment procedure. Please note however that the gasket will bed down considerably when the autoclave is first used.

- **Fitting A New Wandering Thermocouple**

The thermocouple passes through an entry gland located in the right hand side of the pressure vessel, which is accessed by removing the patch panel. To remove the old thermocouple undo and remove the compression nut from the fitting (see diagram). From the inside of the pressure vessel push out the silicone rubber bung from the fitting, using a suitable

blunt instrument and remove it from the thermocouple. It may be necessary to re-slit the bung to do this. Place the nut washer and bung in position on the new thermocouple and re-fit. It is advisable to apply some silicone sealant (such as bath sealant) to the joint to assist sealing. The joint should be checked for leaks when the autoclave is first pressurised. Replacement bungs are available from Priorclave, or alternatively use a silicone rubber bung and trim the top end by about 5mm.



# SPECIFICATION TABLE

## Model PS/RSC/EH450

<b>General</b>	<b>Model</b>	Rectangular Section Priorclave 450 Litres
	<b>Capacity</b>	
<b>Dimensions</b>	<b>Machine (wxd)</b>	855x1250mm
	<b>Installation Area Required (wxd)</b>	1055x1450mm
<b>Weight</b>	<b>Unloaded</b>	800kG
	<b>With water charge</b>	850kG
	<b>Door</b>	
	<b>Pressure Vessel</b>	
<b>Electrical</b>	<b>Power Supply Required</b>	400V 50Hz 45A
<b>Steam</b>	<b>Steam Supply Required</b>	Not Applicable
<b>Water Supply</b>	<b>Water Supply Required (with Vacuum Pump)</b>	De-ionised Water 15mm BSP (Mains Water 22mm BSP)
<b>Drainage</b>	<b>Main Drain Connection</b>	28mm BSP
	<b>Secondary Drain Connections</b>	15mm BSP & 22mm BSP
<b>Max. Sound Level</b>	<b>Without Vacuum Pump</b>	Approx. 60db @ 2M
	<b>With Vacuum Pump</b>	Approx. 75db @ 2M
<b>Max. Heat Emission</b>	<b>Full Cycle</b>	$((31.5h \times 16.25p) \times 0.75) / t$ kW/Hour Where: <b>h</b> = heat-up time (hrs) <b>p</b> = process time (hrs) <b>t</b> = Total cycle* (hrs) * to thermal lock temperature

## Model PS/RSC/EH700

<b>General</b>	<b>Model</b>	Rectangular Section Priorclave 700 Litres
	<b>Capacity</b>	
<b>Dimensions</b>	<b>Machine (wxd)</b>	855x1550mm
	<b>Installation Area Required (wxd)</b>	1055x1750mm
<b>Weight</b>	<b>Unloaded</b>	1000kG
	<b>With water charge</b>	1060kG
	<b>Door</b>	
	<b>Pressure Vessel</b>	
<b>Electrical</b>	<b>Power Supply Required</b>	400V 50Hz 63A
<b>Steam</b>	<b>Steam Supply Required</b>	Not Applicable
<b>Water Supply</b>	<b>Water Supply Required (with Vacuum Pump)</b>	De-ionised Water 15mm BSP (Mains Water 22mm BSP)
<b>Drainage</b>	<b>Main Drain Connection</b>	28mm BSP
	<b>Secondary Drain Connections</b>	15mm BSP & 22mm BSP
<b>Max. Sound Level</b>	<b>Without Vacuum Pump</b>	Approx. 60db @ 2M
	<b>With Vacuum Pump</b>	Approx. 75db @ 2M
<b>Max. Heat Emission</b>	<b>Full Cycle</b>	$((42h \times 21p) \times 0.75) / t \text{ kW/Hour}$ Where: <b>h</b> = heat-up time (hrs) <b>p</b> = process time (hrs) <b>t</b> = Total cycle* (hrs) * to thermal lock temperature

## SPARES LIST.


A full selection of spares are available from Priorclave Service or your local Priorclave dealer. Please give your autoclave serial number when ordering parts.

A selection of the more commonly used parts is listed below:

DESCRIPTION	PART NUMBER	
Air Intake Filter	ACS/AFL/039	
Heating Element 3.5 kW	ACS/E35/016	
Gasket	ACS/GAS/051	
Door Locking Solenoid	ACS/LKS/005	
Low Water Probe Electrode	ACS/LWP/035	
Single Pole Circuit Breaker 6A	ACS/MCB/001	
3 Pole Circuit Breaker 32A	ACS/MCB/004	
15mm (1/2 in BSP) Non-Return Valve	ACS/NRV/015	

22mm (3/4 in BSP) Non-Return Valve	ACS/NRV/022	
28mm (1 in BSP) Non-Return Valve	ACS/NRV/028	
Pressure Gauge	ACS/PGA/009	
Wandering Thermocouple Probe	ACS/PRB/039	
Air Purge Valve (Complete)	ACS/PVC/037	
Air Purge Valve Element	ACS/PVE/005	
Small Cable Port Bung	ACS/SGB/015	
Large Cable Port Bung	ACS/SGB/022	
Setting Lock Keyswitch	ACS/SLK/001	

Safety Valve - Complete	ACS/SVC/009	
Thermal Lock Keyswitch	ACS/TLK/012	
22mm (3/4 in BSP) Solenoid Valve	ACS/VVC/007	
Vent Valve 28mm (1in BSP)	ACS/VVC/008	
Pressure Switch	MID/PSW/028	
15mm (1/2 in ) Solenoid Valve	MID/VVC/007	
Water Level Float Switch	RSC/FLS/000	
Door Roller Microswitch	RSC/MSS/000	
Door Lock Microswitch	RSC/MSS/001	

Output Card	TAC/OPT/054	
Printer Ribbon Cassette	ZZZ/RIB/002	
Printer Paper Roll	ZZZ/ROL/005	



## NOTES



## APPENDIX A - FAULT FINDING & RECTIFICATION GUIDE

SYMPTOM	POSSIBLE CAUSE	POSSIBLE SOLUTION
<b>No Power</b>	<ul style="list-style-type: none"> <li>Power switched off at isolator</li> <li>Circuit Breaker Tripped</li> <li>Electrical Failure</li> </ul>	<ul style="list-style-type: none"> <li>Check</li> <li>Reset and check cause</li> <li>Call Engineer</li> </ul>
<b>Cycle does not commence when start button is pressed (Fault indicator flashes)</b>	<ul style="list-style-type: none"> <li>Door is not closed correctly</li> <li>Microswitch Failure</li> </ul>	<ul style="list-style-type: none"> <li>Open &amp; Reclose. Check Red Safety bolt is correctly closed.</li> <li>Check Microswitches</li> </ul>
<b>Low Water Indicator (F004) stays lit when correct water level is achieved</b>	<ul style="list-style-type: none"> <li>Low Water Conductivity i.e. Distilled water</li> <li>Probe dirty, damaged or removed</li> <li>Wiring connections loose or damaged</li> </ul>	<ul style="list-style-type: none"> <li>Add Tap Water</li> <li>Visually check probe. Clean/Replace as necessary</li> <li>Check connections to probe and main control board.</li> </ul>
<b>Heating slow or not apparent</b>	<ul style="list-style-type: none"> <li>Temperature incorrectly set</li> <li>Circuit Breaker Tripped out</li> <li>Heater(s) Failed</li> <li>Heaters Overfurred</li> <li>Fault in control circuit.</li> </ul>	<ul style="list-style-type: none"> <li>Check setting &amp; reset if necessary</li> <li>Check Circuit Breaker position. Check cause of trip &amp; reset if necessary.</li> <li>Check &amp; Replace as necessary. Check Low Water Probe.</li> <li>Check &amp; replace as necessary.</li> <li>Check all connections, output board function &amp; thermal cutout(s).</li> </ul>
<b>Autoclave does not pressurise</b>	<ul style="list-style-type: none"> <li>Vent button in open position</li> <li>Freesteam time not completed (if option is fitted)</li> <li>Air purge valve failure</li> <li>Vent Valve stuck open</li> <li>Safety Valve stuck open</li> <li>Door incorrectly closed</li> </ul>	<ul style="list-style-type: none"> <li>Check Vent Indicator</li> <li>Check Cycle Progress Indicator Display</li> <li>Check and replace internal parts or valve.</li> <li>Check &amp; Replace if necessary</li> <li>Check for obstructions on lifting handle.</li> <li>Check door position and microswitch setting</li> </ul>

SYMPTOM	POSSIBLE CAUSE	POSSIBLE SOLUTION
<b>Incorrect Temperature/Pressure Correlation</b>	Air not fully purged from autoclave. Due to : <ul style="list-style-type: none"> <li>• Incorrect Load Packing</li> <li>• Faulty Air Purge Valve</li> <li>• Faulty Controller or Gauge</li> </ul>	<ul style="list-style-type: none"> <li>• Re-Load and re-start cycle with (more) freesteaming.</li> <li>• Check &amp; Replace if necessary</li> <li>• Check function and calibration</li> </ul>
<b>Safety Valve opening</b>	<ul style="list-style-type: none"> <li>• Temperature set too high</li> <li>• Contactor Failure</li> <li>• Safety Valve Faulty</li> <li>• Output board Failure</li> </ul>	<ul style="list-style-type: none"> <li>• Check Temperature Setting</li> <li>• Check &amp; Replace if necessary.</li> <li>• Check the lock on the valve is intact and has not been tampered with and that the lifting handle is not obstructed. Check the pressure shown on the gauge is above 2.2 Bar. If not replace the valve</li> <li>• Check &amp; Replace if necessary</li> </ul>
<b>Door will not open once Autoclave has cooled to 80°C</b>	<ul style="list-style-type: none"> <li>• Thermal Lock Temperature not yet reached in Load Simulator</li> </ul>	<ul style="list-style-type: none"> <li>• <b>WAIT.</b> Thermal Lock is set to Load and not Chamber temperature.</li> </ul>
<b>Door does not open when door button is pressed</b>	<ul style="list-style-type: none"> <li>• Safety delay not completed</li> <li>• Thermal Lock Temperature not yet reached in load simulator</li> <li>• Faulty Door Solenoid(s)</li> <li>• Thermal Lock previously overridden</li> </ul>	<ul style="list-style-type: none"> <li>• Wait while 'hoLd' is displayed in the temperature display</li> <li>• Check Cycle Complete indicator is lit on cycle progress display.</li> <li>• Check Solenoid and Output Board Function. Replace if necessary.</li> <li>• Use thermal lock key to open door. Normal function will return after a complete cycle has been run.</li> </ul>
<b>Fault Indication will not go out</b>	<ul style="list-style-type: none"> <li>• Fault not Re-set. (Refer to list of Fault Codes)</li> </ul>	<ul style="list-style-type: none"> <li>• Rectify cause of fault and reset with Keyswitch or re-set button.</li> </ul>

If in any doubt about any of the above procedures do not hesitate to call Priorclave Service on **020 8316 6620** or your nearest Priorclave approved service agent.

