



Quorum Technologies

## **SALES SPECIFICATION**

# **E3000 and E3100 Critical Point Drying Apparatus**



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Quorum Technologies

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## 2 General Description

The E3000 Series Critical Point Dryers comprise of a cylindrical, water-cooled pressure chamber, horizontally mounted, with attached gauges and shut-off valves for process control. Two models are available in the series, the E3000 and E3100 (Jumbo). Both models are identical in construction, the only difference being a larger chamber fitted to the E3100.

The **pressure vessel** is machined from solid brass bar to form a cylindrical tube with a wall thickness of approximately 25mm (1"). The vessel wall acts as a water jacket, with a series of narrow bores, drilled lengthways, forming a water passageway for chamber heating and cooling. The ends of the water jacket are sealed with annular end plates and gaskets. Two hose connectors are screwed into the vessel wall, one at each end, for connection to a water supply.

Each end of the vessel is internally threaded. A 25mm (1") thick, toughened glass, viewing window is held in one end by a retaining ring, and a specimen loading door screws into the other end. A 12.5mm (½") thick clear plastic shield is screwed over the viewing window and acts as a safety guard in the unlikely event of the glass cracking. The same size window is used in both models.

There are three **high-pressure** valves, of the right-angle type, fitted to the pressure vessel using 1/4" BSP threaded unions. The valves seal by contact between a ground steel cone and a brass knife edge.

**NOTE: That the efficiency of the valve will be impaired if this metal to metal contact is overtightened.**

The **INLET** and **OUTLET** valves are screwed directly into the top of the pressure vessel and seal against an O-ring. The O-rings are located on their seats by small stainless steel inserts. When the valves are initially fitted, they are adjusted so that the valves face the desired direction when they have been screwed into the vessel. Locking nuts ensure the valves do not rotate. The **DRAIN** valve screws into the bottom of the vessel horizontally via an adapter plug.

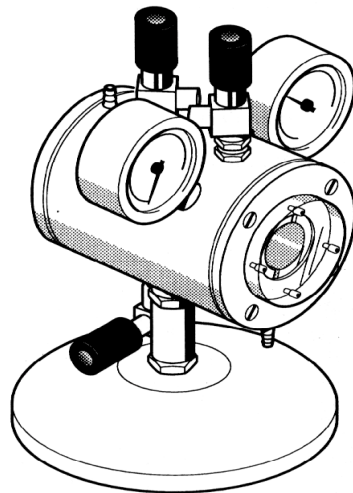
The **thermometer gauge** is of the bi-metallic type and measures the temperature of the pressure vessel brass wall. It attaches to the vessel by means of a push-fit plug inserted in the vessel wall. The gauge screws into the plug such that the sensing head does not penetrate either the water flow in the jacket or the high pressure work chamber.

The **pressure gauge** is a 0-2000 psi bronze Bourdon gauge which screws into a 1/4" BSP threaded port in the upper side of the vessel, and seals onto a fibre washer.

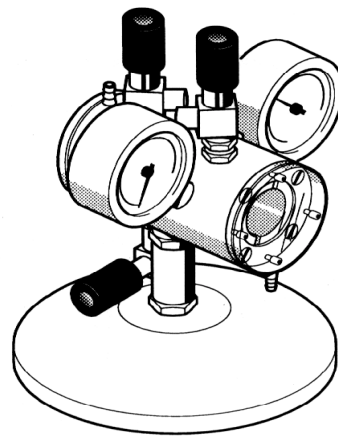
A **safety valve** is incorporated into the stand pillar which supports the pressure vessel. The top of the valve screws into the vessel and is sealed with a bonded seal. The valve exit is a small hole in the side of the pillar. The valve uses a nickel fuse (bursting disc), which is a thin diaphragm guaranteed to rupture at 1850 psi  $\pm$  5% at 20°C. If the disc ruptures as a result of excess pressure, it has to be replaced. A spare bursting disc is included with the apparatus when shipped.

