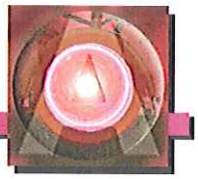
ANATECH USA PLASMA TECHNOLOGY

Hummer® Sputtering Tools Innovative Plasma Systems



Carbon Deposition System User's Manual

For use with Hummer® Sputtering Units

2947 Whipple Road, Union City, California 94587 USA Tel: 800-390-4449

Contents

How to use this Manual

Chapter I - Introduction, provides a very brief description of how the Carbon Evaporation Accessory (CEA II) works.

Chapter 2 - Setting up your CEA II, show you how to unpack the unit and get it ready to use.

Chapter 3 - Operating your CEA II, gives you detailed step-by-step instructions for carbon coating. When you have mastered the process, summary instruction in Appendix A take you quickly through the steps.

Chapter 4 - Maintaining your CEA II, lists the things you need to do on a regular basis to keep your unit in top operating condition,

Chapter 5 - Troubleshooting your CEA II describes the most common operating problems that can occur with your CEA II and shows you how to solve them. Following these guidelines you will be able to quickly take care of most problems yourself.

Chapter 6 - Ordering spare parts and consumables, provides information for ordering replacement items.

Appendix A has summary operating instructions

Appendix B contains a schematic diagram for the CEA II.

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1 Introduction

Carbon is the preferred material for coating electron microscope specimens for x-ray dispersive analysis. Carbon is conductive, but doesn't interfere with the analysis.

The Carbon Evaporation Accessory II (CEA II) consists of two main parts: a console containing a high-current power supply and a top plate that hold two carbon electrodes. The two parts are connected by heavy cables, which carry high current to the electrodes.

By taking advantage of the vacuum capability of a Hummer® sputtering unit, the CEA II can produce carbon coating in a few minutes. The CEA II top plate and glass deposition chamber replace the corresponding parts of you Hummer sputtering unit. The taller glass chamber keeps the hot carbon electrodes away from the specimens.

Two carbon electrodes produce the carbon coatings. The point where the two electrodes touch represents a high resistance. When a high current passes through this point, the carbon gets extremely hot. Carbon atoms evaporate, float throughout the deposition chamber and coat all surfaces, including the specimen.

Carbon electrodes supplied by Anatech are highly purified, uniform in composition and correctly sized. By using these specially-prepared electrodes, you can produce consistent coatings from run to run.

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2 Setting up your CEA II

This chapter shows you how to unpack your CEA II and connect it to power. You'll also review the operating controls.

If you have not installed your Hummer® sputtering unit, do so now. Your Hummer must be set up and properly operating before you can use the CEA II.

Unpacking and installing the unit

1 Locate the Warranty Registration form on page 21. Fill out and mail the Warranty Registration. The warranty on your CEA II will be activated when Anatech receives this form.
2 Open the carton and remove all internal bracing and packing materials from around the unit. Remove any small cartons and set them aside (they contain various accessories). **Note: Save the packing materials in case you need to ship your unit in the future.**
3 Make sure there is about 15 inches (40 cm) of free space next to your Hummer® sputtering system.
4 Lift the CEA II and its top plate from the carton and place the console next to your Hummer®.
5 Carefully unpack the accessories.
6 Check the accessories against the Packing Sheet.
7 Prepare the CEA II glass deposition chamber:

   a. Carefully unpack the chamber and gaskets. Use a lint-free wipe to remove any residual dust from the chamber.
   b. Lightly grease the inner and outer contact surfaces of the boot gaskets and place them on the ends of the chamber.
   c. Examine the boot gasket outer contact surfaces and remove nay foreign material (such as dirt or hair).
   d. Place the chamber on the bottom plate of the Hummer®.
   e. Gently lower the top plate into place over the chamber.
   f. Visually inspect for the desired stage height. Adjust stage height as needed.

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8 Connect the power cord to the socket on the lower rear panel of the CEA II. The CEA II requires 110-115 volts AC at 4 Amps (60 Hz). (To operate from 220-230 Volts AC use a step-down transformer between the unit and the power source.)

