TECHNICS

INSTRUCTION
MANUAL

# PLANARETCH II

PLASMA SYSTEM

INSTRUCTION MANUAL

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Separate instructions from assemblies not manufactured by Technics.

(1) MKS Baratron Instruction Manuals

(1.1) Type 222A Pressure Gauge
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(2) A.T.C. Timer, Model 325A, Installation Instructions

(3) Fenwall Temperature Controller, Series 550, Installation Instructions.

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INSTRUCTION MANUAL

TECHNICS PLANARETCH II PLASMA SYSTEM*

## 1.0 INTRODUCTION

### 1.1 Description

The Technics PlanarEtch II Plasma System generates a low pressure, low temperature, gaseous plasma. In this machine, plasma reactions such as ashing, etching and deposition can be performed quickly and reproducibly. The machine comprises a source of high frequency 30 KHz electrical power, a plasma treatment chamber, and a system to control the flow of reactant plasma gases. It is a versatile system especially well suited to research and development work and low volume processing.

The plasma treatment chamber, (through which samples are inserted, processed and removed) is hinged and "O"-ring sealed. The high frequency generator in this series provides 500 Watts of power, dynamically regulated to maintain pre-set power levels into normal loads during operation.

## 2.0 SPECIFICATIONS

### 2.1 Plasma System

Plasma Treatment Chamber ((1))..... 12" dia. x 4.5" high stainless steel vacuum chamber with an 8" dia. plasma generating electrode centered within the chamber. The chamber has all the necessary electrical, gas and vacuum ports; in addition to provisions for adjusting the electrode - to - baseplate spacing.

Deposition Platen ((2))..... 8" dia. aluminum platen with integral heater element. Removable.

Chamber Window ((3))..... 1 3/4" viewport with quartz window for viewing plasma and parts during treatment. It also includes a U-V absorbing filter.

Vacuum Seals..... Silicone or "Buna-N", "O"-rings.

Vacuum Monitor ((4))..... Digital readout indicator receiving its signal from a capacitive manometer transducer.

*NOTE: Numbers enclosed in double parenthesis (( )) are reference numbers on Technics Drawing No. D - 3100 - 049. (Enclosed)

Vacuum Monitor (cont.).....Pressure is displayed in Torr., below 10 Torr.

Temperature Controller ((5)).....Sets, maintains, and indicates temperature of deposition platen to 400°C. (on/off type control)

Operating Pressure Range.....The system is designed to generate a plasma from .05 to .5 Torr., as it is shipped from the factory.

Power Rating.....500 Watts continuous.

Safety Interlock.....Reactor uses vacuum and water-flow switches.

Vacuum Valve ((6)).....A variable, stainless steel valve is incorporated for process control.

2.2 Generator ((7))

Output Power.....0 - 500 watts at 120 V.A.C. with continuous control, into a purely resistive load of 750 ohms. Peak plasma power depends on gas type and pressure.

Output Frequency.....30 KHz

Output Impedance.....Will operate into plasma of a few hundred ohms to several thousand ohms inpedance.

Output Power Regulation.....Less than 1% for ± 10% line voltage variation.

Output Connector.....Type "UHF".

Wattmeter ((8)).....Digital meter indicates net wattage into load.

Output Protection.....Generator is inherently protected against output "open circuits," and fused for output "short-circuits."

2.3 Vacuum Pump.....Standard equipment is a 7 C.F.M., 2 stage, direct-drive vacuum pump.

2.4 Power Requirements

Plasma System.....115 V.A.C., 20 A., Single Phase.

Vacuum Pump.....115 V.A.C., 13.2 A., Single Phase or 230 V.A.C., 6.6 A., Single Phase.

NOTE: Caution

The standard mechanical pump supplied with the Planaretch II is a two-stage, 7 CFM pump supplied with hydrocarbon oil. If the intended use of the system will possibly create a condition such that oxygen at a level greater than atmospheric passes through the pump, then an oxygen resistant oil (halocarbon type) must be used to prevent possible damage or injury. Please refer to the pump instruction manual and/or the local pump manufacturers representative for instructions to prepare the pump for oxygen or corrosive gas service.

## 3.0 INSTALLATION

### 3.1 Unpacking and Handling

The Technics PLANARETCH II PLASMA SYSTEM is thoroughly tested and inspected, then carefully packed for shipment. The unit should be unpacked with the care due any precision instrument. If the package shows that it has been dropped or handled roughly, return it to the carrier unopened.

