GENERAL INFORMATION

1.1 SAFETY

Plasma-Therm, Inc. designs and manufactures its equipment in accordance with two major criteria; that the units meet or exceed established performance specifications, and also, satisfy stringent operator safety requirements. Wherever personnel hazards exist, all possible precautions have been integrated into the equipment, and appropriate warnings noted. Refer to the detailed safety information in Section Two, paragraph 2.3.

Voltages supplied to and within certain areas of the system are potentially dangerous and can cause injury to personnel. Many gases are toxic and hazardous and vacuum pump outgases may be harmful to personnel if proper exhaust precautions are not taken. Other cautions and warnings are provided where applicable.

Voltage interlocks should not be overridden or bypassed unless competent maintenance personnel are servicing an "Out of Service" unit.

WARNING! POTENTIAL HAZARDS EXIST IN AN ELECTROMECHANICAL ENVIRONMENT TO PREVENT INJURY TO PERSONNEL OR EQUIPMENT DAMAGE, ENSURE POWER IS OFF AT SERVICE PANEL FOLLOW COMPANY AND GOVERNMENT SAFETY REGULATIONS KEEP UNAUTHORIZED PERSONNEL OUT OF THE AREA WHEN WORKING ON EQUIPMENT.

1.2 INTRODUCTION

This manual contains general and specific information on the Batchtop Series of plasma processing systems. Differences among models are highlighted by either eparate paragraphs, tables and charts, or illustrations.

The manual is composed of two parts. Part One (User's Manual) contains the text, pictorial, and block diagrams. Part Two (Service Documentation) contains the schematic, logic, wiring, and assembly diagrams. Where applicable, part identification tables are included.

1.3 GENERAL DESCRIPTION

Plasma-Therm, Inc. manufactures several versions of the Batchtop plasma processing system, depending upon wafer and process requirements. The basic configurations are Models RIE (Reactive Ion Etch), PECVD (Plasma Enhanced Chemcal Vapor Deposition), and PE/RIE (Plasma Etch and Reactive Ion Etch).

The basic Batchtop series system is composed of a single process chamber. The Batchtop chamber is offered in a variety of process configurations as described below.

Batchtop RIE…….is configured for Reactive Ion Etching. It consists of a process chamber, grounded top electrode assembly (with gas feed), and a powered, fluid cooled substrate electrode. This system is primarily used for anisotropic etching processes or for the deposition of hard carbon films.

Other plasma configurations are also possible. One version combines a powered lower electrode (as in RIE) with a heated lower electrode (as in PECVD). This combination is used for high temperature etching as well as deposition of hard carbon films.

Customized chamber configurations are also available to meet specific user requirements.

The Batchtop is controlled by means of an Dell PC which runs under MS-DOS in conjunction with Windows. The Windows graphic user interface (G.U.I.) provides a familiar and easy to learn programming environment for process programming.

An optional programmable endpoint detector permits a selected amount of over-etch resulting in extremely specific and positive endpoint control.

1.4 SYSTEM CONFIGURATION

The Batchtop Series configuration has been developed with consideration given to both present and future installation requirements. Support sub-systems (i.e., vacuum systems and hear exchanger) exist as discrete units allowing remote placement. This concept greatly simplifies maintenance and permits easy adaptation to a variety of clean room or core area situations. The Main Cabinet contains all equipment directly involved in wafer processing. It is compact and cleanroom compatible. All components are easily accessible via the front, rear and side access panels. Maintenance can be preformed in the

cleanroom or the entire system can be easily moved to some other appropriate site. System operations are carried out from the front only, top or side access is unnecessary. The other system components can be located in the clean room or in some adjacent service area. This inherent design flexibility, along with the resulting ease of service and maintenance afforded by having units out in the open, makes the system adaptable to virtually all process environments.

1.4.1 MAIN CABINET

The main Cabinet, shown in Figures 1-1 and 1-2 consist of the following units:

- **Process Chamber**: The configuration is determined by the type of process to be performed.

- **EPO button**: is located at the Main Cabinet left front and is used only to shut down the system under an emergency condition.