This device is fitted with a non-resetable thermal cut out to protect the heater. In the event of failure of this device contact Priorclave Service or your local authorised service agent.

## APPENDIX B - STEAM TABLE

Temperature (°C)	Pressure (Bar)
100	0.00
105	0.20
110	0.43
115	0.69
120	0.99
121	1.06
122	1.13
124	1.26
126	1.41
128	1.56
130	1.72
132	1.89
134	2.07
136	2.20

**Correct Correlation between Temperature and Pressure shows correct operation of the autoclave and that air purging is satisfactory.**

**NB.**

This table is accurate at sea level and at moderate altitudes will be sufficiently accurate for its intended purpose. However, at higher altitudes the pressures indicated will be slightly higher than those shown above.



## APPENDIX C - WIRING DIAGRAMS

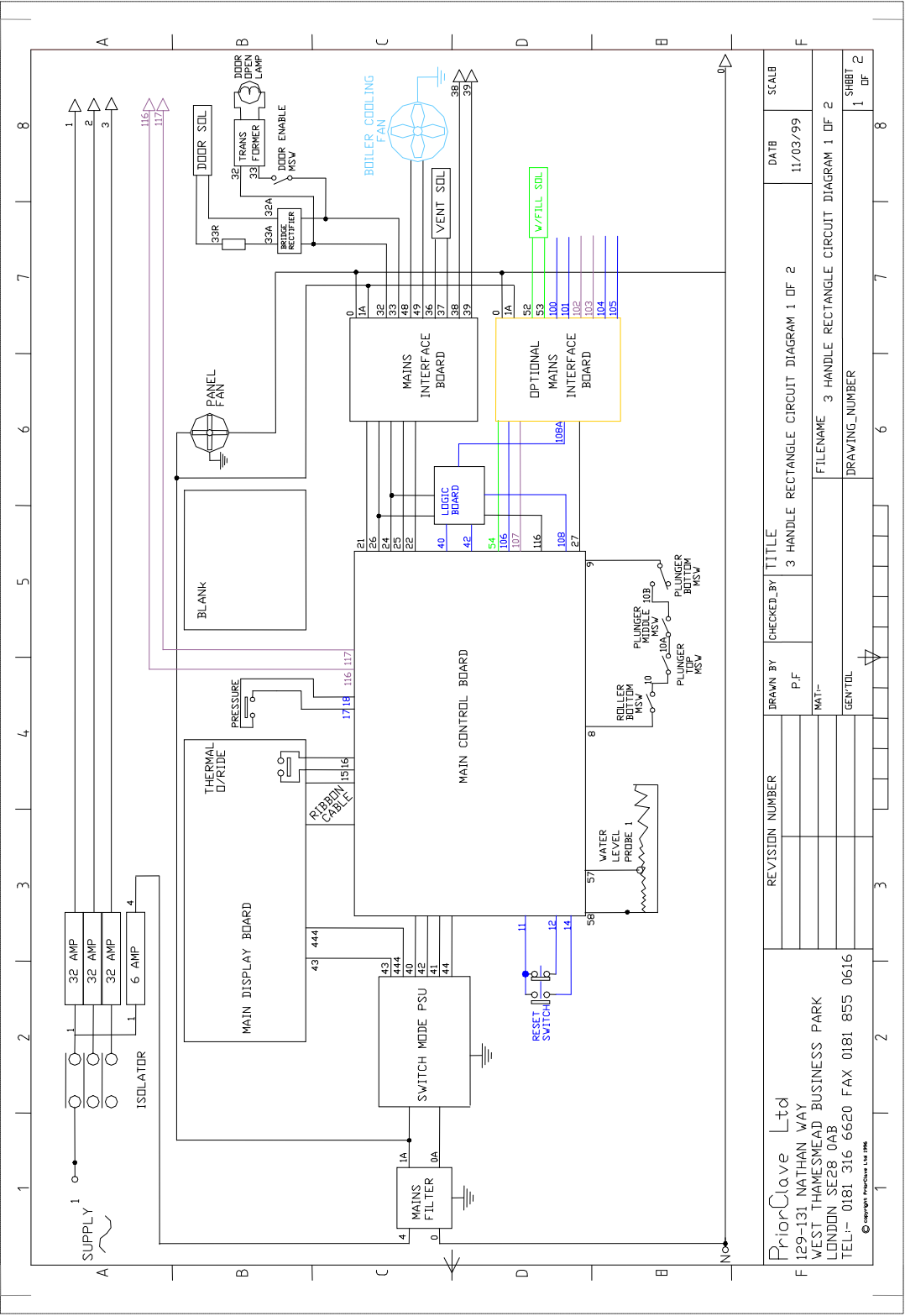
### Output Board Designations

#### Output Board 1

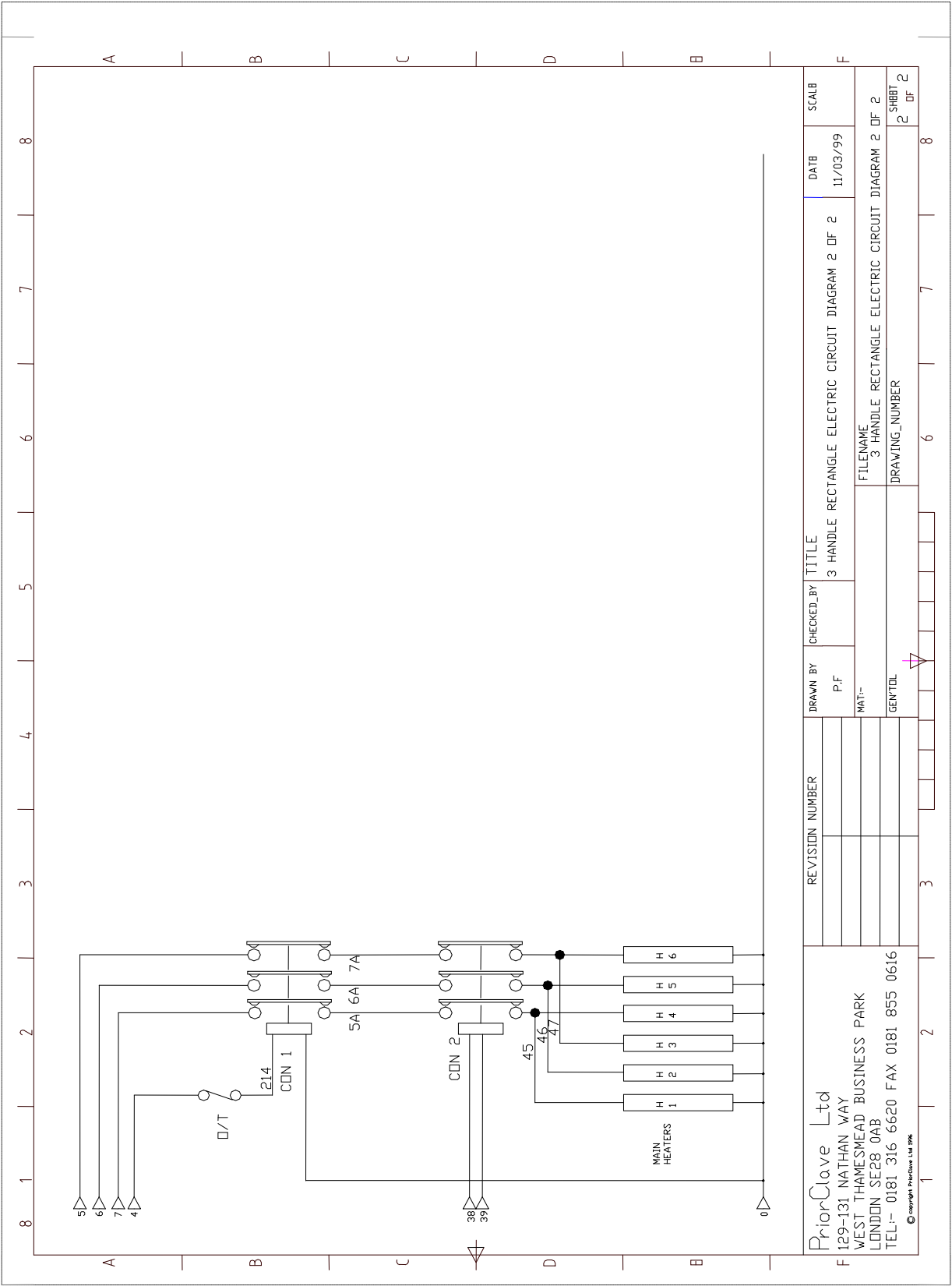
IN		OUT	FUNCTION
	1		
	2		
	3		
	4		

#### Output Board 2

IN		OUT	FUNCTION
	1		
	2		
	3		
	4		









## **APPENDIX D - OTHER OPTIONS FITTED**



# **Motorbloc Liquid Ring Vacuum Pump Type MV**

## **INSTRUCTION, INSTALLATION & MAINTENANCE MANUAL**



**Graham Precision Pumps Limited**

The Forge, Congleton, Cheshire CW12 4HQ, England.

