



## INSTRUCTION MANUAL

SHQ-2D RADIANT SAMPLE HEATER

Version 2

SERIAL # \_\_\_\_\_

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## Preface

Congratulations! You have purchased a UHV vacuum product from Thermionics. This unit is capable of many years of use with minimal care and maintenance. This manual is a tool to aid you in obtaining this service. We at Thermionics encourage your comments and suggestions on this manual.

## Product Description

The SHQ series sample heaters are a series of heaters suitable for operation in environments containing oxygen. The heat source is infrared quartz lamps. The quartz glass housing surrounding the filament protects it from the operating environment. The heat shield and sample mounting plate are made of a nickel alloy capable of high temperatures, in oxidizing environments. The sample plate is electrically isolated. The rear and sides of the unit are water cooled to minimize stray heating and maximize lamp life.

The standard heater is supplied with mounting/water cooling re-entrant seal, power electrical feedthrough, and internal wiring. A thermocouple is not included because of the wide variety requested by researchers. Let us know your requirements. The following equipment is also available:

- Gas introduction systems
- Shutter assemblies
- Power supplies, with and without temperature control
- Units for larger sample sizes

## Shipment

installed. The unit is clean and ready for installation into your UHV system. This is true even with systems which have been qualified to the customers specifications.

SHQ Heaters are shipped in custom foam-in-place packing. We have found this the only system to provide adequate protection for shipment. The foam is separated approximately half way inside the crate with thin plastic.

## Mounting

The SHQ heater can be installed directly from the packing. As usual, care should be exercised to protect the knife seal edges. The standard unit mounts to a 2.75" OD flange. The assembly utilizes a re-entrant seal to allow the heater assembly to be mounted from inside the chamber. The special 2.75 11 OD re-entrant flange should first be installed on the chamber or manipulator. The support shaft/cooling tube should then be installed from inside the chamber and the reentrant seal properly tightened. Proper tightening technique should be observed whenever tightening a metal sealed flange. We recommend a small quantity of high temperature anti-seize lubricant be used on all threaded fasteners outside the vacuum. This is especially important if the unit will be subject to bake-outs.

The heater power is supplied through a two conductor feedthrough with ground (supplied). This must be mounted to a 1.33 11 OD flange. Connect the ground conductor to a suitable safety ground. Verify the connection with test equipment, Route conductor in the vacuum system in such a way as to not allow accidental contact between the conductors and to any equipment.

## Water Cooling

WATER COOLING OPERATION SPECIFICATIONS:

The cooling supply requirements are <20°C water at >50 psi <100 psi. Minimum flow requirement is 0.5 GPM. The cooling water must be of high quality, either very low in salt and particulate or (preferably) a closed loop cooling system with de-ionized and treated water. The water should be filtered in all cases. If a closed loop system is used, it must be of the "open return" type, with the return line at atmospheric pressure. This is required for safety reasons.

The plumbing circuit should include an input shut off valve and an exit flow switch. The exit flow switch should be interlocked to the heater power supply, so as to not allow heater power unless cooling water is flowing. Check the operation of the protection system often.

\*\*\*WARNING\*\*\*

It is important the shut off valve is not on the exit line. The exit line must remain open to the atmosphere. Before bakeout, remove all water from the heater cooling lines. Any water left in the lines will boil, creating high temperature and pressure steam. Be certain the exit line is properly restrained. This equipment is not designed to handle pressures greater than 100 PSI. Equipment and personnel would be in great danger. Read and follow instructions for bakeout.

## Operation

\*\*\* WARNING \*\*\*

Operations involving enriched oxygen environments can be hazardous, including explosive. Many materials commonly considered non-hazardous become dangerous in such environments. Simple mechanical pumps using oil can explode, putting both personnel and equipment at great risk. Many other common materials will violently react to oxygen.

we recommend systems utilizing enriched oxygen environments be undertaken only by those properly skilled to perform such operations in a safe and cautious manner. The SHQ series heater has not been tested in enriched oxygen environments, and is not intended for that use.