After visual inspection of the crate, remove the lid hold-down clamps, and remove the top. Do not discard any packing material until the system is completely installed. Often small parts vibrate into the packing material.

Remove the P.V.C. vacuum manifold and the 4 foam corner blocks. Using 2 people, remove unit grasping the side recesses securely.

Once unit is removed, pull the false floor in bottom of crate. In one corner of the crate floor will be a box containing small parts and spares. Do not discard any of these. Remove hold-down bolts, and remove chamber, placing it on a clean, soft surface to protect the "O"-ring and machined mating surface.

It is suggested that the packing crate be saved in case the unit must be returned for repair or modifications.

### 3.2 General Placement

No special difficulties should be encountered when installing the instrument. A location must be chosen that will allow the placement of the vacuum pump within a few feet of the system. The location preferrably should be a dust free, low humidity, constant, moderate temperature environment. Do not impede air circulation of the system's cooling fans.

### 3.3 Chamber Installation

Refer to Technics Drawing No. D - 3100 - 049.
Remove large "O" -ring ((9)) from chamber ((1)). Clean with denatured alcohol. A very light coating of vacuum grease should be applied. Replace "O" -ring ((9)) in chamber groove.

Place chamber ((1)) on system baseplate ((10)).

Fasten hinge blocks ((11)) loosely with ¼-20 x 3/4" bolts ((12)), lockwashers and nuts. One of the lower hinge block fastening bolts will be a ¼-20 x 1¼" bolt ((13)) that is used to capture the black grounding wire ((14)). The pivot shaft ((15)) is installed through the baseplate ((10)) and hinge block ((11)) holes and the two retaining clips ((16)) inserted.

Attach chamber gas line fitting ((20)) to rear panel fitting ((19)). Remove perforated rear panel ((21)) from rear of system and connect High-Voltage cable assembly ((22,14)) to UHF-output connector at the rear of the generator enclosure ((7)). Attach chamber water lines ((17)) to chamber water fitting ((18)). Tighten all fittings securely. (NOTE: Either water line to the chamber may serve as the supply or return line.)

3.4 Gas Connections

There are two ¼" compression type tube fittings on the back of the system for the reactive gases. The one on the left is the Gas 1 inlet ((22)). The middle one is the Gas 2 inlet ((23)). The third fitting is for the vent gas ((24)).

(Insure that the gas connections are tight.)

3.5 Vacuum Connections

The mechanical vacuum pump is supplied with its own installation instructions. These are shipped in the same container as the pump. The pump manual should be referred to for installation, addition of pump oil and attachment of power cord.

The exhaust manifold extension ((25)) protrudes from the rear of the system. The PVC provided is coupled from the exhaust manifold extension to the vacuum pump, using the 2-6" sections of flexible hose & 4 hose clamps.

(Insure that the hose clamps are tight.)

3.6 Vacuum Check and Final Installation

This step is to assure vacuum integrity, only. DO NOT turn on the GENERATOR POWER switch ((34)) until after familiarizing yourself with the remainder of the instruction manual.

Now connect line power to the system and pump. After all electrical and vacuum connections are made, with chamber ((1)) lowered, and all generator switches in the off position, turn on vacuum pump and turn throttle valve ((6)) fully counter-clockwise (open). Turn on Torr meter power switch ((40)). Turn on Main Power switch ((26)) only. After several seconds the Torr meter ((4)) will begin to indicate as it passes to 10 Torr point.

3.6 (cont.)

The system should pump down to .030 Torr (30 milliTorr) within 3 minutes, the first pump down being quite slow as moisture is being removed from the system. If after initial pump down of 20-30 minutes, the pressure is still over .030 Torr, retighten gas fittings ((19,20)).

A method of checking for leaks is to spray a small quantity of denatured alcohol on fittings, connections, mating surfaces, etc., while watching for pressure changes. A rise of pressure of more than .005 Torr would indicate a possible leak and should be remedied before going further.

Following the vacuum checking procedure above and with the chamber still under vacuum, tighten the 4 bolts ((12,13)) on the chamber hinges ((11)).

Now close the throttle valve ((6)), by turning completely clockwise. The pressure should not rise more than +.035 Torr in the first minute; more than this indicates a possible vacuum leak.