Connect the power cord to a power socket with corresponding specifications.

CAUTION: Always disconnect the CEA II from the electrical supply before removing the front or rear panels.

Learning the operating controls

As you read the following descriptions, find each control on the CEA II operating panel:

Control	Function
Main Power Switch	The Red switch below the operating panel turns on the power supply.
Current Meter	Indicates the current in amperes flowing through the electrodes.
Current Control	Regulates the amount of current flowing through the electrodes.

You should also be familiar with three controls on your Hummer® sputtering unit:

- Main Power Switch
- Gas Control Valves(s) and
- Vacuum Meter

If necessary, review the operation of these controls in your Hummer® User's Manual.

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3 Operating your CEA II

This chapter begins with a preview of techniques useful for operating the CEA II. Next it shows you how to install the electrodes. Finally; you'll learn how to do a coating run.

After you become familiar with the details of CEA II operation, you can follow the operating summary in Appendix A.

CEA II operating techniques

This section discusses several topics that will help you produce consistent coatings with the CEA II.

Critical current operating point - It is characteristic of the carbon evaporation process that operation below a certain current produces no detectable coating, while increasing the current only slightly above this point produces satisfactory coatings. The most favorable operating current then will be just above this point. Higher currents, while accelerating the coating process, will produce higher temperatures, reduce electrode life and can cause the electrode tip to break off before the process is completed.

Proper tip warm-up – Warming up the electrodes evaporates water and various gases that may have been absorbed by the carbon. Absorbed water can cause sputtering and poor coatings. Absorbed oxygen increases the oxidation rate, shortening electrode life. The instructions later in this chapter show you the steps for properly warming up the tip.

Importance of argon – In normal operation, the deposition chamber is evacuated to 30 milli Torr or less and argon is bled in to bring the vacuum up to 100 milli Torr. Argon, and inert gas, reduces oxidation by moisture and impurities.

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Tip breakage – A large flash in the chamber means the tip has broken. This flash normally produces a significant coating so that once the tip breaks, a coating is virtually assured. However, a coating produced by tip breakage may not be uniform. Once the tip breaks, its electrical characteristics change drastically, and no further coating will occur. An electrode with a broken tip must be replaced before coating can continue.

In most instances, it is desirable to avoid breaking the electrode tip. While coating, carefully watch the Current Meter for a decrease in current. When the current begins to drop, quickly reduce current by about 10 amperes (for example, from 70 amperes to 60).

Electrode shape and composition – The dimensions of the fixed electrode (having a thin shaft on one end) are important in determining the operation of the CEA II. The diameter of the thin shaft determines, to a great extent, the amount of current that passes through the electrodes. A thinner shaft would be weaker and more difficult to make, while a heavier shaft would require much more current to heat.

CEA II electrodes are made from high purity carbon. Other less pure carbons may contain excessive amounts of organic and inorganic materials, which could cause the specimen to become charged and reflect x-rays during examination in an electron microscope.

> **Note: Anatech provides electrodes designed specifically for the Carbon Evaporation Accessory. Do not substitute electrodes from other sources.**

Getting Ready to Coat

1. Assure the CEA II Main Power Switch is off.
2. Place the CEA II top plate on the table in front of you with the mounting posts pointing up.

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3 Mount the moving electrode (see top portion of figure), next page).

Caution: Do not touch the electrodes with your fingers – oil and moisture from you fingers can affect the operation.

a. Slide the guide into mounting post A.
b. Thread a socket head screw into the hole on the side of mounting post.
c. Center the guide in the post and tighten the screw using the hex key.
d. Slide the spring into the sleeve.
e. Slide the moving electrode (the one without the narrow tip) into the spring.
f. Place the collar around the moving electrode, and adjust it so the electrode extends about 1/8 inch (3 mm) beyond the collar. Gently tighten the set screw in the collar using the hex key.

