



Operation and Maintenance Manual

4" and 6" Resistive Substrate Heaters

Model No. _____

Serial No. _____

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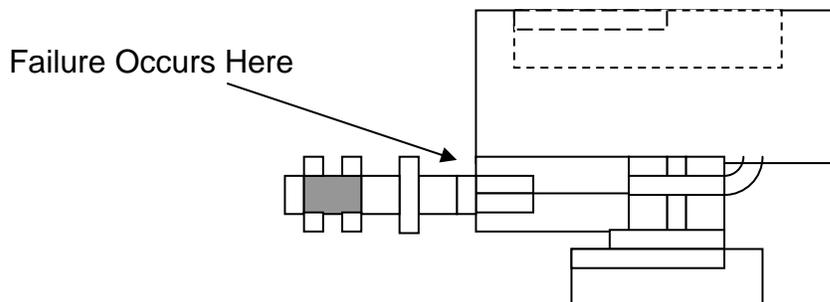
The Maximum Heater Current Limits are:

4" = 14 Amps
6" = 14 Amps

The Maximum Heater Voltage Limits are:

4" = 85 volts DC or AC_{rms}
6" = 135 volts DC or AC_{rms}

Premature failure of the connector block to element wire may occur if the heater is operated with a proportional temperature controller without voltage limit.



Voltage should be limited by the use of a transformer or Variac between the temperature controller and the SCR unit.

Note: Warranty is void if heater is operated without voltage limiting.

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I. INTRODUCTION

The US Inc. High Temperature Resistive Substrate Heater was specifically designed to provide stable, uniform heating of substrates over an area of several square centimeters during thin film deposition. At the heart of the heater is a resistive coil embedded in a super alloy block. When current is applied, the block can reach temperatures of up to 950 °C. This simple design makes the heater quite efficient and durable.

The materials used were carefully chosen for thermal performance, chemical stability, durability, and UHV compatibility. The heater has been successfully used in such processes as sputtering, pulsed laser deposition, and chemical vapor deposition.

This manual contains important information about the installation, operation and maintenance of the heater. In order to insure proper operation, the instructions on the following pages should be followed carefully.

II. PRE-INSTALLATION

Before installing into your system, it is very important to operate the heater in air at 700° C for a minimum of 1 hour. This produces an oxide passivation layer on the heater block surface, thus preventing any contamination of your system and process.

Use a DC or AC power supply (e.g., AC “Variac”, 0-120V) or a temperature controller (e.g., Eurotherm Models 808 controller and 425 SCR). The output of your power source **should not exceed 85V DC or AC rms (typ.) for the 4” heater and 135V DC or AC rms (typ.) for the 6” heater.** Refer to the heater tag for the correct maximum voltage for your heater **DO NOT USE 120V LINE VOLTAGE.** If a temperature controller is used, it may be necessary to use a transformer to reduce the output voltage. Some controllers have a voltage limiter that can be adjusted by the user. **ALWAYS MEASURE THE VOLTAGE ACROSS THE HEATER WHILE IT IS IN USE.**

:::CAUTION:::

DO NOT OPERATE 4” HEATER ABOVE 14 AMPS.

DO NOT OPERATE 6” HEATER ABOVE 14 AMPS.

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III. INSTALLATION

When installing the heater, it is important to take notice what type of equipment will be in close proximity. Even though many applications are performed under vacuum (where heat transfer is reduced), radiated heat can affect water temperatures, magnets, or soft metals, etc.

It is important that the heater, especially the electrical contact posts, be isolated from electrically conductive parts of the system to prevent arcing and possible destruction of the heater. Keep, at least, 1" of space around the heater at all times.

Place the mounting bracket onto the mounting plate or surface which has the same bolt circle as the bracket. It is important that the open end of the mounting bracket be facing upward. Slip the "T" shaped mounting foot on the bottom of the heater into the mounting bracket.

A sheathed type K thermocouple (Omega P/N CHAL-010) or unsheathed type S thermocouple (Omega P/N P10R-010) should be used. If the sheathed type K thermocouple is used, strip the non-thermocouple end to expose the leads. For both thermocouple types, attach the leads to your feedthrough (your feedthrough must be the same type materials as your thermocouple wires). Be sure to cover all exposed areas of the leads with ceramic beads. Place the thermocouple into the hole on the side of the heater block as far as it will go. Position the heater so the thermocouple will not fall out.

IV. OPERATION

After initial burn-in, the unit can be turned up to full power instantaneously. During operation, it is important to remember not to exceed the typical operating specifications.

14 Amperes - 85 Volts (for the 4" Heater)
14 Amperes – 135 Volts (for the 6" Heater)

Refer to the heater tag for the exact power specifications used during final test.

V. MAINTENANCE

Due to repeated thermal cycling, it may be necessary on occasion to tighten the heater's screws, especially the assembly screws to the ceramic standoffs. To avoid damaging the ceramic standoffs, **do not** over-tighten the screws.

All deposited materials can be removed with a plastic metal finishing pad ("Scotch-brite"). If necessary, the heater may be degreased in 1,1,1 trichloroethane or methanol.

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VI. TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE
1. Slight temperature drop during process as material is deposited.	- Emissivity of heater is changing, increase power slightly.
2. Heater needs significantly more power to achieve temperature, or fails to heat up at all.	- Loosen power connections. Clean and re-tighten connections - or - - Power leads crossed or short-circuited to conductive parts of system. Increase space around heater.
3. Heater fails during the deposition process.	- Power supply not functioning - or - - Heater damaged. Test the resistance between contact posts. It should be approximately 10 ohms for the 4-inch and should not change significantly with time or temperature. - Test the resistance between the contact posts and the substrate platter, and between the contact posts and the mounting bracket. They should be at least one megohm.

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VII. SPECIFICATIONS

	4" Heater (SU-400IH)	6" Heater (SU-600IH)
1) Maximum Block Temperature	950°C	950°C
2) Temperature Repeatability	13°C	13°C
3) Temperature Uniformity	± 2%	± 2%
4) Maximum Voltage	85 Volts	135 Volts
5) Maximum Current	14 amps	14 amps
6) Heater Resistance (typical)	6 ohm	10 ohm
7) Power Supply	AC/DC	AC/DC
8) UHV Compatibility	Yes	Yes
9) Electrical Biasing	Yes	Yes

Power leads must be vacuum grade nickel or OFHC copper wire, with a minimum diameter of 0.050". Cover all exposed wire within the vacuum system with ceramic (alumina) beads. Connect the leads to the heater's contact post using connectors. Connect the other ends in your power feedthrough in the same manner. **POWER CONNECTIONS SHOULD BE CHECKED REGULARLY FOR LOOSENESS.**

:::IMPORTANT:::

Install a 15 amp in line fuse between the power supply output and the electrical feedthrough. This will prevent damage to the heater due to a broken thermocouple, a malfunctioning temperature controller, or a power surge.

Use a DC or AC power supply (e.g., AC "Variac", 0-135V) or a temperature controller (e.g., Eurotherm Models 808 controller and 425 SCR). The output of your power source **should not exceed 85V DC or AC rms (typ.) for the 4" heater and 135V DC or AC rms (typ.) for the 6" heater.** . Refer to the heater tag for the correct maximum voltage for your heater.

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