Flip VENT toggle switch ((32)) to the on (up) position, bringing the chamber to atmospheric pressure. Raise chamber ((1)) all the way back to its resting point. Now connect the 2 chamber support springs ((41)) as shown from the lower hinge block ((11)) holes to the 2 eyebolts ((42)).

This completes installation.

## 4.0 OPERATION

### 4.1 Controls and Indicators

The operating controls and indicators for the Technics PLANAR ETCH II series plasma system are located on the front panels of the system. The connectors are on the rear panel. In the text, all operating controls are called out as they appear on the equipment. Front panel controls and rear panel connectors are described in the following tables:

### 4.2 Generator Front Panel Controls and Indicators

(1) MAIN POWER on/off switch((26)).Applies AC power to the generator, Torr meter and temperature controller.

(2) MAIN POWER indicator ((27))...The lamp above the MAIN POWER switch lights when the main power is on.

(3) GAS 1 switch ((28)).....When lighted, this lamp shows and indicator ((29)) that the GAS 1 solenoid valve is open and reactant gas is allowed to flow from the GAS 1

4.2 (3) (cont.) supply to the chamber. In the "OFF" position, the switch prevents the valve from opening either in automatic or manual modes of operation.

(4) GAS 2 switch ((30)) and indicator ((31)) ..... Identical in operation to GAS 1.

(5) VENT switch ((32)) and indicator ((33)) ..... This lamp indicates that the vent valve is open and the chamber is allowed to return to atmosphere.

(6) GENERATOR POWER switch ((34)) and indicator ((35)) . When lighted, the lamp indicates that the GENERATOR POWER switch is ON, and that system interlocks are closed. The generator can now deliver power to the load.

(7) POWER ADJUST control ((36)) ... Allows continuous control of the power output from zero to the maximum available.

(8) AUTO-MAN switch ((37)) and indicator ((38)) ..... Selects either automatic or manual mode of operation. The lamp shows that the system is in the automatic mode.

(9) WATTS panel meter ((8)) ..... Displays, digitally, the power being produced by the generator.

4.3 System Front Panel Controls and Indicators

(1) TIMER ((39)) ..... Sets the "ON" time of the plasma during automatic operation. It displays the time remaining in the automatic cycle in tenths of a minute.

(2) TEMPERATURE controller ((5)) and indicator .. Sets and maintains the temperature of the deposition platen. It indicates the temperature in $^{o}C$.

(3) VACUUM valve ((6)) ..... Opens the vacuum line and allows the chamber gases to be exhausted to the vacuum pump. This valve enables the chamber pressure to be adjusted independently of reactant gas flow.

(4) TORR meter ((4)) and setpoints ((44,45)) ..... Indicates the pressure within the vacuum chamber. There are two variable setpoints whose value is set by the recessed screws beneath the digital pressure read-out ((4)).

4.3 (4) Cont.....The high setpoint is readable by pushing the setpoint toggle switch ((43)) to the right. The coarse and fine adjustments ((44)) for this setpoint are to the right of the toggle switch. The low setpoint is readable by pushing the setpoint toggle switch ((43)) to the left. The coarse and fine adjustments ((45)) for this setpoint are to the left of the toggle switch. The high setpoint controls the pressure at which the generator will automatically shut itself off in order to protect itself from high current loads caused by high pressure plasma. The low setpoint controls the pressure at which gas is introduced into the system in the automatic mode of operation.

(5) GAS 1 flowmeter ((46)).....This flowmeter incorporates a needle valve which adjusts the amount of reactant gas flowing from the GAS 1 supply to the chamber. The flowmeter indicates the flow in SCC/M (Standard cubic Centimeters per Minute) for air only. The glass ball indicates 50 SCC/M of air at STP, full scale. The steel ball indicates 150 SCC/M of air at STP, full scale. The two balls are read independently, and not added together. For gases other than air, accurate measurement is best achieved by establishing a system base pressure. Then turn on GAS 1 bringing gas to the desired pressure as indicated by the TORR meter ((4)). Turn on GAS 2 and adjust the flowmeter ((47)) to bring that gas to the desired pressure based on a ratio of GAS 2 added pressure to GAS 1 added pressure.

(6) GAS 2 flowmeter ((47)).....Identical in operation to GAS 1 flowmeter.

