

Service Manual

Introduction

Description

Maintenance

Illustrated parts list

Read these Instructions before use

Keep these instructions in a safe convenient place for future reference. Read in conjunction with the Publications detailed in Section 1.5.

This Service Manual applies to the following Autoclave REF numbers. (Note: In the parts list section reference is also made to parts required for earlier versions) :-

SES 2000 STANDARD (from Serial Number - SCB8B0000, or SED8B0000 for non-CE)

without printer : 87-028-04 87-028-20 87-028-36 87-029-05 87-029-13 87-029-21
87-029-37 87-029-45 87-029-54 87-029-62 87-029-70 87-029-78
87-029-86 87-030-03 87-030-11 87-030-27 87-030-43 87-030-60
87-031-03 87-031-68

with printer : 87-028-12 87-028-28 87-028-44 87-029-26 87-030-65 87-031-11
87-031-76

SES 2000 LONG (from Serial Number - LSCB8B0000, or LSED8B0000 for non-CE)

without printer : 87-028-53 87-028-69 87-028-85 87-028-90 87-028-97 87-029-29
87-029-94 87-030-70 87-031-19 87-031-84 87-020-05 87-022-01
87-022-17 87-020-21 87-022-49 87-022-66

with printer : 87-028-61 87-028-77 87-030-75 87-031-27 87-031-92 87-020-13
87-022-09 87-022-25 87-020-29 87-022-58 87-022-74

(Note: The alpha parts of the SN are significant.)

Eschmann After Sales Service Department

The Eschmann After Sales Service Department is staffed and equipped to provide advice and assistance during normal office hours. To avoid delays when making enquires, please quote the Model and Serial Number of your Autoclave. Please ensure you include all alpha and numeric digits of the Serial Number. (NOTE: The Serial Number Plate is located inside the door in the top left hand corner).

For further information visit www.eschmann.co.uk

All correspondence relating to the after sales service of Eschmann Equipment to be addressed to :

UK Customers

Eschmann Equipment, Peter Road, Lancing, West Sussex BN15 8TJ, England.

Tel: +44 (0) 1903 765040. Fax: +44 (0) 1903 875711.

Overseas Customers

Contact your local distributor. In case of doubt contact Eschmann Equipment.

Patents and Trade marks

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“Eschmann Equipment” is a trading name of Eschmann Holdings Limited.

“SES2000” is a trade mark of Eschmann Holdings Limited.

Patents : Patents Pending plus - Pat. US5090033 and Pat. GB2238407

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The information in this publication was correct at the time of going to print. The Company, however, reserves the right to modify or improve the equipment referred to.



The CE marking affixed to the product certifies that it complies with the European Medical Devices Directive 93/42/EEC and related legislation.

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**TECHNICAL DATA
(Standard Version)**

Electrical Data

Supply 220/230/240V a.c. at 50/60Hz
110V a.c. at 50/60Hz

Nominal Loading @ 230V - 2kW (8.7A)
@ 110V - 1.4kW (12.7A)

Fuses Chassis
230/240V 10A, Part No.380003, (x2)
400mA, Part No.696181, (x1)
220V 13A, Part No.380002, (x2)
400mA, Part No.696181, (x1)
110V 16A, Part No.111940, (x2)
800mA, Part No.380004, (x1)

Relay board
T2A, 250V (x1)

Dimensions

Autoclave Width 460mm
Length 461mm
Height 360mm

Chamber Diameter 200mm
Length 348mm (max)
Capacity 10.6 litres

Trays Width 183mm
Length 282.6mm
Height 17mm

Tray Loading 1.5 kg per tray

Weight (approx.)
Net 27.5kg
Shipping 32.0kg

Safety standards

IEC 1010-1:1990
IEC 601-1:1977
BS5724:Part 1:1979
ESCHLE (Second Edition 1986)
IEC 601-1-2 (1993)


Sterilizing Data


Sterilizing time
At 134/137°C 3 mins 20 sec.
At 121/124°C 15 mins


Typical overall cycle
time (D indicates
drying included) 134°C : 13 minutes
134°C : 30 minutes (D)
121°C : 24 minutes
121°C : 41 minutes (D)


Note: Overall cycle times may vary depending on machine and loading conditions.


Symbols

 For use with alternating current

 Caution Hot Surface

 Caution refer to accompanying documents

 Sterilising cycle without drying phase (NB. temperature = cycle temperature)

 Sterilising cycle with drying phase (NB. temperature = cycle temperature)

Nominal Operating pressures:
134°C cycle - 3.14 bar abs
121°C cycle - 2.11 bar abs

Water reservoir capacity 2.0 litres

**TECHNICAL DATA
(Long Version)**

Electrical Data

Supply 230Vac at 50/60Hz
 Nominal Loading @ 230V - 2.75kW (12A)
 Fuses Chassis
 15A, 250V, (x2) Part No. 301871
 400mA, Part No. 696181
 Relay board
 T2A, 250V (x1)

Dimensions

Autoclave Width 460mm
 Length 650mm*
 Height 360mm
 * Feet spaced to fit 600mm worktop
 Chamber Diameter 200mm
 Length 500mm (max)
 Capacity 15.6 litres
 Trays Width 180mm
 Length 457mm
 Height 24mm
 Tray Loading 3.0 kg per tray
 Weight (approx.)
 Net 35.5kg
 Shipping 40kg

Safety standards

IEC1010-1 (1990)
 IEC 601-1-2 (1993)

Sterilizing Data

Sterilizing time
 At 134/137°C 3 mins 20 sec.
 At 121/124°C 15 mins
 Typical overall cycle 134°C : 13 minutes
 time (D indicates 134°C : 30 minutes (D)
 drying included) 121°C : 24 minutes
 121°C : 41 minutes (D)
Note: Overall cycle times may vary depending
 on machine and loading conditions.

Nominal Operating pressures:
 134°C cycle - 3.14 bar abs
 121°C cycle - 2.11 bar abs

Water reservoir capacity 2.0 litres

Symbols



For use with alternating current



Caution Hot Surface



Caution refer to accompanying documents



Sterilising cycle without drying phase (NB. temperature = cycle temperature)



Sterilising cycle with drying phase (NB. temperature = cycle temperature)

PART 1 INTRODUCTION

GENERAL (Fig. 1)

1.1 This Manual contains descriptive, maintenance and spare parts information for the SES 2000 Autoclave.

1.2 The autoclave is a portable, electrically operated steam unit designed for sterilizing unwrapped instruments, utensils and other items. It operates automatically at the touch of a single programme selector touch button, and has four programmes 134°C and 121°C, both with and without drying.

1.3 The autoclave is available with short or long chambers and with or without an integral printer for recording details of the sterilizing cycle. Details of the printer are given in Appendix A.

1.4 Some of the information in this manual refers to models built to comply with the Medical Devices Directive and carry the CE mark to indicate compliance. Where the section of this manual refers only to these models it is marked 'CE ONLY'

ASSOCIATED PUBLICATION

1.5 Separate installation and user instructions are given in the SES 2000 Autoclave Instructions for Use, ST-IM30.

SERVICING

1.6 Ensure that routine servicing is carried out at regular intervals by either Eschmann trained personnel or suitably trained engineers only, otherwise the warranty could be infringed.

1.7 Keep the Instructions for Use and this Service Manual readily accessible for reference purposes prior to and during operation, cleaning and servicing of the autoclave.

CAUTION

In common with other systems containing static water reservoirs, water used in this unit can become contaminated over a period of time, or following an aborted cycle, and should be treated as a potential risk of infection.

1.8 Eschmann recommend filling the reservoir with 'Sterile Water for Irrigation'. This is low in dissolved solids and has a low microbial count. In the U.K. the Department of Health recommend that 'Sterile Water for Irrigation' is used in bench-top Autoclaves (NHS Estates document HTM2031).

If 'Sterile Water for Irrigation' is not being used then Eschmann strongly recommend the use of either distilled water, deionized water, purified water or water treated by the reverse osmosis process. These types of water are low in dissolved solids and can help reduce the effects of tap water detailed below.

DO NOT USE TAP WATER, this is high in dissolved solids and can deposit lime scale, block filters and cause damage to the pressure vessel.

Eschmann also recommend that the reservoir is drained, allowed to dry and is refilled on a weekly basis, with the type of water detailed in 'a' (or 'b') above. At every service interval the reservoir **must be removed, be thoroughly cleaned and dried**, and then refilled. This will reduce the build-up of contaminants in the water that may cause blocked filters and/or damage to the pressure vessel. Your local Health Authority may suggest that you change the reservoir water more frequently. Eschmann advise you to follow your local Health Authority's recommendations.

1.9 Check the drain tap is not damaged or leaking and return the tube and drain tap into its location under the autoclave to prevent damage or accidental opening.

IMPORTANT NOTE

If the drain tap is found to be damaged or leaking, replace it **as soon as possible** (order Part No. 380010 directly from Eschmann). When fitting the new tap, drain the reservoir first and ensure it is placed on the drain tube correctly, see Fig. 3.

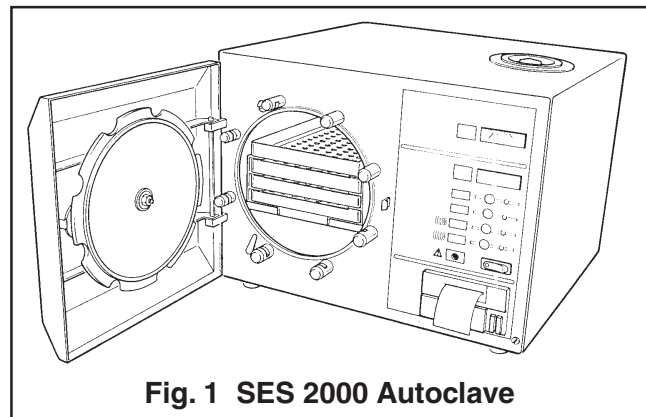


Fig. 1 SES 2000 Autoclave

PART 2 DESCRIPTION
GENERAL (Fig 2)

2.1 The autoclave is a portable steam unit heated by a single element and can be supplied to suit any of the mains supplies shown in Technical Data.

2.2 The unit is electronically controlled and offers a selection of sterilizing programmes as follows:

- 134°C without the drying phase
- 121°C without the drying phase
- 134°C with the drying phase
- 121°C with the drying phase

For sterilizing pressures and drying times refer to Technical Data.

2.3 The required sterilizing programme is selected and started by pressing the appropriate programme button on the front panel of the unit, following which the sterilizing/drying cycle proceeds automatically until complete. If the autoclave has a printer, the printer will start automatically when the programme button is pressed.

2.4 Indication of cycle status is provided by a digital display. If an error should occur during a cycle this also is indicated by the digital display.

OPERATING FEATURES (Figs 2, 3 and 4)

2.5 The following equipment, designed for control and/or protection, is incorporated in the autoclave:

- Pressure Gauge (Fig. 3 item 3). This is used to indicate pressure inside chamber.
- Process Display Window (Fig. 2 item 1). The digital display indicates the temperature inside the chamber and also provides simple messages for the user which indicate the stages through the cycle, and also error conditions, should any occur.
- Four Programme Selector Buttons (Fig. 4, item 15). These are used to select and start a particular cycle. They can also be used to place the machine in the 'Demonstration' or 'Engineering' mode as described later.
- Green Light Emitting Diodes (LED's) (Fig. 4 item 16). There are four LED's and these are used primarily to indicate the point at which the required sterilizing cycle can be selected and started and, when this has been done, to indicate which particular cycle is in progress.
- Power On/Off Switch (Fig. 4 item 17). This switch controls mains power supply to the unit.
- Overheat Warning Lamp (Fig. 4 item 18). The illumination of this warning lamp indicates that the protective thermal fuse (Fig. 4 item 7) has operated.
- Door Latching Handle (Fig. 2 item 4). This handle operates the door mechanism to secure the door in the locked position against the chamber mouth.

- Door Secondary Latch (Fig. 2 item 6). This engages a safety catch to ensure the door does not fly open should there be residual pressure in the chamber when the door latching handle is operated. It is also used to keep the door slightly open during the drying part of the cycle.
- Door Interlock Microswitch (Fig. 4 item 6). This is used to signal to the controller that the door is properly closed. It is operated via a simple adjustable mechanism and should operate just as the door becomes fully closed.
- Pressure Door Lock (Fig. 3 item 7). This is a safety device designed to ensure that the door cannot be opened if the internal chamber pressure exceeds approximately 0.2 bar (3.0 lbf/in²). The device comprises a spring-loaded plunger driven by the chamber pressure via a rubber diaphragm.
- Solenoid Door Lock (Fig. 4 item 22) 'CE ONLY' see note page 38. This lock prevents the door being opened by the operator, once the cycle has been started. The lock holds the door closed until the sterilizing cycle is complete. It will also keep the door closed under all fault conditions. As absence of power to the unit constitutes a 'fault' this also means that the unit power switch must be switched 'on' in order to open the door.

Note: If it is necessary to override the electrical door lock to clear an error code, this is done by switching off the power switch then, after a few seconds, switching it back on again while pressing and holding any one of the programme selector buttons on the front panel.

- Water Reservoir (Fig. 2 item 17). This is used to hold distilled, deionized, or purified water before being admitted to the chamber via the water fill valve, and to receive the hot water and steam vapour emitted from the chamber towards the end of the cycle, via the discharge valve.
- Heating Element (Fig. 4 item 1). This consists of a single immersion element inside the chamber. It is controlled via the solid state relay and heater thermostat. Refer to the Technical Data for heater element loading.
- Solid State Relay (Fig. 4 item 8) 'Non-CE Units' see note page 38. This is switched on and off by the controller as necessary and is the means of controlling the heater output. The solid state relay is fitted on the protection relay printed circuit board which is mounted on the internal bulkhead and is rated at 25A, 400V (repetitive reverse blocking voltage) or such as to be suitable for use on a 230V a.c. supply.
- Solid State Relay (Fig. 4 item 8A) 'CE ONLY' see note page 38. On CE units the Solid state relay is fitted on the relay protection board.
- Mechanical Relay (Fig 4 item 21) 'CE ONLY' see note page 38. This relay isolates the heater circuit

PART 2 DESCRIPTION

- from the electrical supply prior to cycle start, and following cycle completion, to give additional protection.
- ❑ Heater Cycling Thermostat (Fig. 4 items 2 and 3). This is connected in series with the solid state relay to the heating element. It is operated by a fluid-filled capsule clamped to the heating element which will cause the thermostat cut-out device to operate if the heater surface temperature exceeds a preset limit, safeguarding the autoclave. The cut-out is self-resetting and will remake when the temperature drops. Note that operation of the thermostat cut-out during the drying phase of the cycle is quite normal.
 - ❑ Thermal Fuse (Fig. 4 item 7). This is connected so as to remove power from the heater if a serious overheating condition should occur. Note however that operation of this device is unlikely to occur since the heating element is already protected by the heater cycling thermostat.
 - ❑ Fuses (Fig. 4 items 9 and 10). The unit has four fuses as follows:
 - ❑ Three fuses on the rear panel of the cabinet, rated as shown under Technical Data. The two larger fuses are connected into the 'mains' supply to the unit. The smaller fuse protects the primary circuit of the transformer.
 - ❑ A fourth fuse, on the printed circuit board and rated at 2A, protects the secondary circuit of the transformer and other parts of the controller.
- Note:** Units with a printer have an extra fuse which is fitted on the printer PCB.
- ❑ Transformer (Fig. 4 item 11). This converts the incoming mains voltage to 20V a.c. to operate the controller and the water fill and discharge valves. A non-resetting thermal fuse is fitted in the transformer secondary; check for secondary 'continuity' when fitting a replacement transformer.
 - ❑ Water Fill Valve (Fig. 3 item 1). This valve is used to control the water fill sequence. It is electrically operated from a 24V d.c. supply which is generated and signalled from the controller.
 - ❑ Discharge Valve (Fig. 3 item 2). This valve is used principally at the end of the sterilizing cycle to allow water and steam vapour from the chamber to pass back into the reservoir. It is also operated at other times during the cycle. The valve is electrically operated from a 24V d.c. supply generated on the controller board.
 - ❑ Printer Interface Board (Fig. 4 item 20). This board is fitted in autoclaves which have a printer. The board interfaces the printer with the integrated microprocessor-based control board.
 - ❑ Air Valve (Fig. 3 item 6). At the start of a cycle the chamber is full of air, and for a satisfactory result almost all of this has to be removed. This is done by a small air valve. This valve contains a ball and spring which allows air displaced by the steam generated in the chamber to pass out into the reservoir. Once steam starts to pass the ball, the ball then lifts and seals. A small 'bleed' remains, however, and it is quite normal for small quantities of steam to escape into the reservoir throughout the cycle.
 - ❑ Safety Valve (Fig. 3 item 5). This is fitted on the manifold at the rear of the chamber, and is factory set to release excess pressure from within the chamber. It is a primary safety device and should not be readjusted.
 - ❑ Temperature Sensor (Fig. 4 item 4). This is used to sense the chamber temperature and is fitted on the manifold in a position where the manifold is exposed to a small volume of steam bled through the air valve. This device with its associated leads, mounting plate and connector, together form a single assembly. The sensor controls the temperature within the chamber and also the display temperature.
 - ❑ Thermocouple Entry Port (Fig. 4 item 19). This can be used to insert a thermocouple into the chamber 'drain line' to allow the operating temperature to be measured and adjusted if necessary.
 - ❑ Water Drain Pipe (Fig. 3 items 8 and 9). This provides a means of emptying the reservoir for cleaning or for transportation.
 - ❑ PCB Controller Board (Fig. 4 item 12). The autoclave has an integrated microprocessor-based controller. The controller handles every aspect of management of the machine which includes operation and control of the digital display, the light emitting diodes and response to the programme selection push buttons. The controller receives information from the temperature sensor and from the door interlock switch and is able to detect a number of errors, and the times relative to the cycle run when these occur. In addition to controlling the sterilizer in the user mode, the controller also supports a 'demonstration' and an 'engineering' mode (see Special Operating Modes). The controller operates the heater via the solid state relay and also controls the operation of the water fill and discharge valves. A detailed knowledge of the operation of the controller is not necessary in order to service the autoclave; it is a replaceable sub-assembly and should only be changed as a last resort.

