Plasma Prep II Maintenance & Instruction Manual

SPI Supplies Division of STRUCTURE PROBE, INC.

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WARRANTY

The SPI Supplies unit you have purchased is guaranteed to be free of defects in workmanship on the day of shipment. This warranty covers parts and labor for a period of one year, excluding shipping charges or consumables. Breakage of glassware is specifically excluded from this warranty.

Proper use of your unit, according to this instruction manual, should result in trouble-free operation. Any improper use of the SPI Supplies unit through modifications or unreasonable operating procedures will void this warranty.

DISCLAIMER

SPI Supplies instruments are designed for simplicity of installation and operation. This manual provides full and complete information in both these areas. SPI Supplies therefore assumes no liability or responsibility of any kind for damage or injury resulting from incorrect installation or operation of the machine. If questions arise, call SPI Supplies TOLL FREE at (800) 242-4SPI (USA only). FAX at 1-610-436-5755 or EMAIL at SPI2SPI@2SPI.com for assistance.

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SPI PLASMA-PREP II

UNPACKING INSTRUCTIONS

This instrument is shipped complete in one packing carton. Examine the shipping carton for evidence of damage. The unit was thoroughly inspected and carefully packed before leaving our premises. Responsibility for its safe delivery was assumed by the carrier at the time of shipment. Claims for loss or damage to the contents should therefore be made upon the carrier and should be reported to the carrier's agent immediately.

SEE INSTRUCTION SHEET THAT FOLLOWS FOR FILING DAMAGE CLAIM

Open the carton and remove the instruction manual. Immediately beneath it you will find the hose resting on top of the unit as well as an envelope containing two hose clamps. Remove hose from carton and attach a hose clamp to each end. Remove and retain the packing slip.

List Plasma-Prep II out of the carton and remove the foam end caps. Place the unit on a sturdy bench or table.

Remove large styrofoam box from the sidewall partition and place on dry, stable surface. Inside you will find the inner and outer chambers as well as two power tubes.

Carefully inspect machine for any damage to the enclosure, chamber sections, switches, knobs and other components. If components are missing, notify SPI Supplies immediately. For damage caused in shipping, see following page.

*****NEXT STEP: MOVE ON TO THE INSTRUCTION MANUAL*****

FILING A DAMAGE CLAIM

CONCEALED LOSS OR DAMAGE:

This is damage which does not become apparent until the instrument has been unpacked. The contents may be damaged in transit due to rough handling even though the carton may not show external damage. If damage is discovered upon unpacking, make a written request for inspection by the carrier's agent within fifteen (15) days of the delivery date. Carton and all interior packing must be held for carrier inspection. Then file a claim with the carrier since such damage is the carrier's responsibility. By following these instructions carefully we guarantee our full support of your claims to protect you against loss from concealed damage. If packing materials are not held for inspection by carrier's inspector, your claim may be disallowed.

VISIBLE LOSS OR DAMAGE:

Any external evidence of loss or damage must be noted on the freight bill or receipt and signed by the carrier's agent. Failure to adequately describe such external evidence of loss may result in the carrier refusing to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

DO NOT RETURN DAMAGED MERCHANDISE TO US

FILE YOUR CLAIM AS ABOVE

The SPI Supplies Plasma-Prep II system is guaranteed to be free of defects in workmanship and components. This warranty covers labor for a period of 6 months and parts, with the exception of glassware, electron tubes and "O" rings, for a period of one year.

After 6 months, customer will be responsible for cost of labor plus shipping charges.

Proper use of your Plasma-Prep II instrument according to this instruction manual should result in trouble-free operation. Any improper use of the SPI Supplies unit through modifications or unreasonable operation procedure will void this warranty.

DISCLAIMER

SPI Supplies Plasma-Prep II is designed for simplicity of installation and operation. This manual provides full and complete information in both of these areas. SPI Supplies therefore assumes no liability or responsibility of any kind for damage or injury resulting from incorrect installation or operation of the machine. If any questions arise, call SPI Supplies from the USA TOLL-FREE 800-2424-SPI for assistance. From Canada call 800-526-6562 or our office in Toronto, 416-787-9193. For all other countries, contact our nearest agent or SPI Supplies directly, either by phone [610-436-5400], FAX [610-436-5755, or e-mail at spi3spi@2spi.com].

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION 1

PLEASE - TAKE A MOMENT TO READ SECTION ONE [1] BEFORE PROCEEDING TO INSTALLATION

GENERAL DESCRIPTION - SPI PLASMA-PREP II?

1-1 GENERAL COMMENTS

The SPI Supplies Plasma-Prep II is a table top plasma chemistry reactor designed to provide plasma technology at a moderate cost. This simple-to-operate instrument can perform repeatable plasma chemical reactions with a minimum of automation. All controls are manual; however, where necessary, automatic monitors and controls take over to protect the equipment and the samples in the reactor.

The Plasma-Prep II comes equipped with an internally housed RF generator. RF power is transferred from a power amplifier directly coupled to the reaction chamber. A variable capacitor provides a tuning control for resonating the power amplifier. An audible alarm sounds whenever the power amplifier is out of resonance. This also aids in tuning since the alarm-off "window" corresponds to the "in tune" state of the machine.

Instrumentation for the Plasma-Prep II consists of a power tuning indicator and the audible tuning alarm.

1-2 FUNCTIONAL DESCRIPTION

The Plasma-Prep II is a small reactor which weighs under 31 pounds fully assembled, less vacuum pump. With the exception of the external vacuum pump, it is a fully self-contained machine. It consists of an RF generator and associated tuning circuits, a vacuum system with solenoid control valves, a constant feed gas supply system and a reaction chamber system which includes two semitubular electrodes and two Pyrex glass chamber elements.

1-2.1 RF Generator - The RF power source includes a solid state oscillator operating at 13.56 MHz, the FCC-authorized industrial frequency. A solid state driver and two 4-65A vacuum tube power amplifiers operated in parallel to provide a continuous wave power of up to 100 watts. Power transfer to the reaction chamber is accomplished

via the electric field between the semitubular electrodes. Maximum power transfer is realized by a suitable tap on the final amplifier tuned circuit. The tuning control allows the tuning of the final amplifier tuned circuit to resonance providing the maximum output power.

1-2.2 Vacuum System - The vacuum system includes the vacuum pump (not supplied as part of the Plasma-Prep II), the vacuum hose, the vacuum valves and the control circuitry. The vacuum valve switch is interlocked with the RF generator switch to prevent the RF power from coming on unless the vacuum valve is energized. (**CAUTION:** There is no vacuum sensing, so the vacuum pump must be attached and operating).

1-2.3 Gas Supply System - The gas supply system for the Plasma-Prep II consists of the gas delivery system inside the reaction chamber. This delivery system is a glass tube sealed on the inner end and perforated along its bottom surface. Connections to the delivery tube are made by sliding the silicone tubing over the barbed fittings on the glass chamber.

1-2.4 Reaction Chamber - The reaction chamber sub-system consists of an upper and lower electrode and a two element Pyrex glass reaction chamber (See Fig. 2-1). (For CF_4 operation, a quartz chamber should be used). These are open ended cylinders designed to fit into each other to form a closed chamber. The chamber is sealed with a flat silicone gasket which seats against a raised lip on the inner chamber portion. The gas delivery tube feeds through the back of the outer chamber section. This chamber section also provides connection to the vacuum hose by a glass tube joined at the front of the chamber. The inner chamber is perforated by a series of slots located on the bottom surface of the chamber. Four little glass "feet" on the bottom of the inside chamber raise it off the inside surface of the outer chamber to provide a space between the two chamber sections. This arrangement provides for the best gas conduction flow and results in repeatable, dependable processing.