4 Mount the fixed electrode (see bottom portion of figure, previous page):

a. Thread a socket head screw partially into the hole in the side of mounting post B.
b. Insert the fixed electrode in mounting post B.
c. Slide the fixed electrode in until it contact the face of the moving electrode.
d. Continue sliding the fixed electrode in, exerting pressure against the moving electrode and moving it back about ¼ inch (6 mm).
e. While holding the fixed electrode in position, secure it by gently tightening the screw on the side of mounting post B.

5 Examine the electrodes to assure they are properly aligned. If they are not, adjust them so they are.

6 Move the Hummer® top plate to its fully open position,

Note: If you plan to do a lot of carbon coating, you should protect the vacuum gauge from contamination by carbon. You can use a coin to cover most of the vacuum gauge access hole. The access hole is located on the Hummer® right, rear of bottom plate.

7 Place specimens on the Hummer® stage. The holes in the stage accommodate standard SEM stubs, which are useful for small specimens.

8 Place the CEA II glass deposition chamber on the Hummer® bottom plate.

9 Remove the gas supply hose from the Hummer® top plate and attaché it to the CEA II top plate.

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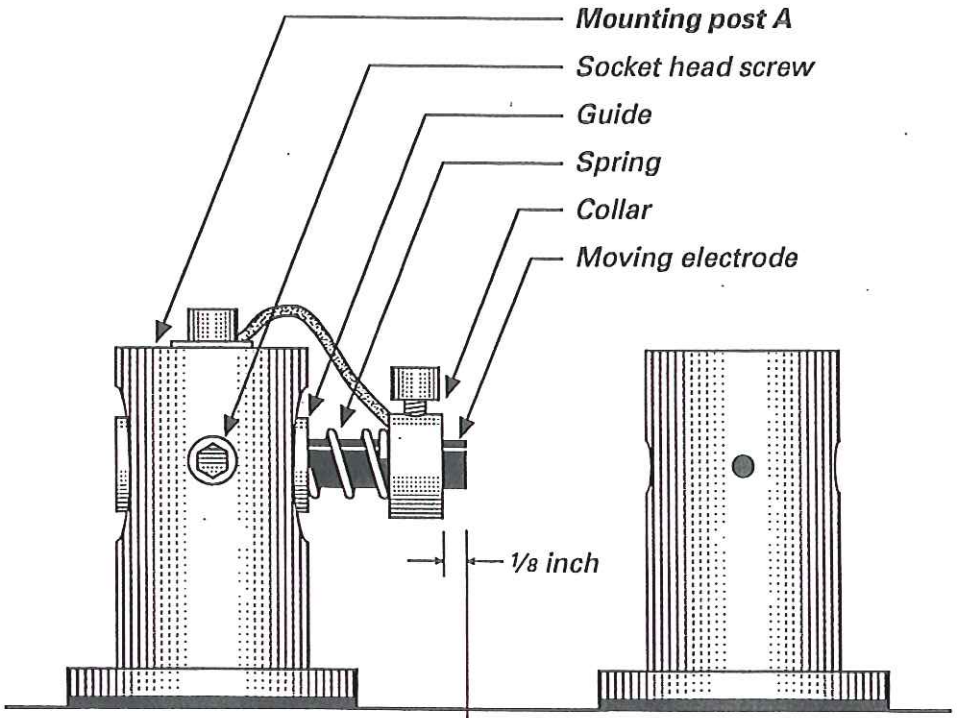
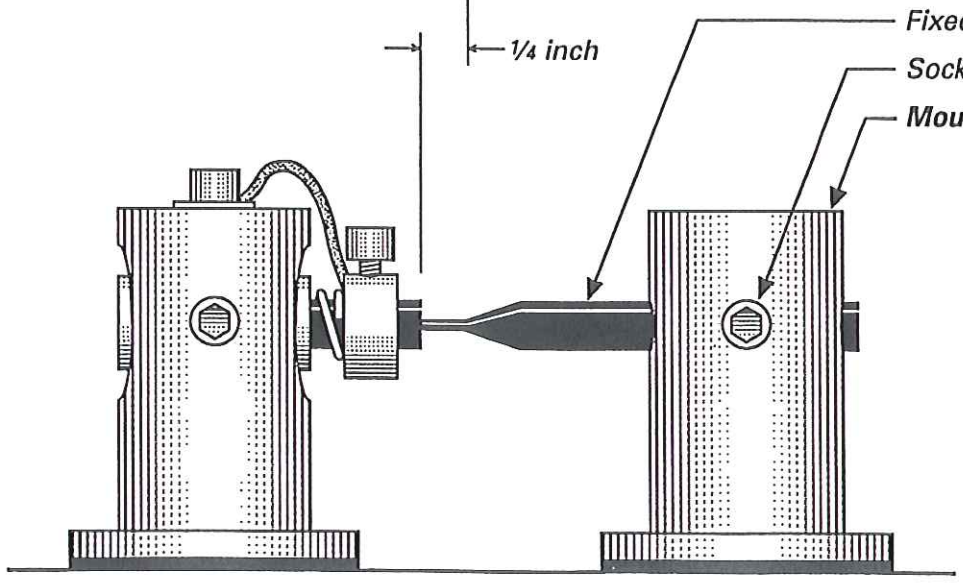