PART 2 DESCRIPTION

- ❑ Integral Printer (Fig. 2 item 22). If the autoclave has a printer, it will start automatically when the programme button is pressed and will print out a hard copy of the sterilization cycle. Details of the printer are given in Appendix A to this Manual.

OPERATION CYCLE

2.6 A detailed knowledge of the operation of the autoclave is not necessary to be able to repair it effectively; however, a basic understanding of the various processes of the unit operation which occur during a cycle is given in the following paragraphs.

Operation

CAUTION

Ensure that the reservoir is filled with water before switching-on.

Note: When filling the reservoir, water treated by reverse osmosis can be used as an alternative to distilled, or deionized water.

2.7 Power to the unit is switched on by selecting the power switch (0-I) to I. If the chamber door is open there now follows a single high-pitched audible signal accompanied by the display 'SES', followed by the number of cycles, and finally 'ready' (or time of day if printer fitted) in the display window.

2.8 If the door is closed, when power is switched on, the display will alternate between 'test' and 'door'. In order to continue with the cycle the door must be opened, at which point the display will change to 'ready' (or time) and the four green indicators will come on.

2.9 After the work trays have been put in the chamber and the door closed, a programme can be selected and initiated by pressing one of the programme selector buttons. If the autoclave has a printer it will automatically start when the programme selector button is pressed.

2.10 When the door is closed, with power switched on, this is sensed by the controller via the door interlock switch. If any attempt is made to open the door once the cycle has begun, the display ERR2 will appear, and an audible signal will sound. Under these circumstances it is necessary to switch the autoclave off and clear the error as detailed in section 3.41.

2.11 On selecting the programme, 'FILL' will be displayed, indicating that the cycle has begun. Once the chamber has filled with water from the reservoir, the display will change to 'HEAT'.

2.12 If all conditions are satisfactory, the controller will set-up the operating parameters for the cycle selected, and will switch on the heater.

2.13 The heater is controlled by a system which ensures that the operating temperature is reached with minimal overshoot. Initially the heater will be 'on' continuously and the measured temperature will be displayed. Note, however, that the system does not register temperatures below 92°C; hence the symbol 'HEAT' will appear and remain on display until a temperature of 92°C is reached.

2.14 Temperatures are displayed and measured to 0.1°C. In addition, the controller uses signal averaging to ensure a stable, accurate display.

2.15 Control of the cycle is now fully automatic with temperature information being collected via the temperature sensor. Timing is controlled by the controller and cycle times cannot be adjusted. By comparing measured values with known time/temperature relationships, the controller is able to detect faults and display them as error codes, this is accompanied by an audible warning signal.

Note: Pressing the bottom 121°C button will display the cycle counter.

2.16 To ensure efficient sterilization, the autoclave operates at temperatures slightly above the minimum recommended. Hence, the operating temperature for the 121°C cycle is set to 122.5°C, and the 134°C cycle is set to 135.5°C.

2.17 As the cycle enters the sterilizing phase the display shows an 'S' (flashing) as a prefix to the displayed temperature. At the end of the sterilizing phase the heater is turned off and the discharge valve is opened. At this point, a certain amount of noise from the reservoir is quite normal.

2.18 Once the controller detects that chamber temperature has fallen to a safe level, the flashing display 'End' appears and an audible signal sounds to indicate that the cycle is complete. When the chamber door is opened the display will show 'ready'.

Note: If the autoclave has a printer, the printout will include the following details:

- ❑ Manufacturer's name
- ❑ Autoclave type and serial number
- ❑ Sterilization cycle type e.g.. 134°C without drying
- ❑ Date and time for the start of sterilization cycle
- ❑ Counter indication (five digits with leading zeros)
- ❑ Sterilization cycle time and temperature information
- ❑ Sterilization cycle ended message
- ❑ Time and date for the end of the sterilization cycle

Operating information relating to the printer is given in Appendix A to this Manual.

PART 2 DESCRIPTION

2.19 The overall time for the cycle is not fixed and depends on many factors such as the supply voltage, the load and the ambient temperature. However, the controller will ensure a satisfactory sterilization cycle even when these factors vary over wide ranges.

2.20 If a cycle employing a drying phase is selected, operation to the end of the sterilizing phase is as described above. After discharge of steam and water back into the reservoir, however, the display 'dry' appears accompanied by a rapid intermittent audible signal over a two second period to indicate the beginning of the drying phase. At this point the operator should first open the chamber door then push it towards the closed position again until it just rests lightly against the door safety catch. This leaves a sufficient gap to allow vapour to escape.

2.21 The drying phase is about 17 minutes long during which the heater is operated at low power. Operation of the heater thermostat is quite normal during this period. At the end of the drying phase the display 'End' will appear for approximately 10 seconds followed by 'ready', assuming that the door has been opened as described in section 2. 20.

DISPLAY MESSAGES

2.22 Throughout a given cycle the following symbols may appear as a digital display:

Display	Meaning
ERR 2	Door opened after cycle has been started
door/test	Test door interlock switch (see section 2. 23)
door, then cycle counter, then ready	Chamber door open and a cycle button has been pressed (audible beep given)
Time of day or 'rEAdY'	Programme can now be selected (printer version shows 'Time', non-printer version shows 'rEAdY')
FiLL	Chamber being filled
HEAt	Chamber temperature below 92°C
92-136	Heating to sterilizing stage
S-135.5	'S' flashing, indicates sterilizing begun and timing started
cond	Steam being discharged and condensed
* dry	Load being dried
End	Cycle complete
cycle counter	Pressing the bottom 121°C button after a cycle has started will display the cycle counter

* If programme 'with drying' is selected

PART 2 DESCRIPTION

ERROR INDICATION

General

2.23 If an error should occur during a cycle, one of the following error code symbols will be displayed:

Display	Cause
* 'ELECT'	Temporary failure of mains power supply to unit
LoH2O	Water has failed to enter chamber from reservoir
H2O	Water level in chamber has dropped slightly
door/test	Door closed and power on
ERR2	- Door opened after cycle started - Door not fully closed at beginning of cycle - Door switch faulty (see door/test)
Error	- Heater not working - Temperature either excessively high or low - Fault with microcomputer system - Low temperature during sterilization

* The display 'ELECT' will occur at any time after switching-on power and beginning a cycle if the power supply has been interrupted and then restored.

2.24 If an error occurs during a cycle, the controller will cancel the cycle (see Fault Diagnosis, and Errors and Error Clearing in Part 3).

Note: If the autoclave has a printer, and if an error occurs during a sterilization cycle, the printer will printout the date and time, the message 'Cycle Failed' and the appropriate error code:

- Err 1* Clock Fault or Faulty temperature/channel
- Err 2 Door open during cycle
- Err 3 Chamber did not fill with water (LoH2O)
- Err 4 Water loss early in cycle (H2O)
- Err 5 No heat
- Err 6 Control temperature low
- Err 7 Control temperature high
- Err 8 Monitor temperature low
- Err 9 Monitor temperature high

Operating information relating to the printer is given in Appendix A to this Manual.

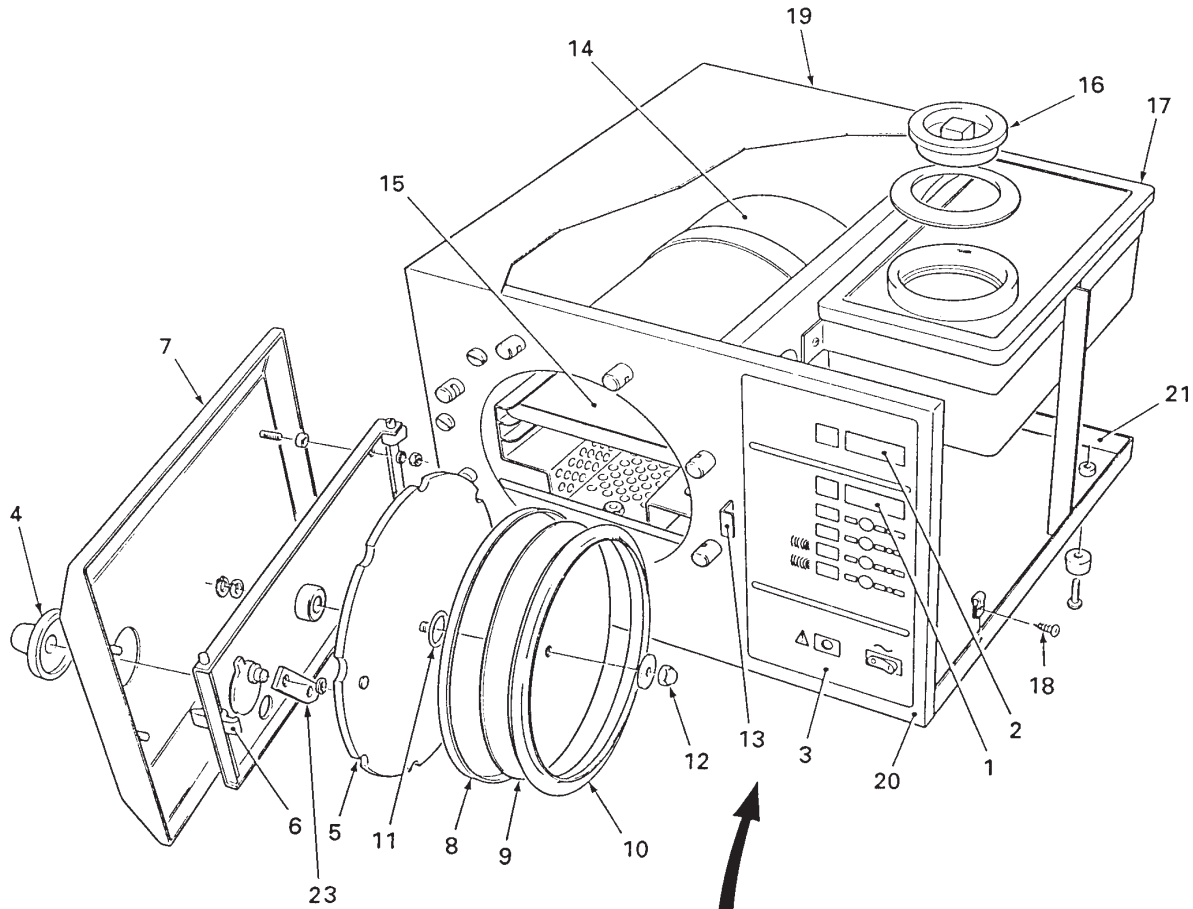
Overheating

2.25 In the unlikely event of overheating, the red overheat warning lamp on the front panel will illuminate and the heating element will be switched-off by a thermal cut-out device.

Schematic diagrams

2.26 Appendix B shows a schematic diagram of the 'Pipework and Valves' and Appendix C shows a schematic diagram of the 'Electrical connections'.

PART 2 DESCRIPTION

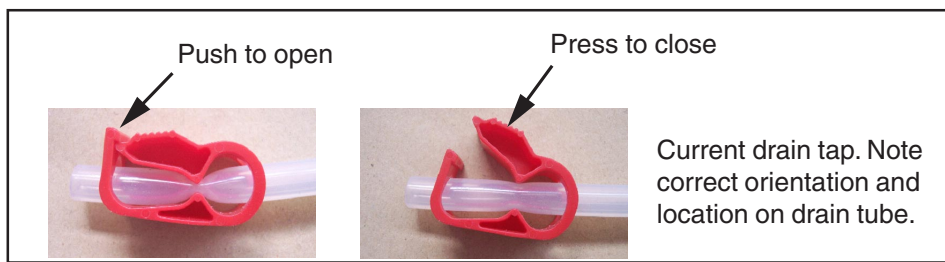
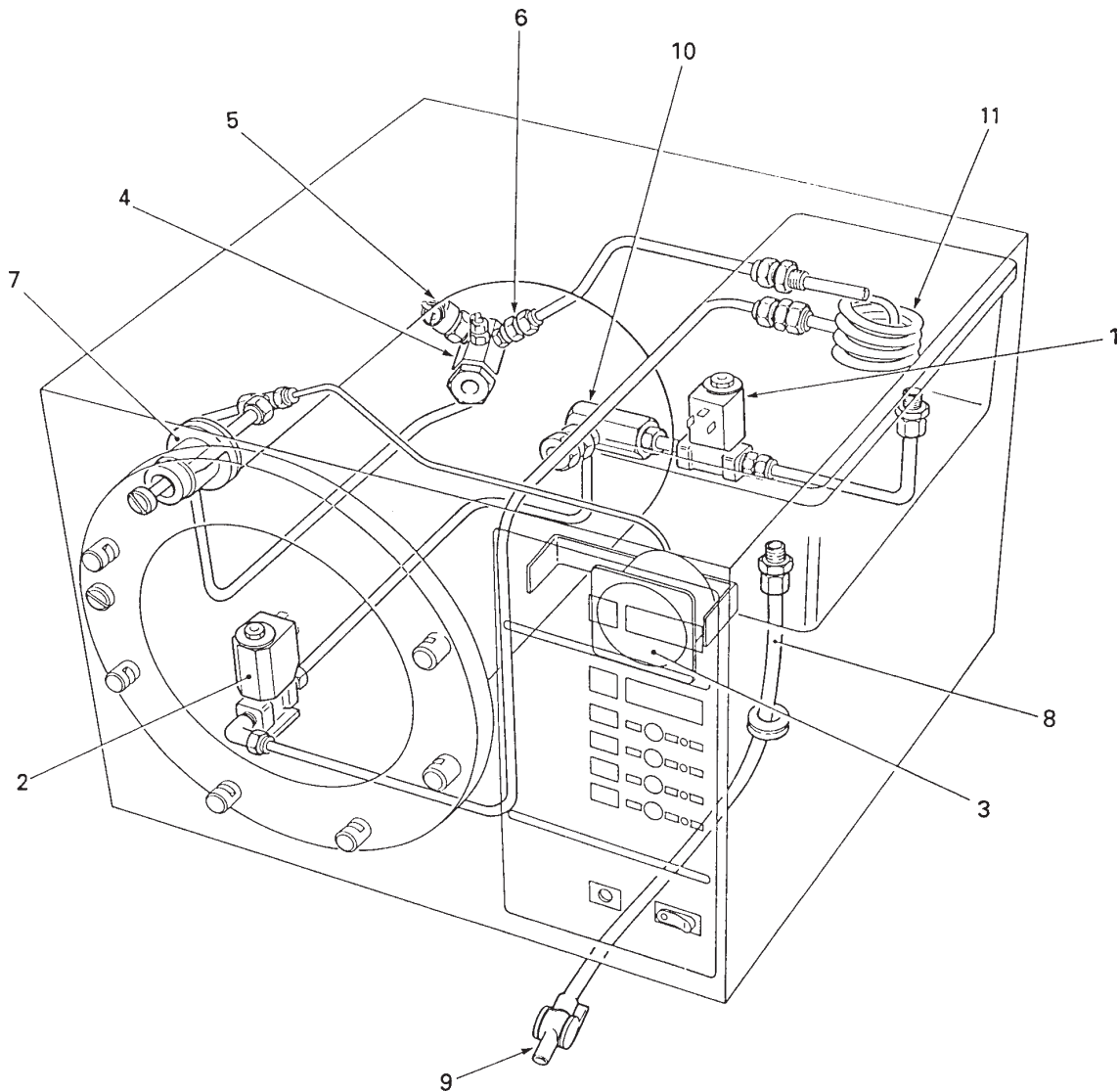


- 1 Process display window
- 2 Pressure display window
- 3 Control panel
- 4 Door latching handle
- 5 Pressure door
- 6 Secondary door latch
- 7 Door cover
- 8 Seal retaining rim
- 9 Seal retaining disc
- 10 Door seal
- 11 'O'-ring (on older models)
- 12 Aerotight nut #
- 13 Door safety catch
- 14 Pressure chamber
- 15 Work tray
- 16 Reservoir access cover
- 17 Reservoir
- 18 Cover screw (self-tapping)
- 19 Unit cover
- 20 Front panel
- 21 Chassis
- 22 Printer
- 23 Link

Now replaced by nut and spring washer, see Parts List 2, item 27.