Telephone: 01260 274721. Telex: 667383. Fax: 01260 276965.



Certificate No. 7445

## **TABLE OF CONTENTS**

	Page No.
SECTION 1.0 - GENERAL DESCRIPTION & PRINCIPLES OF OPERATION	
1.1 General Description	1
1.2 Principles of Operation	1
Figure #1	2
SECTION 2.0 - INSTALLATION INSTRUCTIONS	
2.1 Initial Inspection	3
2.2 Preservation Procedure	3
2.3 Mounting	3
2.4 Seal Liquid Piping Arrangement	3, 4
Figures 2, 3, 4	5, 6
2.5 Piping	7
2.6 Electrical Requirements	7
SECTION 3.0 - OPERATING INSTRUCTIONS	
3.1 Seal Liquid	
3.2 Cavitation.....	8
3.3 Startup Procedures.....	8, 9
3.4 Shutdown Procedures .....	9
3.5 Troubleshooting Chart .....	10
SECTION 4.0 - SPARE PARTS AND REPAIR -REPLACEMENT ORDERS	
4.1 Spare Parts .....	11
4.2 Repair -Replacement Orders .....	11
SECTION 5.0	
5.1 Dismantling Instruction - Close Coupled.....	12
5.2 Assembly Instruction - Close Coupled .....	13
5.3 Dismantling Instructions - Pedestal Version .....	14,15
5.4 Assembly Instructions - Pedestal Version .....	16,17
5.5 Conversion from Close Coupled to Pedestal Version.....	18
SECTION 6.0 - DRAWINGS	
Typical Cross Sectional Dwgs. & Parts List	19,20,21,22

## SECTION 1.0 - GENERAL DESCRIPTION AND PRINCIPLE OF OPERATION

### 1.1 General Description

The motorbloc Graham vacuum pump is of the liquid ring type. The rotary impeller is located eccentrically within the pump casing. The liquid ring, therefore, acts as a piston. These pumps are all of the single impeller design. In addition, they are extremely compact. The pump is mounted directly to the motor with the motor being the complete support, or it is available in a pedestal type which permits pump and motor to be separately supported.

The operating range is from atmospheric down to 30 torr with capacities up to 221m<sup>3</sup>/hr. If an air ejector is added to the suction of pump an inlet pressure as low as 3 TORR may be obtained.

The units are constructed of various materials. The standard construction being cast iron casing, aluminum bronze impeller and bronze port plate, 420 stainless steel shaft and PTFE valves. Some of the other material combinations available are:

- A) casing & port plate in cast iron, 316SS impeller and shaft
- B) all parts in contact with process stream in 316 or 317 stainless steel - plus other high alloys
- C) all parts in contact with process - tin bronze with 316 stainless steel shaft

### 1.2 Principle of Operation

The pump casing is initially, partially filled with seal liquid (usually water). This liquid is thrown to the periphery of the casing and forms a liquid ring. This liquid ring seals the space between the impeller blades and the casing. (See Figure #1.) Note that at the top position of the impeller, the chambers are completely filled with liquid. As the impeller rotates, the liquid ring moves away from the hub, increasing the space in the pumping chamber. This draws the gas into the chamber from the inlet port adjacent to the impeller. As the impeller continues to rotate, any gas in the impeller chambers is compressed by the liquid ring and is expelled through the discharge port. This sequence is again repeated with each revolution. The seal liquid also seals the space, or running clearance, between the impeller blades and the pump casing, plus absorbs the heat of compression and condensation (when handling saturated gas streams).

A continuous supply of seal liquid (make-up) is necessary to limit the temperature rise in the pump, due to heat of compression, friction and condensation. This heat load is absorbed and carried away.

Any excessive rise in temperature will have a detrimental affect upon pump performance, reducing the capacity and degree of vacuum attainable. The seal liquid is continuously discharged with the gas stream through the discharge port and discharge line to the separator vessel downstream.

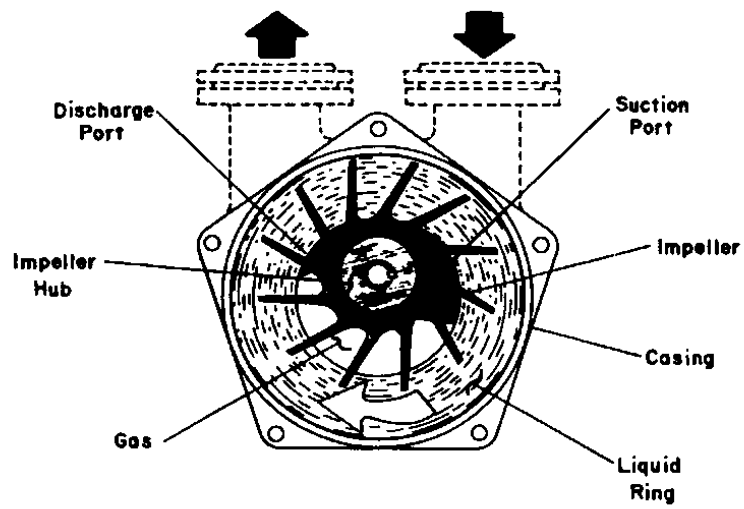


FIGURE 1



## SECTION 2.0 - INSTALLATION INSTRUCTIONS

### 2.1 Initial Inspection

Carefully unpack the pump, taking care not to damage or misalign pump. For package units lift by the separator only. Do not attach slings or hooks to the pump/motor - this can cause misalignment.

Do not attempt to run the pump until the installation work is complete, as detailed in this manual. Do not run the pump without sealant liquid.

### 2.2 Preservation Procedures

The standard pumps are protected with a water soluble preservative which should be flushed from the pump if other than water is utilized in a closed loop system. The location of the installation or storage of unit should be such that liquid is not allowed to freeze.

### 2.3 Mounting

There are basically three (3) types of mounting with the motorbloc pumps.

The units that consist of the pump/motor only have two mounting features:

- A) The standard line utilizes the motor support only. (The pump end is 100% supported by motor.)
- B) The alternate design is a pedestal style which utilizes a separate support for the pump end that is independent of motor support.

The package units, which have the pump/motor mounted on top of the separator, has two supports directly mounted to separator for anchoring to floor, concrete or skid. All joints in piping, whether flanged or screwed, should be checked for leaks prior to startup.

### 2.4 Seal Liquid Piping Arrangements

- A) Seal Liquid: once through - no recovery (arrangement as shown in Figure #2).

Seal liquid is taken directly from a main and supplied to the pump. The seal liquid should be supplied at gauge pressure of 4 to 5 PSIG even though the pump is self-priming. The seal liquid should be free of foreign matter and the use of a strainer is recommended. The seal liquid is separated from the gas and wasted to a drain. No recirculation or recovery takes place. An automatic solenoid valve provides for the flow of seal liquid simultaneously with motor - Jump operation (i.e. upon motor stopping the solenoid valve closes preventing the casing to be filled with seal liquid).

## SECTION 2.0 - INSTALLATION INSTRUCTIONS (cont.)

### 4 2.4 Seal Liquid Piping Arrangements (cont.)

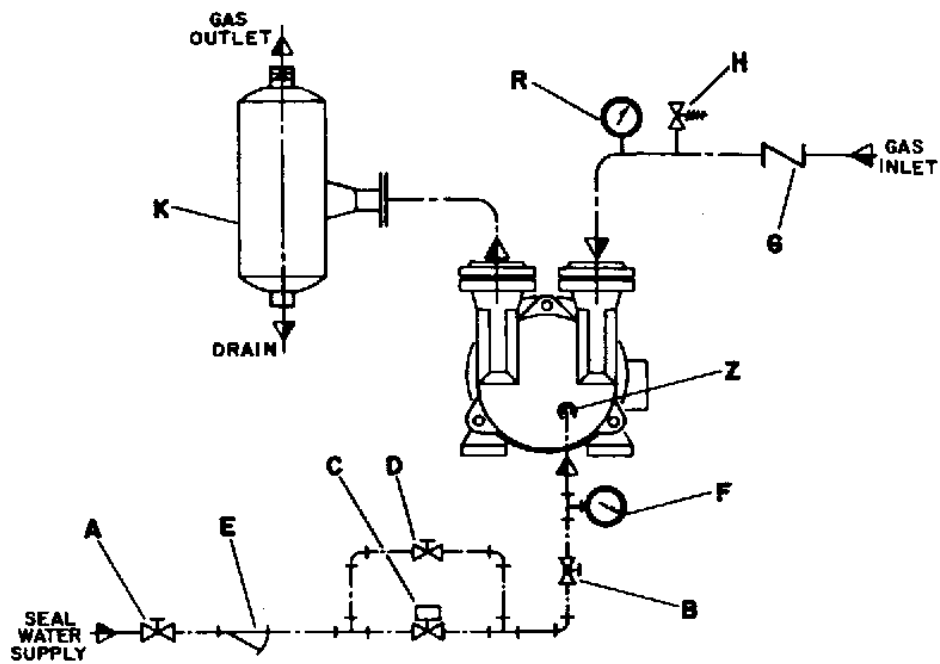
- B) Seal Liquid: Complete Recovery of the Seal Liquid (closed -loop) (Arrangement as shown in Figure #3.)

A heat exchanger is added to the system to remove the heat of compression, friction, and condensation from the seal liquid before it is reintroduced back into the pump. This heat exchanger may be of the shell & tube, plate & frame or helicoil coil design.