- **Valve Pack Panel**: This module is located in the gas panel enclosure in the Main Cabinet. It houses the solenoids that operate all air driven devices in the system.

- **CSC**: This is a 80386 based computer for control of parametric values such as: power, pressure, gas flow and time. Its features a color CRT, VGA graphics and a menu driven operating system, plus a DOS window for data trending and analysis.

- **Fluid Input Panel**: This module is located at the lower left rear of the Main Cabinet. It contains the connections for all fluid and pneumatic inputs to and outputs from the Main Cabinet.

- **Automatic Matching Network**: The Automatic Matching Network is located in the Main Cabinet. It is used to match the chamber with the RF Generator. It consists of a fluid cooled inductor, two variable capacitors, and detection circuitry to monitor the quality of the match.

  Basically, its function is to match the impedance of the chamber to the output amplifier of the RF Generator, which must see a resistive load of 50 ohms to operate properly.

  Normally, this is done automatically by way of detection circuitry within the matching network, which monitors both the phase angle between the incoming RF voltage and current, and the relative magnitudes of these same two parameters, as they arrive from the RF Generator.

If these detectors find that the generator is "looking" into a non ideal load, appropriate error signals are sent to the AMN Controller which in turn drives the variable capacitors of the AMN in an appropriate fashion to optimize the generator's output load.

The quality of this match is displayed by the reflected power meter on the RF Generator itself, and also on the video monitor. Typically, a match of under 10-watts reflected power is maintained, and is considered nominal.

- **Gas Panel**: This panel is located within the top right area of the Main Cabinet. It contains the connections for the gas lines. It also houses mass flow controllers, gas pressure switches, and the pneumatic control module. This panel is completely isolated from other components in the Main Cabinet. All gas lines are

connected inside the gas panel. The panel is exhausted by means of a 2-inch OD port.

- **Electrical Interface Panel**: This unit is located at the right rear of the Main Cabinet. It interfaces all standard component power requirements to the Main Cabinet via flexible conduit from the facility power feed.

DC power (+24VDC,+-15VDC) is distributed to devices in the Main Cabinet from this unit. Power supply sense terminals are connected to its outputs. Each voltage has a 6-amp circuit breaker on 24-volts DC, a 2-apm circuit breaker on +-15volts DC, and a 2-amp circuit breaker on the -15-volts DC in series to either two or three pins of the DC distribution connector, J1. EPO circuit wiring is brought to the Front Panel Control through the unit, by way of the AUX EPO connector.

- **Automatic Pressure Controller (APC):** The APC controls a 63MM throttle valve which varies the effective pumping speed, thereby maintaining a constant pressure within the process chamber. Typically, the control system consists of three basic parts: (1) a pressure sensor on the chamber, (2) a controller and control valve also on the chamber, (3) the system whose pressure is to be controlled.

The system's 15-volt DC power supply provides an output to power a pressure transducer. The APC accepts a 0- to 10-volt DC pressure signal from that transducer. The 10-volt DC signal from the transducer equals 2 torr. External signals from the system controller are used to supply the external setpoint. The APC will take the DC pressure transducer signal compare it to the setpoint signal from the computer, and position the valve in such a manner as to drive the actual pressure to the set pressure. Additionally, the APC sends the pressure signal from the capacitance manometer and the valve limit signals to the computer.

- **Core Control Panel**: This module is located at the right rear of the Main Cabinet. It contains a connector which interfaces the pump control control signals to the Main Cabinet.

- **Automatic Matching Network Controller**: The Automatic Matching Network (AMN) Controller is located on the lower front of the Main Cabinet.

- **RF Generator**: The RF Generator is located at the front lower right of the system as viewed from the front. It is a 500-watt solid-state 13.56MHz generator. All cables and services enter at the rear of the unit. It is interfaced to the computer. Power and voltage control is normally accomplished by choosing values which are then displayed on the video monitor. The unit may also be operated manually. Power for the RF Generator is supplied by the electrical interface panel.

- **Electric Heat Control**: This unit is located at the lower left front of the Main Cabinet. The unit controls the heating of up to four electrodes in various configurations.