Fig. 2 Autoclave General Arrangement

PART 2 DESCRIPTION



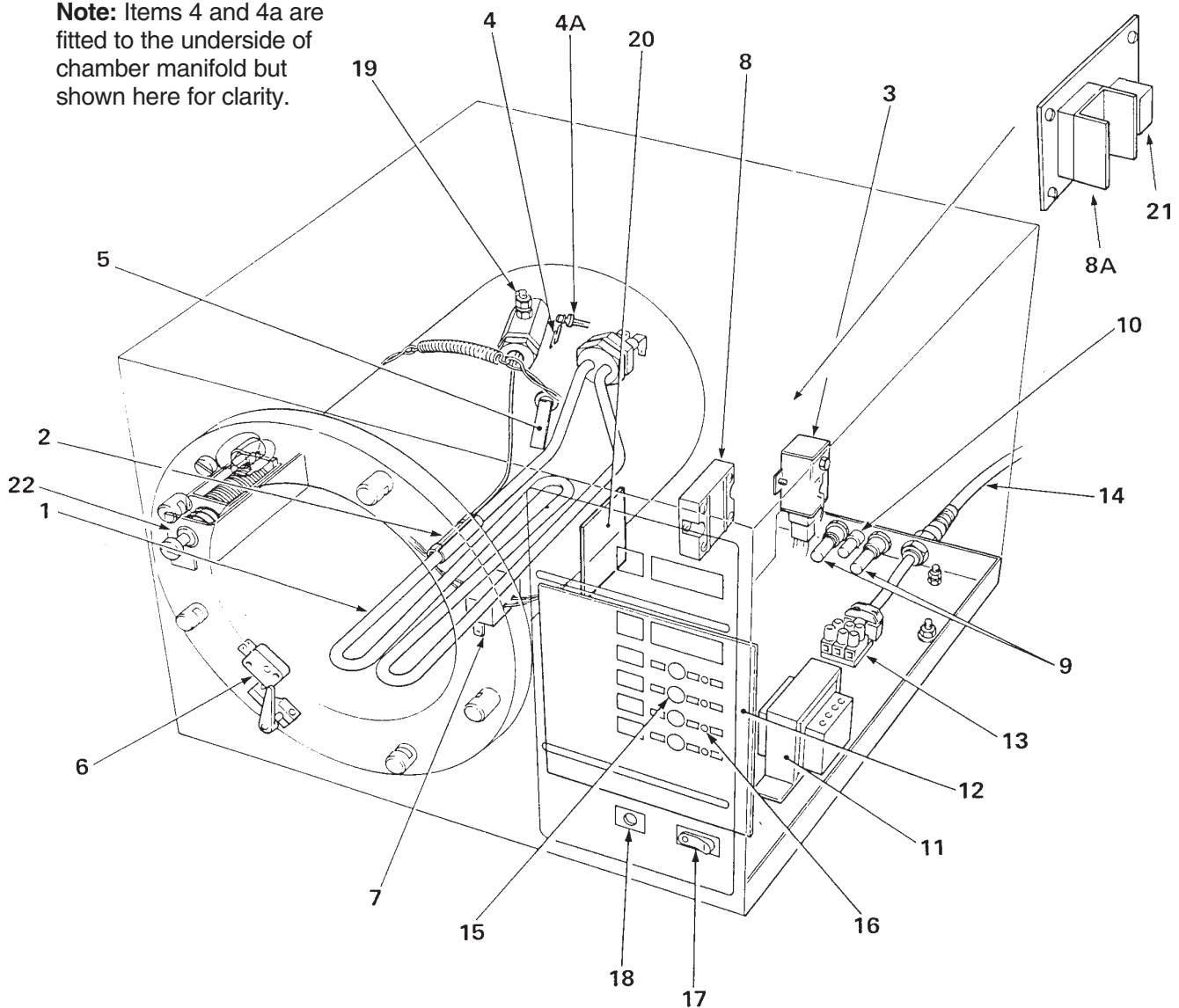
- | | | | |
|---|------------------|----|----------------------|
| 1 | Water fill valve | 7 | Pressure door lock |
| 2 | Discharge valve | 8 | Reservoir drain tube |
| 3 | Pressure gauge | 9 | Drain tap |
| 4 | Chamber manifold | 10 | Filter unit |
| 5 | Safety valve | 11 | Coil |
| 6 | Air valve | | |

NOTE: On the latest units the copper pipes and fittings have been replaced by plastic tubing and modified fittings. Refer to the parts list for more details.

Fig. 3 Autoclave: Pipes and Valves

PART 2 DESCRIPTION

Note: Items 4 and 4a are fitted to the underside of chamber manifold but shown here for clarity.



- | | |
|------------------------------|---|
| 1 Heating element | 11 Transformer |
| 2 Thermostat sensor bulb | 12 PCB (controller) |
| 3 Cycling thermostat | 13 Terminal block |
| 4A Temperature sensor* | 14 Power supply cable |
| 4 Sensor retaining plate | 15 Programme selector buttons |
| 5 Water level sensor | 16 Light emitting diodes (LED's) |
| 6 Door interlock microswitch | 17 Power on/off switch |
| 7 Thermal fuse | 18 Overheat warning lamp |
| 8 Solid state relay | 19 Thermocouple entry port |
| 8A Solid state relay | 20 Printer interface board |
| (CE ONLY see note page 38) | 21 Mechanical relay (Relay protection board) (CE ONLY see note page 38) |
| 9 Fuses (10A, 15A or 16A) | 22 Solenoid door lock (CE ONLY see note page 38) |
| 10 Fuse (400mA or 800mA) | |

* Autoclaves which incorporate a printer are fitted with two temperature sensors

Fig. 4 Autoclave: Heater and Process Controls

PART 3 MAINTENANCE

FUSES (Fig. 4 and 8)

3.1 The autoclave is protected by four fuses. Three mains supply fuses are fitted on the autoclave back panel (Fig. 4). The fourth fuse (process and control circuits) is fitted on the controller board inside the autoclave (Fig. 8). Printer versions have an extra fuse on the printer PCB. All fuse ratings are given in Technical Data, pages 4 and 5.

FAULT DIAGNOSIS

3.2 The following table sets out a number of typical ‘faults’ which could occur, and indicates likely causes and how to rectify them. For maintenance procedures refer to Parts Replacement And Adjustment. Cross references in the ‘Remedy’ column refer to paragraphs under Part Replacement and Adjustment.

WARNINGS

Switch-off and disconnect mains power supply before removing the autoclave cover, or doing maintenance procedures. During certain procedures mains voltage may have to be present with the cover removed and extreme care should be taken to avoid contact with mains voltage.

Check that chamber is at atmospheric pressure before opening the door.

Should the door be opened beware of possible very hot water or steam escaping from the chamber.

Fault Diagnosis Table

Fault	Possible Cause	Remedy
(1) Nothing happens when power switched on (No display).	(a) Mains supply failure. (b) Main fuses blown (rear panel). (c) Faulty power switch. (d) Thermal fuse blown (e) Transformer failed. (f) Short circuit on 24V circuit.	(a) Check mains supply, also plug and supply cable for loose connections or breaks. (b) Replace fuse(s)*. (c) Replace power switch. (d) Replace thermal fuse. (e) Check transformer secondary voltage (20V a.c. rms). Replace transformer if output is zero (section 3.6). (f) Check sensor, fill valve, vent valve etc. for short circuit Replace where necessary.
(2) Door cannot be opened.	(a) Pressure door lock jammed.	(a) Replace pressure door lock (section 3.8). To open chamber door, disconnect body from unit (section 3.10) and pull it backwards so that the locking bolt clears the door.

***Note:** Blown fuses can indicate further problems. Always investigate the reason for any fuse blowing, but bear in mind that fuses can ‘age’ and blow for no other reason.

Continued

PART 3 MAINTENANCE

Fault	Possible Cause	Remedy
	(b) Pressure in chamber.	(b) Switch-on power to release pressure in chamber.
	(c) Vacuum in chamber.	(c) As (b) to open door then clean or replace air valve (section 3.9).
(3) Chamber will not fill ('LoH2O' displayed).	(a) No water in reservoir.	(a) Fill reservoir.
	(b) Water fill valve or associated pipes blocked	(b) Empty reservoir, strip pipework and clean. Clean reservoir. Refill with distilled water.
	(c) Air valve stuck in closed position	(c) Replace air valve (section 3.9)
(4) Display still shows 'door' after programme selector button pressed	(a) Door not correctly closed	(a) Close door
	(b) Door interlock microswitch out of adjustment	(b) Adjust switch lever position, or fit new microswitch if adjustment seems to be correct (section 3.10)
(5) Display shows 'ERR 2' after programme selector button pressed	(a) Door not properly closed	(a) Clear error as detailed in section 3.41 and restart cycle.
	(b) Door opened after a cycle started	(b) Repeat (a)
	(c) Door switch out of adjustment	(c) Adjust switch lever position, or fit new microswitch (section 3.10).
		WARNING Should door be opened beware of possible hot water leaking from chamber.
(6) Safety valve operates even though temp is below 136°C (See also Fault (15))	(a) Air valve sticking	(a) Clean or replace air valve (section 3.9)
	(b) Safety valve fault	(b) Fit new safety valve (see section 3.50 and 3.51).
	(c) Check calibration of 134°C cycle	(c) See Routine Calibration Procedure (section 3.44)
	(d) Re-calibration needed	(d) As (c) above
	(e) Temperature sensor fault	(e) Fit new temperature sensor (section 3.13)
	(f) Controller fault	(f) Fit new controller board (section 3.7)

Continued

PART 3 MAINTENANCE

Fault	Possible Cause	Remedy
(7) 'LoH2o' or 'Error' displayed before sterilizing temp. reached	(a) No water in chamber	(a) Ensure chamber water level sensor is clear of obstructions. Also, ensure sensor is not dirty or corroded.
	(b) Water fill valve is leaking	(b) Drain reservoir and fit new water fill valve (section 3.14)
	(c) Discharge valve leaking	(c) Strip and clean discharge valve or fit a new one (section 3.14)
	(d) Temperature sensor fault	(d) Fit new temperature sensor (section 3.13)
	(e) Solid state relay failed	(e) Fit new solid state relay (section 3.15 or 316)
	(f) Heater failed	(f) Fit new heater if resistance of element is not approx. 30ohms
	(g) Controller fault	(g) Fit new controller board (section 3.7)
(8) 'H2O' or 'Error' displayed after sterilizing temperature reached and fall below set temperature	(a) Steam leak	(a) Carefully check for steam leak and rectify
	(b) Water fill valve leaking	(b) As for Fault (7) (b).
	(c) Discharge valve leaking	(c) As for Fault (7) (c).
	(d) Temperature sensor fault	(d) As for Fault (7) (d).
	(e) Solid state relay failed (No voltage across heater)	(e) As for Fault (7) (e)
	(f) Heater failed	(f) As for Fault (7) (f)
	(g) Controller fault	(g) As for Fault (7) (g)
	(h) Voltage regulator not properly mounted, or loose	(h) Secure voltage regulator (see also section 3.20)
(9) Temperature differs and 'Error' displayed	(a) Recalibration required	(a) Follow Routine Calibration Procedure (section 3.44)
	(b) Air valve partially blocked	(b) Clean or fit new air valve (section 3.9)
	(c) Controller fault	(c) As for Fault (7) (g).
	(d) Voltage regulator not properly mounted, or loose	(d) As for Fault (8) (h).
	(e) Temperature sensor fault	(e) Fit new temperature sensor (section 3.13) and recalibrate (section 3.44)

Continued

PART 3 MAINTENANCE

Fault	Possible Cause	Remedy
(10) No discharge of steam/water at end of cycle	(a) Discharge valve fault	(a) Test valve, using 'Engineering Mode'. Replace if faulty
	(b) Wiring fault	(b) Ensure connections to discharge valve are sound
	(c) Blockage in discharge line	(c) Strip pipework and clean
	(d) Controller fault	(d) Replace controller board (section 3.7)
	(e) Filter blocked	(e) Clean or replace filter (section 3.23)
(11) Cycle time excessive compared with usual value	(a) Low mains voltage	(a) Check supply to autoclave
	(b) Autoclave overloaded	(b) Avoid overloading. See tray loading shown in Technical Specification.
	(c) Slow discharge at end of cycle	(c) See Fault (10) (c) and (e)
(12) Unusual display when first switching on power	(a) Controller failed to re-set properly	(a) Switch-off power, wait for approx. 5 seconds and switch on again
	(b) Controller fault	(b) Replace controller board (section 3.7)
(13) Display shows 'ELECT'	(a) Temporary mains failure during cycle	(a) Carry out error cancellation procedure (section 3.41) then reselect and restart cycle
(14) Leakage of water from chamber door and 'H2O' displayed	(a) Door gasket not sealing correctly	(a) Clean mating surface and gasket around door with a soapy cloth. If leakage persists, replace gasket
	(b) Check centre nut and seal	(b) Replace 'O'-ring (Fig. 2 item 11)
(15) Safety valve leaks (See also Fault (5))	(a) Dirt on valve seat	(a) With low pressure in chamber CAREFULLY operate valve by hand. If leakage persists, replace safety valve (see section 3.50 and 3.51).
	(b) Check pressure gauge display to see if sterilizing temperature is set too high	(b) Recalibrate controller board (section 3.44)

Continued

PART 3 MAINTENANCE

Fault	Possible Cause	Remedy
(16) Excessive noise from reservoir during discharge	(a) Positioning of discharge line in reservoir incorrect	(a) Check cooling coil position
(17) Thermal fuse blows and overheat warning lamp illuminates	(a) Failure of heater thermostat cutout to reset automatically (b) Wiring fault (c) Failure of component in solid state relay (d) Thermal fuse fault (These can age with use)	(a) Replace heater thermostat (section 3.12) (b) Look for evidence of short circuits and correct as necessary (c) Change solid state relay (section 3.15 or 3.16) (d) Replace Thermal fuse (section 3.5)
(18) Pressure gauge reads incorrectly (too high or too low)	(a) Gauge fault (b) If gauge reads high - air valve sticking (c) If gauge reads low - thermocouple calibration faulty	(a) Adjust against a known pressure source, or replace pressure gauge (section 3.22) (b) Clean or replace air valve (section 3.9). Check temperature calibration (c) Check temperature with thermocouple and recalibrate (section 3.44)
(19) Door stiff to open	(a) Door mechanism needs lubricating (b) Gasket mating surfaces sticking	(a) Lubricate hinge pivots with silicone compound (b) As for Fault (14) (a)

PART 3 MAINTENANCE

PARTS REPLACEMENT AND ADJUSTMENT

WARNING

Switch-off and disconnect mains power supply before removing autoclave cover, or doing maintenance procedures.

Check that chamber is at atmospheric pressure before opening the door. When the door is opened beware of possible very hot water or steam escaping from the chamber.

IMPORTANT NOTE: On the latest units the copper pipes and related fittings have been replaced by silicone tubing and modified fittings. Please refer to the parts list for details during any part replacement.

Removing Cover (Fig. 2, item 19)

3.3 To remove the cover:

CAUTION

An earth lead is connected between the terminal block and the earth stud inside the rear of the cover. Disconnect the lead before removing the cover completely.

- Unscrew and remove the four cover screws (two on each side) from the casing lower edge.
- Remove reservoir access cover.
- With unit facing towards you, remove the cover - lifting it from the rear of the unit first.

Refitting Cover (Fig. 2, item 19)

3.4 To refit the cover:

- Re-connect the earth lead between the terminal block and the earth stud inside the rear panel of the cover.
- Carefully locate the front upper flange of the cover in the small gap between the stainless steel dividing plate and the front panel of the unit, then lower the cover down in position.
- Refit the four cover screws and the reservoir access cover.

Thermal Fuse (Fig. 4, item 7)

3.5 Detach the two female push-on connectors. Unhook one end of mounting spring and remove thermal fuse assembly. Fit replacement in reverse order and ensure that fuse body is located at the bottom of the chamber about half way between the front and the back.

Transformer (Fig. 4, item 11)

3.6 Detach the transformer connections, noting the position of each one. Remove the transformer securing

nuts and bolts. The replacement transformer should be an identical unit. To install replacement transformer, reverse the removal procedure.

Controller Board (Fig. 4, item 12)

3.7 Note the orientation and position of the plugs connecting the controller board to the unit, and then disconnect them. Remove the bolt securing the controller board voltage regulator to the dividing panel. Remove the four bolts securing the controller board to the dividing panel, and remove the control board, complete with the regulator. To fit replacement, reverse the removal procedure. When mounting the voltage regulator, coat the mating surface with a thin layer of zinc oxide-based heat transfer compound and ensure that the bolt is well tightened. When tightening the controller board securing nuts, ensure that control switches do not foul the holes in the front panel through which they protrude.

Note

- Avoid overtightening the nylon nuts securing the controller
- When a new controller is fitted, it will be necessary to recalibrate it to suit the temperature sensor fitted in the machine (see Routine Calibration Procedure).

Pressure Door Lock (Fig. 3, item 7)

3.8 To remove the pressure door lock for adjustment or replacement proceed as follows: From front of pressure door lock remove screw-slotted locking bolt. Detach plumbing connection from rear of lock body, then slacken the two hexagon headed screws in the lock housing to release lock body. Clean old locking compound fragments out of threaded hole in piston, if re-fitting original lock unit. To fit original or replacement pressure lock unit, proceed as follows:

- Apply a drop of 'Loctite 542' thread lock to female thread only in hexagon shaped piston, then fit lock body into lock housing on chamber neck ring and secure it with the two hexagon headed screws using thread lock (part number 306033).
- Attach and secure plumbing connection.
- Apply a smear of silicone compound (MS4) to shaft only of locking bolt, avoiding the thread.
- Insert locking bolt into front of lock body and screw it into piston thread until bolt head stands 1/2mm clear of cabinet front plate. Ensure that bolt is free to move in and out easily.
- Ensure locking bolt is fully engaged with the door at its maximum extension.