1-2.5 The AAS (Audio Alarm System) is provided to give an alarm when the plate dissipation of the final amplifier is excessive. Simultaneously, the AAS will disable the RF

drive to the final amplifier and reduce this plate dissipation. This sets up a cyclical or pulsed mode. In this mode the RF power is turned on and off on a duty cycle that is inversely proportional to the plate dissipation. That is, the greater the dissipation, the shorter is the time the power is on. This will effectively protect the final amplifier tube's life, as excessive plate dissipation shortens tube life.

1-3 SAFETY INFORMATION

Interlocks - There are two microswitch interlocks engineered into the machine to prevent injury to operating personnel. These are:

a. Front door interlock-cuts off AC to the RF power supply
b. Right side, front and rear-shuts off all primary power

*****WARNING*****

SINCE THE GAS MOST USUALLY USED IN THE PLASMA-PREP II IS OXYGEN, NO SMOKING SIGNS SHOULD BE POSTED NEAR THE MACHINE AND THE NO SMOKING BAN OBSERVED

Even if a different gas is going to be used, we still recommend the enforcement of the NO SMOKING ban because, quite frequently, the user has an unanticipated need for oxygen and the NO SMOKING ban would be appropriate.

1-4 TYPICAL PLASMA PROCESS

The "Plasma Process" is accomplished through the use of a low pressure, RF induced gaseous discharge. The material or specimen is loaded into the reaction chamber. The chamber is evacuated to a mild vacuum (approximately 200 microns) by a mechanical vacuum pump. A carrier gas is drawn through the chamber over the specimen. Radio frequency power is applied around the chamber (at 13.56MHz). This excites the carrier gas molecules and changes some of them into chemically active atoms and molecules.

The mechanism employed in this process is one of oxidation. Electrons produced by ionization of gas, gain energy in the electric field. Subsequent collisions between these energetic electrons and neutral gas molecules result in an energy transfer to the molecules producing chemically active atoms, free radicals, ions and free electrons. The combustion

products, which are completely dissociated and harmless, are carried away in the gas stream. The unique property of this process is that it occurs near ambient temperatures without employing toxic chemicals.

1-5 ACCESS TO PROCESS MONITORING

Another connection is provided for the addition of a pressure transducer to monitor chamber pressure. Recommended Model #11019 (see page 10). This connection is marked PRESS (Pressure) PORT. Spare parts are available (see page 25).

TABLE OF SPECIFICATIONS

PHYSICAL DIMENSIONS

Height	10.5 inches (26.7cm)
Width	11.8 inches (30.0cm)
Length	14.8 inches (37.6cm)

WEIGHT

Assembled	31 pounds
Ship w/container	44 pounds

EFFECTIVE CHAMBER SIZE

Inside length	5.9 inches (15.0cm)
Inside diameter	4.15 inches (10.54cm)

RF POWER	0 to 100 Watts
RF FREQUENCY	13.56MHz crystal controlled
RF TUNING	Variable capacitor to maintain resonance
AC POWER	120 VAC, 50/60Hz 15 amp line service (not including vacuum pump)

NOTE: The Plasma-Prep II meets Article 18 of the FCC and NIOSH radiation standards.

SECTION 2

INSTALLATION AND PREPARATION FOR USE

2.1 FACILITY REQUIREMENTS

The Plasma-Prep II is designed for table top use. The facility requirements to operate the Plasma-Prep II are:

a. Vacuum pump capable of 50-100 liters per minute. We recommend the SPI#10405-AB (equipped with Fomblin oil). For use with CF_4 process gas 10404-AB (with hydrocarbon oil) is recommended.

b. Gas supply - oxygen (O_2), industrial grade with regulator capable of supplying 5 PSIG, and shut off valve.

c. 120 VAC 50/60 Hz, 15 amp service.

2-2 SITE REQUIREMENTS

There are very few constraints on the location of the Plasma-Prep II in use. The machine should be operated in a well ventilated area away from any corrosive fumes. The supply from the cooling fan should not be obstructed. The machine's exhaust (the vacuum pump exhaust) should be vented away from operating personnel. Finally, the machine should be far enough away from high voltage equipment to prevent possible high voltage interference.

2-3 ASSEMBLY

The only assembly required when installing a Plasma-Prep II consists of putting the outer chamber into the electrodes, connections to gas, vacuum and electrical power.

INSTALLING THE OUTER CHAMBER (Fig. 2-1) - with the machine resting on a convenient work surface, remove the four screws (two on each side) at the bottom of the sheet metal top cover. Remove the top cover only.

a. Open the door and remove the two nylon screws and spacing bushings on the left side and loosen the two nylon screws on the right side.

b. Remove the outer chamber from its shipping container. Make sure no packing material is in the chamber.

c. Lift the upper shell (cover will "hinge" on the two loosened screws). Slide chamber to the rear of the shell and engage the two silicon tubes over the barbed fittings on the glass chamber.

d. Locate the exhaust manifold at the front-center floor of the cabinet. Loosen the brass compression nut to accept the extension of the outer chamber for fitting into vacuum manifold.

e. Following insertion of the glass extension inside the manifold, tighten the knurled compression nut, finger tight. **DO NOT OVERTIGHTEN** as this can affect the vacuum.

f. Replace the two nylon screws that were removed from the left side and retighten them. **DO NOT OVERTIGHTEN** as this can damage the threads.

WARNING

Never use metallic screws in place of the nylon screws. Metal, even this small amount, will short circuit the chamber's electrodes.