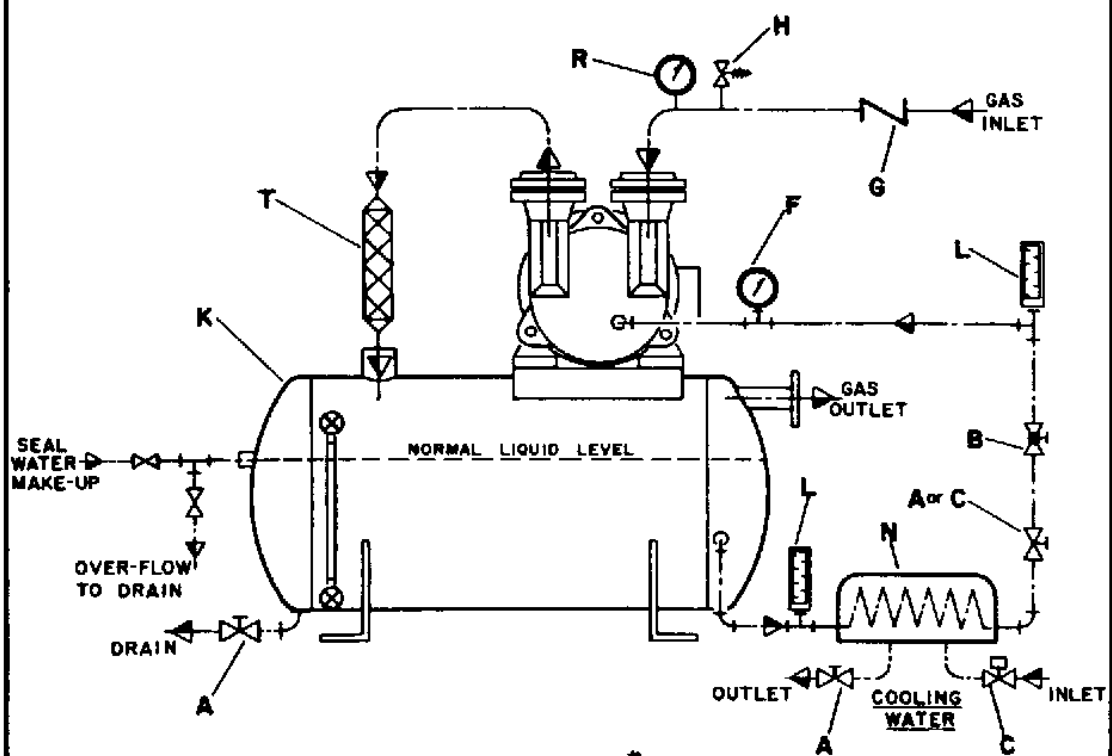
- C) Seal Liquid: Partial Recovery of the Seal Liquid (Arrangement as shown in Figure #4.)

A portion of the seal liquid is recirculated back from the separator tank to the pump. The remainder is discharged from separator and wasted to drain. The fresh make-up seal liquid is introduced in

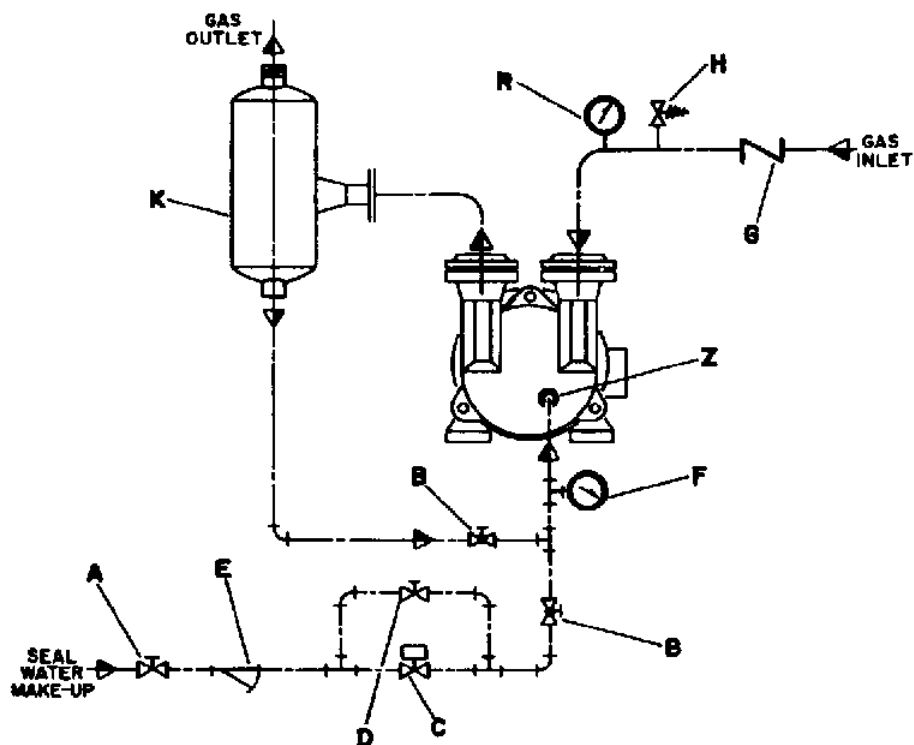
sufficient quantity to maintain proper temperatures essential to good pump performance. This type of arrangement is used where seal liquid conservation is important.



**FIGURE \*2**  
No Recovery of the Seal Liquid



**FIGURE \*3**  
Complete Recovery of the Seal Liquid (Closed-Loop)



**FIGURE #4**  
Partial Recovery of the Seal Liquid

PART DESIGNATIONS FOR FIGURES #1, #2 & #3

A — Shut-off Valve	K — Discharge Separator
B — Regulating Valve	L — Thermometer
C — Solenoid Valve	M — Gauge Glass
D — By-pass Valve	N — Heat Exchanger
E — Strainer	R — Vacuum Gauge
F — Compound Gauge	T — Flexible Connector
G — Check Valve	Z — Seal Liquid Inlet
H — Vacuum Relief Valve	

## SECTION 2.0 - INSTALLATION INSTRUCTIONS (cont.)

### 2.5 Piping

- A) Suction & Discharge - The suction and discharge flanges on the pump are arranged vertically and are marked by arrows on the pump casings. These lines should be the same size as the pump connections. The maximum elevation of the discharge line should be limited to 18" above the face of the discharge flange of the pump. Too high of an elevation in this discharge line will cause a back pressure on the pump, overloading the motor and also reducing the pump capacity.
- B) The seal liquid supply pipe should be the same size as the connection on the pump.
- C) Remove the protective coverings from the pump openings immediately before connecting the pipe work. Check that all foreign matters such as welding slag, nuts, bolts, rags, and dirt have been thoroughly cleared out of pipe work before connecting to pump. When connecting the pipe work, check that the flanges fit easily without strain and that the flange holes are in perfect alignment. The flange gaskets must not protrude into the interior bore of the pipe or pump flange. All pipe work must be supported independently on each side of the pump and must fit easily without transmitting strain to the pump casing. It is recommended that during the first three weeks of operation, a protective mesh be fitted at the pump suction inlet.

### 2.6 Electrical Requirements

Standard induction motors are suitable for driving Graham Liquid Ring Motorbloc pumps. Starting loads are low so that across the line operation is normally employed for these motors.

It is recommended that a motor controller with over-current protection of the heater or fuse type be used. The full load current rating, stamped on the motor nameplate, should be used in making the selection for protection rating. A disconnect switch should also be installed between the motor controller and the power supply.

After the electrical work is completed, the motor should be started to check rotation. First, jog the motor to see that it rotates freely. The direction of rotation is marked by an arrow on the pump. Fill the pump casing halfway with seal liquid and then switch on the motor to check for rotation. If the direction is wrong, reverse any two of the three motor leads and recheck.

It is recommended that low voltage single phase supply be used for control circuits. Items such as solenoid valves, vacuum and pressure switches, level controllers, alarms, etc. should be supplied with only 115 volts to comply with electrical safety code requirements.

## SECTION 3.0 - OPERATING INSTRUCTIONS

### 3.1 Seal Liquid

Seal flow rates and the temperature rise are important because of their affect on pump performance. Too little seal flow will result in loss of capacity at higher vacuums and too much seal flow will result in excessive horsepower requirements. An easy procedure that can be used to establish the minimum seal flow required is with the pump operating at the desired vacuum on process, slowly reduce the *flow* of seal liquid until the suction pressure begins to increase or fluctuate and-then gradually increase the flow until the suction pressure again stabilizes.

If hard water is used as a seal liquid, scale deposits caused by the precipitation of salts will occur. This will vary with the nature of the seal fluid temperature at which it is used. Scale deposits on the working surface of the pump will cause an increase in absorbed power, wear of the working parts, and may ultimately cause seizure of the pump. It is advisable to check the hardness of the water and/or seal fluid and if excessive, arrange to use only treated water and/or seal fluid in the pump.

If no alternatives to using hard water are possible, it may be necessary to use descaling compounds in the pump to remove deposits; or from time to time, dismantle the pump and strip off the encrusted salts.

### 3.2 Cavitation

Cavitation is recognized by a characteristic metallic or grinding noise inside the pump. It is caused when the pump suction pressure is too close to the vapor pressure of the seal liquid. If the seal liquid temperature rises such that the corresponding vapor pressure closely approaches the total suction pressure, then cavitation will occur.

When cavitation takes place, vapor bubbles form and collapse within the liquid ring. This is detrimental to the surfaces of the impeller, side plates, and casing. The cavitation shock force causes erosion by tearing away metal particles and deforming soft materials. Damage can be especially severe in a corrosive condition.

Cavitation is prevented by bleeding air into the pump casing. Vacuum relief valves can be fitted in the suction piping for this purpose.

If the problem is not a low flow of non-condensable gases, then the seal liquid temperature should be checked. With the proper temperature, the operating vacuum can be increased. Ultimately the vacuum at which the pump can be operated is governed by the vapor pressure of the seal liquid.

### 3.3 Startup Procedures

A) Jog motor to make sure rotation is correct plus to check for binding. (If the rotation is wrong, reverse any two of the three motor leads and recheck.)

SECTION 3.0 - OPERATING INSTRUCTIONS (cont.)3.3 Startup Procedures (cont.)

- B) Fill pump with seal liquid to the shaft centre line. CAUTION: Do not start pump with seal liquid above pump centre line.
- C) open any valves in discharge line.
- D) Open any valves in suction line.
- E) Restart the motor and at the same time turn on seal liquid and adjust as necessary.