Note

Do not attempt to repair a leaking or otherwise unserviceable door lock.

PART 3 MAINTENANCE

Air Valve (Fig. 3, item 6)

3.9 The air valve is fitted in the manifold at the rear of the sterilizing chamber. To remove the air valve:

- a Remove plumbing connection on reservoir side (hold large hexagon body stationary while removing the pipe nut).
- b Use the small hexagon body to unscrew valve from manifold.

Note

Do not disturb the relationship between the large and small hexagons as this would upset the spring calibration inside the valve.

- c When fitting replacement valve, use PTFE tape to make a leakproof joint.

Note

- ☐ It is recommended that an air valve suspected of unsatisfactory performance is renewed.
- ☐ In an emergency, or where it is known that the valve has been subjected to sticky materials, it can be washed in a solvent such as white spirit, methylated spirit or paraffin. Ensure that the valve is dried thoroughly before refitting it.

Door Interlock Switch (Fig. 5)

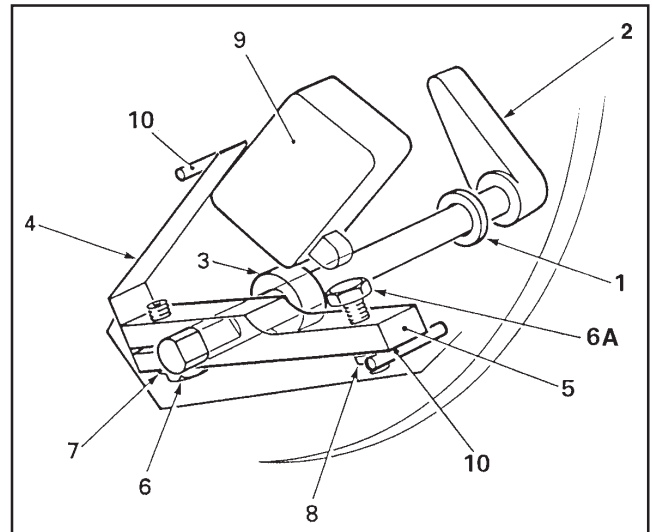
3.10 The door interlock microswitch is operated by an actuator lever. To remove and dismantle the microswitch actuator lever proceed as follows:

- a Loosen clamp screw (6) and slide microswitch actuator lever (5), complete with leaf spring (4), from actuator lever (2), and then remove nylon washer (3).
- b Withdraw actuator lever (2) from the front of the panel, and remove nylon washer (1).
- c Remove clamp screw (6) and washer (7) to release leaf spring (4).
- d Remove nut (8) and striker screw (6A).
- e Inspect, and renew all defective items.

Reassemble and adjust the mechanism as follows:

- f Apply a smear of silicone grease (MS4) to both sides of nylon washer (1) and position it on spindle of actuator lever (2).
- g Apply a little silicone grease on spindle of actuator lever (2) and slide the lever through the front panel. Apply a smear of silicone grease to both sides of nylon washer (3) and position it on spindle of actuator lever (2)

- h Fit leaf spring (4) to microswitch actuator lever (5), with clamp screw (6) and washer (7).
- i Fit striker screw (6A) and nut (8) to microswitch actuator lever (5).
- j Fit microswitch actuator lever (5) to actuator lever (2) ensuring that the mechanism is located between limit stops (10).
- k Ensure leaf spring (4) is positioned and adjusted to keep microswitch actuator lever (5) clear of microswitch (9).
- l While tightening clamp screw (6A) using thread lock (part number 306033), twist levers (2) and (5) apart to minimise any slack between the flats on the spindle and lever.
- m Set microswitch actuator lever assembly by closing the door and revolving the door knob, to lock the door. Using a 5BA spanner, adjust striker screw (6) until the head of the screw just touches the body of the microswitch. Then undo striker screw (6) a ¼ turn and tighten locking nut.
- n Open and close the door and check that microswitch (9) operates correctly.



- 1 Nylon washer
- 2 Actuator lever
- 3 Nylon washer
- 4 Leaf spring
- 5 Microswitch actuator lever
- 6A Striker screw
- 6 Clamp screw
- 7 Washer
- 8 Nut
- 9 Microswitch
- 10 Limit stops

Fig. 5 Door Interlock Switch

PART 3 MAINTENANCE

Solenoid Door Lock (Fig. 4, item 22) CE ONLY see note page 38.

3.11 Maintenance procedures will depend upon whether the malfunction is mechanical (e.g. bolt or return spring sticking) or due to solenoid unit failure. Proceed as follows:

- a Switch-off and disconnect mains power.
- b To remove locking bolt, compress the spring with a suitable tool and open the autoclave door to provide access to the slotted bolt head screw.
- c Grip the solenoid plunger, forward of the E-clip, and insert a screwdriver in the slot of the locking bolt head to remove the locking bolt.
- d Before refitting or replacing the locking bolt apply a little 'Loctite 542' threadlock to the thread of the solenoid plunger.
- e Refit the nylon washer in the correct position.
- f To remove the solenoid unit, proceed as in (b) and (c) and detach the electrical connector from the solenoid coil, then remove the solenoid bracket fixing screws from the chamber head ring. Fit replacement solenoid unit by reversing the removal procedure.

Heater Cycling Thermostat (Fig. 4, items 2 and 3)

3.12 To remove and replace thermostat, proceed as follows:

- a Switch-off and disconnect mains power. Then detach electrical connections from thermostat noting terminals for re-connection.
- b Situated inside the chamber beneath the tray carrier is the clamp which secures thermostat sensor to the heater; carefully remove the clamp.

CAUTION

Do not kink capillary tube.

- c Disconnect thermostat body from dividing panel (2 screws), then carefully unscrew gland from rear of chamber manifold through which the capillary tube, connecting thermostat sensor to thermostat unit, passes.
- d To fit replacement thermostat, reverse the procedure described for removal. Note that it is necessary to use PTFE tape or a suitable sealing compound to make the joint between the gland and the chamber fitting.

Temperature Sensor (Fig. 4, item 4)

Note: Autoclaves which incorporate a printer are fitted with two sensors

3.13 The sensor is mounted on the manifold and retained by a fibre plate. To remove the sensor, slide

the plate out from the manifold and slide the sensors out of the plate. When removing the sensor carefully note the wire colour positions at the plug (i.e. red wire towards edge of controller board). Remove the plug from the controller board. When fitting replacement unit, coat the end of the sensor with a thin layer of zinc oxide-based heat transfer compound and ensure that no dirt or grit enters the mounting hole.

Note: When a new temperature sensor is fitted it will usually be necessary to make some small adjustments to R17, and R14 on the controller board. In addition the autoclave must be re-calibrated (see Routine Calibration Procedure).

Fill and Discharge Valves (Fig. 3, items 1 and 2)

3.14 To remove and replace the fill and discharge valves proceed as follows:

Note: When removing a fill valve, ensure that the reservoir has been drained.

- a Disconnect electrical connections from valve and release plumbing connections at each side.
- b Note carefully the orientation of the valves 'fill' and 'discharge' ports to ensure correct re-connection.
- c Remove pipework from valve, then remove securing screws.
- d Examine the unit. If only the valve coil has failed (e.g. short-circuiting) it can be renewed. The valve can also be stripped and cleaned, although care must be taken to ensure no damage is caused to valve seat or rubber sealing plunger.

CAUTION

Do not lose the small internal springs in plunger.

- e Fit new or refurbished valve in exactly the same way as the original one, making connections as noted in (b).

Solid State Relay (Fig. 4 item 8) Non CE units, see note page 38.

3.15 Remove electrical connections from relay, noting their relative positions, and remove the two securing screws. When fitting a replacement relay unit, ensure that its mating face is coated with a thin layer of zinc oxide based heat transfer compound, also avoid overtightening the connector screws when reconnecting the wiring. (For CE units see 3.16)

Note

- Replacement unit should be rated at 25A, 400V (repetitive reverse blocking voltage) or greater (i.e. it must be suitable for use on 240V rms a.c. supply).

PART 3 MAINTENANCE

- ❑ Replace varistor across mains terminals of solid state relay

**Solid State Relay (Fig. 4 item 8A)
CE ONLY see note page 38.**

3.16 Remove electrical connections from relay board noting their attachment positions. Un-fasten four screws to remove relay board from dividing panel. Un-fasten four screws from behind the board to release the solid state relay unit, together with its heat sink. Un-fasten and remove the heat sink. When fitting a replacement relay unit, coat the face which mates with the heat sink with a thin layer of zinc oxide based heat transfer compound, having first cleaned-off old compound if re-using the original heat sink. Fit heat sink to new relay unit, fit relay to board, and fit board to autoclave dividing panel by reversing the disassembly procedure. Re-connect electrical connections.

**Mechanical Relay (Fig. 4 item 21)
CE ONLY see note page 38.**

3.17 To remove mechanical relay unit cut the plastic cable tie then unplug the relay unit from the relay board. When fitting replacement relay unit, fit a new cable tie.

Heating Element (Fig. 4 item 1)

3.18 To replace heating element, proceed as follows:

- a Remove electrical connections from heating element terminals.

CAUTION
Avoid kinking the capillary tube.

- b Remove sterilizing trays and tray carrier, and remove element clamp from inside chamber, together with heater thermostats sensor and clip.
- c Unscrew and remove large nut from heater mounting boss at rear of chamber.
- d Extract heating element via chamber mouth.
- e Fit replacement heating element by reversing order of removal procedure.

Note

Ensure heating element is horizontal when fitted. Also ensure that a new sealing washer is used and that the nut is fully tightened, to avoid leaks.

Printer Interface Board (Fig. 4 item 20)

3.19 Remove the printer interface board as follows:

- a Disconnect all electrical connections noting their position and orientation for correct reconnection.
- b Disconnect the voltage regulator from the partition wall.

- c Remove two screws securing the interface board to the partition wall, and remove printer interface board complete with voltage regulator unit.

- d Refit printer interface board (complete with rectifier unit) using the reverse removal procedure but note that:

- ❑ The voltage regulator/partition wall contact surface must be smeared with zinc oxide heat transfer compound, and the securing screw is firmly tightened.

Note: If a new printer interface board is fitted, it must be set-up as described in section 3.30.

Voltage Regulators (Fig. 8)

3.20 The voltage regulators form part of the controller board and the printer interface board and must be mounted so that they make good thermal contact with the steel partition. The leads to the voltage regulator are easily broken and if one should snap off at the body of the unit, it can be replaced by a standard 7805 voltage regulator. This avoids the need to change the entire controller. In such a case some re-adjustment of the calibration will be required.

Door Seal (Fig. 2 item 10)

3.21 Open chamber door and remove central airtight nut, stainless steel washer, retaining plate and door seal. When fitting a new door seal, ensure the nut is tight. Check O-ring behind seal spinning and replace if necessary. Use a smear of silicone grease on the O-ring.

Note: Do not allow silicone grease to come into contact with the door seal (Fig. 2 item 10).

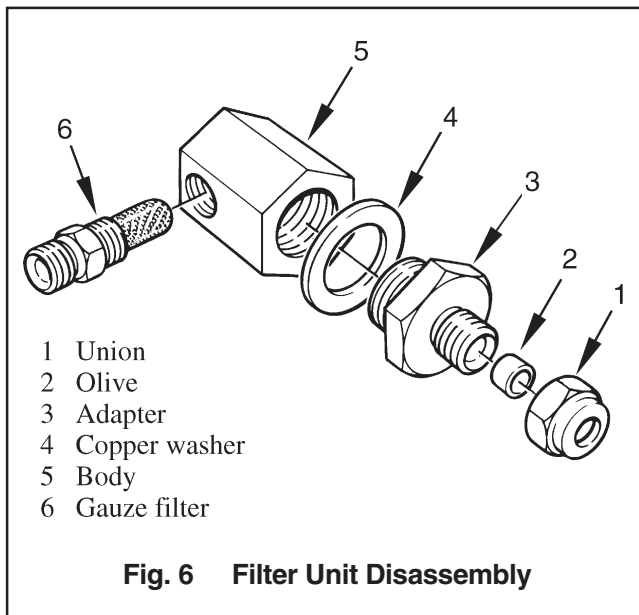
Pressure Gauge (Fig. 3 item 3)

3.22 Ensure chamber is at atmospheric pressure and remove plumbing connection from rear of gauge. Disconnect bracket from panel by removing two nuts, spring washers and nylon spacers. Note that when fitting gauge, the spacers must be replaced between gauge and bracket. Gauge adjustment is possible by rotating the adjusting screw at the rear of the gauge, but this should only be carried out when the chamber is at working pressure (2.2 bar) on the 134°C cycle.

CAUTION

When adjusting the pressure gauge, it is important that the adjustment screw should not be rotated more than a few degrees in either direction. Permanent damage to the mechanism could result if this caution is ignored.

PART 3 MAINTENANCE



Discharge Line Filter (Fig. 3 item 10 and Fig. 6)

3.23 The filter in the discharge line should be removed and cleaned approximately every 12 months as follows:

- a Ensure all water has been discharged from chamber back into the reservoir and switch off unit.
- b Remove filter assembly from discharge line, disassemble components and rinse clean all parts, using distilled water **only**.
- c Allow components to dry, then reassemble filter unit. Ensure that copper washer is correctly positioned with bevel side of washer against filter body. If washer is damaged, renew it.

Printer (Fig. 2 item 22)

3.24 Remove the printer as follows:

- a Disconnect all electrical connections noting their position and orientation for correct reconnection.
- b Remove two screws from the printer securing bracket.
- c Withdraw the printer through the front panel.
- d Refit the printer using the reverse removal procedure.

SPECIAL OPERATING MODES

Demonstration Mode

3.25 Demonstration mode provides a selection of the available display messages for use at exhibitions and for customer education in whatever language has been selected. To enter this mode proceed as follows:

- a Switch off power.
- b Push and hold the 134°C and 121°C (without drying) programme buttons and switch on power.
- c Release programme buttons when messages start to appear:

3.26 To exit the demonstration mode, switch off power to the unit, then switch it on again.

Engineering Mode

CAUTION

Inbuilt protection by the controller is not operational in Engineering Mode.

3.27 To enter the Engineering Mode proceed as follows:

- a Switch off power.
- b Push and hold the 134°C and 121°C 'with drying' programme buttons (the bottom two buttons) and switch on power.
- c Release programme buttons when messages start to appear. The messages, in order are: 8.8.8.8. with a continuous audible signal and all programme selection LED's illuminated, followed by 'count', then the accumulative number of completed cycles, then the error code (see section 3.40) for the last error stored in memory and finally 'Engin'.

Note

In the engineering mode the display will read 'Engin' unless the heater is on, in which case the normal temperature display will show.

3.28 In the Engineering Mode the programme selector buttons and programme indicator LED's function as follows:

- a Button 134°C (without drying). Press to check chamber discharge valve function. If the valve is working, the valve solenoid will be heard to click.
- b Button 121°C (without drying). Press to check water fill valve function. By opening chamber door the water can be seen to flow into the chamber.

Note

Only one of the valves can be energised at a time.

PART 3 MAINTENANCE

- c (CE ONLY see note page 38) Button 134°C (with drying). Press to check the solenoid lock retracts.
- d Button 121°C (with drying). To switch on heater, press and hold in this button until 'HEAT' or (if hot) temperature display appears, then release. To switch off heater, press and hold in this button again until 'Engin' display appears, then release it.

CAUTION

The thermal fuse will 'blow' if the heater is left switched on and the cycling thermostat is faulty.

- e Programme '134°C without drying' LED will illuminate if door switch closes.
- f Programme '134°C with drying' LED will illuminate if chamber water level sensor is immersed.

Note: This condition can be simulated as follows. With the door open and furniture removed check that LED is not illuminated. Then using a long screw driver, short the chamber level sensor to ground (the chamber wall) and check that the LED illuminates.

3.29 To exit Engineering Mode, switch off power to the unit, then switch it on again.

Set-Up Mode

3.30 The set-up procedure will only have to be done if the printer interface board is changed. Once started, the procedure must be completed in full, do not switch-off the power before it has been completed. If a mistake is made, switch-off the power, and start again. On autoclaves fitted with a printer, a printout showing the main items selected within the set-up procedure will be printed when the procedure has been completed.

Switch Identities and Functions (Fig. 7)

3.31 Throughout the set-up procedure, the following switches are used, and they have the following identities and functions:

- Switch 1 (SW1) Indicates 'yes' or 'up'.
- Switch 2 (SW2) Indicates 'no' or 'down'.
- Switch 3 (SW3) Indicates 'accept'.
- Switch 5 (SW5) Initiates the set-up mode, and is fitted in the top left-hand corner of the controller board.