## 4.4 Rear Panel Fittings

(1) GAS 1 ((22))..... This is the system inlet for the GAS 1 supply, and should be pressurized with 5-10 psi of the reactant gas.

(2) GAS 2 ((23))..... Identical in operation to GAS 1 fitting ((22)).

(3) VENT ((24))..... When a special vent gas is required (other than room air), this fitting should be used. (CAUTION: DO NOT USE OXYGEN OR OTHER REACTIVE GASES TO VENT SYSTEM)

(4) CHAMBER GAS ((19))..... This is the reactant and vent gas outlet to the chamber.

(5) WATER SUPPLY IN ((48))..... Electrode and baseplate cooling water from building supply. It should be less than 30°C and at least 20 psi. It must be potable.

(6) WATER SUPPLY OUT ((49))..... This is the water return, and should be exhausted into an open drain.

(7) CHAMBER WATER ((18))..... These two fittings are the water supply and return for the electrode and are interchangeable.

## 4.5 START-UP

### General

The following sections deal with the operation of the system in both the automatic and manual modes of operation. At this point, check to see that interconnecting cables, gas lines, vacuum pump, and line power are connected. The chamber top should be tightly closed. Until the support springs have loosened a little, it may be necessary to physically pull the chamber ((1)) down onto the baseplate ((10)).

Before commencing start-up, insure that the switches and controls are in positions described below.

MAIN POWER switch ((26))..... OFF
POWER ADJUST ((36))..... Fully counter-clockwise (off)
GENERATOR POWER switch ((34))..... OFF
AUTO-MAN switch ((37))..... MAN
VENT switch ((32))..... OFF
GAS 1 switch ((28))..... OFF
GAS 2 switch ((30))..... OFF

4.5 General - Cont.

TEMPERATURE CONTROLLER knob ((5)).Fully counter-clockwise (off)
TIMER ((39))....Anywhere
TORR Meter power ((40))....ON
TORR Meter low setpoint ((45))....(.050 or as required)
TORR Meter high setpoint ((44))....(.500)
(NOTE: The setpoints are pre-set before shipment to the above values.)
VACUUM valve ((6))....Fully clockwise (OFF)
GAS 1 flowmeter valve ((46))....Clockwise, but do NOT TIGHTEN!
GAS 2 flowmeter valve ((47))....Clockwise, but do NOT TIGHTEN!

Turn on the vacuum pump. The sound should rapidly decrease to a very low level.

Turn on the MAIN POWER switch ((26)). Be certain water supply is on, and at least 20 psi or the GENERATOR POWER interlock will not allow the generator to come on. Be certain TORR Meter power ((40)) is ON. The Torr Meter ((4)) will indicate only after the pressure is below 10 Torr (Note: Atmosphere is 760 Torr.) The MAIN POWER lamp should be ON. Open the vacuum valve ((6)) fully counter-clockwise. The vacuum pump noise will change, indicating a flow of air through the pump. After a minute or so the system pressure will be less than 1 Torr. It should be allowed to pump down to at least .05 Torr. This will insure that the vacuum system is leak tight and reduce the residual contaminants inside the reactor.

Turn on either GAS 1 ((28)) or GAS 2 ((30)), or both depending on the process, and adjust the flowmeter needle valve ((46,47 respectively)) to the desired flow rate or system pressure.

Once the pressure has stabilized, turn the GENERATOR POWER switch ((34)) to ON. Set the POWER ADJUST control ((36)) to the desired operating power as indicated by the WATTS meter ((8)). The system will maintain and operate at the above parameters until re-set by the operator.

The system is now set up for manual operation, and the parts to be plasma treated can be loaded after venting. This is accomplished by turning OFF the GENERATOR POWER switch ((34)), the GAS switch(es), ((28,30)), closing the VACUUM valve ((6)) (fully clockwise), and turning ON the VENT switch ((32)); in that order. The system pressure will return to atmosphere. (Note: It is unnecessary to re-set the POWER ADJUST control ((36)) after its initial adjustment.)

4.6 Manual Operation

Once the system has been set-up with the operating parameters to be used, manual operation will consist of the following steps:

(1) Load the parts to be treated inside the vacuum chamber ((1)). They should be located within an 8 " diameter circle in the center of the baseplate for optimum uniformity. Do not place them where they will overlap the vacuum port ((64)).

4.6 Manual Operation - Cont.

(2) Close the chamber top, making sure it is resting evenly on the baseplate. ((10)) Turn the VENT switch OFF. ((34)).