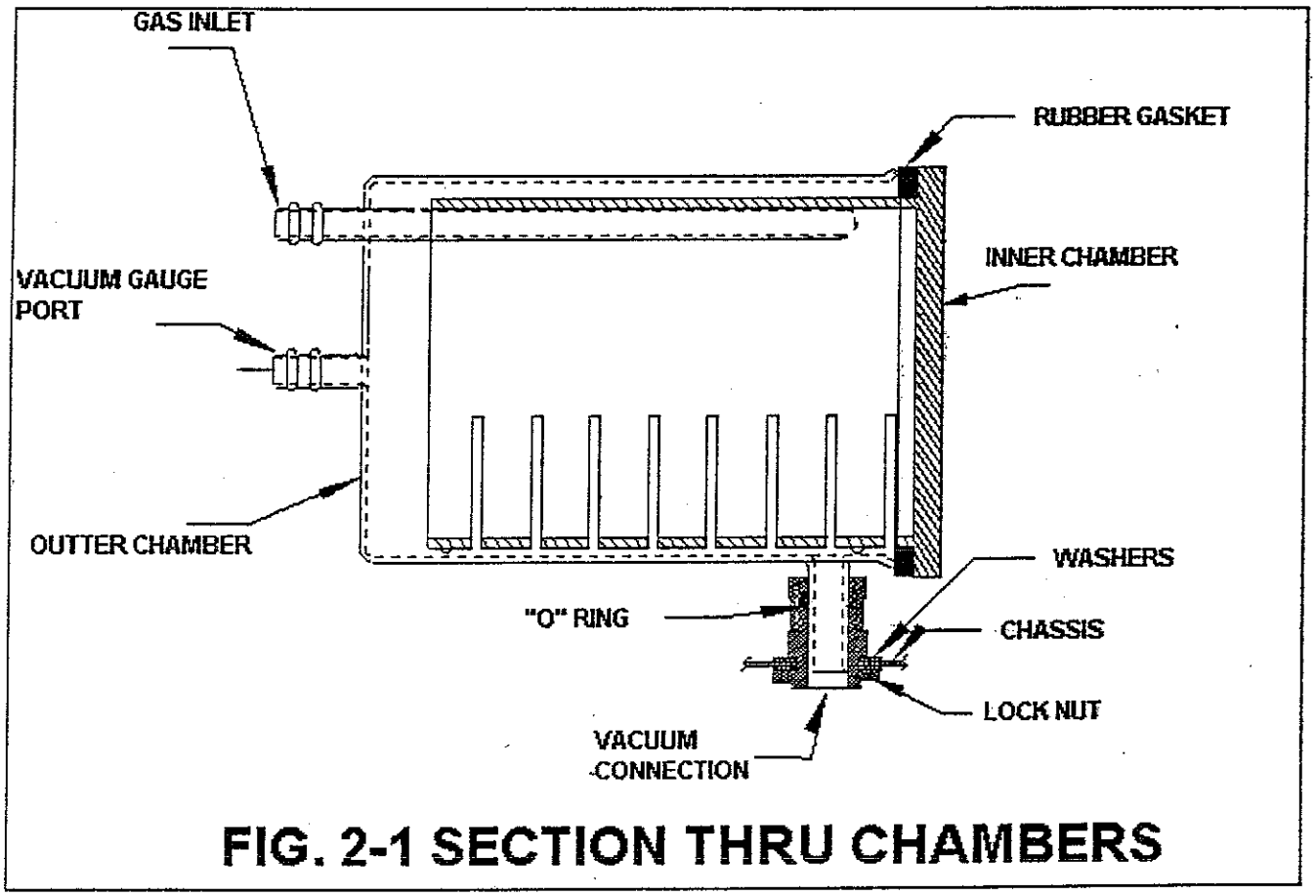


Figure 2-1. Connecting Outer Chamber to Vacuum Manifold

2-3.1 CONNECTING VACUUM PUMP

A. Connect the flexible metal vacuum pipe to the nw16 flange connection on the rear of PPII and to the vacuum pump using the "O" ring and clamp provided.

b. Connect the regulated gas supply hose to the quarter-inch fitting GAS IN, Item 12 of Figure 3-2, located at rear of the machine.

machine.

*****WARNING*****

Make sure that the VACUUM switch, the RF switch and the METER switch are all off (down position). Turn the LEVEL control fully counterclockwise.

2-3.2 INSTALLING THE INNER CHAMBER

a. On the Inner Chamber Section, make sure that the sealing "O" ring is not twisted and will seat against the inner lip of the chamber section.

b. Carefully insert the Inner Chamber into the Outer Chamber, orienting the slot perforations to the bottom of the chamber. There are four little glass knobs which function as "feet" to provide some space at the bottom between the Inner and Outer Chamber sections.

c. Remove the RF power tubes from their shipping container. As a matter of good practice, handle the tubes by their ends rather than in the middle. Use clean hands to avoid depositing finger oils on the glass barrel of the tube. Install the tubes into their sockets. The tube base and socket are keyed by one tube prong being larger this allows the proper orientation of the tube in the socket.

d. Put the power tube connectors (these are taped to the top of the chassis for shipping) on the tube plate caps on the top of each tube and secure them with the hardware supplied with the connector.

e. Replace the top cover and secure with the four screws.

NOTE OF CAUTION: There are two interlock switches mounted on the right side (as viewed from the front) at chassis height. These are lever types. When replacing the top cover, be sure to pull it slightly up, to clear the switch levers, to avoid damaging the interlock switches.

2-3.3 INSTALLATION OF OPTIONAL VACUUM GAUGE

SPI#11019 VACUUM GAUGE INSTALLATION INSTRUCTIONS

Remove the pipe plug located on rear of instrument, labeled pressure port.

Tape the thermocouple tube using Teflon tape. Three wraps should be sufficient.

Screw the gauge into the port.

Insert and tighten with wrench.

DO NOT OVERTIGHTEN

Plug in octal socket into thermocouple gauge tube.

Insert 110AC plug into 110 grounded AC outlet.

Green indicator light will come on.

SECTION 3

OPERATION

3-1 GENERAL

Operation of the Plasma-Prep II consists of loading the object to be processed, evacuating the reaction chamber, applying the process gas and applying the energizing RF power. The RF amplifier must be resonated and power level adjusted to the appropriate level. Upon completion of the process, the RF power switch is turned off, the vacuum valve switch is turned off. The primary power must remain on for the chamber to bleed back to atmospheric pressure.

3-2 CONTROLS AND INDICATORS

Table 3-1 and Figures 3-1, 3-2 are a table of controls and indicators and illustrations of their location on the machine respectively.

3-3 OPERATION

To operate the Plasma-Prep II, proceed as follows:

a. Power, vacuum and RF switches should be off. Meter and AAS switches on.

b. Start vacuum pump. Turn on AC power by depressing the AC switch (No. 1, Fig. 3-1). The pilot lamp will light and the filament of the tubes will glow yellow. Allow the tubes and the vacuum pump to warm up for at least 2 minutes.

c. Open the chamber access door. Make sure the inner chamber is fully into the outer chamber and the gasket is sealed between inner and outer chambers.* Turn on vacuum switch (No. 2, Fig. 3-1), allow approximately 1 minute for pumpdown. Close access door.

***CAUTION:** Do not put excessive pressure on the inner chamber. This can cause stress on the glass extension to the vacuum connection and possible failure by implosion of the chamber.

d. Check to be sure the alarm switch (No. 8, Fig. 3-2) and meter switch (No. 7, Fig. 3-1) are on (upward position). Turn the RF power switch (No. 3, Fig. 3-1) on (upward position). Advance (clockwise) the power level control (No. 4, Fig. 3-1) until there is an indication on the plate current meter (No. 6, Fig. 3-6) of approximately 10 to 30ma. Turn the tuning control (No. 5, Fig. 3-11) counterclockwise and clockwise until a dip in the plate current meter is seen. Rock the tuning control back and forth until a minimum is achieved. Advance the power level control until the meter is indicating 80 to 100mA and again rock the tuning control until a minimum is achieved. Full power out will be when the meter indicates 100maE(+/- 20%) at the minimum setting of the tuning control. Operating at lower levels of power is achieved by reducing the power level but maintaining a minimum with the tuning control.

NOTE 1:
The meter levels are dependent on a number of variables including but not limited to line voltage, type of gas used and the pressure in the chamber. The minimum RF meter level when set at full RF power is typically in the 80 to 100mA range, but may not register at that level and still be properly functioning.