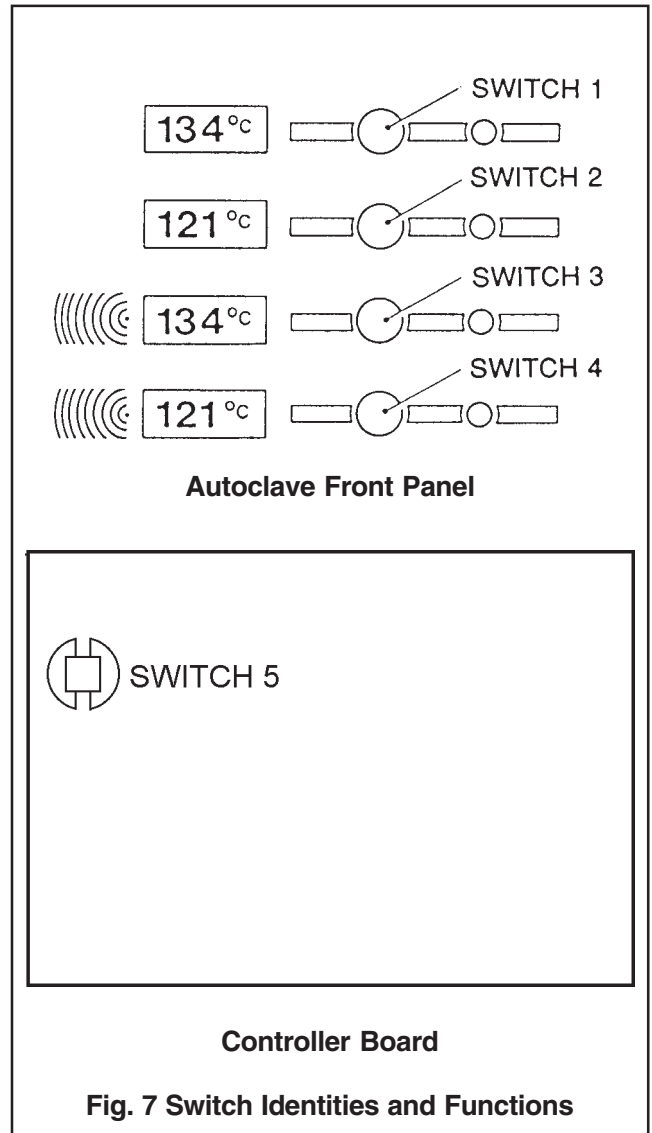


Fig. 7 Switch Identities and Functions

Power-On Modes

3.32 The following switches, 'held-pressed' when power is switched-on, will initiate their associated modes:

- Switch 5 Set-Up Mode.
- Switches 3 and 4 Engineering Mode
- Switches 2 and 3 Calibration Mode
- Switches 1 and 2 Demonstration Mode.
- Switches 1 and 4 Clock-Set Mode.

Note

When setting the clock (to change from BST to GMT for example) use the switch 1 and 4 combination, not the set-up procedure.

PART 3 MAINTENANCE

Set-Up Procedure

3.33 After changing the printer interface board, the autoclave must be set-up as follows.

WARNING

During the following procedure, the autoclave cover is removed, and mains voltages are exposed

Autoclave Without Printer (Fig. 4 and 7)

3.34 To set-up an autoclave without a printer, proceed as follows:

- a Switch mains power on/off switch to 'off' (O).
- b Press and hold switch 5 and switch mains on/off switch to 'on' (I). Continue holding switch 5 until 'Set-Up' is displayed, and then release it.
- c After a short time 'LS3' will be displayed.
- d Press switch 2 to reject 'LS3', and check that the display changes to 'SES'.
- e Press switch 1 and check that the display changes to 'Print'.
- f Press switch 1 and check that the display changes to 'CyC-0' (cycle counter).
- g Press switch 2 and check that the display changes to 'Eng' (English).
- h If English is the required language press switch 1 to accept the 'Eng' code. If English is not the required language, press switch 2 until the required language code is displayed as follows:

<input type="checkbox"/>	'Fre'	French.
<input type="checkbox"/>	'Ger'	German
<input type="checkbox"/>	'Ita'	Italian.
<input type="checkbox"/>	'Spa'	Spanish.
<input type="checkbox"/>	'Por'	Portuguese.
- i Press switch 1 to accept the required language code. Display changes to 'CE', press switch 1 for CE units press switch 2 for non-CE units (see Note page 38).
- j Several bleeps will now sound indicating that the set-up procedure is complete.

Autoclave with Printer (Fig. 2 and 7)

3.35 To set-up an autoclave with a printer, proceed as follows:

- a Switch mains power on/off switch to 'off' (O).
- b Press and hold switch 5 and switch mains on/off switch to 'on' (I). Continue holding switch 5 until 'Set-Up' is displayed, and then release it.
- c After a short time 'LS3' will be displayed.
- d Press switch 2 to reject 'LS3', and check that the display changes to 'SES'.

- e Press switch 1 and check that the display changes to 'Print'.
- f Press switch 1 and check that the display changes to 'CyC-0' (cycle counter).
- g Press switch 2 and check that the display changes to 'Eng' (English).
- h If English is the required language press switch 1 to accept the 'Eng' code. If English is not the required language, press switch 2 until the required language code is displayed as follows:

<input type="checkbox"/>	'Fre'	French.
<input type="checkbox"/>	'Ger'	German
<input type="checkbox"/>	'Ita'	Italian.
<input type="checkbox"/>	'Spa'	Spanish.
<input type="checkbox"/>	'Por'	Portuguese.
- i Press switch 1 to accept the required language code. Display changes to 'CE', press switch 1 for CE units press switch 2 for non-CE units.
- j The display will have changed to 'od01', indicating that the autoclave serial number must be set as described in section 3.36 and 3.37.
- k After setting the serial number note that the display has changed to 'Set', and then to 'd-t', and then to 'on01' indicating that the time and date must be set as described in sections 3.38 and 3.39.

Setting the Autoclave Serial Number

3.36 The autoclave serial number (which is on the dataplate on the inside of the autoclave door, and on the back of the autoclave cover) comprises four parts:

SED 4 H 1127

- D indicates the modification state
 4 indicates the year of manufacture
 H indicates the month of manufacture

1127 is the serial number comprising two groups:
 11 is the Hi group (thousands and hundreds)
 27 is the Lo group (tens and units)

- The modification state ('od01') which is represented by a letter from A to Z, is entered into the autoclave as a two-digit code (01 = A, to 26 = Z). Note that on the printout, the letter will be shown, not the number.
- The year of manufacture ('yr00'), which is represented by the last digit of the year, is entered into the autoclave as a two-digit code (00 = 1990, to 09 = 1999).
- The month of manufacture ('on00') which is represented by the last two digits of the month, is entered into the autoclave as a two-digit code (01

PART 3 MAINTENANCE

= January, to 12 = December). Note that on the printout, the month will be shown as a letter (A = January, to L = December).

- The serial number ('hi00' and 'lo00') which is represented by four digits, is entered into the autoclave as two, two-digit groups, 'hi' and 'lo' ('hi' = the thousands and the hundreds) and ('lo' = the tens and the units). Thus, for serial number 1127, 'hi' = 11 and 'lo' = 27.

Entering the Autoclave Serial Number (Fig. 7)

3.37 Enter the autoclave serial number as follows.

- a Check that the display shows 'od01' and:
 - Enter the modification state (01 = A, to 26 = Z) by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.
- b Check that the display has changed to 'yr00' and:
 - Enter the year (00 = 1990, to 09 = 1999) by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.
- c Check that the display has changed to 'on01' and:
 - Enter the month (01 = January, to 12 = December) by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.
- d Check that the display has changed to 'hi00' and:
 - Enter the first two digits of the serial number by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.
- e Check that the display has changed to 'Lo00' and:
 - Enter the last two digits of the serial number by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.

The autoclave serial number is now set. Note that the display has changed to 'on01' indicating that the time and the date must be entered as described in section 3.38 and 3.39.

Entering the Time and Date (Fig. 7)

3.38 The date and time comprises five elements:

- The month 'on01'.
- The year 'yr00'.
- The day 'dy01'.
- The hour 'hr00' (based on the 24-hour clock).
- The minutes 'in00'.

3.39 Enter the time and date as follows.

- a Check that the display shows 'on01' and:
 - Enter the month (01 = January, to 12 = December) by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.
- b Check that the display shows 'dy01' and:
 - Enter the day (01 = the first, to 31 = thirty-first) by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.
- c Check that the display shows 'yr00' and:
 - Enter the year (00 = 1990, to 99 = 1999) by pressing switch 1 to increase the number, or switch 2 (to decrease the number).
 - When the number is correct, press switch 3 to accept the entry.
- d Check that the display shows 'hr00' and:
 - Enter the hour (00 = 00.00hr, to 24 = 24.00hr) by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.
- e Check that the display shows 'in00' and:
 - Enter the minute (01 = the first minute, to 59 = the fifty-ninth minute) by pressing switch 1 to increase the number, or switch 2 to decrease the number.
 - When the number is correct, press switch 3 to accept the entry.

The time and date are now set, and several bleeps will sound indicating that the set-up procedure is complete. If a printer is fitted, it will produce a printout for checking.

PART 3 MAINTENANCE

ERRORS AND ERROR CLEARING

General

3.40 Various situations can give rise to an error code being displayed. Any error is stored in the internal memory of the microcomputer. The autoclave is automatically 'locked' out of action until the error has been cleared. The area of error is stored for service engineering and indicated briefly by the display of one of the error codes shown below on entering the 'Engineering' mode (section 3.27). This will only be displayed once as entering the 'Engineering' mode also cancels the message.

Code	Meaning
Err 1*	Clock fault or Faulty temperature sensor/channel detected
Err 2	Door open during cycle
Err 3	Chamber did not fill with water (LoH ₂ O)
Err 4	Water loss early in cycle (H ₂ O)
Err 5	No heat
Err 6	Control temperature low
Err 7	Control temperature high
Err 8*	Monitor temperature low
Err 9*	Monitor temperature high

* Printer version only

Note: These error codes are not displayed during normal operation (see Part 2, section 2.23).

3.41 Once the fault has been corrected, clear the error from the microcomputer memory as follows:

- Switch off power to the unit.
- Push and hold in any one of the programme selector buttons (not switch 5) and switch on power.
- Release programme selector button after two seconds.

Control Sensor Selection (Printer version only)

3.42 At any time during normal operation of the autoclave, when the heater is operating and the temperature display is showing, pressing switch 5 will 'switch' the display to the control sensor and 'c' will be displayed in the far left position for as long as the button is pressed. This feature enables a check to be made on the control temperature in relation to the display temperature.

Autocheck (Printer version only)

3.43 When the sterilizing phase has been reached a check is automatically made to ensure that the temperature recorded on each sensor does not exceed specific limits for the cycle selected. Should this happen, the appropriate error code from E6 to E9 will be displayed (see section 3.40).

ROUTINE CALIBRATION PROCEDURE

General

3.44 The autoclave will retain its calibration well over long periods of time but, occasionally, and when a new sensor or controller board has been fitted, re-calibration is necessary. The chamber temperature should be measured using a 'needle' thermocouple connected to a temperature indicator of known accuracy. In the factory a chart recorder is used. The thermocouple should be inserted through the port available in the manifold at the rear of the chamber (Fig. 4 item 19).

CAUTION

Take care not to damage the internal seals in the test port fitting. Avoid using a sharp pointed thermocouple probe, if possible.

3.45 It is recommended that the calibration is checked at least every twelve months, or more often if the unit is heavily used or if local codes of practice require it.

3.46 For the purpose of this description it will be assumed that the autoclave is working correctly and that a routine temperature calibration is required.

3.47 It is particularly important that the following points are noted before calibration is attempted:

- There must be no steam leaks.
- The air valve must close between 99 and 104°C.
- The machine should have been run sufficiently to become thoroughly warm.

Note 1

A machine with suspect calibration should only be run using the calibration sequence described below. This should avoid the possibility of the safety valve lifting due to excess chamber pressure, which might be the case if the 134°C programme were to be selected.

Note 2

To ensure accurate calibration the cover should be replaced (not fixed) whenever possible during stages 3.48 'b to e'.

PART 3 MAINTENANCE

Calibration Procedure (Fig. 8)

3.48 The autoclave control programme contains a special calibration sequence to ensure accurate calibration in the shortest possible time. Do not set-up the sterilizer by carrying out normal sterilizing cycles; it is important to proceed methodically as follows:

- a With the unit cover removed, insert needle thermocouple probe from a calibrated chart recorder into the manifold test port (Fig. 4, item 19) at the rear of the chamber. Ensure that the chart recorder has thoroughly 'warmed up'.
- b Switch off the autoclave. Ensure the water reservoir is full and, for safety reasons, ensure that the reservoir is then properly covered. Ideally, a test load should be placed in the chamber; but this is not essential. With power switched off, press and hold the two centre buttons on the front panel (121°C without drying and 134°C with drying). Holding-in these two buttons, switch on power. The display 'CALIB' will appear, the solenoid door lock will engage (CE ONLY, see note page 38) 'FILL' will be displayed for approximately 150 seconds followed by 'HEAT' as the heater is switched on. The unit will heat to the temperature reached during the 121°C cycle.
- c When the temperature has been achieved and the machine has been in the sterilizing mode for 5 to 6 minutes calibrate to between 121°C and 124°C on the chart recorder. Carefully adjust R 17 on the controller board (clockwise to increase) until this temperature is achieved. Adjust the control a little at a time and observe the effect after each adjustment. Once this setting is correct the display should read values similar to those shown on the chart recorder.

Note 1

If the chart trace 'sawtooth' effect is excessive switch off the sterilizer, wait for 10 seconds and switch on to allow the chamber contents to discharge back to the reservoir, then check the seating of the temperature sensor. It should be in good thermal contact with the flat bottom of the 'well' formed in the outlet manifold at the rear of the chamber. A small amount of zinc oxide-based heat transfer compound should be smeared on the surface of the sensor. If it has been necessary to make readjustments to the temperature sensor, switch off power then re-start the calibration cycle as described in para. (b).

Note 2

The next adjustment will have to be completed within approximately three minutes, before two 'bleeps' are heard indicating completion of the 134°C cycle. At this point temperature will fall to 122.5°C. Note, however, that it is possible to repeat the 134°C cycle at any time by pressing the '134°C without drying' programme button again.

- d Push the 134°C button on the front panel. After a short time an audible signal should be heard. Release the button. The sterilizer will now perform a 134°C cycle from the baseline of 122.5°C. Once the sterilizing temperature has been reached and the chart recorder trace has levelled-off, adjust R14 on the controller board (clockwise to decrease) carefully until the recorder trace indicates between 134°C and 138°C.
- e Repeat (c) and (d) to ensure consistent calibration is achieved.
- f Once calibration is complete, switch off the unit, wait for 10 seconds then switch it on. The discharge valve will now open and exhaust steam and condensate back into the reservoir. After this has happened, switch off and seal the adjustment positions of potentiometers R17 and R14 on the controller board (e.g. with nail varnish).

Note 1

Issue 7 of pcb (top left-hand corner). Turn R1 (instead of R17) counter-clockwise to increase temperature, and turn R2 (instead of R14) clockwise to increase temperature. Issue 8 March 1991. Revert to original instructions.

Note 2

Running calibration cycles will not advance the cycle counter. Some of the error detection systems are automatically 'switched off' during the calibration phase.

- g A label should be fixed to the autoclave indicating the date on which it was calibrated, the technician responsible and the date when it should next be calibrated. The recorder charts should be kept. The temperature sensing systems used in the autoclave have been shown to be reliable and relatively drift-free over long periods. Nevertheless it is recommended that the calibration be checked at least every 12 months, or more often if the sterilizer is heavily used.

PART 3 MAINTENANCE

Safety Valve (Fig. 3 item 5 and Fig. 7)

3.49 Test the safety valve as follows:

CAUTION

**Ensure reservoir access cover is fitted
Fig. 2 (item 16)**

Note

To cancel the safety valve test, switch-off the on/off switch for 4 seconds, then switch it on again. This will vent all pressure and water to the reservoir.

- a Refer to Routine Calibration Procedure and carry out the instructions in section 3.48 and run the autoclave up to 134°C.
- b When 134°C is reached, switch-off power at the power on/off switch.
- c Enter the 'Engineering Mode' (see section 3.27).
- d Switch-on the heater by pressing and holding-in switch 4 (Fig. 7).
- e With the heater switched-on, the temperature will rise without control from the controller. The safety valve should start to vent at approximately 138.5°C (read from the chart recorder). The temperature and pressure should increase until the safety valve operates and maintains pressure below a maximum of 2.9bar (42 p.s.i.) at 142.5°C.

Operational Test

3.50 The safety valve should be checked every 12 months for correct function and test of set pressure, full flow and reseal pressures. Particular care should be taken with the use of sealing compounds and PTFE tape to ensure that they do not enter the valve.

3.51 It is recommended that adjustments, maintenance and repair of safety valves should only be carried out by Eschmann personnel or accredited agents. Removal and installation of the valve is a straightforward procedure, but on installation, wrap PTFE tape around the valve threaded pipe fitting.