Moving electrode installed in Mounting Post A



Fixed electrode installed in Mounting Post B

10 Place the CEA II top plate on the CEA II glass deposition chamber, with electrodes inside the chamber.
11 Set the argon pressure regulator to 5-15 PSI (35,000-100,000 N/m² or 35-100 kPa).
12 Turn the CEA II Current Control to the off (counterclockwise) position.

Coating

1 Follow the instructions in *Getting ready to coat*, on pages 6-9.
2 Turn the Hummer® Main Power Switch on (this turns on the vacuum pump).
3 Allow the Hummer® to evacuate to 30 milli Torr.
4 Open the Hummer® Gas Control Valve(s) and use it to adjust the chamber vacuum to 100 milli Torr.
5 Turn the CEA II Main Power Switch on.
6 Warm up the electrode tip:
   a. Turn the CEA II Current Control clockwise until the CEA II Current Meter reads 5 amperes.
   b. After 10 seconds, slowly turn the CEA II Current Control counterclockwise until the CEA II Current Meter reads 0 amperes.
   c. Wait 20 seconds.
   d. Repeat steps 6.a. through 6.c. two or three times until the electrode tip glows orange.
7 When the tip glows bright orange, increase the current until the tip is almost white.
8 Reduce the current until the tip is yellow.
9 Increase the current while carefully watching the current meter. When you see the current drop (when current reaches 40 to 60 amperes), immediately decrease the current by about 10 amperes. Deposition is now taking place. **Caution: Do not look directly at the electrode tip when it is glowing white.**
10 When deposition is complete (about 5-30 seconds):
   a. Rotate the CEA II Current Control to the off (clockwise) position.
   b. Turn the CEA II Main Power Switch off.
   c. Turn the Hummer® Main Power Switch off.
11 Remove the CEA II top plate, remove the glass deposition chamber and remove the specimens.

Continued....

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How to Convert the Hummer® Unit back to the plating, etching and plasma processing mode:

When you are finished Carbon Coating do the following:

1. Change the Argon pressure to 5-6 psi (35000-4100 N/m² or 35-41 kPa.

2. Disconnect the gas supply hose from the CEA II Top Plate. Place the CEA II Top Plate in a safe place.

3. Attach the gas supply hose to the Hummer® Top Plate.

4. Thoroughly clean the Hummer® stage, dark space shield and other parts that are coated with carbon. Clean with Scotch Brite nylon scouring pads, then rinse with Isopropyl or acetone and a lint-free wipe.

Continued....

