MODEL 5070
MULTIZONE HEATER
USER'S MANUAL

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For

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SECTION 1.

GETTING TO KNOW YOUR MULTIZONE HEATER

1.1 HOW THE MULTIZONE HEATER WORKS

The Research, Inc. Model 5070 Multizone Heater (figures 1–1 and 1–2) consists of a heater unit with the following major components :

1. Q1000 T3/4CL infrared lamps
2. Wiring harness
3. Clear quartz window
4. Specular aluminum, water-cooled reflector
5. Air pressure tap: 10-32NF to 1/8 hose

The 5070 heater can heat specimens up to 2.5 inches (63.5 mm) wide and from 1.20 inches (Model 5070-1) to 14.40 inches (Model 5070-12) long.

Each zone in the heater contains two infrared lamps, and can be individually controlled by an external controller. The wiring harness identifies each zone by number, and each lamp within a zone by the letter A or B.

Lamp envelopes, the quartz window, and lamp end seals are air cooled. The reflector body and heater frame are cooled by water. A gas port on the rear side of the heater offers the capability of using air or an inert gas to accelerate specimen cooling.

For more information about product support, contact your customer service engineer at Research, Inc. His or her telephone number in the United States is (612) 941-3300.

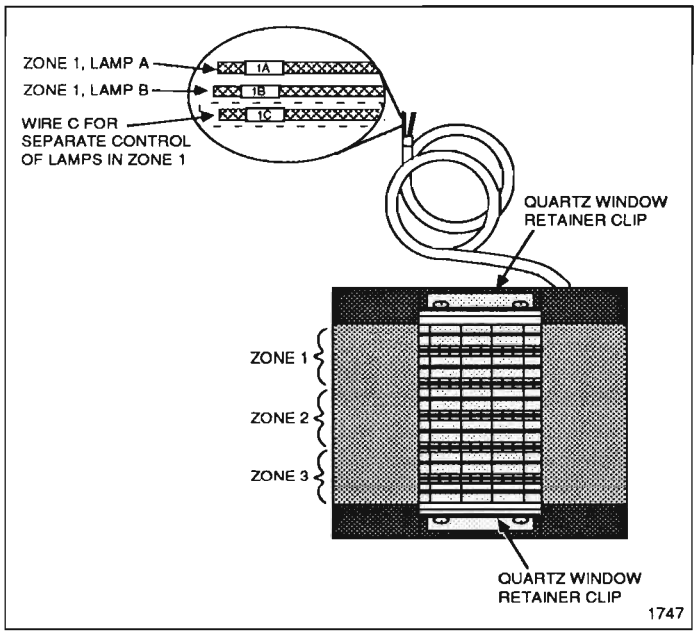

Figure 1–1. Model 5070, front side.

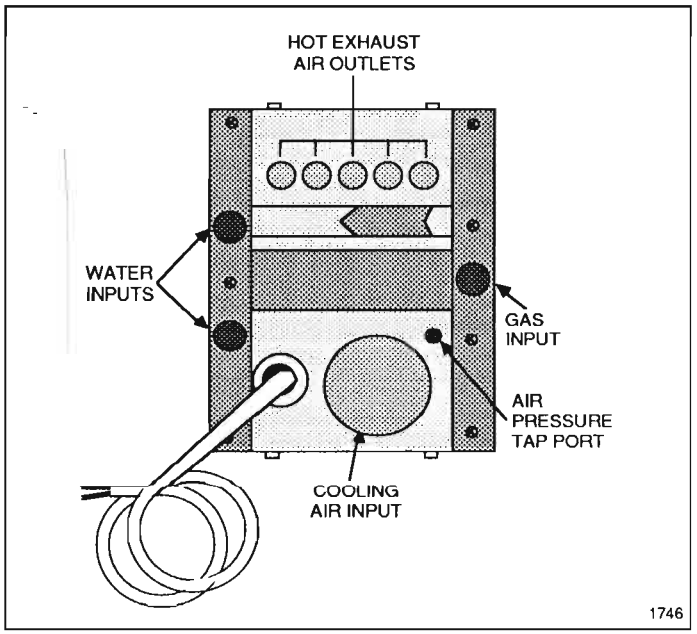

Figure 1–2. Model 5070, rear side.

1.2 SPECIFICATIONS

The Model 5070 specifications are shown in tables 1–1 and 1–2.