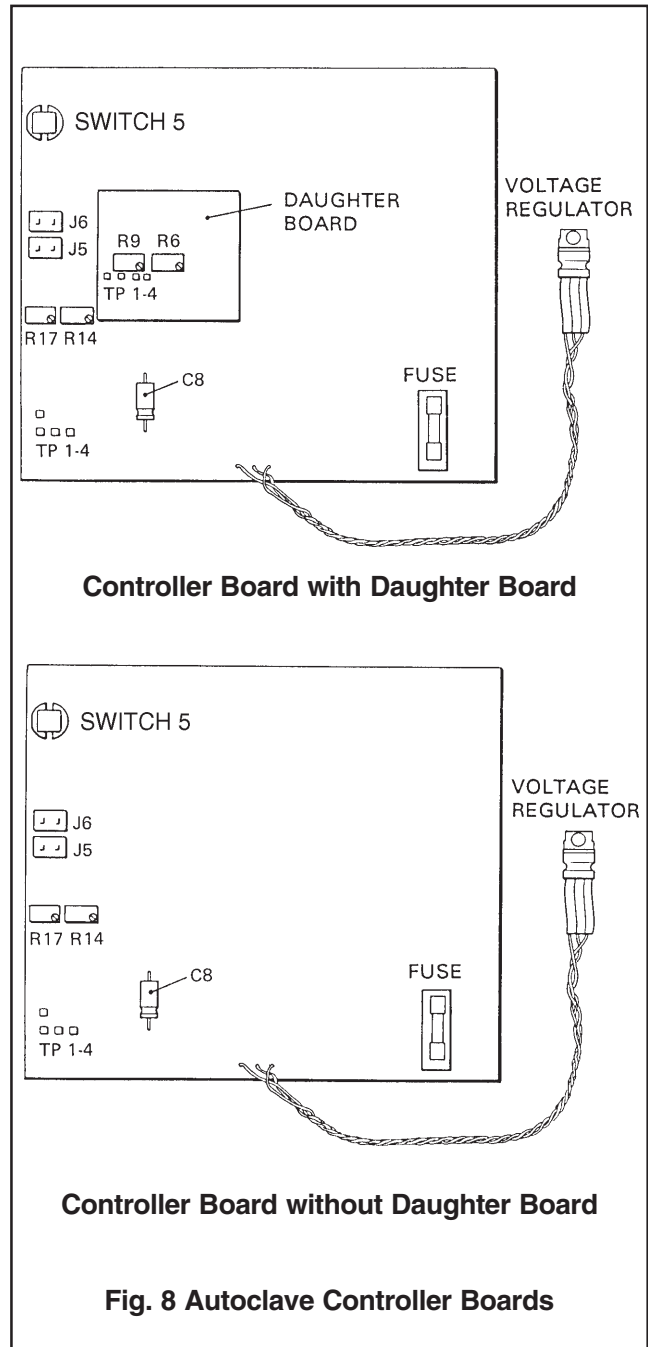
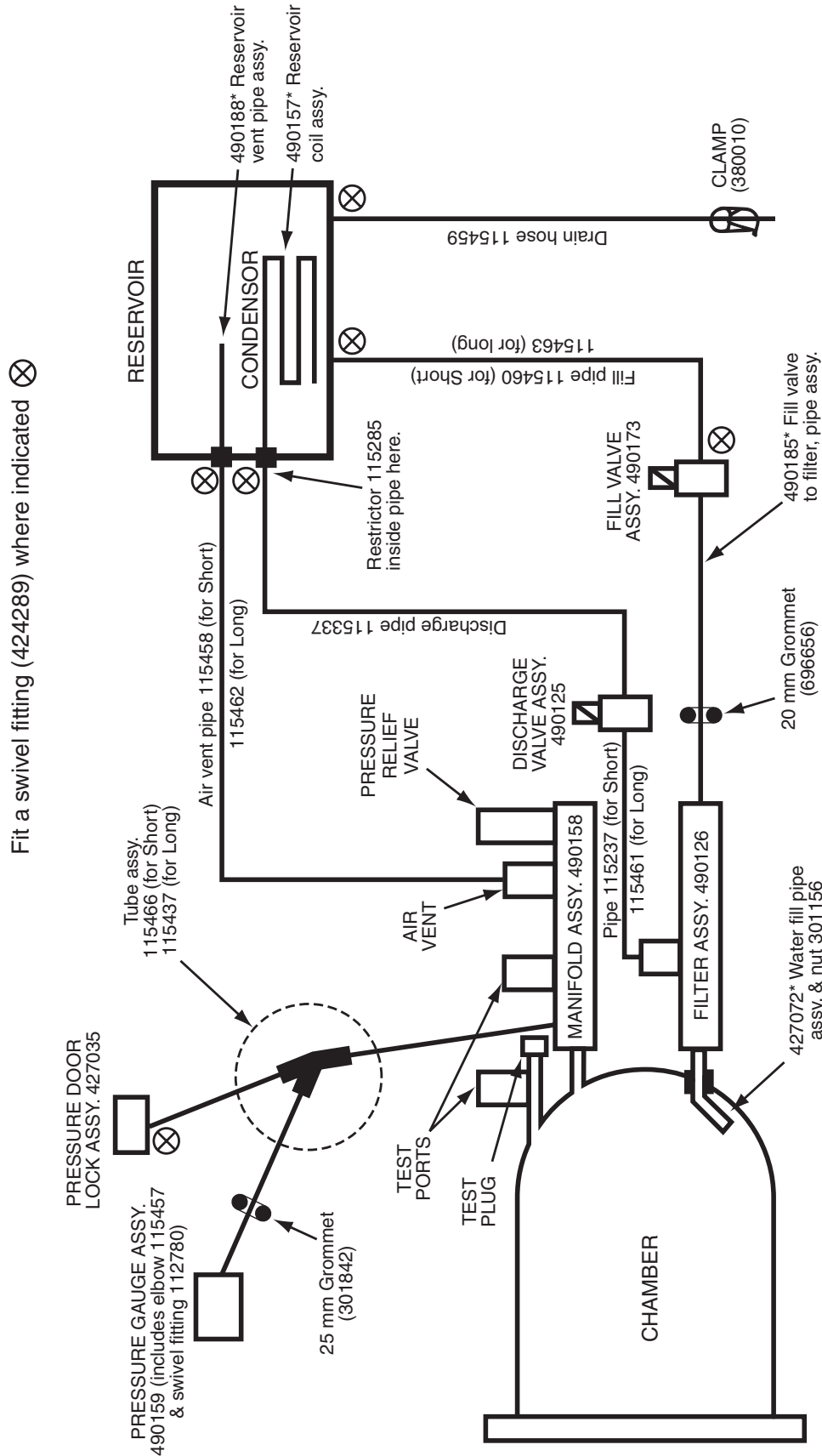


Fig. 8 Autoclave Controller Boards

PART 4 ILLUSTRATED PARTS LIST

IMPORTANT NOTE: From SN prefix SCC (std.) and LSCC (long) the pipes and fittings have been changed to those shown in the Schematic Diagram below (i.e. pipes changed from copper to reinforced silicone).

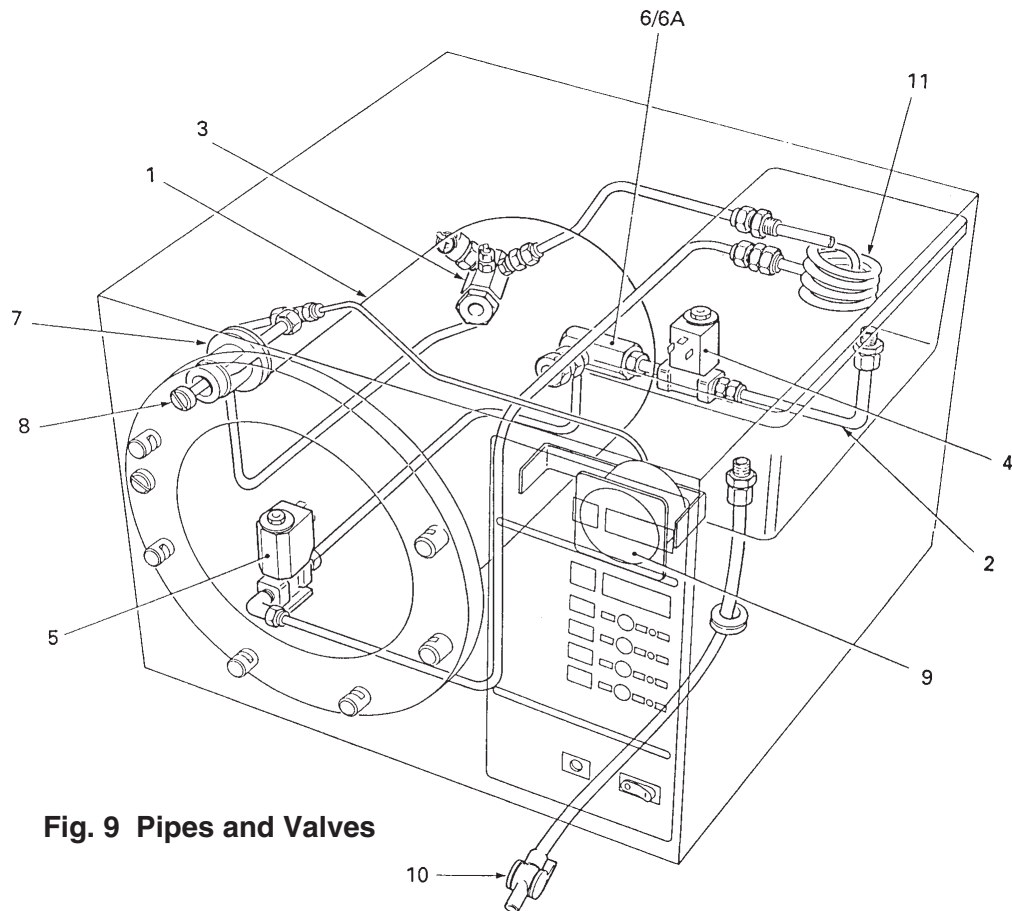


Fit a swivel fitting (424289) where indicated ⊗

Apply a cable tie (695777) to all silicone pipe connections using Tool No. 2157 on setting 2.

* These copper pipe assemblies come complete with the required olive(s) and nut(s).

PART 4 ILLUSTRATED PARTS LIST 1: PIPES AND VALVES



For units with silicone (i.e. not copper) pipes see page 31.



Fig. 9 Pipes and Valves

Fig. 9 Item No	Part No Standard	Part No Long	Description	Qty.Per Unit	Recommended Holding Per Unit, Per Year
1	490090**	490117**	Pressure chamber assy. Chamber	1	- Not available for purchase
2	490191#		Waterfill pipe assy.	1	-
3	490268		Manifold, assy., including	1	-
-	380082		. . 'T' piece	1	-
-	380020		. . 1/4" Plug	1	-
-	391132		. . 1/4" Washer	1	-
-	490258		. . Manifold	1	-
-	301349		. . Test plug (no longer fitted)	1	-
-	301739		. . Safety valve	1	1
-	301625		. . Coupling	1	-
-	425176		. . Air valve (see below for 110Volt)	1	-
-	110064		. . Air valve (110Volt models only)	1	-
4	490173		Valve, solenoid (water fill) assy.	1	1
5	490048		Valve, solenoid (discharge) assy.	1	1
6	490195		Filter assy.	1	1
6A*	380036		. Washer, copper	1	1
7	427035		Pressure lock assy.	1	-
8	427060		. Bolt, locking	1	-
9	490010		Pressure gauge	1	-
10	380010		Tap	1	1
11	490157		Coil	1	-

* Not illustrated ** see 'Chamber changes notes' on page 33

was 490252 pre SN SED311798 for Standard and 490220 pre SN LSEB310045 for Long.

Chamber changes on current models:

To ensure easy access into the chamber to meet the requirements of PSSR2000, the following parts have been fitted. This enables temperature and pressure measurement at this point.

Standard Chamber

The Chamber (part number 490040) has been fitted with the following new parts at the top rear port:

427030	1	¼" BSP chamber fitting
490037	1	Blank chamber fitting
490031	2	Chamber nut
427041	2	Copper washer
380082	1	Tee
301349	1	Twinlock
380020	1	¼" BSP Plug
391132	1	¼" BSP Dowty washer

Long chamber

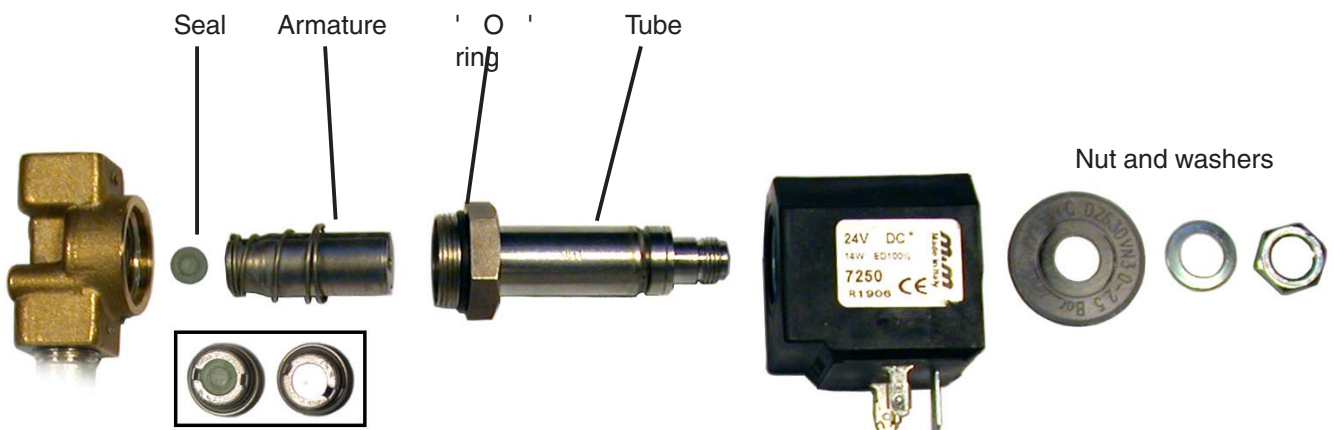
The Chamber (part number 490117) has been fitted with the following new parts at the top rear port:

427030	1	¼" BSP chamber fitting
380082	1	Tee
301349	1	Twinlock
380020	1	¼" BSP Plug
391132	1	¼" BSP Dowty washer

8 watt solenoid valve spares

The latest (from early 2007) solenoid valve tubes fitted to these machines do not have an angle for sealing to the brass manifold, they rely on the 'O' ring to seal. The basic valve is part number 301906, the spare valve parts are illustrated and detailed below:

Description	Part No.
Tube	110765
Armature	110764
Valve seal	111536
'O' ring	115454



End of armature shown with and without the seal in place.