NOTE 2: After the Plasma-Prep II is tuned on the initial use, allow the unit to run for approximately one hour before using it. This will eliminate any contamination, which might be present in the chamber. Either air or process gas (O^2) can be used for this purpose.

e. When the alarm sounds, the final amplifier should be returned to resonance, which will be indicated by a dip in the plate current meter and simultaneously an increase in plasma. The audio alarm will stop but may not respond immediately as the infrared of the plates will not dissipate instantly.

f. When operating the unit unattended, the meter switch should be turned off. In this position the power limit circuit is engaged and will protect the power amplifier tubes. To retune, turn the meter switch back on.

Turn off Plasma-Prep II as follows:

a. Turn LEVEL control fully counterclockwise.

b. Turn RF switch off (down).

c. Turn VACUUM switch off (down).*

d. The machine can now be loaded and a process performed.

e. If this is the last cycle of the day, precautions must be taken to avoid contaminating the exhaust line with pump oil. [See NOTE 1].

* If the main power switch is turned off before the chamber returns to atmosphere, it may take a long time to vent. The main power should remain on and the vacuum switch off to vent the chamber.

1. Remove the sample from the chamber. Remove the inner chamber.

2. With AC on (lighted) and VACUUM toggle switch DOWN, shut off the vacuum pump.

NOTE 1: Make sure tank pressure is shut off or else gas will continue to bleed and empty the bank.

3. Leave the pump off for about a minute.

4. Throw the VACUUM toggle UP, then turn the pump back on again for another minute, then shut it off [See NOTE 2].

NOTE 2: When using system for asbestos filter preparation, place inner chamber back before proceeding with Step 4.

3-4 OTHER USEFUL INFORMATION

Each gas produces a slightly different color for the resulting plasma:

a. oxygen	blue/white
b. argon	fuchsia
c. carbon tetrafluoride	blue/white

If the color of the plasma is red to violet, and the etch rate seems low, then air is leaking into the chamber (the color is due to the presence of nitrogen).

The most likely sources of air leaks would be:

a. vacuum line to back of Plasma-Prep to mechanical pump.

b. "O" ring seal between the chambers (check to make sure no extraneous particles are present that would interfere with the vacuum).

c. vacuum line from back of Plasma-Prep to the glass etching chamber.

Sometimes mixtures of gases are required in order to accomplish specific ends. One very important case is the removal of epoxy or silicone thermosetting materials (such as the plastic package of an electronic device). Although basically "organic", they are oftentimes filled with various inorganic (most common SiO_2) fillers. The gas composition usually used is 10% CF_4, 90% O_2, with the CF_4 removing the filler and the O_2 taking away the polymer.

Typical etch times are as follows:

a. Removal of 1ìm SiO_2: 25-30 minutes.

b. Removal of 1ìm Si_3N_4: 30-35 minutes.

c. Cleaning of hybrid device: several minutes.

d. Package decapsulation of I.C.s with several mils of polymer remaining: 85 minutes. In this case, the top portion of the package is ground or milled away so that what remains is only several mils.

e. "Etching" or "ashing" away of a "Nuclepore" membrane filter: 30 minutes.

f. Etching of a "thick section" of OsO_4 stained biological material for SEM observation: 3 minutes or less.

g. Gentle etching to reveal inorganics in an organic polymer matrix, such as magnetic storage media, pigment plastics, etc.: several minutes.

h. Cleaning of metallographically prepared samples prior to electron probe microanalysis for carbon: several minutes.