(3) Open the VACUUM valve. ((6))

(4) Once a low pressure (.2 Torr or less) has been reached, turn the GAS switch(es) ((28,30)) to ON.

(5) After the pressure has stabilized, turn the GENERATOR POWER switch ((34)) to ON. The power indicated on the WATTS meter ((8)) should be as set earlier in 4.5.

The plasma will be established at this time, and should be allowed to operate for the complete processing cycle. This is determined by time, or visual inspection of the treated parts through the chamber window. ((3))

When the process cycle is completed:

(1) Turn the GENERATOR POWER switch ((34)) to OFF.

(2) Turn the GAS switch(es) ((28,30)) to OFF

(3) Close the vacuum valve. ((6))

(4) Turn the VENT switch to ON ((32))

(5) When the reactor ((1)) reaches atmosphere, raise the chamber ((1)) and remove the parts.

4.7 Automatic Operation

Assuming the system has been set up for the manual mode of operation, going to automatic operation consists of the following:

(1) Load the parts to be treated inside the vacuum chamber ((1)).

(2) Close the chamber top ((1)).

(3) Move the AUTO/MAN switch to the AUTO position. ((37))

(4) Turn the GENERATOR POWER ((34)), GAS 1 ((28)) and/or GAS 2 ((30)) (as required) switches and VENT switch ((32)) to their ON positions.

(5) Set the TIMER ((39)) to the desired process time.

(6) Set the TORR meter low setpoint to some pressure slightly below the desired operating pressure. (Typically 50 MilliTorr)

The system is now ready for automatic operation.

(7) Open the VACUUM valve ((6)). The system will start pumping down. Once the TORR meter low setpoint ((45)) is reached the GAS solenoid(s) will open, as indicated by the GAS 1 ((29)) and GAS 2 ((31)) lamps.

Several seconds (approximately 45) will elapse before the plasma is initiated. This allows the system pressure to stabilize and any residual air to be removed from the reactor ((1)) before starting the plasma. (Note: This delay is factory set before shipment, but can be re-set by the operator to somewhere between 5 and 120 seconds. The adjustment is located on the top of a plug in type time delay relay, located in the front of the generator ((7)) enclosure (inside).

After the delay, the GENERATOR POWER lamp ((35)) will light and a plasma will be established. The TIMER ((39)) will also be energized, as indicated by its lamp ((70)), and start counting down to zero.

When the TIMER ((39)) indicates 000.0, indicating that the process is complete, the GENERATOR POWER ((35)) and GAS lamps ((29,31)) will go off and the plasma will extinguish. The system will now pump all the way down, until vented by the operator.

(8) Close VACUUM valve. ((6))

(9) Move AUTO/MAN switch ((37)) to the OFF position. This will automatically open the VENT solenoid and return the chamber pressure to atmosphere.

For subsequent processes, it is only necessary to use the VACUUM valve ((6)) and AUTO/MAN switch. ((37))

Note: In some processes it may be desirable to throttle the vacuum pump during the cycle. This is done by using the VACUUM valve in the "partially-open" position, and using it to set the system operating pressure. This is usually desirable only in the manual mode of operation since it takes longer to set than is allowed by the 45 second delay of the AUTOMATIC mode.

4.8 Deposition Platen ((2))

The deposition platen ((2)) is supplied with this system to allow both deposition and elevated temperature etching to be accomplished. The temperature of the platen is controlled and measured by the TEMPERATURE controller ((5)) and an internal thermocouple probe ((48)) in direct contact with the platen. The probe and platen are installed as follows:

(1) UPPER SPACER RING ((55)) removal for platen clearance is accomplished by the following steps-- (2 - 20)

4.8 Deposition Platen ((2)) - Cont.

(2) Disconnect Line Power to the system and remove the perforated rear panel ((21)).

(3) Disconnect chamber water fittings ((18)) at system rear panel. Using compressed air, blow out remaining water in chamber water lines. ((17))

(4) Open the chamber and place a 3" thick block of foam in the center of baseplate. ((10)) This supports the electrode ((49)) after its retaining bolts ((50)) are removed.

(5) Close chamber ((1)) and remove 4 countersunk screws ((51)) in bakelite (black) coverplate. ((52))

(6) With a 7/16" socket wrench remove 6 bolts ((50)) from green fiberglass retainer plate. ((53)) Slide both the bakelite ((52)), and green fiberglass plates ((53)) up the tubing/wire bundle ((17,22)) and out of the way.