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4 Maintaining your CEA II

Daily/After Each Run	CEA II deposition chamber – Clean with Isopropyl and a lint-free wipe. If there is excessive build-up of carbon, use a mild scouring agent. Scouring will scratch the chamber, so you should try to clean it every day to avoid too much build-up.
Daily/After Each Run	Metal Hummer® components in the deposition chamber area – Clean when carbon builds up. Clean with Scotch Brite nylon scouring pads, then rinse with Isopropyl or acetone and dry with lint free wipe.
Daily/After Each Run	CEA II top plate, mounting posts and related metal components – Clean when carbon builds up. Clean with Scotch Brite nylon scouring pads, then rinse with Isopropyl or acetone and a lint-free wipe.
As Needed	CEA II console exterior – Keep exterior clean by wiping with a damp cloth and a non-abrasive household cleaner, such as Formula 409 or Fantastic. Avoid excessive scrubbing of the front panel and controls.

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5 Troubleshooting

If you have problems with your Carbon Evaporation Accessory II

1 **Stay Calm** – As with any piece of laboratory equipment, problems can sometimes do occur. There is little that can go wrong with the CEA II, so most problems are easy to find and correct. This troubleshooting guide provides clear instructions for finding and solving the common problems. In most cases, you will be able to quickly take care of the problem(s) yourself.

2 **Install Properly First** – This guide assumes you have already correctly installed your CEA II according to the instructions in Chapter 2. If you haven't followed the step-by-step instructions in Chapter 2; do so now. CEA II operation also requires a properly operating Hummer® sputtering unit.

3 **Use This Guide** – Find the symptom you are experiencing and investigate each of the possible causes listed. Record any unusual observations; your notes will be useful if you need assistance.

4 **If Your Unit Still Doesn't Work** – Call Anatech 510-401-5990 or fax 510401-5994. Be prepared to discuss the observations you made while troubleshooting. A Specialist will help you get your CEA II operating as quickly as possible.

CAUTION: Always disconnect the CEA II from the electrical supply before removing the front or rear panels.

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Troubleshooting Symptoms

1. Hummer® pump operates but no vacuum can be achieved:

    a. Check all hoses and clamps for tightness.
    b. Examine boot gaskets on top and bottom of CEA II glass deposition chamber. Remove dust, dirt, hair or any other debris.
    c. Assure that Gas Control Valves is/are closed (gently).
    d. Examine process gas hose connection at CEA II top plate to assure it is secure.
    e. Examine oil viewing port to assure there is sufficient oil in Hummer® pump.
    f. Assure that Hummer® stage height adjusting nut is gently tightened.
    g. When installing CEA II glass deposition chamber, assure it is properly seated on bottom plate.
    h. If problems persist, examine O-ring under stage height adjusting nut. (See instructions in your Hummer® sputtering unit manual). O-ring should be lightly greased and properly seated.
    i. If problem persists, refer to the troubleshooting chapter in you Hummer® sputtering unit manual.

2. Nothing happens when CEA II Main Poser Switch is turned on. Main Power Switch doesn't light up.

    a. Examine line cord to assure it is properly connected at rear panel and at wall receptacle.
    b. Examine circuit breaker on real panel. Push to reset.

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5 Ordering Spare Parts and Consumable

You can order spare parts and supplies by contacting Inside Sales:

Anatech USA
2947 Whipple Road
Union City, CA 94587
800-390-4449 Phone
510-401-5990 Phone
510-401-5994 Fax
igurnee@anatechusa.com
tawatts@anatechusa.com

Terms:

We accept Visa, Master Card, American Express, all forms of money transfers and upon approved credit Purchase Orders with Net 30 only.

FOB:

Anatech USA
2947 Whipple Road
Union City, CA 94587

Delivery:

On Customer Shipping Account or indicate at time of order you would like Anatech to PREPAY and ADD to your Invoice total.

Minimum Order Level:

$100.00

Prices are subject to change without notice.

Appendix A Operating Summary

This appendix contains condensed operating instructions for the Carbon Evaporation Accessory II. You can use this summary after you have become familiar with the detailed steps described in Chapter 3.