spi
Plasma
Prep II
TUNING
AC
VACUUM
ON
LEVEL
METER
RF POWER

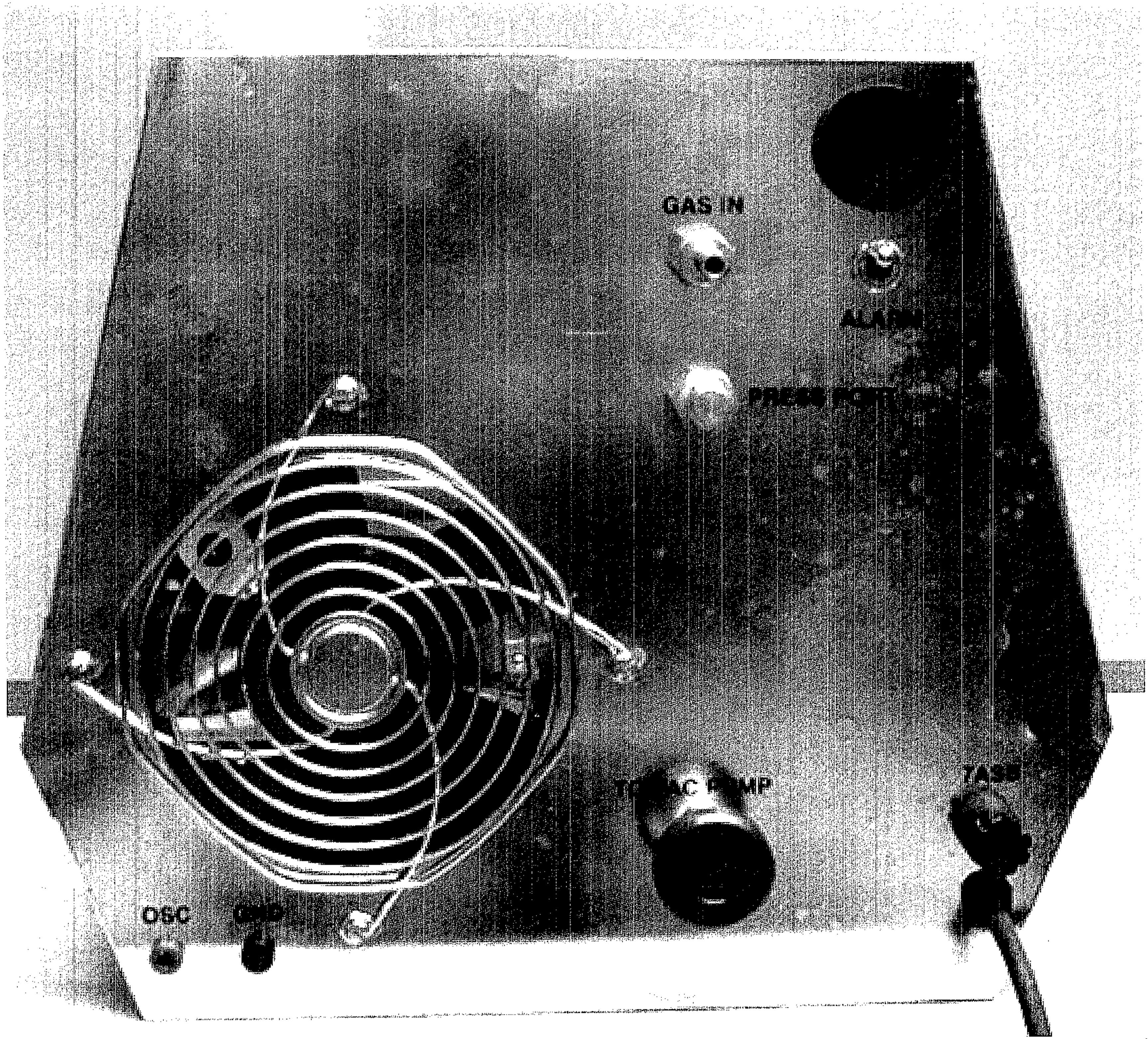

GAS IN
OSC

TABLE 3-1 AND CONTROLS AND INDICATORS

ITEM	CONTROL OR INDICATOR	POSITION	TYPE	FUNCTION
1	AC	PUSHBUTTON/LAMP	PUSHBUTTON/LAMP	CONTROLS PRIMARY POWER WITH INDICATOR LAMP
2	VACUUM UP		TOGGLE SWITCH	VACUUM SOLENOID VALVE OPEN AND BLEED SOLENOID VALVE CLOSED
		DOWN		VACUUM SOLENOID VALVE IS CLOSED AND BLEED SOLENOID VALVE IS OPEN. CHAMBER IS OPEN TO ATMOSPHERE
3	RF	UP	TOGGLE SWITCH	RF POWER IS ON
		DOWN		RF POWER IS OFF
4	LEVEL		POTENTIOMETER	CONTROLS RF POWER LEVEL
5	TUNING		VARIABLE CAPACITOR	TUNES RF POWER AMPLIFIER
6	METER	0 THROUGH 5	EFFICIENCY METER	POWER AMPLIFIER PLATE CURRENT
7	METER (SWITCH)	UP (ON)	TOGGLE SWITCH	METER OPERATES TO DISPLAY POWER TRANSFER. PULSER IS DISABLED SO THAT THE RF CAN BE TUNED FOR BEST IMPEDANCE MATCH
		DOWN (OFF)		METER IS OFF. PULSER IS OPERATIONAL
8	ALARM ON	ON	TOGGLE SWITCH	AAS ALARM IS OPERATIONAL
	OFF	OFF		AAS ALARM IS DISABLED
9			AUDIO ALARM (HORN)	OPERATES WHEN RF OUT OF TUNE AND BEING PULSED

10		FLOW METERING VALVE (INSIDE TOP COVER) FACTORY SET	SET AT FACTORY FOR GAS FLOW RATE TO PROVIDE 200 MICRONS AT 5 PSIG OF OXYGEN
11	TO VACUUM PUMP	VACUUM FITTING	PROVIDES CONNECTION TO VACUUM PUMP
12	GAS IN	1/4" HOSE BARB	PROVIDES CONNECTION FOR INPUT GAS
13	PRESS	FITTING FOR OPTIONAL PRESSURE TRANSDUCER	PROVIDES ACCESS FOR PRESSURE TRANSDUCER
14	ASB	FUSE	7AMP SLOW BLOW FUSE, A/C POWER
15/16	OSC GND	TEST POINTS	PROVIDES ACCESS TO POWER AMPLIFIER GRID CURRENT FOR RETURNING GRID DRIVE

SECTION 4

USER MAINTENANCE

4-1 GENERAL

Maintenance on the Plasma-Prep II consists of cleaning, changing RF tubes, replacing such spare parts as "O" rings, lamps and fuses. In addition, a procedure is given for tuning the RF oscillator circuit board (see Section 4-9, 4-10). Any other repairs should be performed by SPI Supplies. The maintenance flow chart (Figure 4-2a, 2b, 2c) is a convenience to help both the user and maintenance personnel understand the relationship between symptom and cause.

4-2 CLEANING

Cleaning consists of a routine procedure which should be performed periodically. This schedule will depend on frequency of use, type of materials processed and the environment in which the machine has to operate.

Routine Procedure: The inner chamber will require more frequent cleaning than the outer chamber as it is more likely to "see" contamination. For light contamination, running an oxygen plasma for a few minutes should be enough to clean the chamber. For more difficult contaminants, (inorganic films and residues), use standard laboratory cleaning procedures. Remove the inner chamber and wash the chamber with a test tube brush and a good laboratory detergent. If this is not effective, it will be necessary to use an oxidizing agent. Refer to the "Handbook of Chemistry and Physics" for the proper agent.

The outer chamber will also require a similar procedure, but requires cleaning about half as frequently as the inner chamber.

4-3 REPLACING RF TUBES

WARNING - Disconnect the Plasma-Prep II from AC power before replacing the RF tubes.

If the RF tubes have to be replaced, proceed as follows: [refer to the operation and maintenance flow chart (Fig. 4-1) for RF tube failure symptoms].

a. Remove the 4 screws that fasten on the sheet metal cover and remove the top cover.

b. Unscrew the attaching hardware and remove the leads to the tube plate caps. The old tubes can then be lifted out of their sockets. **CAUTION:** Tubes can be hot.

c. Replace with the new tubes and reattach the leads to the plate caps with the same hardware.

NOTE: It is good practice to avoid handling the tubes by the glass barrels. Always hold the tubes by their bases with clean hands. This will increase tube life.

4-4 TUNING THE RF OSCILLATOR

To retune the RF oscillator, proceed as follows: (this procedure should be performed by a qualified electronic technician).

WARNING - Make sure that RF is OFF and the RF tubes are seated in their sockets.

a. Unplug the AC connector from the power source.

b. Remove the top and bottom cover and turn the Plasma-Prep II on its side.

c. The AC interlock switches have to be overridden; that is, mechanically held in "closed" position.

d. Connect VOM test leads between OSC and GND test points at rear of the machine. Set the VOM to the 50mA DC scale (or as close to that scale as your test instrument supplies).

e. Plug in the AC cord of the Plasma-Prep II. Push AC pushbutton switch. Allow at least 1 minute for the tubes to warm up.

f. On the oscillator circuit board (see Figure 4-2) adjust trim capacitor C7 for maximum reading on the VOM.

g. Tune trim capacitor C11 for a maximum reading on the VOM. The reading should be at least 8-12mA and can be higher. Repeat (f) and (g) until no more can be achieved.

h. The machine can be closed up again. Make sure that the interlock overriding devices are removed before the top and bottom covers are replaced.

Figures 4-2a to 4-2d are first level flow charts for troubleshooting.