3.4 Shutdown Procedures

- A) Shut off seal liquid.
- B) Stop motor drive.
- C) Close all suction and discharge valves.
- D) If pump is down a long period of time, protect pump from freezing and/or fill with a protective preservative on the standard materials of construction for protection against rust and scale buildup.

3.5 Troubleshooting Chart - see page 11

### TROUBLESHOOTING CHART

Problem	Cause	Solution
Reduced Capacity	Speed too Low Leak in suction line Seal liquid temperature too high Insufficient seal liquid	Check voltage Repair Check coolant flow and heat exchanger Provide correct flow rate
Excessive Noise	Excessive or insufficient seal liquid Coupling misalignment Defective bearing Cavitation	Adjust flow rate Realign coupling Replace bearing Open attenuation valve or reset vacuum relief valve for higher pressure.
High Power Consumption	Excessive seal liquid Coupling misalignment Excessive back pressure Defective bearing Improperly mounted pump	Reduce flow rate Realign coupling Correct as necessary Replace bearing Make sure surface is level and all feet are touching surfaces using shims, if necessary.
Overheating	Seal liquid temperature too high Insufficient seal liquid Coupling misalignment Defective bearing Improperly mounted pump	Check coolant flow and heat exchanger Provide correct flow rate Realign coupling Replace bearing Make sure surface is level and all feet are touching surfaces using shims, if necessary.
Vibration	Coupling misaligned Pump not properly anchored Improperly mounted pump	Realign coupling Anchor Make sure surface is level and all feet are touching surfaces using shims, if necessary.
Abnormal Bearing Wear	Coupling misalignment Strain on pump casing from connecting pipework Shaft flinger missing	Realign coupling Support connecting pipework Replace flinger
Mechanical Seals 'Squeal'	Insufficient lubrication.	Check flow of coolant to seals
Shaft will not turn or Partially Seizes	Scale from hard water Foreign object in pump Improperly mounted pump	Descale pump Dismantle pump and remove Make sure surface is level and all feet are touching surfaces using shims, if necessary.



## SECTION 4.0 - SPARE PARTS AND REPAIR - REPLACEMENT ORDERS

### 4.1 Spare Parts

The following minimum parts should be stocked:

- 1) impeller
- 2) mechanical seal
- 3) motor bearing
- 4) gasket compound or PTFE gasket
- 5) thrower

### 4.2 Repair / Replacement Orders

When it is necessary to obtain spare parts, please address your communication to:

**GRAHAM PRECISION PUMPS UNITED**

THE FORGE, CONGLETON, CHESHIRE, CW12 4HQ, ENGLAND  
CONGLETON (01260) 274721 TELEX 667383 FAX 01260 276965

Important The following information should be given in order to identify the spare parts required:

1. Serial number of unit (stamped on nameplate).
2. Name or description of part required.
3. Method of shipment (i.e. freight, express, etc.).

Graham Precision Pumps Ltd. presents the information in this manual as good engineering practice. we cannot be held responsible for any damage to equipment that may result from mal-operation nor for any personal injuries should they occur during normal or abnormal operation.

SECTION 5. 1 - DISMANTLING INSTRUCTIONS FOR MOTORBLOC PUMPS / CLOSE COUPLED  
MOTOR  
DESIGN / WRITTEN FOR PUMPS WITH STAINLESS STEEL IMPELLERS

DISCONNECT ELECTRIC SUPPLY BEFORE COMMENCING

STEP	REMOVE	PART NUMBER
1	COUNTERFLANGE NUTS-BOLTS-WASHERS	63,563.1,563.5
2	FLANGE GASKETS	400
3	DRAIN PUMP THROUGH 1/4" R&P.DRAIN CONN.	
4	TIE BOLTS	905
5	END CASING	02
6	PTFE GASKET	00.5
7	SIDE PLATE	137
8	VALVE ASSEMBLY FROM SIDE PLATE	02, 360 & 435
9	PTFE GASKET	400.6
10	SCREW	800
11	RETAINER	820
12	IMPELLER	230
13	IMPELLER KEY	940
14	ABUTMENT RING	235
15	ROTARY UNIT OF MECHANICAL SEAL	433
16	BOLTS	901
17	IMPELLER CASING	109
18	STATIONARY MECH. SEAL SEAT FROM IMPELLER CASING	433.1

FOR PUMPS WITH IMPELLERS OF ALUMINUM BRONZE OR TIN BRONZE ELIMINATE STEPS 10, 11 & 14.

**SECTION 5.2 - ASSEMBLY INSTRUCTIONS FOR MOTORBLOC PUMPS / CLOSE COUPLED MOTOR**  
**DESIGN / WRITTEN FOR PUMPS WITH STAINLESS STEEL IMPELLERS**

STEP	ASSEMBLE	PART NUMBER
1	CLEAN ALL PARTS THOROUGHLY BEFORE COMMENCING REBUILD	
2	MECH. SEAL STATIONARY SEAT IN IMPELLER CASING	433.1
3	IMPELLER CASING TO MOTOR FLANGE	109
4	BOLTS TO IMPELLER CASING AND TIGHTEN	901
5	ROTARY UNIT OF MECH. SEAL ON SHAFT AGAINST STATIONARY SEAT	433
*6	ABUTMENT RING	235
7	KEY 940	
8	IMPELLER	230
9	RETAINER	820
10	SCREW (COVER THREADS WITH LOCTITE THREADLOCK)	800
11	VALVE ASSEMBLY TO SIDE PLATE 902,360,435	
12	PTFE GASKET TO IMPELLER CASING	400.6
13	SIDE PLATE TO IMPELLER CASING (ENSURE DOWEL 137,562 PIN IS LOCATED)	
14	PTFE GASKET TO SIDE PLATE 400.5	
15	END CASING TO SIDE PLATE (ENSURE DOWEL PIN IS LOCATED)	102,562
16	BOLTS THROUGH END CASING TO IMPELLER CASING AND TIGHTEN ROTATE MOTOR FAN THROUGH COWEL TO ENSURE NOTHING BINDS INTERNALLY.	905

\* THIS MUST BE ADJUSTED BY SHIMS OR REMACHINING IF ANY INTERNAL PARTS HAVE BEEN REPLACED OR REMACHINED. MINIMUM CLEARANCE BETWEEN IMPELLER & PLATE OR BACK OF IMPELLER AND IMPELLER CASING = 0.2 MM (0.008"), UNLESS OTHERWISE ADVISED.

FOR PUMPS WITH IMPELLERS OF ALUMINUM BRONZE OR TIN BRONZE ELIMINATE STEPS 6, 9 & 10.

SECTION 5.3 - DISMANTLING INSTRUCTIONS FOR MCTORBLOC PUMPS / PEDESTAL MOTOR

DESIGN / WRITTEN FOR PUMPS WITH STAINLESS STEEL IMPELLERS

DISCONNECT ELECTRIC SUPPLY BEFORE COMMENCING

STEP	REMOVE	PART NUMBER
1	COUNTERFLANGE NUTS-BOLTS-WASHERS	563,563.1,563.5
2	FLANGE GASKETS	400
3	DRAIN PUMP THROUGH 1/4" NPT DRAIN CONN.	
4	TIE BOLTS	905
5	END CASING	102
6	PTFE GASKET	400.5
7	SIDE PLATE	137
8	VALVE ASSEMBLY FROM SIDE PLATE	902,360,435
9	PTFE GASKET	400.6
10	SCREW	800
11	RETAINER	820
12	IMPELLER	230
13	IMPELLER KEY	940
14	ABUTMENT RING	235
15	ROTARY UNIT OF MECHANICAL SEAL	433
16	BOLTS	901
17	IMPELLER CASING	109
18	STATIONARY MECHANICAL SEAL SEAT FROM IMPELLER CASING	433.1
19	NUTS & BOLTS	806,805
20	PEDESTAL ASSEMBLY TO A WORK BENCH	
21	THROWER	507
22	BEARING COVER SCREWS	807
23	BEARING COVERS DE & NDE	600,601
24	BEARING LOCKNUT	840
25	LOCK WASHER	841
26	BEARING (DRIVE SHAFT TOWARDS "DE" FAR ENOUGH TO CLEAR PEDESTAL AND ALLOW BEARING PIILLERS ACCESS TO PULL BEARING OFF SHAFT)	321
27	BEARING (DRIVE SHAFT TOWARDS "NDE" UNTIL SHAFT & BEARING IS FREE OF PEDESTAL)	322

SECTION 5.3 - DISMANTLING INSTRUCTION FOR MO'RORBLOC PUMPS / PEDESTAL MOTOR  
DESIGN / WRITTEN FOR PUMPS WITH STAINLESS STEEL IMPELLERS (CONT.)

DISCONNECT ELECTRIC SUPPLY BEFORE COMMENCING

STEP	REMOVE	PART NUMBER
28	BEARING FROM SHAFT	322
29	CIRCLIP FROM PEDESTAL	340

FOR PUMPS WITH IMPELLERS OF ALUMINUM BRONZE OR TIN BRONZE ELIMINATE STEPS 10, 11 & 14.