Table 1–1. Specifications for the Model 5070 Multizone Heater

MODEL NUMBER	NO. OF ZONES	NUMBER OF LAMPS	POWER MAX. KW	(A) CHAMBER HT., INCHES	(B) OVERALL HT., INCHES
5070-1	1	2	2	1.20	2.70
5070-2	2	4	4	2.40	3.90
5070-3	3	6	6	3.60	5.10
5070-4	4	8	8	4.80	6.30
5070-5	5	10	10	6.00	7.50
5070-6	6	12	12	7.20	8.70
5070-7	7	14	14	8.40	9.90
5070-8	8	16	16	9.60	11.10
5070-9	9	18	18	10.80	12.30
5070-10	10	20	20	12.00	13.50
5070-11	11	22	22	13.20	14.70
5070-12	12	24	24	14.40	15.90

NOTE

Maximum heat flux density at the specimen (target) surface is .44 KW per inch². Maximum allowable specimen (target) temperature is 1454°C (2650°F) where specimen absorptance is greater than .5.

Table 1–2. Minimum Air and Water Flow Requirements for the Model 5070*

MODEL NUMBER	AIR CFM	WATER GPM
5070-1	6	.06
5070-2	12	.12
5070-3	18	.18
5070-4	24	.24
5070-5	30	.30
5070-6	36	.36
5070-7	42	.42
5070-8	48	.48
5070-9	54	.54
5070-10	60	.60
5070-11	66	.66
5070-12	72	.72

*More than the minimum coolant flows are recommended and as a result will enhance component life and performance.

NOTES

SECTION 2.

SAFETY

2.1 SAFETY

2.1.1 General Safety Practices

1. Always wear safety glasses when using the Model 5070 Heater to provide protection from infrared radiation.
2. Use gloves when handling specimens because the specimens can be hot enough to cause severe burns.

> **WARNING**
> **Hot exhaust air leaving the heating chamber can get as hot as 230°C (446°F). Keep hands away from the region of the hot air exhaust ports while the heater is operating or serious injury due to burns may result.**

2.1.2 Fire Safety

1. Obey the same fire-safety rules you observe when you work with hot plates, high intensity infrared heaters, propane or acetylene torches, soldering irons, and other equipment that gets very hot.
2. Remove all solids, liquids, and gases that burn easily from the area around the heater.
3. Know where the nearest fire extinguisher is located and how to use it.
4. Know how to put out fires from all the types of material near the Model 5070 Heater.

2.1.3 Maintaining Proper Air and Water Pressure for Cooling

Be sure to have sufficient air and water pressures to meet the specifications listed in table 1–1 for the model heater which you are using. Failure to do so could result in overheating and damage to the unit.

For example, if cooling air is insufficient, the quartz lamp envelopes may soften and distort, and lamp endseals and insulators located in the exhaust endseal chamber are likely to fail prematurely.

If cooling water is insufficient, the O-ring seals for the water passages will fail and the risk of catastrophic meltdown is likely.

2.2 UNPACK AND CHECK FOR DAMAGE

1. Take the Model 5070 Heater out of its shipping container.
2. Check the heater unit for shipping damage. If you find damage:
   A. Keep the shipping container and packing material.
   B. File a damage claim with the shipper who delivered the Model 5070 Heater to your company.

2.3 WHERE TO SET UP THE MODEL 5070

The Model 5070 Heater can be used on a flat, level surface made of firebrick or similar fireproof material.

Consider doing setups in a load test machine, and on a special stand on a workbench. Also consider mounting the unit in a processes machine.

2.4 POWER NEEDS

The Model 5070 Heater uses up to 240 volts RMS. All models come with lamp power wires labeled for proper connection to an external controller. See section 1.2 for complete power specifications.

2.5 CLEANING THE HEATING CHAMBER

Before turning on the heater, be sure the quartz window is clean. Use a non-abrasive glass cleaner and a clean, dry, lint-free cloth to remove any smudges or debris:

1. Be sure the heater controller is **OFF**.
2. Let the heater cool down to room temperature before commencing cleaning operations.

SECTION 3.

INSTALLATION

3.1 HOW TO WIRE THE HEATER TO A POWER CONTROLLER

3.1.1 Introduction

Model 5070 Multizone Heaters are wired at the factory for easy installation with a power controller. Each zone has two lamps wired in series (figure 3–1). Each lamp wire in the wiring harness is labeled with a zone number and the letter A or B (figure 3–2).