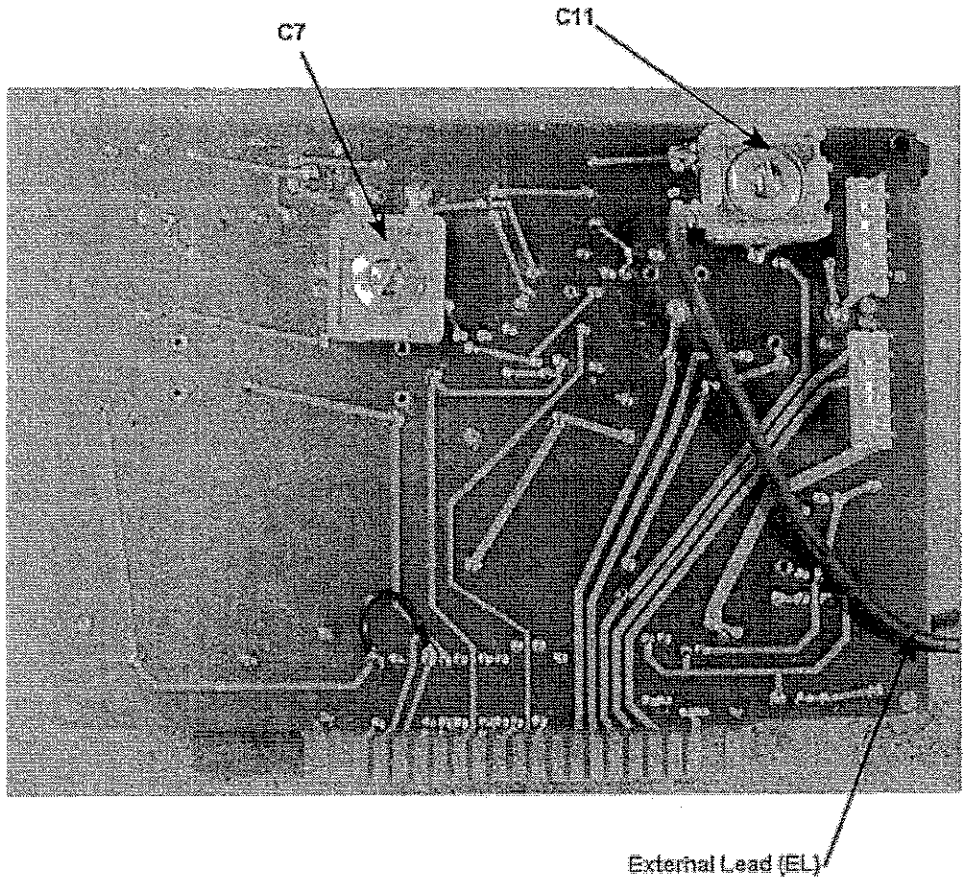


Figure 4-1 Bottom View of Plasma-Prep II
Showing Oscillator Tuning Capacitor Location

4-5 VACUUM SYSTEM ADJUSTMENTS

The process gas flow is adjusted by the internal needle valve located at the rear top of the instrument just after the connector for the gas line. This should be adjusted for the appropriate chamber pressure by attaching a vacuum gauge to the pressure monitor port.

The chamber bleed to atmosphere is controlled by a bleed valve solenoid located on the left side of the chassis beside the chassis connector for the power transformer. The adjustment is a set screw. Turning it clockwise closes the valve and increases the time to bleed to ATM.

4-6 SUCCESSFUL FUNCTIONING OF YOUR EQUIPMENT

Successful functioning of your equipment depends upon a proper vacuum. Your vacuum pump should be serviced on a frequent and regular schedule. Pump fluid changes should be done on a regular schedule per the pump manufacturers recommendation.

4-7 SPARE PARTS LIST

SPI#	PART NUMBER DESCRIPTION
11008	4" ID Inner Pyrex Chamber
11009	4" ID Outer Pyrex Chamber
11010	4" ID "O" Ring
11011	Fuse, Bus 7AMP
11013	Solenoid Valve, Straight thru
11014	Solenoid Valve, Metering
11015	Lamp, 12V
11024	"O" Ring for Outer Chamber
11022-AC	RF Power Tubes (Set of 2)
11022	RF Power Tube (1)
11026	Quartz Inner Chamber
11027	Quartz Outer Chamber
11005RF	Power Board
11005M	Meter
11005P	Photodetect Board
11005T1	H.V. Supply Transformer
11005T2	Bias/Filament Supply Transformer

4-8 CUSTOMER RETURN INFORMATION

If a Plasma Prep II is to be returned to SPI Supplies for whatever reason, the following procedure should be followed:

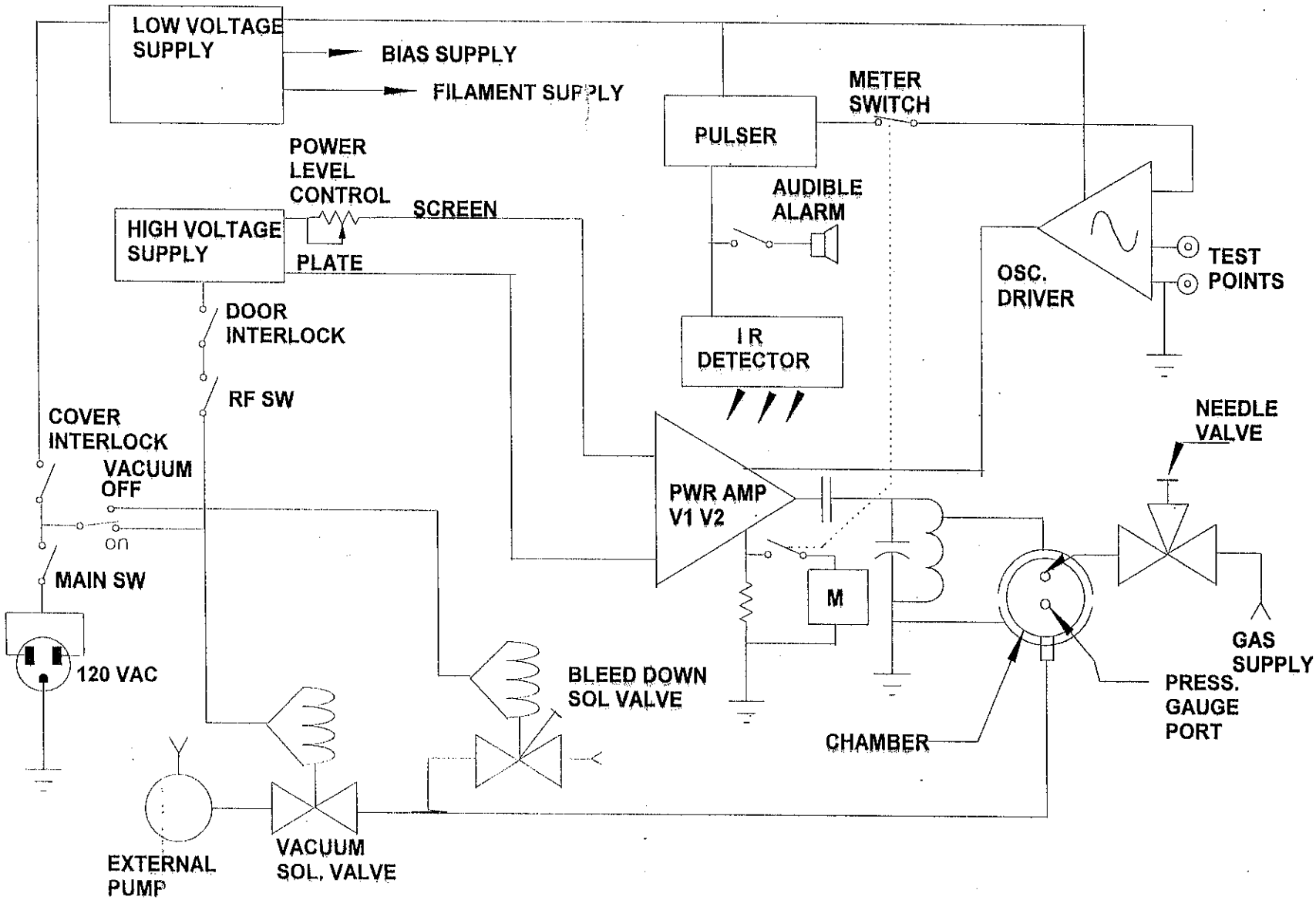
1. From the USA, call SPI Supplies' Customer Service Department, 800-2424-SPI for a Return Authorization Number (RA#). If unit is not received with this RA number on the outside of the box, it will be rejected by the Receiving Department. From Canada, call (610) 436-5400 following the same instructions. For other countries, contact either your closest SPI Supplies agent or SPI Supplies in the USA by phone (610) 436-5400, FAX: (610) 436-5755 or e-mail SpiSupp@aol.com following the same instructions.