SECTION 5.4 - ASSEMBLY INSTRUCTIONS FOR MOTORBLOC PUMPS/ PEDESTAL MOTOR.  
DESIGN WRITTEN FOR PUMPS WITH STAINLESS STEEL IMPELLERS

STEP	ASSEMBLE	PART NUMBER
1	CLEAN ALL PARTS THOROUGHLY BEFORE COMMENCING REBUILD	
2	DE BEARING TO SHAFT	321
3	BEARING LOCKWASHER	841
4	BEARING LOCKNUT AND TIGHTEN	840
5	CIRCLIP IN PEDESTAL	340
6	SHAFT WITH BEARING IN PLACE IN PEDESTAL AGAINST CIRCLIP	210,321,515
7	DE BEARING COVER	600
8	BEARING COVER SCREWS AND TIGHTEN, ENSURING BEARING IS LOCKED AGAINST CIRCLIP	807
9	NDE BEARING (WITH DE OF SHAFT HELD SOLID TAP IN BEARING TOWARDS DE WITH A SLEEVE, ENSURING THAT THE SLEEVE LOCATES ON BOTH INNER AND OUTER BEARING FACES AT THE SAME TIME)	322
10	NDE BEARING COVER	601
11	BEARING COVER SCREWS AND TIGHTEN	807
12	THROWER	507
13	MECHANICAL SEAL STATIONARY SEAT IN IMPELLER CASING	433.1
14	IMPELLER CASING TO PEDESTAL FLANGE INCLUDING FEET	109,520,521
15	BOLTS TO IMPELLER CASING AND TIGHTEN	901
16	ROTARY UNIT OF MECHANICAL SEAL ON SHAFT AGAINST STATIONARY SEAT	433
*17	ABUTMENT RING	235
18	KEY	940
19	IMPELLER	230
20	RETAINER	820
21	SCREW (COVER THREADS WITH LOCTITE THREAD-LOCK) OR HELI-COIL SPRING	800
22	VALVE ASSEMBLY TO SIDE PLATE	902,360,435
23	PTFE GASKET TO IMPELLER CASING	400.6
24	SIDE PLATE TO IMPELLER CASING (ENSURE DOWEL PIN IS LOCATED)	137,562
25	PTFE GASKET TO SIDE PLATE	400.5

**SECTION 5.4 - ASSEMBLY INSTRUCTIONS FOR MOTORBLOC PUMPS / PEDESTAL MOTOR DESIGN / WRITTEN FOR PUMPS WITH STAINLESS STEEL IMPELLERS (CONT.)**

STEP	REMOVE	PART NUMBER
26	END CASING TO SIDE PLATE (ENSURE DOWEL PIN IS LOCATED)	102, 562
27	BOLTS THROUGH END CASING TO IMPELLER CASING & TIGHTEN ROTATE SHAFT END TO ENSURE NOTHING BINDS INTERNALLY	905
28	PUMP COUPLING TO SHAFT (ENSURING THAT THIS IS NOT FORCED, BUT ALLOWED TO SLIDE IN PLACE AND GRUB SCREWED IN POSITION ON THE SHAFT)	
29	PUMP TO THE BED AND ALIGN PUMP HALF COUPLINGS	

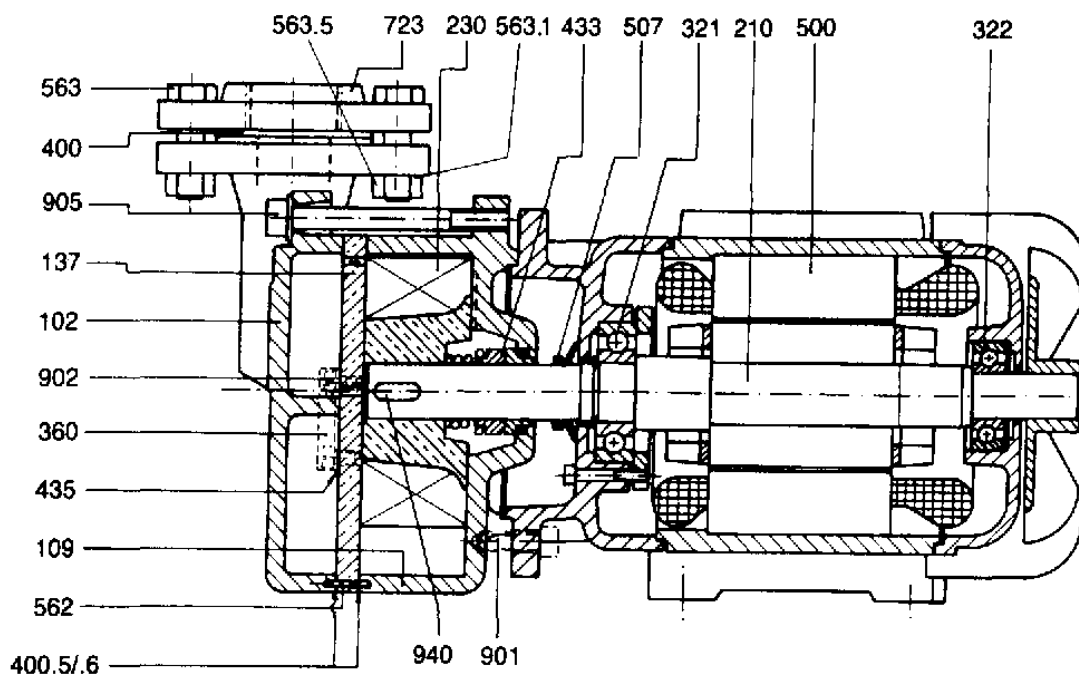
\*THIS MUST BE ADJUSTED BY SHIMS OR REMACHINING IF A14Y INTERNAL PARTS HAVE BEEN REPLACED OR REMACHINED. THE MINIMUM CLEARANCE BETWEEN IMPELLER AND PLATE OR BACK OF IMPELLER AND IMPELLER CASING = 0.2MM (0.008") UNLESS OTHERWISE ADVISED.

FOR PUMPS WITH IMPELLERS OF ALUMINUM BRONZE OR TIN BRONZE ELIMINATE STEPS 17, 20 & 21.

**SECTION 5.5 - CONVERSION FOR CLOSE COUPLED TO PEDESTAL VERSION**

For conversion instructions from close coupled to pedestal-design motorbloc pumps, disconnect electric supply before commencing and use dismantling instruction sheet 1 and assembly instruction sheets 16 & 17 steps 12 to 29 inclusive.

For conversion from pedestal to close coupled design motorbloc pumps, disconnect electric supply before commencing, and use dismantling instruction sheets 14 & 15 and assembly instruction sheet 13, all steps.



CLOSE-COUPLED MV TYPE PUMP

CROSS-SECTIONAL DRAWING AND PARTS LIST

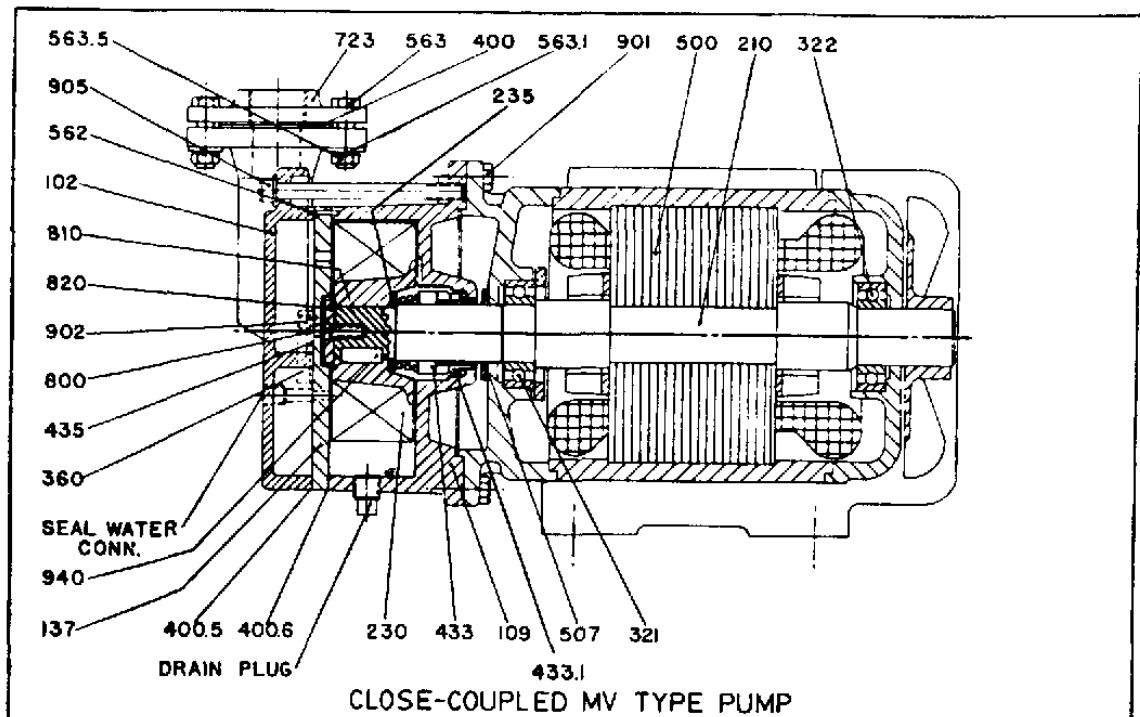
PART NUMBER	DESCRIPTION	MAT'LS. FOR STANDARD CONSTRUCTION
102	END CASING	CAST IRON
109	IMPELLER CASING	CAST IRON
137	SIDE PLATE	BRASS
210	SHAFT	STAINLESS STEEL
230	IMPELLER	BRONZE
321	BALL BEARING	STEEL
322	BALL BEARING (MOTOR)	STEEL
360	VALVE PLATE	STAINLESS STEEL
400	FLANGE GASKET	KLINGERIT
400.5	JOINTING MATERIAL	EPPL 32
400.6	JOINTING MATERIAL	EPPL 32
433	MECHANICAL SEAL	VITON RUBBER/CERAMIC/CARBON
435	VALVE	PTFE
500	STATOR	—
507	THROWER	RUBBER
562	PIN	STEEL
563	BOLT	STEEL
563.1	WASHER	STEEL
563.5	NUT	STEEL
723	COUNTERFLANGE	CAST IRON
901	SCREW	STEEL
902	SCREW	STEEL
905	BOLT	STEEL
940	KEY	STEEL