(7) CAREFULLY open chamber ((1)) leaving electrode ((69)) and spacer rings ((54,55)) resting on foam block.

(8) Disconnect High Voltage lead screw. ((56))

(9) Hold water fittings ((57)) with a ½" wrench and loosen upper fitting nut. Pull the two water hoses ((17)) free.

(10) Notice that there are 3 "O" - rings ((58,59,60)) of equal size in the electrode, spacer ring assembly. Two will be reinstalled when the upper spacer ring is removed.

(11) Replace lower spacer ring ((59)) with its two "O" -rings ((58,59)) onto electrode, leaving out the upper spacer ring ((55)) and one "O" -ring. ((60))

(12) Reinstall water lines ((17)) and the High Voltage wire. ((22))

(13) Recheck that the water fittings are tight. ((57))

(14) Slowly lower chamber onto electrode stack. ((69,54, etc.)) Be careful not to pinch the "O" -rings. ((58,59)) The foam block should position the spacer ring ((54)) against the chamber lid. ((1))

(15) Slide green retainer plate ((53)) down tubing bundle and, while holding chamber ((1)) closed, reinstall it with the 6 shorter hex head bolts. ((50)) They will be ¼-20 X 1 3/4" that were included in small part package that came with the system.

(16) It may be necessary to use 2 of the longer bolts initially to pick up the electrode ((69)) and then start the shorter bolts.

4.8 Deposition Platen ((2)) - Cont.

(17) Before tightening, make sure that tapped holes in green plate ((53)) are at $45^{0}$, $135^{0}$, $225^{0}$, and $315^{0}$ positions looking from the front of the system. This places the tubing bundle ((17,22)) at the rear of the assembly. Tighten every other bolt ((50)) in an alternating fashion to equalize forces as you would when tightening an automobile's wheel lug nuts.

(18) Replace black cover plate ((52)), and its 4 screws. ((51))

(19) Reconnect chamber water lines ((17)) at rear of system and tighten fittings ((18)) securely.

(20) Raise chamber lid ((1)) and remove foam block. Check to make sure that there are no vacuum leaks or water leaks. (Look into the hole through which the tubing bundle ((17,22)) passes into chamber and be sure electrode stack is not filling with water!)

(21) INSTALLING DEPOSITION PLATE ((2)) is accomplished by following steps 21 - 26.

(22) Reaching through the rear of the system, loosen the large knurled quick disconnect fitting ((61)) and remove the blank-off plug. ((62))

(23) Insert deposition plate tubulation ((63)) into vacuum port ((64)) in center of baseplate ((10)), positioning the heater feed-thru ((65)) into its fitting. ((61)) Re-tighten knurled disconnect fitting. ((61)) It is advisable to lightly lubricate items ((63,65)) with vacuum grease so that they will pass through the fitting ((61,64)) more easily. (Note: Other versions of the PLANARETCH II may have two heater feed-thru provisions. They are installed in the same manner, the only difference being that each feed-thru has only one electrical connector.)

(24) Connect the two heater wires from the temperature controller to the two male disconnect lugs ((66)) on the heater.

(25) Loosen small knurled fitting ((67)) and push thermo-couple ((68)) up until it has good thermal contact with deposition plate ((2)) and retighten fitting. ((67))

(26) Replace perforated panel ((21)) on rear of system. Reconnect Line Power to the system.

The deposition platen is now installed and ready for operation. It is only necessary to turn the GENERATOR MAIN POWER switch ((26)) to ON and set the TEMPERATURE controller ((5)) to the desired operating temperature. The platen ((2)) temperature will rise quickly as seen by the indicator on the TEMPERATURE controller.

4.8 Deposition Platen ((2)) - Cont.

((5)) Once the pre-set temperature has been reached, the controller will cycle "on" and "off" to maintain this pre-set temperature. (Note: The controller will control the platen temperature as long as the MAIN POWER is on, and is independent of the operation of the rest of the system.

## 5.0 MAINTENANCE

### 5.1 General

This section covers procedures used to keep the Technics PLANARETCH II Plasma System in good operating condition. Only the system is discussed here since the Vacuum Pump has its own instruction manual.