NOTE

The first and last zones in the heater have a third wire labeled with the zone number and the letter C (figure 3–1 shows a Model 5070-3, so zones 1 and 3 have a C wire). This wire may be used to provide separate control for each lamp in those zones.

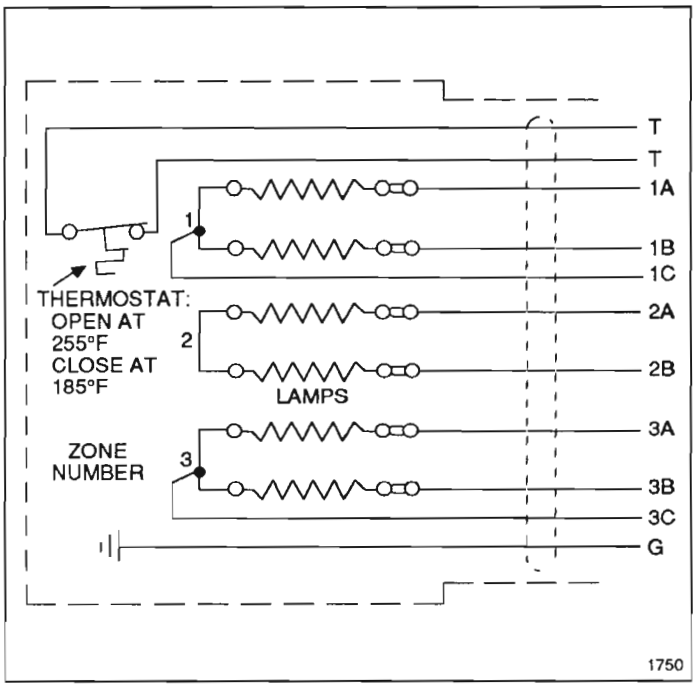

Figure 3–1. Lamp wire numbers for connection to a power controller.

3.1.2 Balancing Tungsten Filament Quartz Lamp Loads

Although lamps are designed for standard line voltages, current flow through the lamp must be accounted for during its heatup to operating temperature. The resistance of a lamp element may be 15 times lower at room temperature than it is at operating temperature. A lamp element has very little mass and heats up quickly. Output signal conditioning, which is available on quality SCR power controllers, provides a ramping of the output voltage from 0 to operating level in two to three seconds. This amount of time is considered adequate to bring the resistance of the element high enough to be within the rating of the power controller.

CAUTION

The maximum allowable voltage across the two lamps wired in series in each zone is 240V.

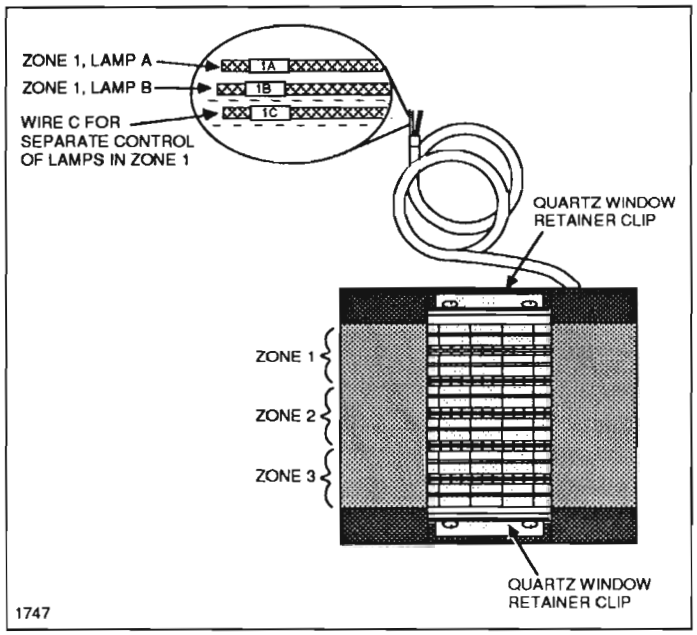

Figure 3–2. Zone/wire configuration (Model 5070-3 shown).

3.2 COOLING

3.2.1 Connections for Water Cooling

WARNING

Clean cooling water is required for safe operation of the heater. Operating the heater without water cooling will cause heater destruction and may be a hazard to the operator and product.

The reflector body and unit frame of the Model 5070 are water cooled. The water input and output are on the rear side of the unit (figure 3–3). Either port may be used as the input.