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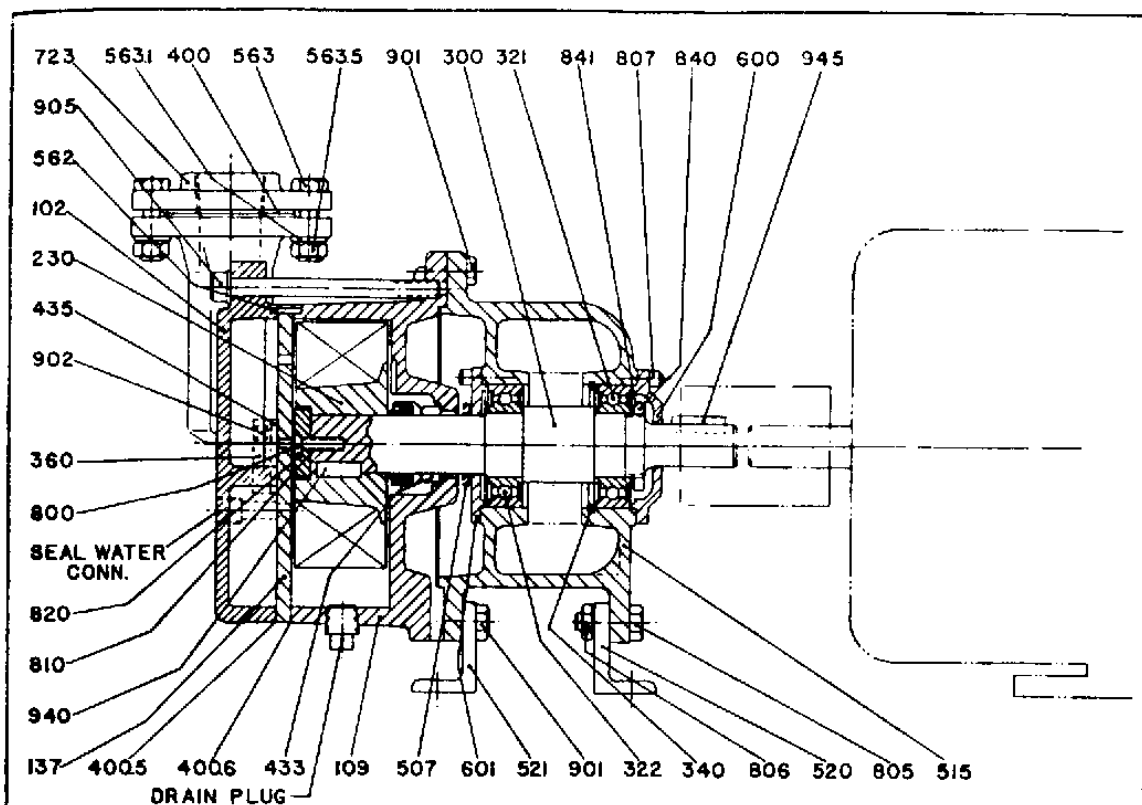
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CROSS-SECTIONAL DRAWING AND PARTS LIST		
PART NUMBER	DESCRIPTION	MAT'L'S. FOR STAINLESS STEEL CONSTR.
102	END CASING	316 STAINLESS STEEL
109	IMPELLER CASING	316 STAINLESS STEEL
137	SIDE PLATE	316 STAINLESS STEEL
210	SHAFT	316 STAINLESS STEEL
230	IMPELLER	316 STAINLESS STEEL
321	BALL BEARING	STEEL
322	BALL BEARING (MOTOR)	STEEL
360	VALVE PLATE	316 STAINLESS STEEL
400	FLANGE GASKET	KLINGERIT
400.5	JOINTING MATERIAL	P.T.F.E.
400.8	JOINTING MATERIAL	P.T.F.E.
433	MECHANICAL SEAL-ROTARY	P.T.F.E./ CERAMIC /CARBON
435	VALVE	P.T.F.E.
500	STATOR	—
507	THROWER	RUBBER
562	PIN	316 STAINLESS STEEL
563	BOLT	STEEL
563.1	WASHER	STEEL
563.5	NUT	STEEL
723	COUNTERFLANGE	316 STAINLESS STEEL
800	SCREW	316 STAINLESS STEEL
810	LOCTITE	—
820	IMPELLER RETAINER	316 STAINLESS STEEL
901	SCREW	316 STAINLESS STEEL
902	SCREW	316 STAINLESS STEEL
905	BOLT	STEEL
940	KEY	316 STAINLESS STEEL
235	ABUTMENT RING	316 STAINLESS STEEL
433.1	MECHANICAL SEAL - STATIONARY	

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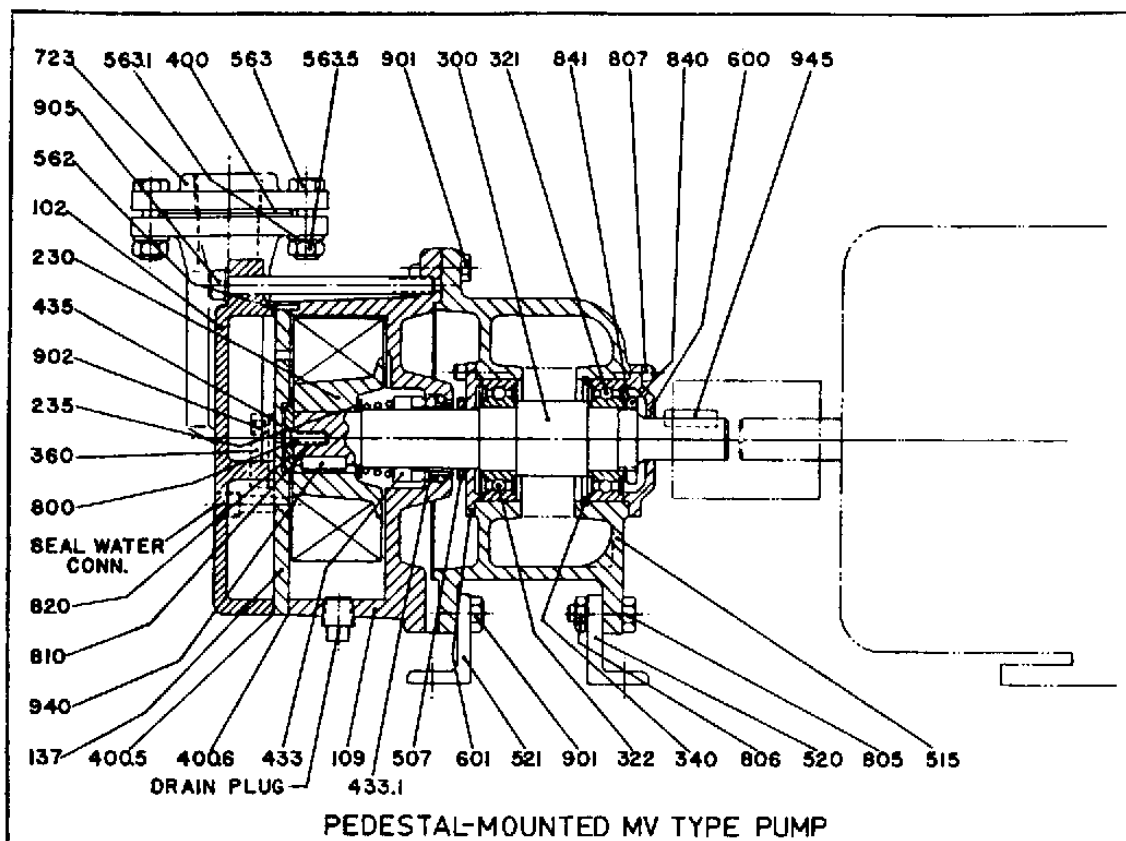


PEDESTAL-MOUNTED MV TYPE PUMP

CROSS SECTIONAL DRAWING AND PARTS LIST

PART NUMBER	DESCRIPTION	MATLS. FOR STAND. STEEL CONST.	PART NUMBER	DESCRIPTION	MATLS. FOR STAND. STEEL CONST.
102	END CASING	CAST IRON	563.5	WASHER	STEEL
109	IMPELLER CASING	CAST IRON	600	BEARING COVER	
137	SIDE PLATE	BRASS	601	BEARING COVER	
230	IMPELLER	BRONZE	723	COUNTERFLANGE	CAST IRON
			800	SCREW	STEEL
300	SHAFT		805	BOLT	STEEL
321	BALL BEARING	STEEL	806	NUT	STEEL
322	BALL BEARING	STEEL	807	SCREW	STEEL
340	RETAINER		810	LOCTITE	
360	VALVE PLATE	316 STAIN. STEEL	820	IMPELLER RETAINER	STEEL
400	FLANGE GASKET	KLINGERIT	840	BEARING LOCKNUT	
400.5	JOINTING MATERIAL	EPPL 32	841	LOCKING WASHER	
400.6	JOINTING MATERIAL	EPPL 32	901	SCREW	STEEL
433	MECHANICAL SEAL-ROTARY	VITON RUBBER / CERAMIC / CARBON	902	SCREW	STEEL
			905	BOLT	STEEL
			940	KEY	STEEL
			945	KEY	STEEL
435	VALVE	P.T.F.E.			
507	THROWER	RUBBER			
515	PEDESTAL				
520	PEDESTAL FOOT				
521	PEDESTAL FOOT				
562	PIN	STEEL			
563	BOLT	STEEL			
563.1	WASHER	STEEL			

