SECTION 1

SPECIFICATIONS

1.1 INTRODUCTION

The Airco Temescal Model BJD-1800 bell jar deposition system is designed specifically for research and production vacuum deposition. The primary design criteria were to provide a system that would ease the workload of the operator and at the same time have a high pumping speed. To accomplish this, the substrate holder is placed at the convenient height of 42 inches, and the net pumping speed is in excess of 800 liters/second in the vacuum chamber.

The Model BJD-1800 system accommodates the majority of commercially available vapor desposition equipment: planetaries, electron beam guns, resistance-heated sources, sputtering modules, shutters, wire feeders, deposition thickness/rate controllers, and substrate heaters, to mention a few.

The Model BJD-1800 system is also adaptable to high-pressure and ion plating. Its low profile allows the installation of a conductance baffle in the evaporation chamber while the high-pressure region is maintained at a convenient work height.

1.1.1 Design Features

a) Loading and unloading substrates is done at slightly above waist level.

b) The 18-inch-diameter by 9-inch-high stainless steel substrate chamber is hinged and spring-loaded. It requires little effort to raise and lower. This eliminates the need for a bell jar hoist and such accompanying problems as hoist "chatter" and mechanical failure.

c) The standard pumping module has a speed of 1000 liters/second at the high-vacuum plenum chamber and more than 800 liters/second at the evaporation chamber. These high pumping speeds are extremely important in handling the gas loads given off during high-rate evaporation.

d) The pumping port into the high-vacuum chamber measures a full 6 inches high by 12 inches wide (72 sq. in.) and is located where it is most effective--between substrates and evaporation source.

e) The Model BJD-1800 system is all stainless steel to achieve highest vacuum integrity and easy cleaning. All internal surfaces exposed to high vacuum are #4 finish. In addition, all dynamic seals are bellows-sealed, and o-rings are used only as static seals.

f) The evaporation sources and associated shutters are mounted on a bottom plate which can be lowered by a built-in jackscrew. When lowered, the evaporation source plate swings out to the front of the system for easy access.

g) The pumping port is offset from the evaporation chamber to eliminate the possibility of broken substrates or evaporation materials, and dropping tweezers into the pumping module.

1.2 EQUIPMENT

1.2.1 Pumping System

1.2.1.1 **Diffusion pump.** The standard system utilizes a 2400 liter/second, 6-inch, high-speed diffusion pump with a cold cap to minimize backstreaming. The pump is charged with highly stable DC-705 diffusion pump oil and is supplied with a thermal protection switch to ensure adequate water cooling.

1.2.1.2 **Cryogenic pump.** Cryogenically pumped systems use an 8-in. high-speed pump that consists of a cold head and a vacuum housing that contains 2 condensing arrays, a cryoadsorbing array, and a radiation shield. The cold head is connected by piping to a remote compressor unit.

1.2.1.3 **Liquid nitrogen (LN_2) trap.** The LN_2 trap has an LN_2-cooled antimigration barrier, a capacity of 6.5 liters, and a holding time of 24 hours. It is optically dense.

1.2.1.4 **High-vacuum valve.** The high-vacuum valve is a 7-3/4 inch ID all stainless-steel poppet valve with a welded bellows shaft seal. The valve is built into the stainless-steel high-vacuum chamber for high conductance. It is electro-pneumatically actuated.

1.2.1.5 **Roughing, foreline, and vent valves and manifolding.** The roughing and foreline valves are Airco Temescal 1-1/2-inch Model 2030 stainless-steel and Model 1130 brass angle valves, respectively. Both valves are electro-pneumatically actuated and incorporate replaceable bellows. In the roughing valve all surfaces exposed to high vacuum are stainless steel.

The vent valve is an Airco Temescal 1/4-inch Model SV-1 stainless steel solenoid valve. Manifolding includes a port in the foreline for leak detection.

1.2.1.6 **Mechanical pump.** One 23.3-cfm two-stage mechanical pump performs roughing and foreline service. The pump is complete with motor, belt guard, vented exhaust, and initial charge of pump fluid. It is mounted on the floor within the cabinet and is isolated from the main pumping chamber to prevent the transmission of pump vibrations.