### 5.2 Vacuum Chamber

The principal maintenance required is the periodic cleaning of the vacuum chamber. With some processes, a buildup of contamination may occur which can cause an increase in the processing time. Removal of this contamination can usually be done by wiping the dirty areas with a paper towel soaked in denatured alcohol, acetone, etc. The harder to remove buildups may require steelwool and alcohol. In addition, if the anodized aluminum type spacer rings ((54,55)) are used, there may be occasions where they will have to be replaced. This is unusual but might occur if the anodization (which is the primary electrical insulation) is damaged in any way.

### 5.3 Valves

The gas valves in the system should last the full life of the system, but may periodically require disassembly and cleaning. This is necessary only when an accumulation of foreigh matter is in the gas supply and lines, and causes the valve to "leak thru" or stick in the open or closed position. The vacuum valve should be inspected for ashing of the valve seat "O" -ring, which is subjected to the plasma. If it is ashed to the point of affecting its usefulness, it should be replaced.

### 5.4 Flowmeters

Flowmeters are simple and reliable devices, and need no preventitive maintenance. Occasionally the ball may stick in the indicator tube due to dust particles in the gas lines. If tapping the top of the flowmeter housing, or removing the protective cover and tapping the tube doesn't free the ball, then removal of the tube is necessary. This is done by loosening the nut on the bottom of the flowmeter frame. Carefully blow the tube out by using dry air or nitrogen. The pressure should be just high enough to do the job, and not over a few P.S.I. Once the ball is free, carefully replace the tube and protective cover. The needle valve is designed to vary gas flow, and not to completely shut off.

5.4 Flowmeters - Cont.

When closing the valve, DO NOT OVERTIGHTEN.

5.5 "O" - Rings

Due to high temperature or corrosive gases, the "O" -rings may eventually become brittle and crack. Close, periodic inspection of these will usually alleviate any unexpected vacuum leaks. It is recommended to have at least one complete set of replacement "O" -rings on hand.

5.6 Generator

The generator is completely solid-state and has no components which require replacement on a routine basis. The only maintenance necessary is periodic inspection of internal dust build-up that may cause arcing. Use compressed air to remove any dust found. Under high stress circumstances over a considerable period of time there is possibility of power transistor damage. If there is a generator failure, consult with a factory representative immediately for assistance.

5.7 Recommended Spare Parts

The spare parts listed will minimize down time in the event of system failure. They are either expendable, or long lead time items. This should be considered a minimum quantity to have on hand. Vacuum pump spare parts are listed in its instruction manual.

| QTY | DESCRIPTION | MANUFACTURER -- | PART NUMBER | TECHNICS PART NO. |
|---|---|---|---|---|
| 1 | Switch, SPDT | C & K | 7101 | 4412010219 |
| 1 | Switch, 4 PDT | C & K | 7403 | 4412040211 |
| 1 | Lamp, Red | Leecraft | 32R-2311T-RED | 28031R0109 |
| 1 | Lamp, Amber | Leecraft | 32R-2313T-AMBER | 28031Y0109 |
| 5 | Fuses, 20 A., 250V | Bussmann | ABC-20A | 2203332001 |
| 5 | Fuses, 4A., 250V | Bussmann | MTH4 | 2203330401 |
| 1 | Integrated Circuit | National Semiconductor | LM 358 | 4206000000 |
| 6 | Transistor | Motorola | MJE 13009 | 4218000101 |
| "O" Ring kit consisting of: | | | | |
| 1 | "O" -ring (Silicone, Buna-N) | Parker | 2-127 | 3211270102 |

5.7 Recommended Spare Parts - Cont.

"O" ing kit consisting of: Cont.

| QTY | DESCRIPTION | MANUFACTURER -- | PART NUMBER | TECHNICS PART NO. |
|---|---|---|---|---|
| 3 | "O" -ring (Silicone, Buna-N) | Parker | 2-263 | 3212630102 |
| 1 | "O" -ring (Silicone, Buna-N) | Parker | 2-453 | 3214530102 |
| 1 | "O" -ring (Silicone, Buna-N) | Parker | 2-225 | 3212250102 |
| 1 | "O" -ring (Silicone, Buna-N) | Parker | 2-218 | 3212180102 |
| 1 | Window, Quartz | Technics | | A-3100-006-1 |
| 1 | Window, Plexiglass | Technics | | A-3100-006-2 |