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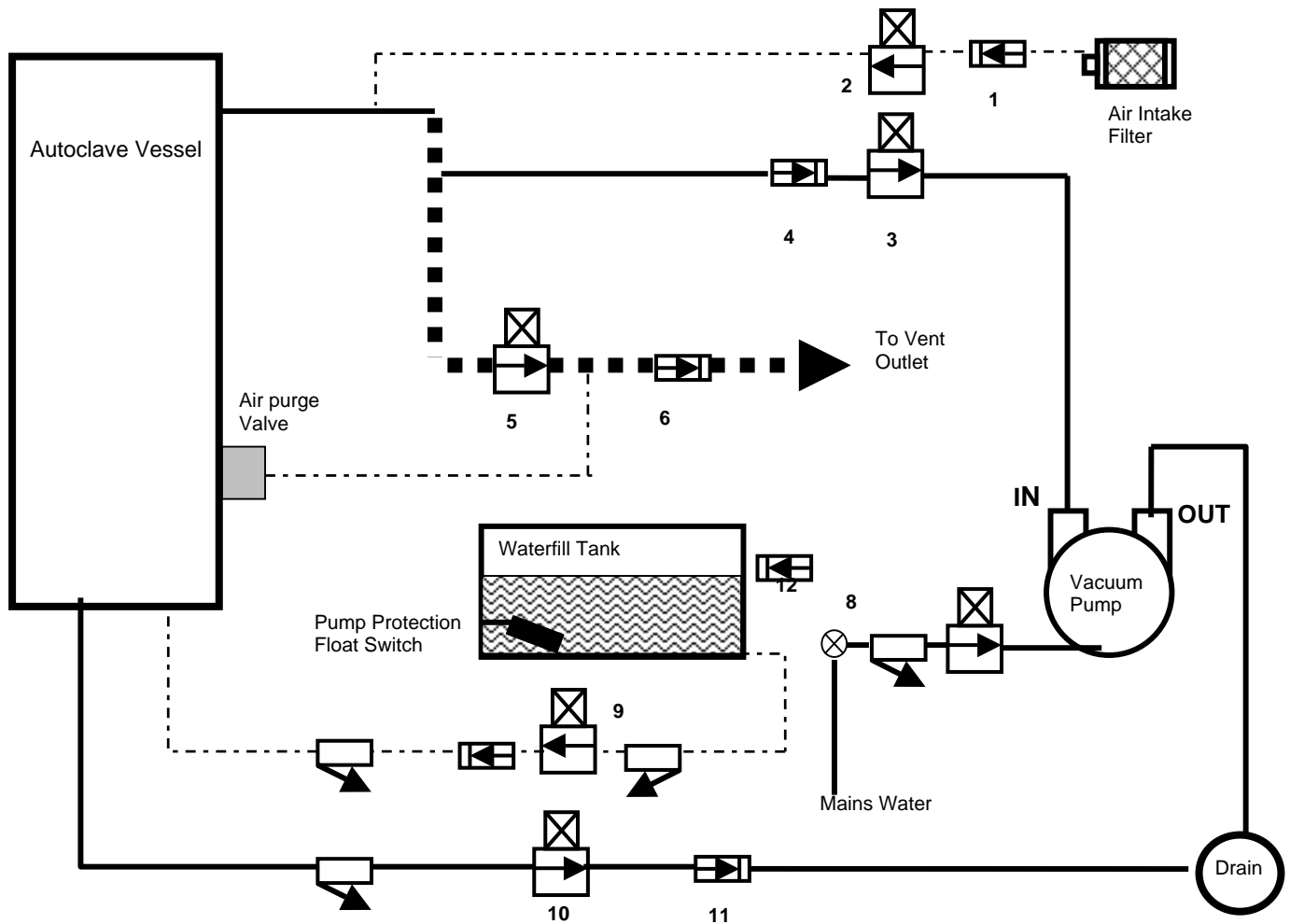


CROSS SECTIONAL DRAWING AND PARTS LIST

PART NUMBER	DESCRIPTION	MATLS FOR STAIN. STEEL CONST.	PART NUMBER	DESCRIPTION	MATLS FOR STAIN. STEEL CONST.
102	END CASING	316 STAIN. STEEL	563.5	WASHER	STEEL
109	IMPELLER CASING	316 STAIN. STEEL	600	BEARING COVER	
137	SIDE PLATE	316 STAIN. STEEL	601	BEARING COVER	
230	IMPELLER	316 STAIN. STEEL	723	COUNTERFLANGE	316 STAIN. STEEL
235	ABUTMENT RING	316 STAIN. STEEL	800	SCREW	316 STAIN. STEEL
300	SHAFT		805	BOLT	
321	BALL BEARING	STEEL	806	NUT	
322	BALL BEARING	STEEL	807	SCREW	
340	RETAINER		810	LOCTITE	
360	VALVE PLATE	316 STAIN. STEEL	820	IMPELLER RETAINER	316 STAIN. STEEL
400	FLANGE GASKET	KLINGERIT	840	BEARING LOCKNUT	
400.5	JOINTING MATERIAL	P.T.F.E.	841	LOCKING WASHER	
400.6	JOINTING MATERIAL	P.T.F.E.	901	SCREW	
433	MECHANICAL SEAL - ROTARY	P.T.F.E. / CERAMIC / CARBON	902	SCREW	316 STAIN. STEEL
433.1	MECHANICAL SEAL - STATIONARY		905	BOLT	STEEL
			940	KEY	316 STAIN. STEEL
			945	KEY	
435	VALVE	P.T.F.E.			
507	THROWER	RUBBER			
515	PEDESTAL				
520	PEDESTAL FOOT				
521	PEDESTAL FOOT				
562	PIN	316 STAIN. STEEL			
563	BOLT	STEEL			
563.1	WASHER	STEEL			



# PIPEWORK SCHEMATIC (VACUUM OPTIONS ONLY)



## Key:

Solenoid Valve		Check Valve		Strainer	
----------------	--	-------------	--	----------	--

15mm Tubing:	
22mm Tubing:	
28mm Tubing:	

## Valves:

1. Vacuum Break Check Valve
2. Vacuum Break Solenoid Valve
3. Vacuum Enable Solenoid
4. Vacuum Enable Check Valve
5. Vent Solenoid Valve
6. Vent Check Valve
7. Water Ring Inlet Solenoid Valve
8. Water Ring Inlet Control Ball Valve
9. Waterfill Solenoid Valves
10. Drain Solenoid (Vacuum Drying Only)
11. Drain Check Valve (Vacuum Drying Only)
12. Water Inlet Check Valve





129-131 Nathan Way  
West Thamesmead Business Park  
London SE28 0AB

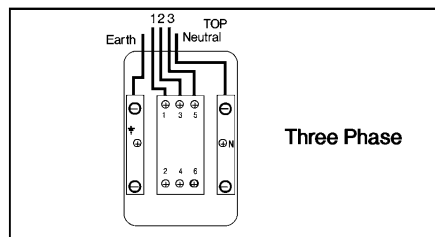
## Opening Instructions

Your Priorclave Autoclave is electrically locked. In order to open it and access the full operating instructions it will first be necessary to connect it to a suitable electrical supply as follows:

To connect your Priorclave to the power supply simply connect a suitable cable from your isolator to the isolator at the rear of the unit. Wiring for three phase supplies is as shown in the diagram.

- **3 PHASE – 31.5 kW HEATING AND 42 kW HEATING**

The power supply should be a 3 phase and neutral isolated supply, rated at 45 Amps per phase for 31.5 kW heating or 60 Amps per phase for 42 kW heating and connected to the isolator below. Sufficient length of cable should be used to allow the autoclave to be pulled out and worked on from the back. The cable used to the earth line and neutral feeds should be capable of carrying the per phase amperage of the supply. The neutral line must be nominally at earth potential and must **NOT** be fused. This equipment must be earthed.



After connecting the autoclave to a suitable power supply it can be opened as follows:

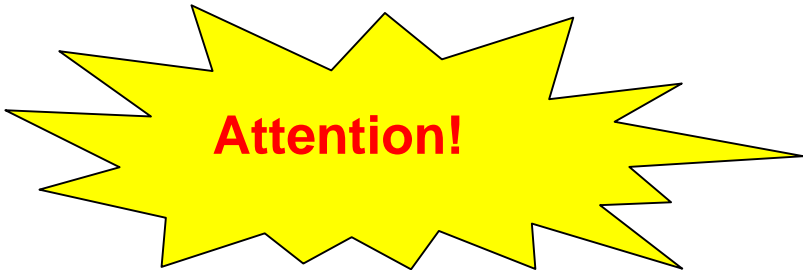
1. Check electricity supply is **ON**.
2. When opening the autoclave for the first time the error code **F004** will be showing in the temperature display. You may ignore this at this stage as opening the autoclave and filling it with water will reset this error. Press the 'door' button on the control panel there will be a bleep. Wait for about 20 seconds short time until there is another bleep and the door indicator illuminates. The door button can now be pressed again to release the lock.
3. Open the pressure door by undoing the lower black handwheel first followed by the central handwheel and finally the red safety handwheel. With the door free, carefully pull open.





# Specification Sheet

Form Specs sheet Issue 1 20/04/99 aec



**Model Number:** .....

**Working Capacity:** .....

**Heater Power:** .....

**Power Supply Required:** ..... **Volts**  
..... **Hz**  
..... **Phase**  
..... **Amps/Phase**

**Steam Supply:** .....

**Options Fitted:**  
.....  
.....  
.....

**Accessories Supplied:**  
.....  
.....  
.....

Please read this manual before attempting to operate your Priorclave. Connection to the wrong power supply could lead to an expensive and unnecessary call out.



# Customer Warranty Registration

Form Warreg Issue 4 05/09/00 aec

Please complete the details below and return by post or fax to the above address within 14 days of delivery of your Priorclave Laboratory Autoclave.

You will then be registered as a Priorclave user and your 12month\* Parts and labour warranty will commence from the date entered below.

## IMPORTANT

If this form is not returned we can only commence your warranty period from the date of completion at our works.

**\* UK customers only. Outside the UK a full 12month warranty applies for parts only. Refer to your supplier for further details.**

**Priorclave Model :** .....

**Serial Number:** .....

**Delivery Date:** .....

**Company Name:** .....

**Address:** .....

.....

.....

.....

.....

**Telephone:** .....

**Fax:** .....

**E-mail:** .....

**Contact:** .....

**Purchased From:** .....

**Date:** .....



### **Priorclave Service**

129-131 Nathan Way  
West Thamesmead Business  
Park  
London SE28 0AB

Tel: 020 8316 6620

Fax: 020 8855 0616

E-Mail: [service@priorclave.co.uk](mailto:service@priorclave.co.uk)



Certificate Number 6973