The two water inputs are tapped for 1/4-18 NPT connectors. Water pressure should be between 25 and 150 PSIG. Recommended water flow rates are different for different sized units, depending on the number of lamp zones. Refer to table 1–2 for the minimum recommended flow rate for your unit.

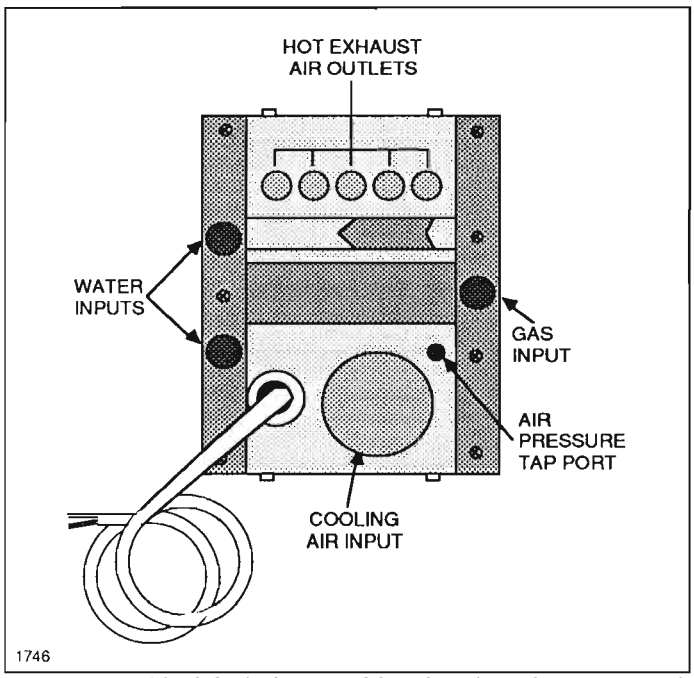

Figure 3–3. Model 5070, rear side, showing air, water, and gas inputs.

3.2.2 Connection for Air Cooling

WARNING

Clean cooling air is required for safe operation of the heater. Operating the heater without air cooling can cause overheating of the quartz lamps and insulators, producing premature failure. Also, it may be a hazard to the operator and product.

Lamp envelopes, the quartz window, and lamp end seals are air cooled. On Models 5070-1 through -8, there is one air input tapped for a 1 1/4-11 1/2 NPT connector (figure 3–3). Models 5070-9 through -12 have two air inputs of this size. Clean cooling air at a temperature of 55°C (100°F) or cooler must be supplied. Recommended air flow rates are different for different sized units, depending on the number of lamp zones. Refer to table 1–2 for the minimum recommended flow rate for your unit.

Air exhausts through several output ports on the rear side of the unit (the number of exhaust ports depends on the number of lamp zones in the unit). These exhaust ports must be unobstructed for proper cooling of the lamps and end seals. See figure 3–4.

WARNING

Hot exhaust air leaving the heating chamber can get as hot as 230°C (446°F). Keep hands away from the region of the hot air exhaust ports while the heater is operating or serious injury due to burns may result.

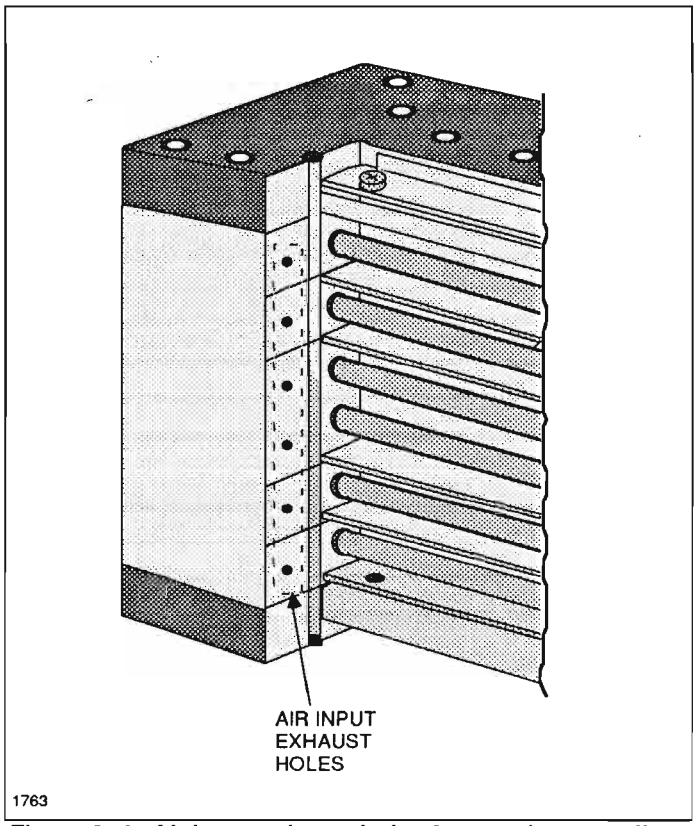

Figure 3–4. Air input exhaust holes for specimen cooling.