Carbon Coating – Summary Instructions Carbon Evaporation Accessory II

1) CEA II Main Power off.
2) Mount electrodes in CEA II top plate.
3) Place specimens on Hummer® stage.
4) Install CEA II glass chamber on Hummer® bottom plate. Attach Hummer® gas supply hose to CEA II top plate. Place CEA II top plate on glass chamber.
5) Set argon pressure to 5-15 psi (35,000-100,000 N/m² or 35-100 kPa).
6) CEA II Current Control off (counterclockwise).
7) Hummer® Main Power on.
8) Evacuate to 30 milli Torr.
9) Open Hummer® Gas Control Valve(s) and adjust vacuum to 100 milli Torr.
10) CEA II Main Power on.
11) Warm up electrode tip: repeat {5 amps for 10 seconds, off for 20 seconds} until tip glows orange.
12) Increase current until tip is almost white then reduce current until yellow.
13) Increase current until deposition begins (40 to 60 amps); then immediately decrease current by 10 amps.
14) When deposition is compete:
    a. CEA II Current Control OFF (counterclockwise).
    b. CEA Main Power OFF.
    c. Hummer® Main Power OFF
15) Remove specimens.

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Appendix B Schematic Diagram

The Diagram is behind this page.

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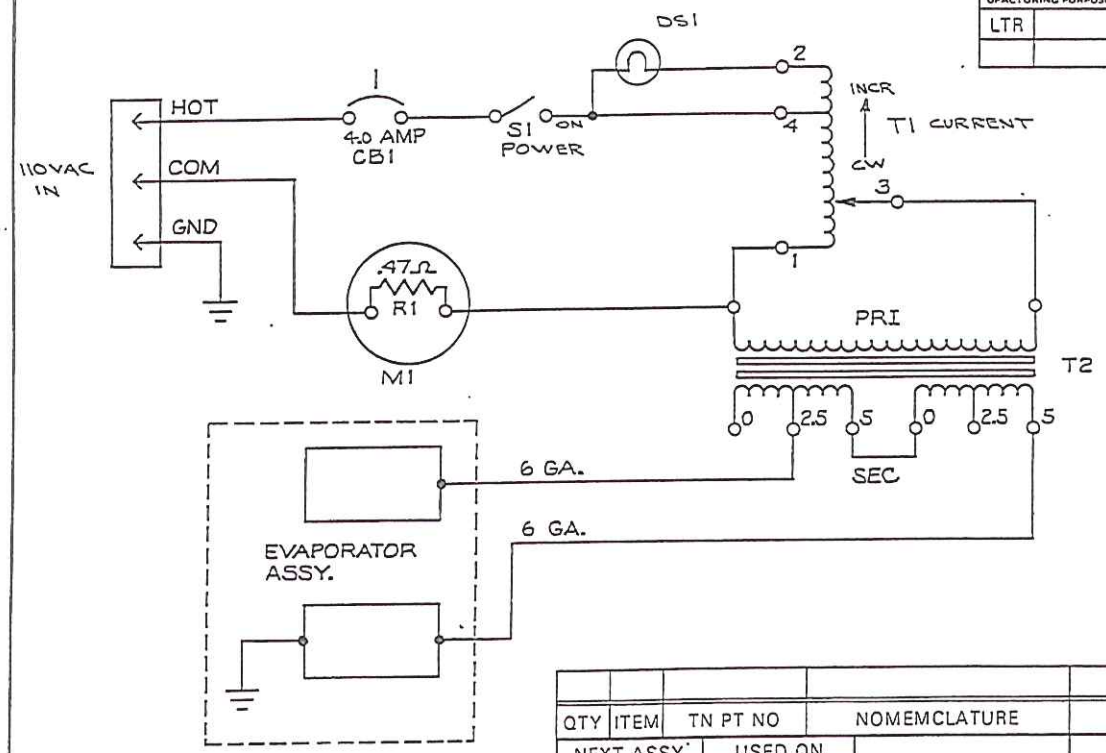
LTR	REVISION	DATE	APP