1.2.2 **High-Vacuum Chamber**
The high-vacuum chamber has three sections:

1.2.2.1 **The evaporation chamber.** This chamber is all stainless steel with a clear 4-inch viewing port in the front. The chamber measures 18 inches in diameter by 18 inches deep with a 12-inch-wide, 6-inch-high, and 14-inch-deep valve plenum chamber. Two one-inch-diameter blank bolt-type feedthroughs are installed in the evaporation chamber.

1.2.2.2 **The source tray.** The evaporation source tray is an 18-inch-diameter flat plate for mounting electron beam guns and resistance-heated sources. The tray seals against the bottom of the evaporation chamber with a Viton o-ring. It can be raised and lowered with a built-in jackscrew. When lowered, the source tray swings out to the front of the system for easy access. Ten one-inch-diameter blank bolt-type feedthroughs are installed in the source tray of a basic system.

1.2.2.3 **The substrate chamber.** The standard substrate chamber is an 18-inch-diameter by 9-inch-high stainless-steel dome. A Viton o-ring seals between the substrate and evaporation chambers. The substrate chamber is equipped with a spring-assisted hinge mounted at a height of 42 inches for easy loading and unloading.

1.2.3 **Instrumentation and Controls**

1.2.3.1 **Gauge controller.** The standard gauge controller is a VersaVac™ 2 ionization/thermocouple gauge controller described in Airco Temescal manual 0101-8941-0.

1.2.3.2 **Vacuum map and vacuum control module.** The arrangement of the valves is indicated on a front panel vacuum map with lights to show their location and status. The associated valve controller operates in the manual mode or in one of several automatic modes. In the automatic mode a START button initiates the

cycle and a STOP button terminates it. In the manual mode toggle switches control the valves.

CAUTION
Interlocks do not protect the equipment in the manual mode.

1.2.3.3 **Control panel.** All circuit breakers necessary for complete system operation are located on this panel.

1.2.4 **Pumping Performance**
The performance of a dry, clean, and empty Model BJD-1800 system (15-inch-diameter by 9-inch-high domed substrate chamber) having a 2400 liter/second diffusion pump or an 8-inch cryogenic pump and a 23.3-cfm mechanical pump is described below.

a) Pumpdown from atmosphere to 5×10^{-7} torr: 15 minutes or less.

b) Pumpdown from atmosphere to 1×10^{-7} torr: 60 minutes or less.

c) Ultimate vacuum: mid 10^{-8}-torr range.

1.3 WEIGHT AND DIMENSIONS (APPROXIMATE)

1.3.1 **Weight**
The total system weight is approximately 980 pounds with exact weight depending on the system configuration and options specified.

1.3.2 **Dimensions, Main Unit**
Width: 56 inches (1422 mm)
Depth: 34 inches (864 mm)
Height: 43 inches table top (1067 mm)
54 inches overall (1372 mm)

1.3.3 **Dimensions, Instrumentation Cabinet, Counter-Top**
Width: 23.75 inches (503.3 mm)
Depth: 27 inches (586 mm)
Height: 30 inches (762 mm)

1.3.4 **Dimensions, Instrumentation Cabinet, Floor Mounted**

Width: 23.75 inches (503.3 mm)
Depth: 27 inches (586 mm)
Height: 70 inches (1778 mm)

1.4 ELECTRICAL SPECIFICATIONS

The system is designed for 208-volt, 3-phase, wye-connected, 60 hertz operation. (Different voltages, configurations, phases, and frequencies can be supplied on special order.) The total power required for the basic system without optional equipment is 4200 watts. Maximum line current at 208-volt, 3-phase, wye-connected operation is 15 amperes.

1.5 SUPPORT UTILITIES

1.5.1 Water

The minimum flow rate for the diffusion pump is 0.25 gallon per minute (gpm). Total water requirements will vary depending on the equipment installed (i.e., electron beam gun).

1.5.2 Air

Valve air pressure: 60 to 125 psig.

1.5.3 Heat Discharge

The heat discharged into the room by the basic system is approximately 7000 Btu/hr.

1.5.4 Optional Equipment

Consult the manufacturers' published material, listed under "Component Manuals" for the utility requirements.