The standard **specimen holder** assembly, consists of a liquid transfer boat, mesh specimen baskets and a stainless steel gauze cover. The transfer boat is an aluminium dish with an integral drain valve and holds the specimens, immersed in substitution fluid (acetone, amyl acetate, freon 113, etc.), during transfer to the pressure chamber. During transfer, a spigot on the end of the transfer boat locates into a drilled hole in the centre of the inside face of the chamber door. In this way, the transfer boat can be carried by the door and loaded into the chamber. As the boat is loaded, the drain valve is activated by a locating pin embedded in the chamber floor. The valve aperture is sufficiently small (0.75mm) to ensure the specimens remain covered until the chamber is filled with liquid CO<sub>2</sub>. The specimen baskets slide into channels formed by the gauze cover returned edges. The cover then fits over the liquid transfer boat, immersing the baskets into the substitution fluid. Various designs of transfer boat and specimen holder are available, with internal slots and cut-outs to accommodate different specimen types and sizes (i.e. glass slides, coverslips and wire tissue baskets).

The apparatus comprises of the following units, Pressure vessel assembly with integral water jacket, end plates (2), window assembly, specimen loading door and water connectors (2), Control valves (3), Thermometer and Pressure gauges, Baseplate, Specimen holder assembly and Transfer pipe.



**Model E3100**



**Model E3000**

## 3 Mechanical Characteristics

### 3.1 Site Requirements

#### 3.1.1 Liquefied Gas

The E3000 and E3100 require a **syphon** cylinder of liquid **CO<sub>2</sub>**. Cylinder connection threads vary from country to country and even between manufacturers in the same country. For example, the transfer pipe supplied is fitted with 1/4" British Standard Pipe (BSP) and 0.860" x 14 tpi. unions. These are standard threads for the UK, but will not fit cylinders in the USA. An **E3000-US** kit should be specified for use within the USA, this includes a transfer pipe adaptor which will fit USA cylinders.

#### 3.1.2 Water

The E3000 and E3100 require both heating and cooling water during the operational cycle. Cooling water is required at between 5°C – 15°C to facilitate filling the workchamber with the liquefied gas. Warm water at up to 40°C is required to heat the pressure above the critical temperature of the process-liquefied gas.

**NOTE:** *Running mains water to waste may contravene local regulations. If in doubt, the user is advised to seek advice from the local water authority.*

An alternative to using mains water supplies is to use the optional E4860 Heater/Chiller closed circuit water circulator.

#### 3.1.3 Exhaust

During operation of the Critical Point Dryer, it is usual to monitor the presence of intermediate fluid (acetone/ethanol) in the exhausting gas. For this reason it is unwise to make a permanent connection to the exhaust port. An arrangement incorporating an in-line type breakable connection would be more practical. With this method, except during gas monitoring, the exhausting CO<sub>2</sub> can be piped into a fume cupboard or out through an open window.

### 3.2 Physical Description

The E3000 Series Critical Point Drying Apparatus (CPDA) has been designed for the dehydration of biological tissue prior to examination in the Scanning Electron Microscope (SEM). Two models are available: the E3000 and the E3100 (Jumbo), the only difference being a larger work chamber on the E3100 model.

Critical Point Drying is an established method of dehydrating samples prior to examination in the Electron Microscope and was first introduced commercially for SEM specimen preparation by POLARON in 1970. The original design concepts which included a horizontal chamber, are still embodied in the design today. These two units have found general acceptance in many laboratories throughout the world. Together these Critical Point Dryers offer the user a choice most suited to the particular specimen preparation requirements.

Although a choice of liquid gases may be used for the critical point drying process, the procedures described in this document assume the use of liquid carbon dioxide (CO<sub>2</sub>) as it is the most commonly used and cheapest option. The E3000 Series apparatus is designed to work at the critical temperature and pressure of CO<sub>2</sub>. The high pressure coupling hose supplied with the E3000 or E3100 has been provided with the appropriate union for connection to a Distillers Company (CO<sub>2</sub>) Ltd. carbon dioxide syphon cylinder.

Cooling water is applied to the water jacket to lower the temperature of the chamber to below 20°C. Chemically dehydrated specimens are loaded and the chamber is filled with liquid CO<sub>2</sub>. A series of flush cycles completely purge the specimens of dehydration fluid, replacing it with liquid CO<sub>2</sub>. Once the specimens are completely saturated in liquid CO<sub>2</sub>, hot water is applied to the water jacket to increase the temperature of the chamber. Chamber pressure increases as the temperature rises, taking the CO<sub>2</sub> through its critical point. The chamber is then slowly decompressed and the dried specimens removed. A slow decompression rate is essential to avoid damage to the specimens.