QTY	ITEM	TN PT NO	NOMEMCLATURE	MATL – VENDOR – SPEC	NOTE

NEXT ASSY	USED ON
PL11049-01	CEA-II

UNLESS OTHERWISE NOTED DIMS ARE IN INCHES AFTER PLATING. DEBURR & BREAK SHARP EDGES TOL ON DECIMALS.
. XX ± .010
. XXX ± .005
ANGLES ± 0° 30'
SURFACE √

ANATECH LTD

TITLE: SCHEMATIC DIAGRAM CEA-II

DRAWN: SOLOMON	APP:	
SCALE:	DATE: 8-3-88	DWG NO: 24188
JOB NO:	SH 1 OF 1	

RECORDER NO. A-5279

Warranty Registration/Information Request/Address Change

Copy, fill out and mail or Fax this form when you install your Anatech Equipment.

Anatech USA
2947 Whipple Road
Union City, CA 94587-1207
510-401-5994 Fax

Warranty Registration

Model_____ Serial No._____
Purchase from: _____
Owner Name: _____ Mail Stop_____
Company: _____
Street: _____
City/State/Zip: _____

Information Request

Please send me more information about the following Anatech Products:

□ Hummer® Sputtering Equipment □ Spare Parts
□ Hummer® Accessories □ please call me_____
□ Other _____
My application is _____

_____
Name: _____ Mail Stop_____
Company: _____
Street: _____
City/State/Zip: _____

Change of Address Notification - Old contact information

Name: _____ Mail Stop_____
Company: _____
Street: _____
City/State/Zip: _____

Change of Address Notification - New contact information

Name: _____ Mail Stop_____
Company: _____
Street: _____
City/State/Zip: _____

Limited Warranty

Coverage

Anatech USA warrants each instrument to be free from defects or workmanship under normal use and service for one year. Malfunctions of an instrument or other article of equipment caused by abuse, incorrect installation or use, or neglect of the instrument or equipment by the purchaser are not covered by this warranty. No other express warranty is given, and no affirmation of Anatech or its agents, by word or action, shall constitute a warranty.

Anatech USA's sole and exclusive obligation to an original purchaser under this warranty shall be to repair at its factory any instrument or other articles of equipment which is returned intact to Anatech USA by the original purchaser, transportation and freight charges prepaid, within 360 days after delivery of such instruments or other articles of equipment to the original purchaser, and which in the sole opinion of Anatech USA has malfunctioned due to defects in original materials or workmanship. This remedy shall be the original purchaser's sole and exclusive remedy under this warranty.

Anatech USA shall not be liable under this warranty for any consequential damages including loss of profits, delays, expense, damage to goods or property used in connection with, or process by or in the instrument or other articles of equipment covered by this warranty, or damage to such instrument or other articles of equipment, or for damages suffered as a result of personal injury.

Anatech USA and the original purchaser of the instrument or other articles of equipment covered by this warranty expressly agree that this warranty is in lieu of all other warranties expressed or implied, including any implied warranty of merchantability or implied warranty of fitness for a particular purpose, and all other obligations or liabilities on the parts of Anatech USA. There are no warranties which extend beyond the description on the face hereof. Anatech USA neither assumes nor authorizes any person to assume for it any other liability or obligation in connection with the sale or service of any of its producers.

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Warranty Service Procedures

Note: ALL products returned to Anatech USA for service (under warranty or otherwise) MUST have prior approval, which can be obtained by calling Anatech USA.

1) To obtain service for an Anatech unit or product, call 510-401-5990 to obtain a Return Material Authorization (RMA) form and number along with shipping instructions. Completed form can be faxed to 510-401-5994 or emailed to tawatts@anatechusa.com. Ship the unit or product to Anatech USA to the attention of your assigned RMA number.
2) Although you must pay shipping charges to Anatech USA for warranty service; Anatech USA will pay return shipping charges.
3) If Anatech USA determines that the unit in NOT defective within the terms of this warranty; the owner will pay the cost of all shipping charges.