## Operational Requirements:

### UTILITY REQUIREMENTS:

- 0 to 120 VAC, 8 amp variable power supply, with proper isolation and overload protection
- 0.5 gal/min water cooling

The SHQ-2D heater is a resistive heater with a nominal maximum power requirement of 120 volts at 8 amps (1,000 watts). This may be AC or DC. Under operating conditions, the following performance was found on the sample face with a 111 OD SS sample disc 0.015 11 thick, properly mounted. The sample was heated from the back side with the thermocouple welded on the face side:

72 volts  
120 volts

5.5 amps  
7.5 amps

700 C  
1,000 C

The power supply employed by the user must be capable of current or power limitation and be of electrically isolated design. The filament resistance changes over its temperature operation range.

The heater should always be started slowly, minimizing any fast thermal stresses to the system .... consistent with the experimental requirements.

#### BULB LIFE:

Do not operate this heater beyond 120 volts or 7.5 amps. Bulb life will be significantly shortened if currents in excess of 7.5 amperes are used.

The bulb manufacturer indicates an expected bulb life of 3,000 hours for atmospheric applications. We anticipate 1,000 to 1,500 hours expected bulb life when operated at 700 c, with short excursions (< 5 minutes) up to 1,000 c. Good data has not yet been obtained on bulb life.

The quartz envelope will soften at 1,000 c if allowed to operate for longer periods of time. This can cause bulb failure.

If the heater is operated for long runs under 400 to 500 C, the heater should be "exercised" to over 500 c for short periods of time(> 10 minutes) from time to time. This allows the material deposited upon the inside of the quartz bulb to re-deposit back onto the filament. If this is not done, shorter bulb life may be experienced.

#### SAMPLE PLATE MOUNTING/ DIS MOUNTING:

The sample plate is attached to the heater assembly with four Phillips head 4-40 screws. The screws are stainless, into stainless mounting posts. With high temperature operation in a high vacuum environment, the tendency for cold welding (galling) of screws is increased.

The following procedures should be followed to minimize difficulty.

1. Do not over-tighten any threaded fasteners used in the assembly.
2. Apply tungsten di-sulfide powder to all threads upon attachment. This acts as a lubricant and an anti-seizing compound.
3. A suitable liquid (eg. alcohol) applied in very small quantity as a "screw lubricant" just prior to removal can be beneficial.

## Bakeout

Bakeout instructions on any heater assemblies involving water cooling:

Turn off the water supply. Disconnect the supply and blow out all remaining liquid. Use dry gas ( < 10 psi for safety!) to dry out the internal lines. Leave both entrance and exit lines open to the atmosphere.

Proceed with bakeout.

Reconnect after cooldown, and verify correct operation.

## Maintenance

### BULB REPLACEMENT:

The bulbs should be replaced by someone of technical skill. The following instructions should help the individual successfully perform the task. All the following instructions should be done with gloved hands, even if the assembly is not used in UHV applications . The bulbs will give shorter life if skin oils are deposited on the quartz bulb envelopes. If difficulty is encountered, please contact the factory.

- a) Remove the sample mount/ heater assembly from the vacuum chamber.
- b) Remove the sample plate, following the procedure above. This will expose the bulbs.
- c) Inspect the heater assembly, noting how the bulbs, clamps, power lines, etc . are dressed and mounted.
- d) Carefully remove the cooling straps from across each end of the bulbs. remove the copper braid. Disconnect the power lines. Remove The bulbs.
- e) Replace the bulbs, taking care not to allow skin contact with the lamps. Re-assemble the braid cushions as originally found. Do not make direct contact between the quartz and the cooling strap or copper heat sink. The copper braid must be allowed to cushion the quartz and allow for minor movement.
- f) Tighten the strap screws. These should be tightened only adequately to seat the bulb ends and supply conductive cooling.

- g) Attach electrical leads as required. Take care to dress the power leads so that a short circuit cannot occur.
- h) Re-assemble remaining components.

We at Thermionics have a large stake in your new equipment operating up to your expectations. If you experience difficulty with this unit, or any other aspect of your endeavor where our experience might be of value, we want to hear from you. We want to be part of your success.

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