PART 4 ILLUSTRATED PARTS LIST 2: GENERAL SPARES

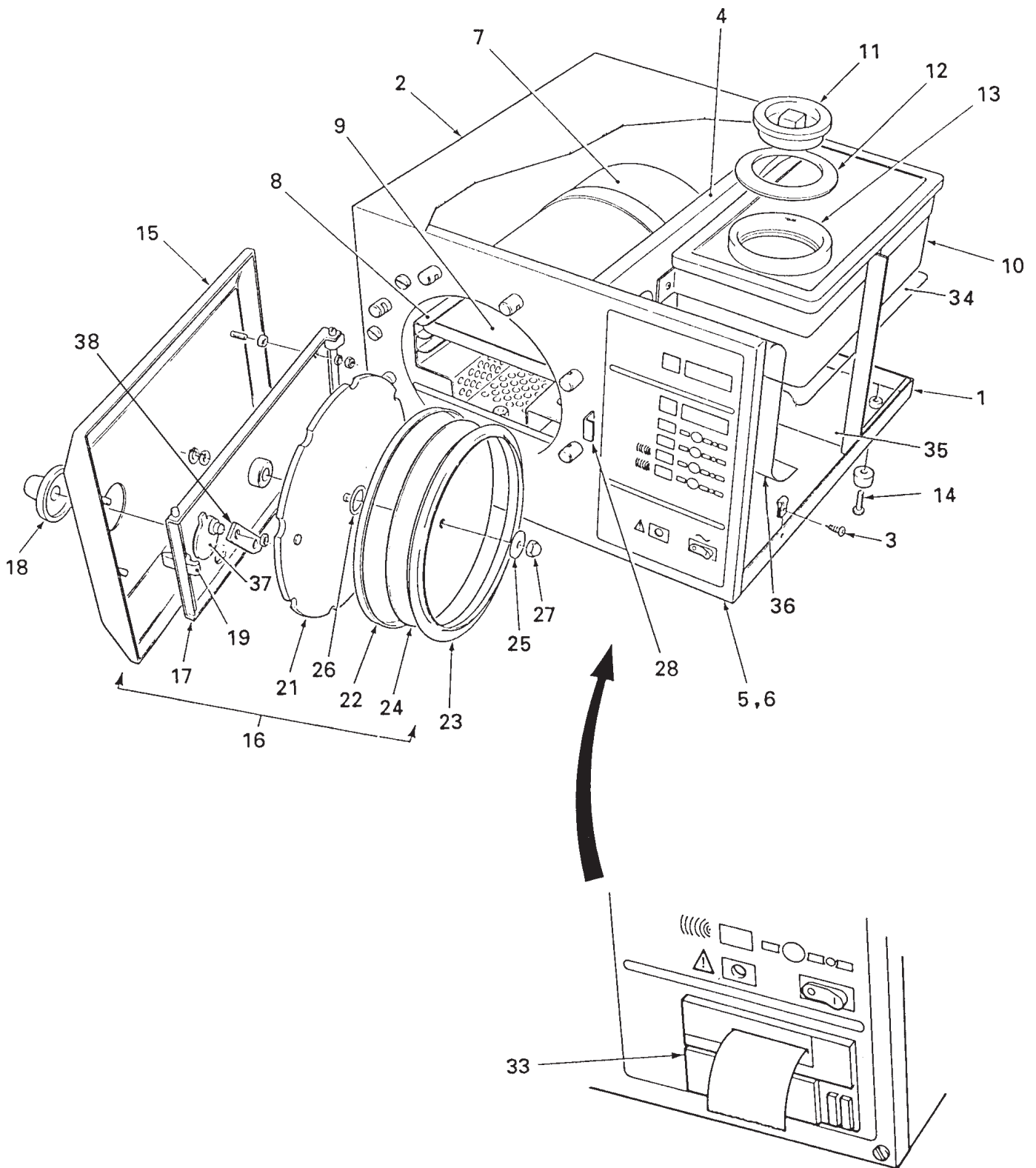


Fig. 10 General Spares

PART 4 ILLUSTRATED PARTS LIST 2: GENERAL SPARES

Fig. 10 Item No	Part No Standard Long	Description	Qty.Per Unit	Recommended Holding Per Unit Per Year
1	490290	490142 Chassis	1	-
2	490310	490144 Top cover	1	-
3	111928	Screw, self tapping	4	4
4	490063	490146 Dividing panel	1	-
5	490283	Front panel (without printer)	1	Not available for purchase
6	490282	Front panel (with printer)	1	-
7	-	Pressure chamber assy. (See Parts List 1)		
8	490228	490178 Carrier assembly, tray	1	-
9	-	Tray (REF 87-040-07)	4	-
10	490046	Reservoir (requires kit 112472)	1	-
*	425170	. Surface tension breaker		
*	425062	. Reservoir lid rectangular (without switch hole)		
11	475872	. Reservoir aperture cover (round)	1	-
12	425146	Ring, grey rubber	1	1
*	425165	. Ring, adhesive	-	-
13	425141	Ring seal, silicone	1	1
14	480301	Foot, c/w fixing screw	4	-
*		380045 Spacer, foot	2	-
15	490302	490304 Door cover assy.	1	-
16	-	Door assy.	1	-
17	480315	. Door beam assy.	1	-
18	490076	. Door knob	1	-
19	427011	. Door secondary latch	1	-
20*	427023	. Spring, secondary latch	1	-
21	490017##	. Door, pressure assy.	1	-
22	424238##	. Seal, retaining rim	1	-
23	427037	. Door seal (gasket)	1	1
24	427015	. Retaining disc, seal	1	-
25	427090	. Seal washer, steel	1	1
26	713651##	. O-ring (on older models)	1	1
27#	307232#	. Aerotight nut#	1	1
28	427010	Safety catch, door	1	-
29*	-	Tray lifter (REF 87-040-90)	1	-
30*	301409	Drip tray	1	-
31*	425188	Accessory pack containing 4 off each, cups and spacers for cabinet feet	1	-
32*	REF 87-040-66	Pouch rack accessory	A/R	-
33	490291	Printer assembly	1	-
34	490397	S.S.R.B.Insulation	1	-
35	424395	Fuse cover	1	-
36	424396	Water shield, control board	1	-
37	427007	Door spindle assembly	1	-
38	427008	Link	1	-
*	380034	Cable saddles	A/R	-
*	380033	Self mount cable ties	A/R	-
*	301600	P.T.F.E.Tape	A/R	-
*	306234	Hydraulic sealant	A/R	-

* Not illustrated

Now replaced by M6 Nut (710372) and M6 Spring washer (710721)

For units with an 'O' ring (before c.1999) replace parts 21, 22 and 26 with parts 21 and 22 only (latest design of these parts eliminates need for 'O' ring).

PART 4 ILLUSTRATED PARTS LIST 3: HEATER AND PROCESS CONTROLS

Note: Items 9 and 9a are fitted to the underside of chamber manifold but shown here for clarity.

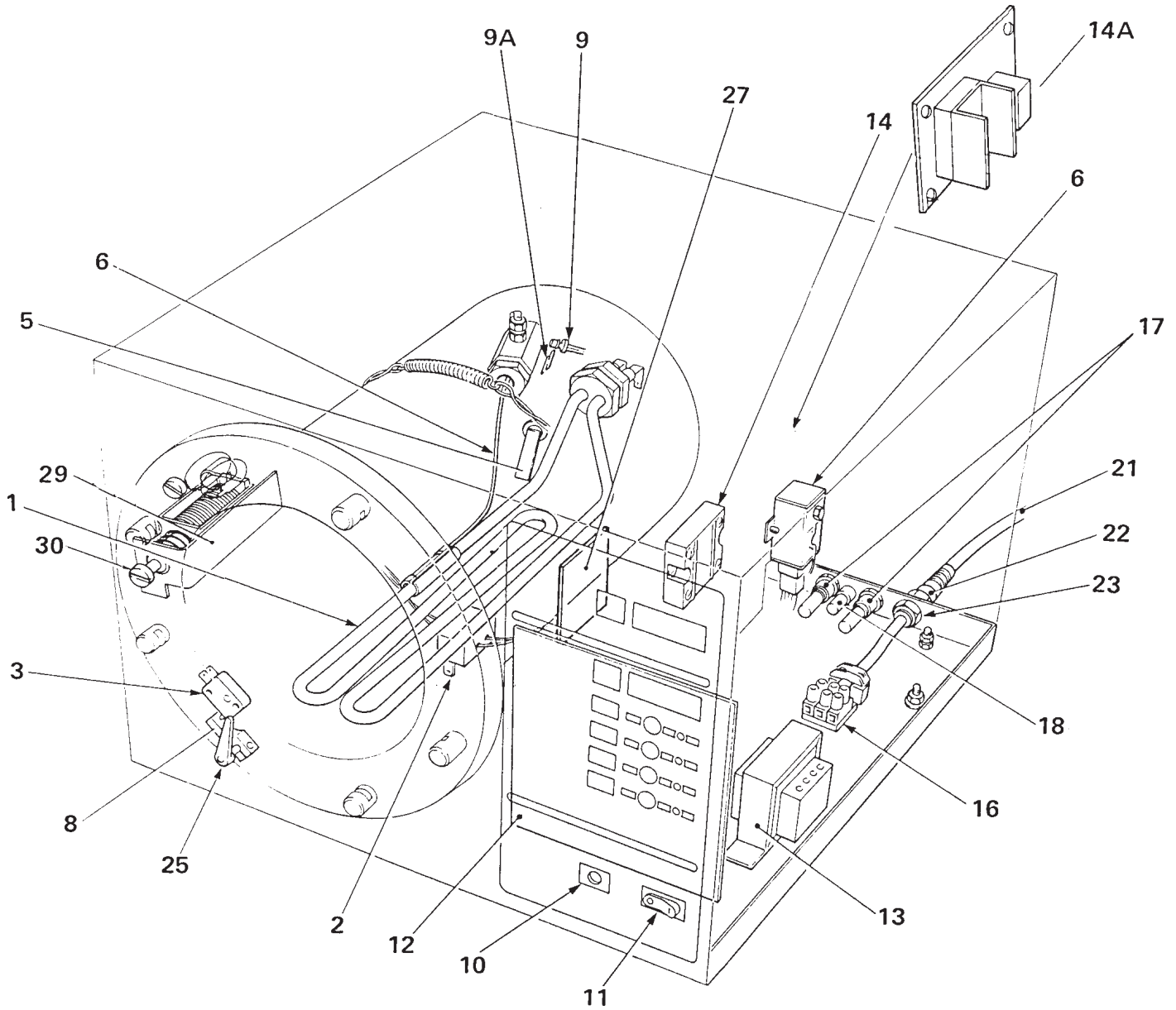


Fig. 11 Heater and Process Controls

PART 4 ILLUSTRATED PARTS LIST 3: HEATER AND PROCESS CONTROLS

Fig. 11 Item No	Part No Standard	Long	Description	Qty.Per Unit	Recommended Holding Per Unit Per Year
1	412012		Heating element 230V, 2kW	-	-
		416220	Heating element 230V, 2.75kW	-	-
	412008		Heating element 110V, 1.4kW	-	-
2	425114		Thermal fuse assy. 10A (220V/240V units)	1	1
	380081		Thermal fuse assy. 20A (110V units)	1	1
		380081	Thermal fuse assy. 20A	1	1
3	301162		Microswitch	1	1
4*	427021		Stop pin, microswitch	2	-
5	480314		Sensor, water level assy.	1	-
*	301806		. Shouldered washer	1	1
*	301807		. Silicone bush	1	1
*	425124		. Insulation bush	1	1
*	425121		. Water level body	1	1
6	380026		Thermostat assy.	1	-
7*	416149		Clamp, thermostat sensor bulb	1	-
8	427020		Actuator arm, microswitch	1	-
9	490260		Sensor, temperature, assy.	1	1
	490260		Sensor, temperature, assy. (for units with printer)	2	2
9A	490262		Plate, retaining sensor	1	-
10	301127		Lamp, neon, red (overheat)	1	-
11	380000		Power switch, on/off	1	-
12	490335	490338	Controller board assy.	1	-
*	490336		. Daughter board	1	-
*	301797		. Fuse F2A, 20 mm	1	1

* Not illustrated

Continued

PART 4 ILLUSTRATED PARTS LIST 3: HEATER AND PROCESS CONTROLS

Fig. 11 Item No	Part No		Description	Qty.per Unit	Recommended Holding	
	Standard	Long			Per Unit	Per Year
13	110249		Transformer with shroud	1		-
*	110250		. Transformer shroud	1		-
14	301478		Solid state relay (not for CE Units**)	1		-
14A	301481		Relay control board	1		-
15*	696952		Varistor assy.	1		-
16	380012		Terminal block	1		-
17	380001	301890	Fuse holder, large	2		-
18	301814		Fuse holder, small	1		-
19*	-		Fuse:	2		2
			Standard Long			
*	380003	301871	F10A 230/ 240V F15A 240V	2		1
*	380002	301871	F13A 220V F15A 220V	2		1
*	111940		F16A 110V	1		1
20*			Fuse:	1		1
*	696181		F400mA 220/230/240V	1		1
*	380004		F800mA 110V	1		1
21	490080		Cable, power supply, assy. UK# (inc. fused plug) (230V)	1		-
22	710894		Clamp, cable	1		-
23	710897		Nut, cable clamp	1		-
24*	427022		Leafspring, microswitch actuator arm	1		-
25	427104		Lever assy. microswitch	1		1
26*	427020		Actuator arm, microswitch	1		-
27	490337		Printer interface board	1		-
29	490025		(CE ONLY**) Solenoid door lock	1		-
30	427060		(CE ONLY**) Locking bolt	1		-
31*	380072		(CE ONLY**) Ferrite clamp mains loom	3		1
32*	380073		(CE Printer version ONLY**) Printer ribbon	1		1
33*	490342		(CE ONLY**) E.M.I. Shield	1		-

* Not illustrated

** See note below

For other countries consult manufacturer.

IMPORTANT NOTE: From late 2008 all non-CE units are built as CE units (i.e. all units will be built to the CE format). Comments qualified by 'non-CE units only' no longer apply and 'CE only' will apply to all units.

APPENDIX A - OPERATING INSTRUCTIONS FOR PRINTER

Printer Output

The printer output gives the following information:

- ◆ Manufacturer's name Eschmann Equipment
- ◆ Machine type SES 2000
- ◆ Serial number Nine character code
- ◆ Cycle type e.g. 134°C no drying
- ◆ Time and date started At hh:mm:ss
 On dd:mm:yy
- ◆ Counter reading Five digits with leading zeros
- ◆ Time/temp information Time every 22 secs (approx.) + temp. + graph of temperature.
- ◆ Cycle ended message
- ◆ Time and date ended The 'cycle end' is defined as the end of the sterilizing phase.

If an error occurs during the cycle, it is recorded with date and time on the printout and the message 'CYCLE FAILED'. Errors are designated by error codes as follows:

- ERR1 - Faulty temperature sensor/channel detected
- ERR2 - Door open during cycle
- ERR3 - Chamber did not fill with water (LoH₂O)
- ERR4 - Water loss early in cycle (H₂O)
- ERR5 - No heat
- ERR6 - Control temperature low
- ERR7 - Control temperature high
- ERR8 - Monitor temperature low
- ERR9 - Monitor temperature high

These error codes will generally require investigation by an Eschmann trained engineer.

Front Panel Controls (Fig. A1)

All controls for the printer are on the front of the panel.

- a. Door Latch Button - To open door (1) push the door latch (2) sideways, in the direction of arrow, and pull the door open to expose paper roll (4).
- b. Paper Feed Button - Ensure the sterilizer mains 'on/off switch is in the 'I' (on) position. Press lower part of paper feed button (3) to activate paper feed, which will continue for as long as the button is depressed.

Paper Roll Renewal

CAUTION:
DO NOT USE ALTERNATIVE PAPER ROLLS

The quality and size of paper rolls used in the printer, can only be supplied by Eschmann Equipment.

Renew paper roll as follows (Fig. A1 and A2):

- a. Open autoclave chamber door to provide more access.
- b. Push door latch button (2) sideways, in direction of arrow and pull door open to expose paper roll (4).
- c. If any paper remains in the printer, tear end off against paper tear bar (8) and carefully withdraw the remaining paper backwards from the rear of printer mechanism (5).
- d. Compress paper roll spring-loaded retainer button (6) and withdraw empty paper spool from spindle.
- e. Take new roll of paper, separate paper end from the roll. Remove any damaged or gummed part of the paper.
- f. Compress paper roll spring-loaded retainer button (6) and locate new paper roll on spindle with paper unreeling counter-clockwise as seen from open end of spindle (Fig. A1).
- g. Using scissors, trim end of paper roll at an angle of approximately 30° (Fig. A4) and insert this end of the paper into the paper insert slot (1). Press paper feed actuator arm (7) until mechanism grips paper and pulls it through to front of printer door.
- h. Turn paper roll by hand to take up any slack paper
- i. Close the printer door. Check paper feed by pressing paper feed button (3) until the end of the trimmed paper is clear of the tear bar. Ensure that the paper feeds freely from the printer.

Ribbon Cartridge Renewal (Fig. A3 and A4)

Renew ribbon cartridge as follows:

- a. Remove paper roll.
- b. Support door with left hand and press upwards with right hand on bottom of printer mechanism chassis (Fig. A2-2) and separate chassis from door.

CAUTION:
Do not pull printer mechanism chassis from door until catch has been released.

- c. Leaving printer door fully open, expose printer mechanism and ribbon cartridge (Fig. A4-1).
- d. Pinch the end of ribbon cartridge marked 'PUSH' (Fig. A4-1) and remove cartridge.
- e. Install new cartridge, checking that left hand side of cartridge is correctly located on drive shaft, and CAREFULLY press cartridge into place.
- f. Ensure ribbon is taut. If necessary tighten ribbon by turning faceted disc (Fig. A2-2) on cartridge, clockwise, using finger or fingernail.
- g. Fit paper roll as described above.

Spares Pack

A spares pack is available comprising:

- ◆ Five paper rolls
- ◆ Two ribbon cartridges

The spares pack is available from Eschmann Equipment please quote REF 87-034-05.

Setting Date and Time (Fig. A5)

1. To change the clock setting (e.g. from GMT to BST or the reverse) proceed as follows:
 - a. Select mains 'on/off switch to '0' (off).
 - b. Push and hold switch 1 and switch 4 simultaneously then select 'on/off switch to '1' (on).
 - c. The display will read '01'.
 - d. Then proceed as described in paragraph 2 (a) to (g).
2. To set the date and time proceed as follows:
 - a. If closed, open chamber door.
 - b. Display reads '01'. Push and hold switch 1. Observe that number changes to 02, 03 etc. through to 12. Also note that pushing and holding switch 2 makes the number decrease. Use switch 1 and switch 2 to set the number corresponding to the month (01=January etc.). Push switch 3 to retain selection.
 - c. Display reads 'dy01'. Again use switch 1 and switch 2 to display the day of the month (push switch 3 to retain the day). **Note:** The computer will prevent entry of dates such as 31st Nov.
 - d. Display reads 'yr00'. Use switch 1 and switch 2 to set any year from 00 to 99 (e.g. 97=1997). Then push switch 3 to retain it.
 - e. Display reads 'hr00'. Use switch 1 and switch 2 to set the hour - the system utilises a 24 hour clock. Then push switch 3 to retain it.
 - f. Display reads 'in00' (minutes). Use switch 1 and switch 2 to show current minutes and push switch 3 to retain it.
 - g. The clock is now set.