2. Repack the machine in its original shipping container. If this is no longer available, take special precautions to avoid damage to the glass chamber sections and other fragile components. **DO NOT SHIP ANY GLASSWARE ASSEMBLED WITH THE UNIT.**

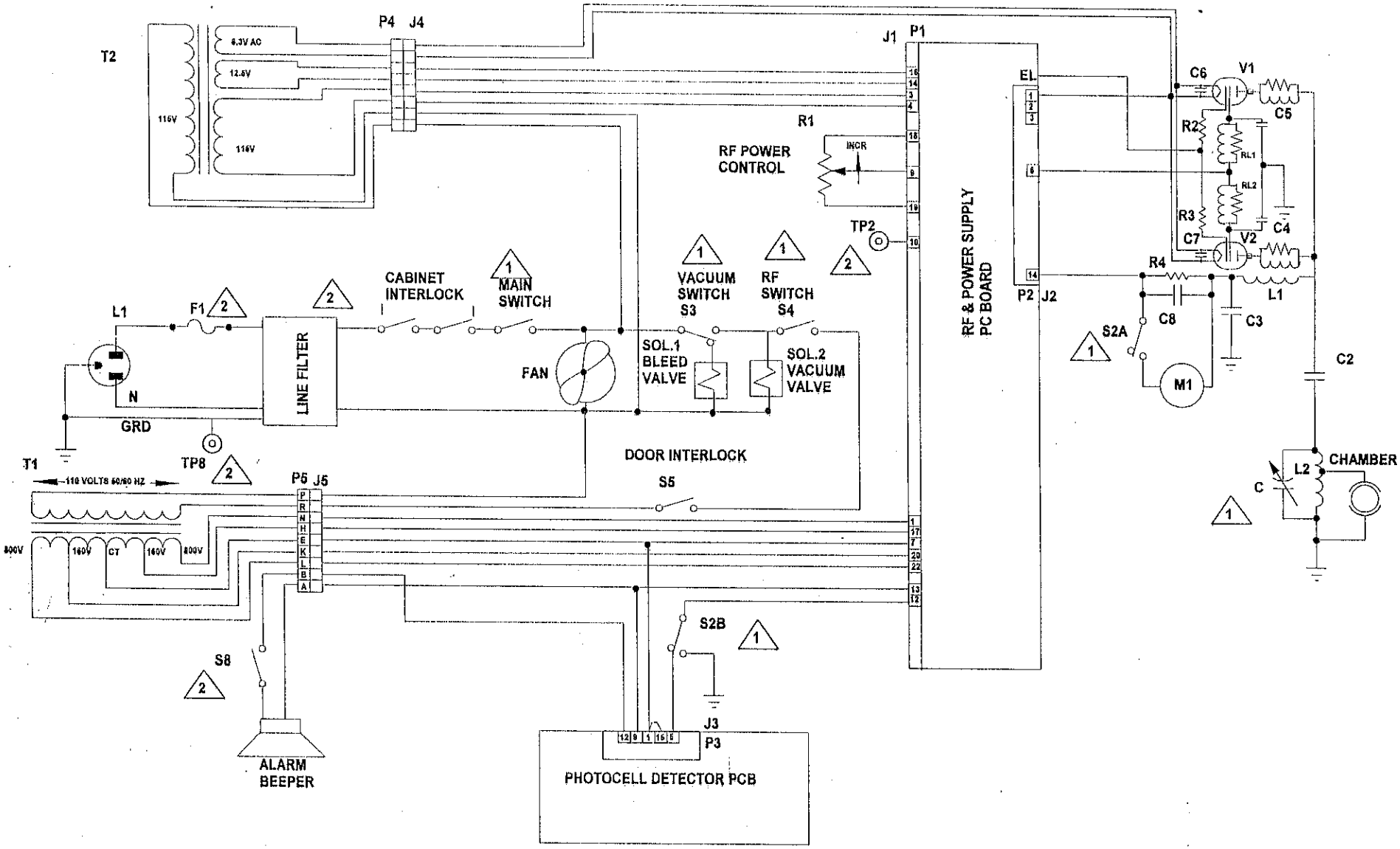
3. If the machine is still under warranty, the only charges are shipping costs. If the machine is out of warranty, a purchase order will be required for approved accounts and customer can expect to be billed for all parts and service. All others will require some form of guaranteed prepayment such as a letter of credit.

4-9

SUBSTRATE TO BE ETCHED	REACTIVE GAS OR GAS MIXTURE
Stainless Steel	CF_4 CF_4/O_2 mixture (experiment for correct proportions) CCl_4-necessary if chromium present
Hydrocarbons, all organics, polymers, etc.	O_2
Metal oxides	Ar
SiO_2; Si_3N_4 (passivation layers)	CF_4 or other reactive fluorine gases
Plastic packages	Combination of O_2 and CF_4, O_2 to etch plastic, CF_4 to etch glass filler. Typical formula: % 10 O_2/% 90 CF_4
Aluminum and aluminum alloys	Cl_2; CCl_4; or mixtures of Cl_2 + CCl_4 **NOTE:** Initially use small amount of Br_2 in mixture to remove surface skin of Al_2O_3. Also useful are CF_4 and CHF_3 for this purpose
Al_2O_3; all forms of anodized aluminum; oxide layers on electronic circuits	