3.2.3 Connection for Specimen Cooling Via Inert Gas or Air

A gas input is provided on the rear side of the unit to be used for inert gas or air for specimen cooling (figure 3–3). Specimen cooling is accomplished when the gas exhausts through ports in the heating chamber. The gas input is tapped for a 1/4-18 NPT connector.

3.3 AIR PRESSURE TAP

The Model 5070 has an air pressure tap on the rear side (figure 3–3). A barbed fitting for connecting a 1/8-inch hose to the tap is included with the heater when it is shipped.

NOTES

SECTION 4.

TROUBLESHOOTING

4.1 INTRODUCTION

Sections 4.5, 4.6, and 4.7 will tell you how to clean or replace parts.

Before you check for problems, turn the power controller **OFF** and make sure all wires inside both the control unit and the heater unit are connected properly. A loose wire may be the only problem. If all the connections look good, then you can begin checking the items in the table.

4.2 REPLACING PARTS OF THE MULTIZONE HEATER

4.2.1 Parts List and Ordering Information

Section 4.4 lists spare parts for the Model 5070. If you need any parts, call our customer service department. The telephone number in the United States is: 1-612-941-3300.

4.2.2 Returns

If you have to return the Model 5070 or one of its parts to Research, Inc. for repair or replacement, please do these two things:

1. Call our field service department at 1-612-941-3300 and request an authorization to return the material. You will be given a return material authorization (RMA) number.
2. Return the unit or part to:

   Research, Inc.
   RMA # _____
   6425 Flying Cloud Drive
   Eden Prairie, MN 55344, USA

4.3 TOOLS AND TEST EQUIPMENT

You will need these tools and test equipment to replace parts on the Model 5070:

1. Philips screwdriver to remove the access cover and the quartz window hold-down bracket.
2. Long-nose pliers or forceps to remove lamps.
3. Lamp insert tool to retract the spring-loaded lamp contact electrode. This tool is provided with the unit (RI part no. 075978-001).
4. Tissue or clean, lint-free cotton gloves to prevent lamp envelope contamination.

4.4 RECOMMENDED SPARE PARTS LIST

We suggest that you keep the following spare parts on hand. To order extra parts, see section 4.2.1.

1. Q1000 T3/4CL infrared lamps.
2. Quartz window.

4.5 REPLACING PARTS

4.5.1 Lamps

See figures 4–1 through 4–4.

1. Disconnect all power to the unit.
2. Remove the lamp terminal access cover located at the air and power input side of the unit (figure 4–1):
   A. Loosen the #8 philips head screws.
   B. Slide the cover toward the front of the unit and press down until the other end lifts away from the unit enough to remove.
   C. Slide the cover out of the unit.

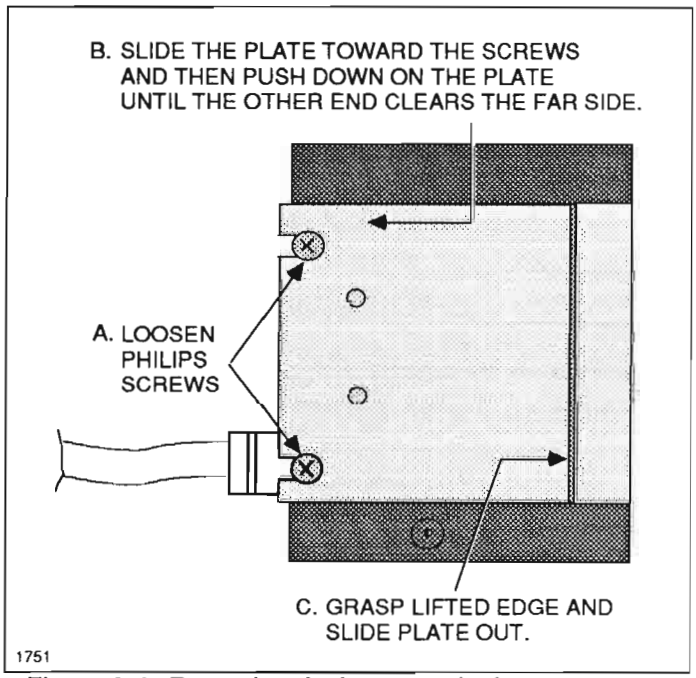

Figure 4–1. Removing the lamp terminal access cover.