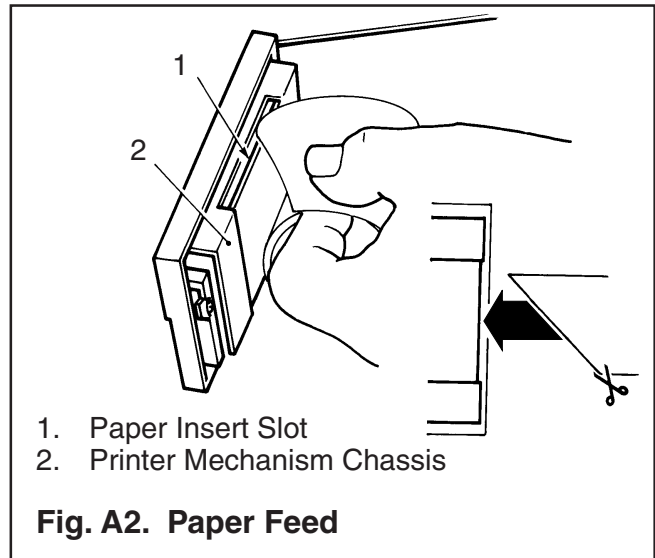


Fig. A2. Paper Feed

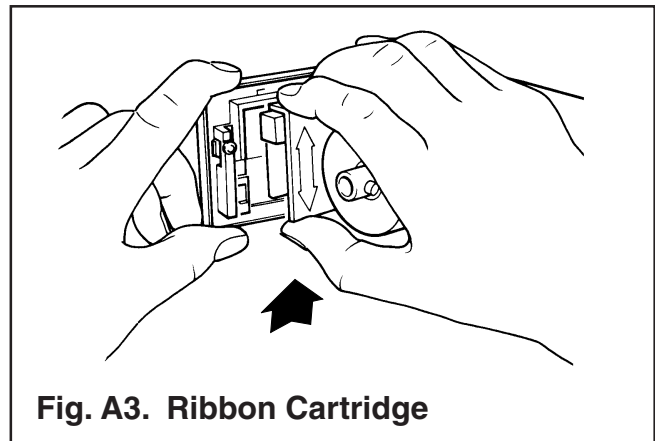


Fig. A3. Ribbon Cartridge

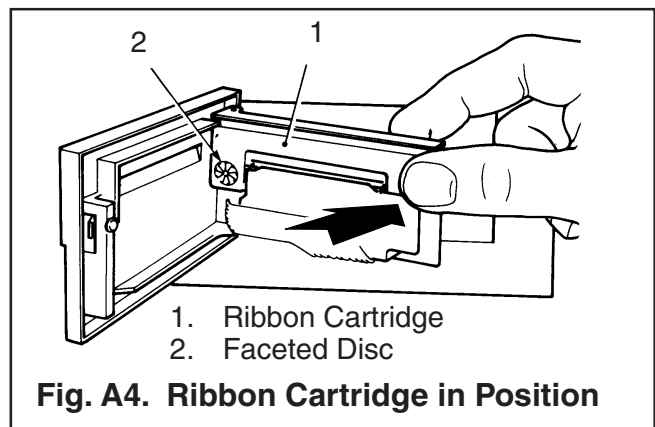


Fig. A4. Ribbon Cartridge in Position

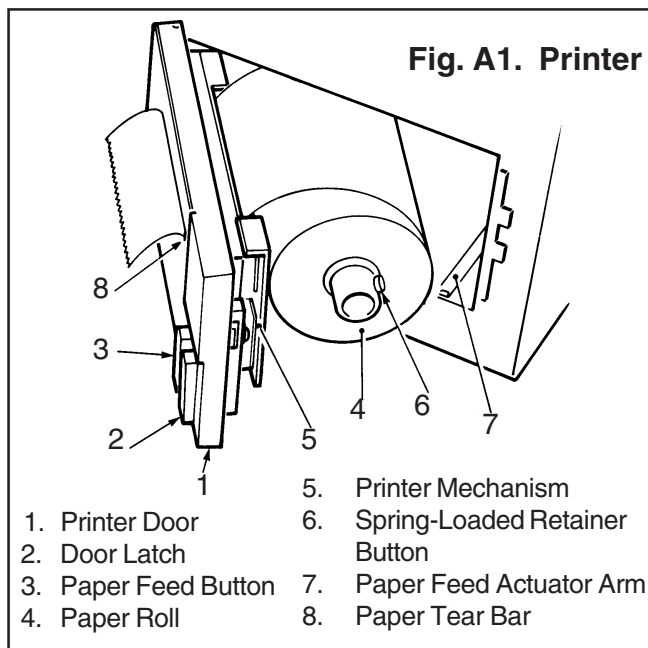


Fig. A1. Printer

- | | |
|----------------------|----------------------------------|
| 1. Printer Door | 5. Printer Mechanism |
| 2. Door Latch | 6. Spring-Loaded Retainer Button |
| 3. Paper Feed Button | 7. Paper Feed Actuator Arm |
| 4. Paper Roll | 8. Paper Tear Bar |

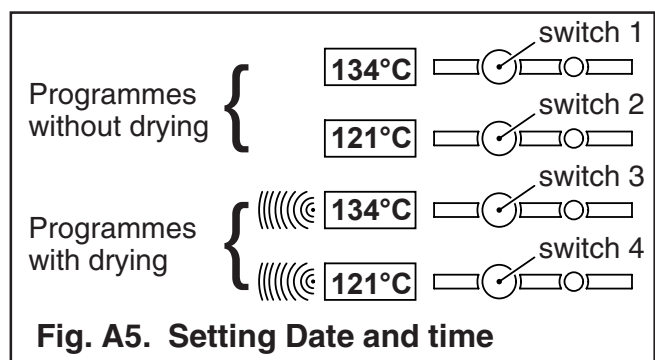
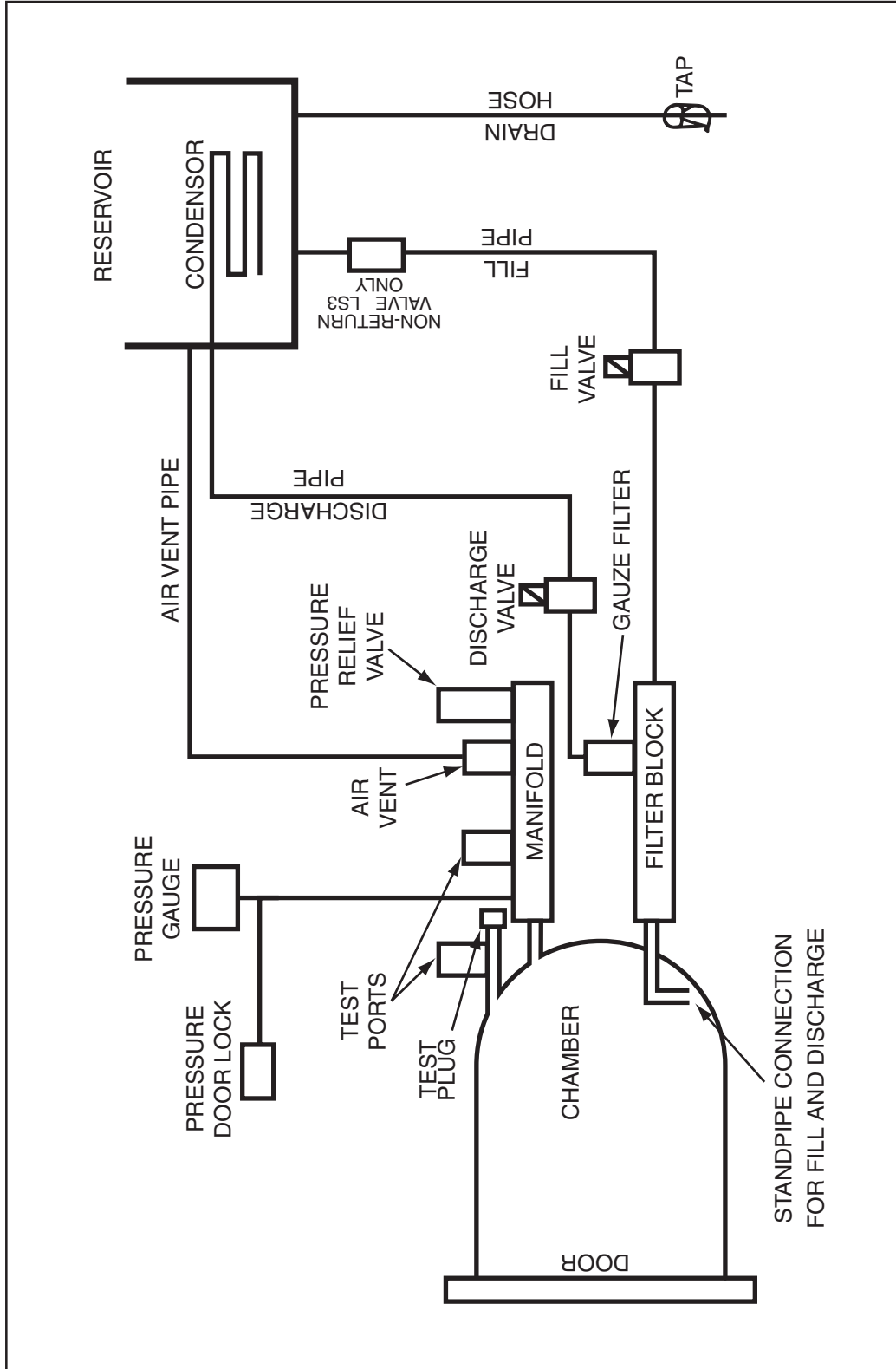


Fig. A5. Setting Date and time

APPENDIX B - Schematic diagram - Pipework and valves



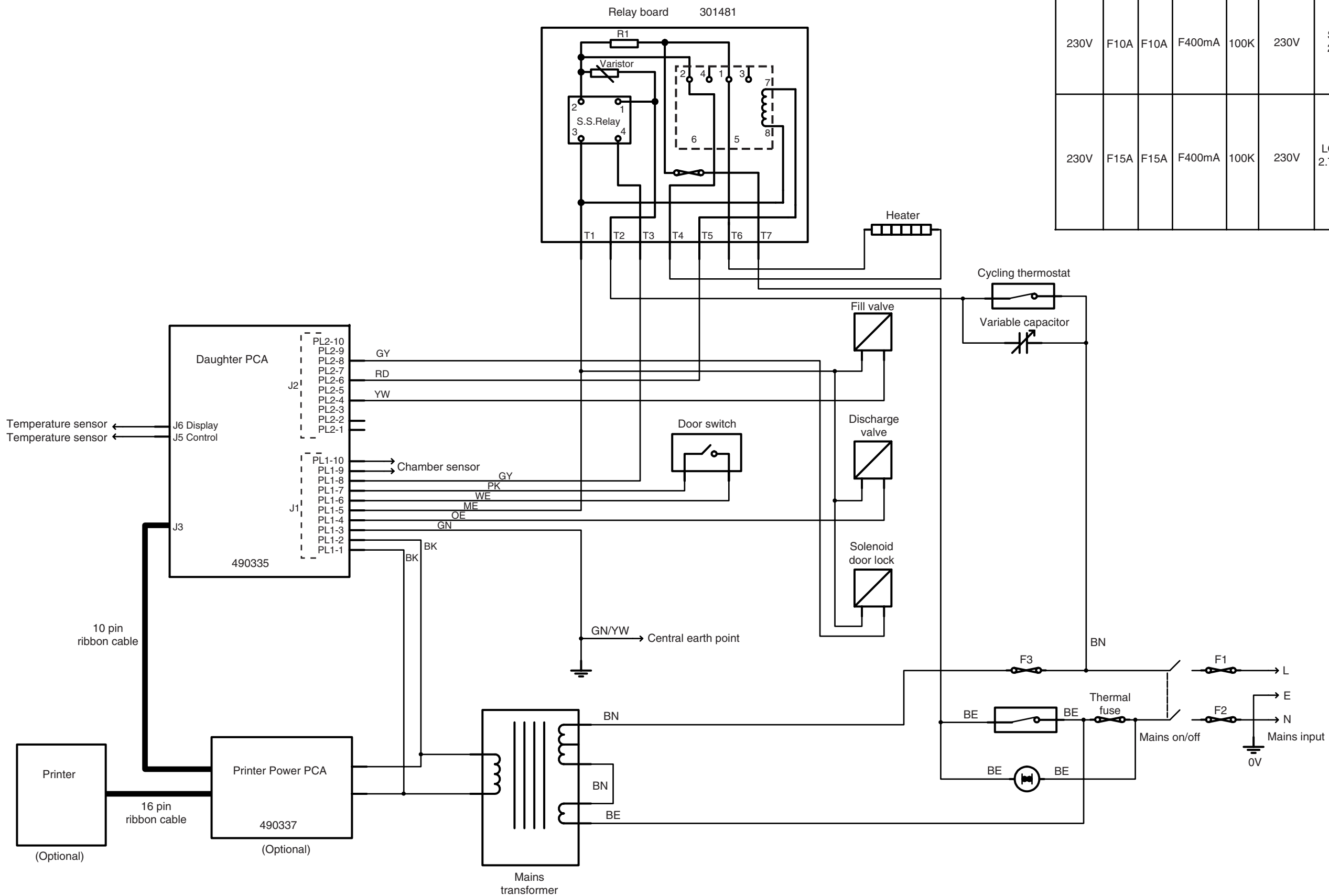
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APPENDIX C - Schematic diagram - CE version (see note page 38)

Options chart

Voltage rating	F1	F2	F3	R1	Overheat neon	Heater	Transformer tapings
230V	F10A	F10A	F400mA	100K	230V	STD 2kW	
230V	F15A	F15A	F400mA	100K	230V	LONG 2.75kW	

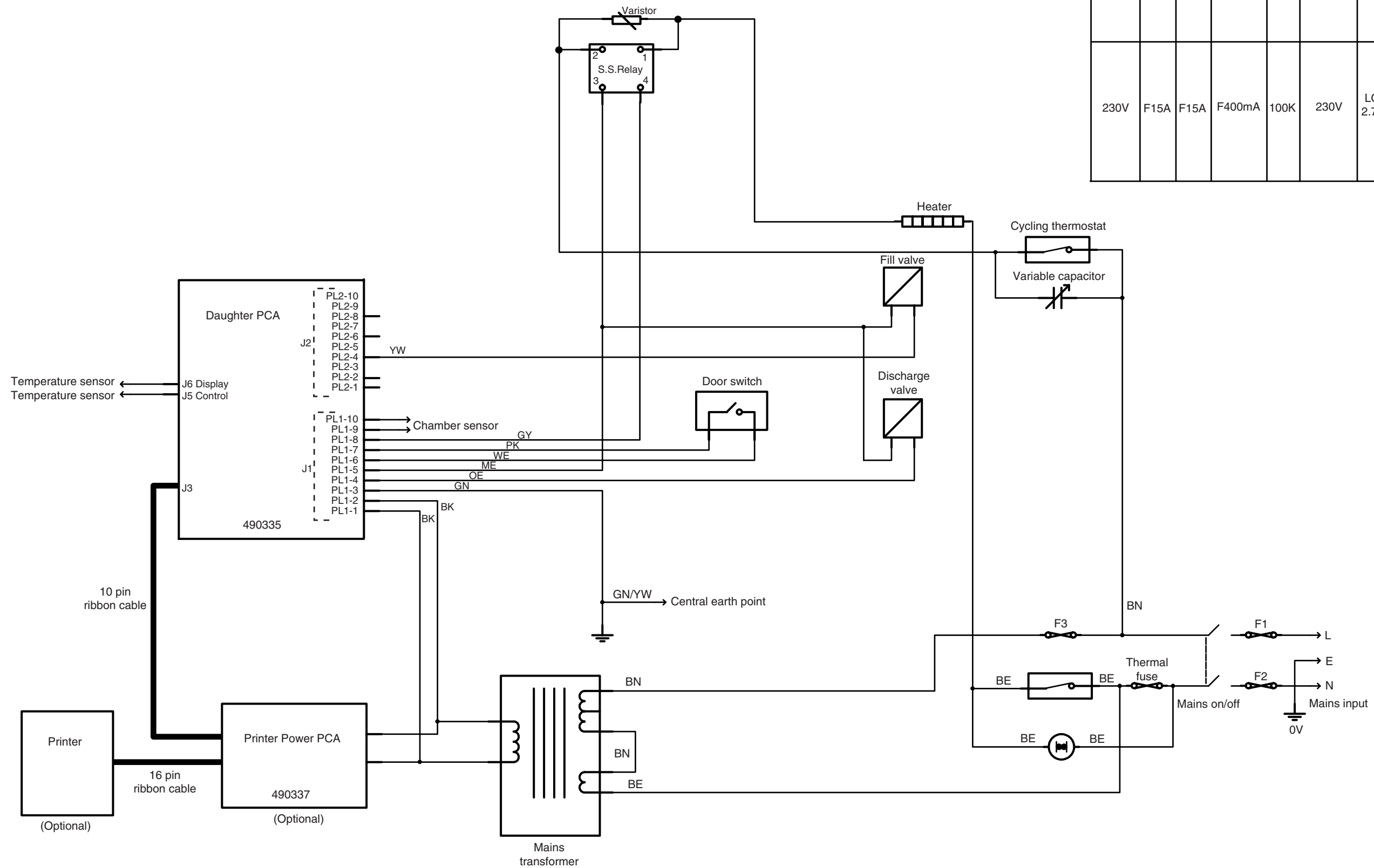


Wire colours	
Abbreviation	Colour
BK	Black
BN	Brown
RD	Red
OE	Orange
YW	Yellow
GN	Green
GN/YW	Green/Yellow
BE	Blue
ME	Mauve
GY	Grey
WE	White
PK	Pink
RD/BK	Red/Black

APPENDIX C - Schematic diagram - non-CE version (see note page 38)

Options chart

Voltage rating	F1	F2	F3	R1	Overheat neon	Heater	Transformer tapings
230V	F10A	F10A	F400mA	100K	230V	STD 2kW	
230V	F15A	F15A	F400mA	100K	230V	LONG 2.75kW	



Wire colours	
Abbreviation	Colour
BK	Black
BN	Brown
RD	Red
OE	Orange
YW	Yellow
GN	Green
GN/YW	Green/Yellow
BE	Blue
ME	Mauve
GY	Grey
WE	White
PK	Pink
RD/BK	Red/Black