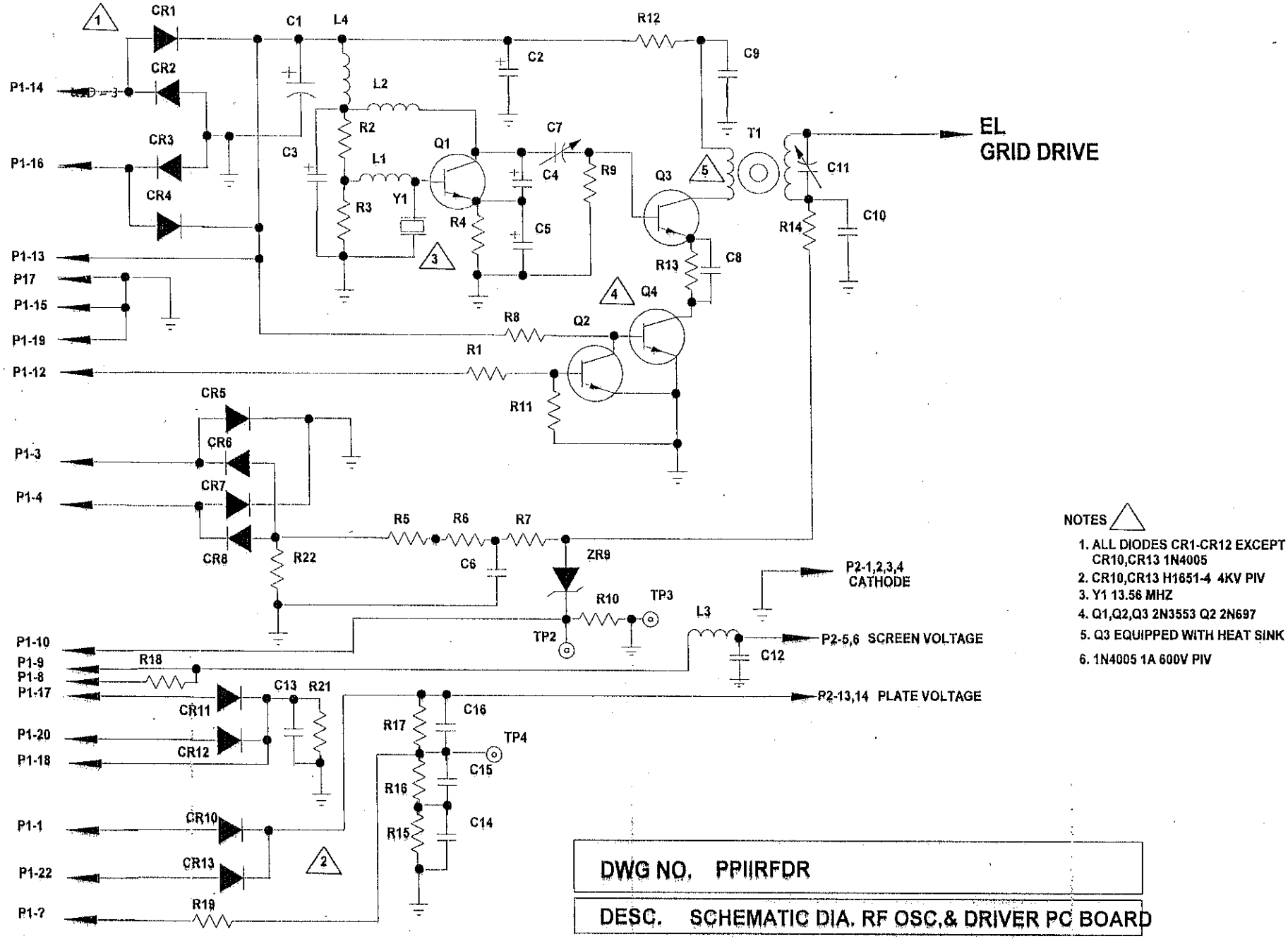
PPII SYSTEM BLOCK DIAGRAM



1 INDICATES COMPONENT IS MOUNTED ON FRONT PANEL

2 INDICATES COMPONENT IS MOUNTED ON REAR PANEL

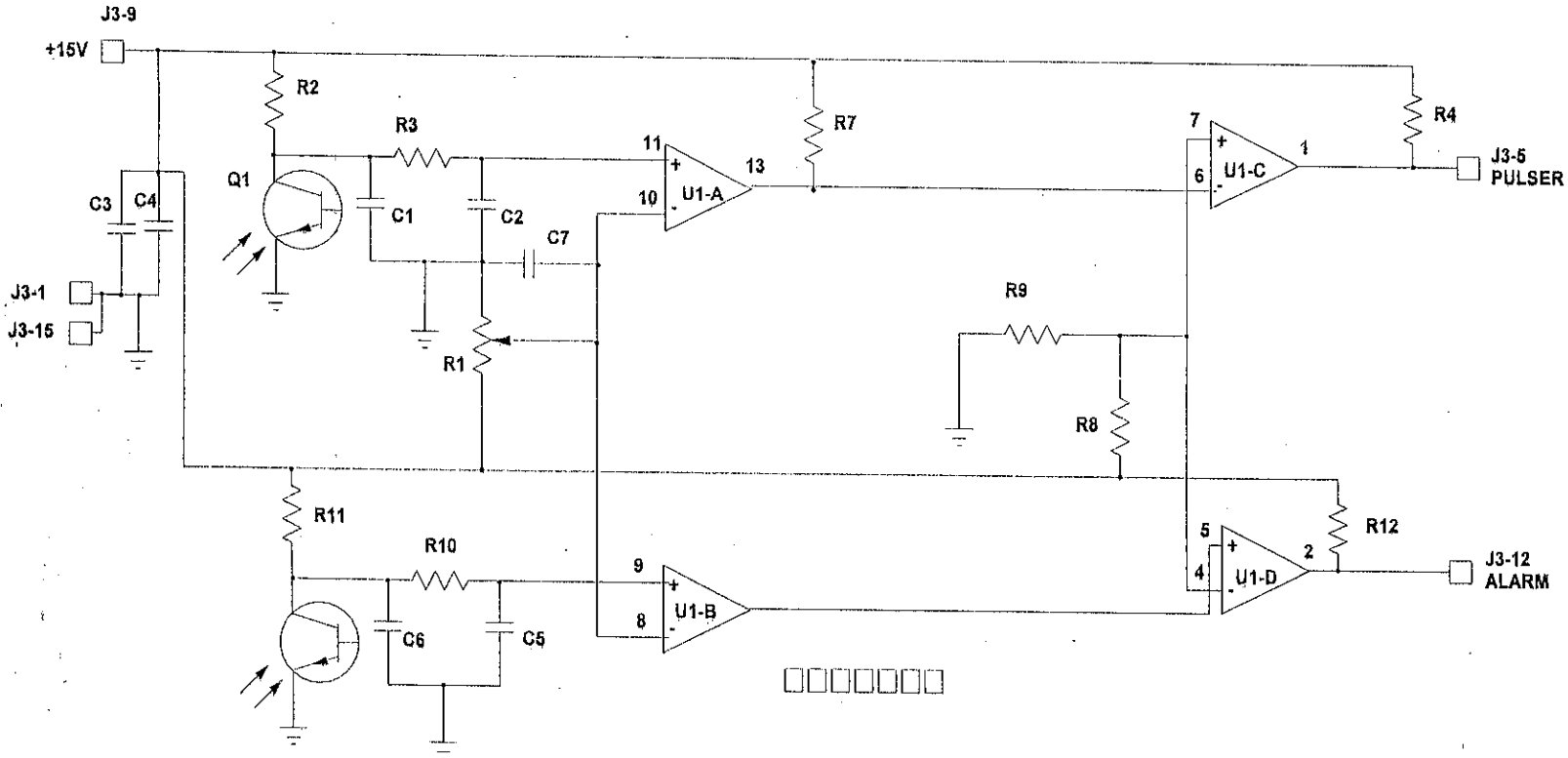
DWG NO. PPIICHAS.CAD	
DESC. PPII CHASSIS SCHEMATIC	
DATE 3/3/96	BY ALM

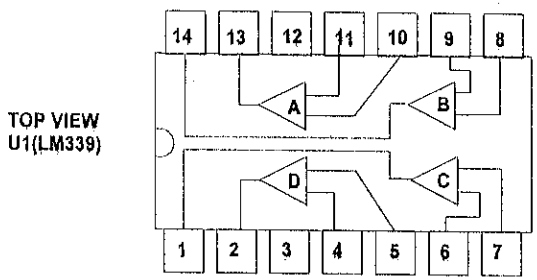


NOTES

1. ALL DIODES CR1-CR12 EXCEPT CR10,CR13 1N4005
2. CR10,CR13 H1651-4 4KV PIV
3. Y1 13.56 MHZ
4. Q1,Q2,Q3 2N3553 Q2 2N697
5. Q3 EQUIPPED WITH HEAT SINK
6. 1N4005 1A 600V PIV

DWG NO.	PPIIRFDR
DESC.	SCHEMATIC DIA. RF OSC.& DRIVER PC BOARD
DATE	2/29/96 BY ALM





TOP VIEW
U1(LM339)

DWG NO.	PPIIPHOT.CAD
DESC.	SCHEMATIC DIAG. PHOTODETECT PC BOARD
DATE	3/5/96 BY ALM