3. Remove the Q1000T3/4CL, 1000W, 120V lamps from their protective containers in such a way that the clear quartz envelopes remain free from contaminating finger oils (use a clean tissue or clean, lint-free cotton gloves).

NOTE

This unit will also accept lamp part number Q500T3/CI/6, 500W, 120V lamps.

4. Secure the heater to a fixed frame or bracket so that the unit will not slip during lamp electrode holder retraction.
5. Retract the lamp electrode holder using the lamp insert tool provided with the unit (figures 4–2 and 4–3).

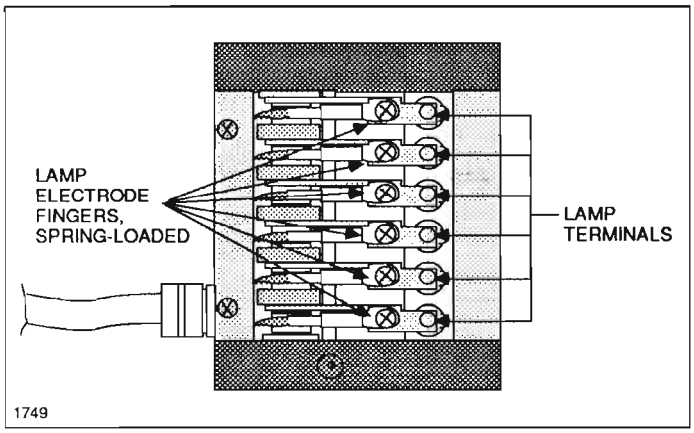

Figure 4–2. Top of heater, access cover removed.

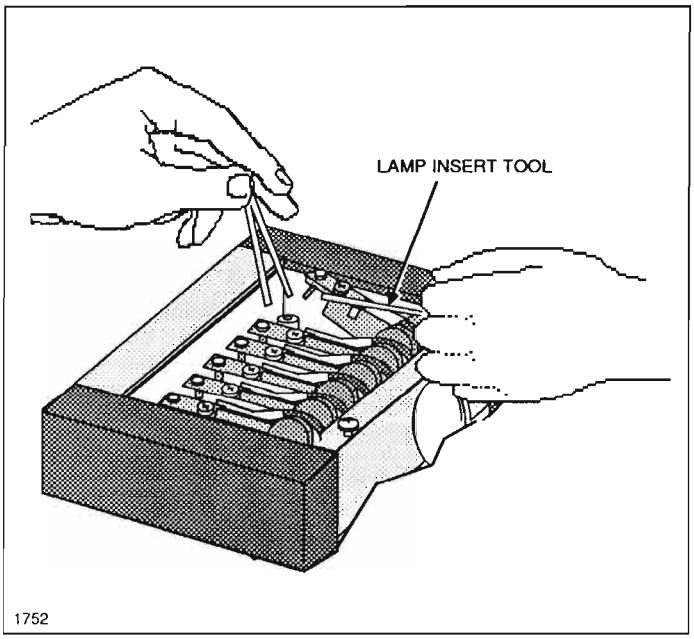

Figure 4–3. Changing a lamp.

6. Insert the new lamp into the heater while the holder is retracted in such a way that the far end rests on its fixed electrode contact pin. Some practice may be required to assure that the far electrode electrical contact is made.
7. Slowly release the retracted electrode holder onto the lamp electrode.
8. Visually inspect electrode seating into the lamp contact recesses. The lamp axis and electrode axis should be aligned for good electrical contact. If they are not aligned, repeat the installation procedure. If the axes are still not aligned, try a different lamp.
9. Install all remaining lamps using the same procedure.

CAUTION

All lamp sockets must be filled in order to have adequate cooling air flow past all operating lamps. Therefore, if non-operating lamps are desired, insert a lamp with a burnt out filament into the desired position.