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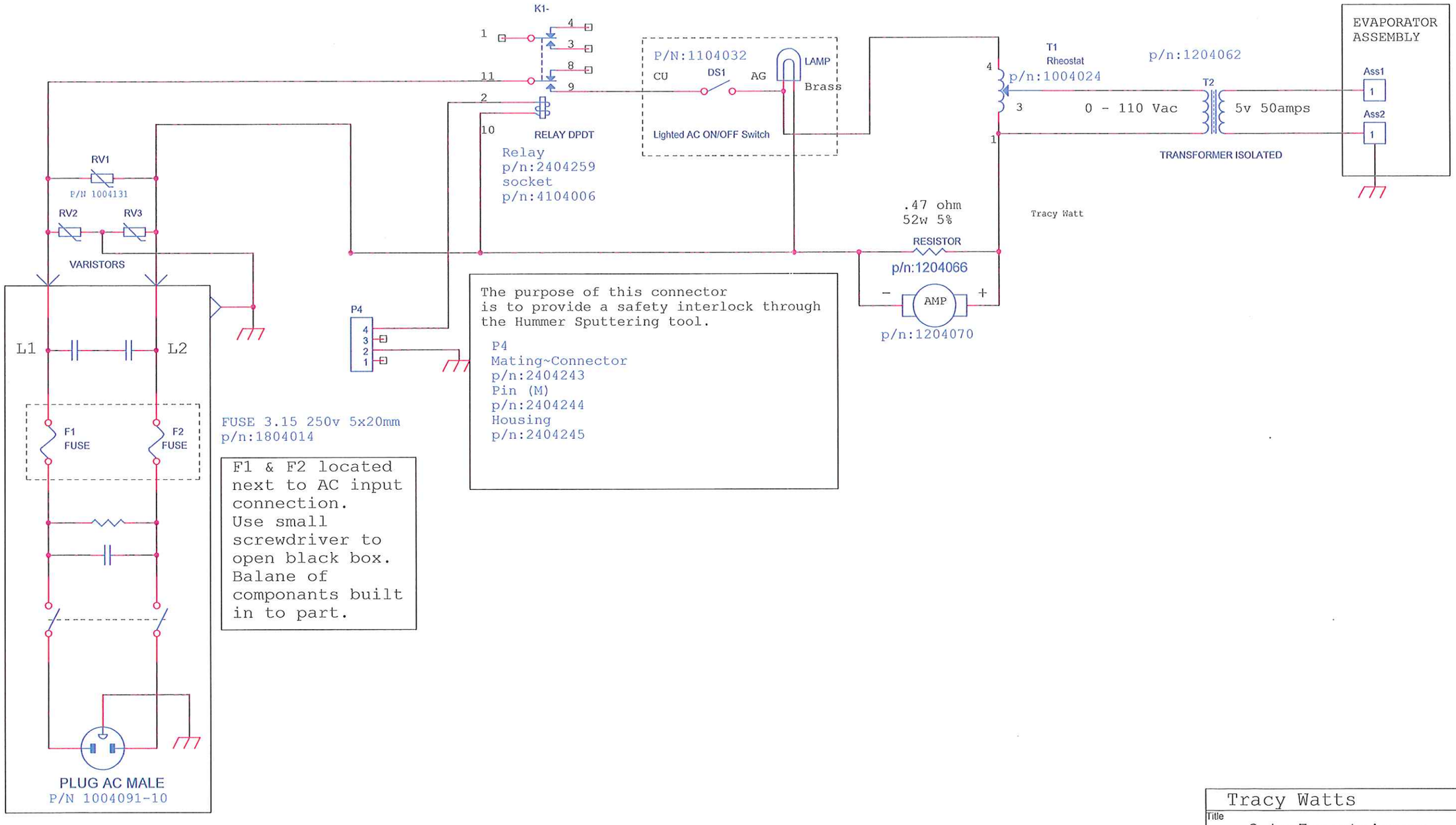

Tracy Watts		
Title: Carbon Evaporator Accesory		
Size: B	Document Number: 1209008-CEA	Rev: C
Date: Wednesday, August 12, 2009	Sheet 1 of 1	