### 3.3 Technical Specification

#### E3000 Critical Point Dryer Specification

Specimen Chamber:	Horizontal 32mm (1.25") internal diameter x 75mm (3.0") long.
Front Viewing Window:	25mm (1.0") thick toughened glass with clear plastic shield 12.7mm (0.5") thick.
Pressure Chamber:	Water cooled.
Drying medium:	Carbon Dioxide (CO <sub>2</sub> ) or Freon 13 (CClF <sub>3</sub> ).
Working Pressure:	1200 psi with a critical point of approximately 35 <sup>0</sup> c using CO <sub>2</sub> .

#### E3100 Critical Point Dryer Specification

Specimen Chamber:	Horizontal 60mm (2.50") internal diameter x 78mm (3.12") long.
Front Viewing Window:	25mm (1.0") thick toughened glass with clear plastic shield 12.7mm (0.5") thick.
Pressure Chamber:	Water cooled.
Drying medium:	Carbon Dioxide (CO <sub>2</sub> ) or Freon 13 (CClF <sub>3</sub> ).
Working Pressure:	1200 psi with a critical point of approximately 35 <sup>0</sup> c using CO <sub>2</sub> .

### 3.4 Drawing Numbers

The assembly drawing numbers are as follows:

730000101	E3000 Standard Critical Point Dryer Final Assembly
731000101	E3100 Jumbo Critical Point Dryer Final Assembly

## 4 Electrical Characteristics

### 4.1 Electrical Requirements

No electrical requirements needed for this range of Critical Point Dryers. A 230v or 110v supply is required for the optional water circulation equipment.

## 5 Associated Equipment

### 5.1 Accessories

The following are accessories available from Quorum Technologies, which are used on the E3000 and E3100 Critical Point Dryers.

<b>E3000-US:</b>	Cylinder Adaptor Kit to suit CO <sub>2</sub> Cylinders in the USA.
<b>E3000-1:</b>	Specimen Holder for 3.05mm grids.
<b>E3000-2:</b>	Specimen Holder for 2.30mm grids.
<b>E3000-01:</b>	Specimen Holder for Tissue. (For use with the E3000)
<b>E3100-01:</b>	Specimen Holder for Tissue. (For use with the E3100)
<b>E3000-02:</b>	Specimen Holder for Coverslips. (For use with the E3000)
<b>E3100-02:</b>	Specimen Holder for Coverslips. (For use with the E3100)
<b>CPD800:</b>	Porous Specimen Pots (12.7mm diameter x 12.7mm)
<b>CPD801:</b>	Porous Specimen Pots (25.4mm diameter x 25.4mm)

## 6 Optional Equipment

### 6.1 Water Circulation Equipment

<b>E3500:</b>	Thermo-circulator for control of the heating cycle.
<b>E4860:</b>	Heater/Chiller for control of the heating and cooling cycle.

## 7 Performance Specification

### 7.1 Test Performance

Working pressure of 2000 psi with a critical point of approximately 35°C using CO<sub>2</sub>

## 8 Ordering Information

Order No.	Order information
<b>E3000:</b>	Standard Critical Point Dryer complete with Manual.
<b>E3100:</b>	Jumbo Critical Point Dryer complete with Manual.
<b>E3000-US:</b>	Cylinder Adaptor Kit to suit CO <sub>2</sub> Cylinders in the USA.
<b>E3000-1:</b>	Specimen Holder for 3.05mm grids.
<b>E3000-2:</b>	Specimen Holder for 2.30mm grids.
<b>E3000-01:</b>	Specimen Holder for Tissue. (For use with the E3000)
<b>E3100-01:</b>	Specimen Holder for Tissue. (For use with the E3100)
<b>E3000-02:</b>	Specimen Holder for Coverslips. (For use with the E3000)
<b>E3100-02:</b>	Specimen Holder for Coverslips. (For use with the E3100)
<b>E3000-052:</b>	Safety Bursting Disc.
<b>CPD800:</b>	Porous Specimen Pots (12.7mm diameter x 12.7mm)
<b>CPD801:</b>	Porous Specimen Pots (25.4mm diameter x 25.4mm)
<b>E3500:</b>	Thermo-circulator for control of the heating cycle.
<b>E4860:</b>	Heater/Chiller for control of the heating and cooling cycle.