10. Replace the lamp terminal access cover.
11. Reconnect the power.

CAUTION

Do not operate the Model 5070 heater without adequate cooling air and water (see drawing TD075909, Revision 4). Refer to table 1–2 for minimum air and water flow rates for your unit.

NOTE

Inner shields between lamp zones provide additional zone separation if desired. However, the separation is gained at the expense of heater efficiency. Therefore, shields should not be used unless necessary.

4.5.2 Replacing the Quartz Window

See figure 4–4.

1. Disconnect power to the unit.
2. Loosen the two #8 philips head screws on the window retainer bracket and lower the bracket.
3. Remove the old quartz window.
4. Insert a clean, uncontaminated clear quartz window into the window groove in the heater unit.

CAUTION

Use a clean tissue or clean, lint-free cotton gloves to handle the window in order to prevent contamination from finger prints, which can cause quartz devitrification.

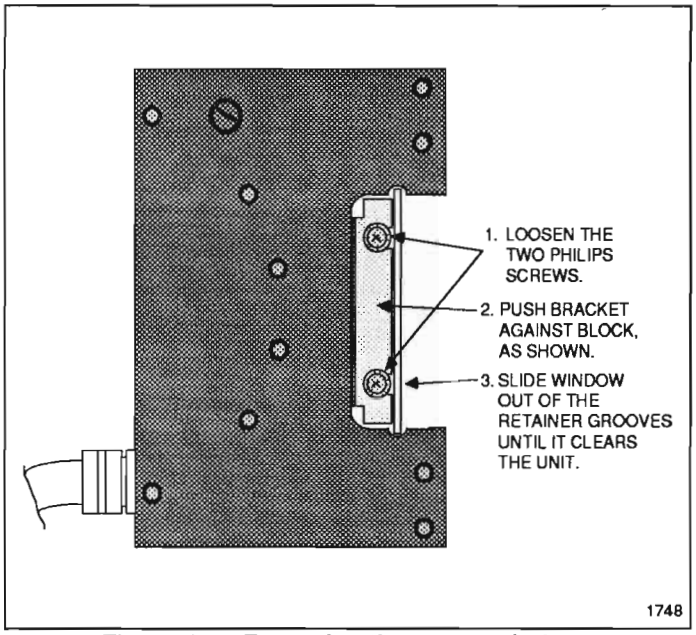

Figure 4–4. Removing the quartz window.

5. If desired, insert a 2.50 inch ceramic fiber seal strip (provided with the unit) into the window seal grooves.
6. Raise the window retainer bracket and tighten the two #8 philips head screws.

4.6 CLEANING THE REFLECTOR

A clean reflector provides the greatest radiant unit efficiency. If the reflector surfaces become contaminated for some reason, they reflect less radiant energy out of the emitter opening of the radiant unit. The energy that does not emit from the unit must be absorbed by the unit itself, and removed from the unit by the cooling water and air. This lost energy is wasted heat.

Therefore, if the reflector surfaces become excessively contaminated, remove the quartz window to gain access to the heater cavity. In some cases, the lamps must also be removed to adequately expose the reflector surfaces for cleaning.

The cleaning method will depend on the type of contamination:

1. Dust: Remove with a feather duster or soft-bristled brush.
2. Film: Wipe with a very soft tissue or lint-free cotton cloth which has been moistened with a mixture of household ammonia and warm water. The soft tissue or cloth is necessary to prevent scratching the specular aluminum reflector surface.
3. Coating: Select a solvent that dissolves the coating and use the same procedure as used for removing a film (step 2 above). If this fails to remove the coating, the unit should be partially disassembled to repolish the surfaces.

NOTE

Before employing any of the above cleaning procedures, it is advisable to experiment with it on a small scale in order to verify success and prevent possible damage to the unit.

If there are questions, please contact:

Research, Inc.
P.O. Box 24064
Minneapolis, MN 55424, USA
(612) 941-3300

4.7 Shipping List

The following items are normally shipped unassembled with the Model 5070 heater:

1	Lamp Insertion Tool (part # 075928-001)	1
2	Lamp #Q1000T3/4CL	2/zone
3	Inner Zone Shield (part #075990-001)	1/zone
4	Window, Clear Quartz (part #075971-___)	1
5	Window Seal Material	10"
6	Air Pressure Tap: 10-32NF to 1/8 hose	1
7	Instruction Manual	1

NOTES