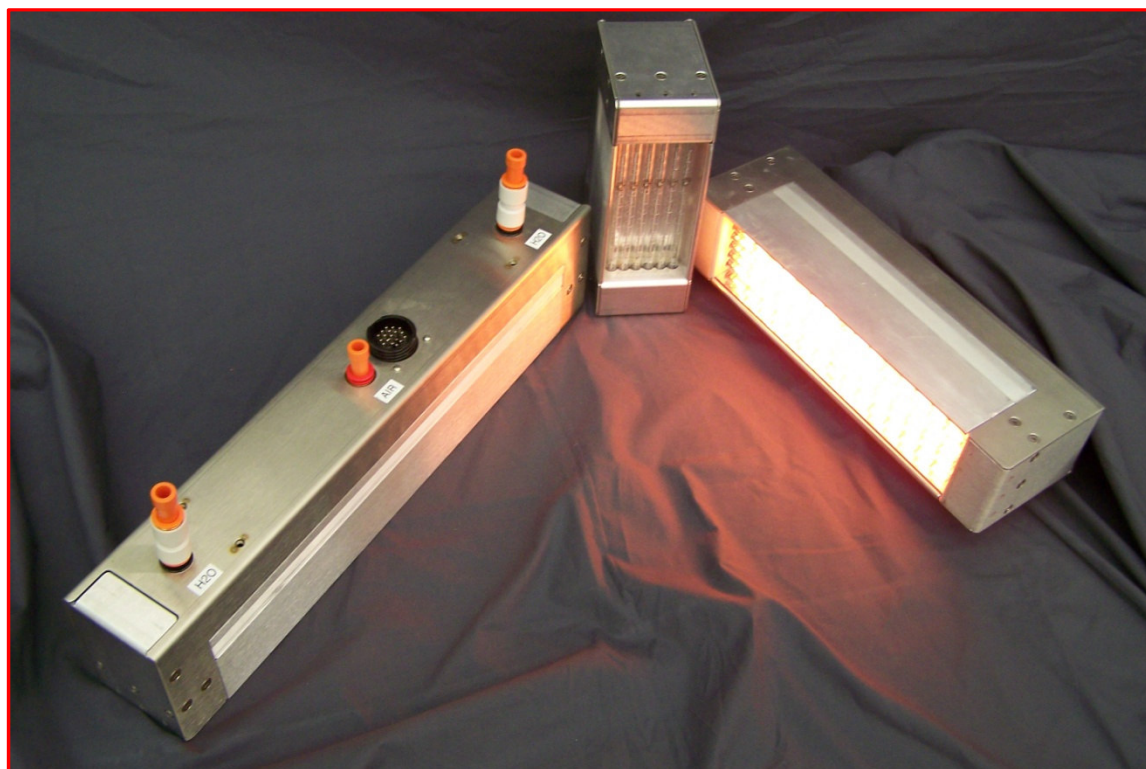




# Instruction Manual HiTempIR Heater

*Model 5209*

November, 2008



Another quality product from:



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## 1. Introduction

### General Description

The Model 5209 Hi-TempIR<sup>®</sup> heater is designed to provide high-intensity infrared heat onto localized areas.

Typical applications for these heaters include:

- Aerodynamic heating simulation
- Thermal stress testing
- Heating tensile and fatigue test specimens
- Semiconductor wafer processing
- Chemical processing
- Stress relieving
- Metal brazing processes



The Model 5209 includes the following major components:

#### Heater Module

The heater consists of a specular aluminum reflector that directs the infrared energy generated by six ceramic end-seal, 'T-3 style', quartz halogen lamps factory-installed in the heater. Heated lengths of 5-, 10-, and 16-inches (127-, 254-, and 406 mm) are offered for the Model 5209. Additional lamps can be ordered separately from the heater.

#### Water Cooling

Adequate cooling water is required during operation of the Model 5209. Flexible tubing and plumbing fittings are supplied with each heater for easy installation. Required cooling water flow rates are listed in Specifications, Section 6.

#### Air Cooling

Compressed air cooling must also be supplied to the heater for proper operation. This cooling air removes excess heat from around the lamp end-seals. Flexible tubing and matching plumbing hardware is included with each heater. Required airflow rates and pressures are listed in Specifications, Section 6.

#### Removable Electrical Cable

The Model 5209 heater is electrically wired from the T3 lamps to intermediate terminal blocks within the heater. Further wiring from each terminal block to a pinned connector on the top of the heater is also included. A 10-ft. (3 m) removable electrical cable is supplied with each heater that is designed to mate with the heater's pinned connector. This cable is designed for installation within an electrical junction box (optional item) or installed within an appropriately designed power source.

**Heater Safety**

An integrated thermostat is mounted to the backside of the aluminum reflector. The thermostat is wired to the pinned connector with corresponding wiring residing in the removable electrical cable. When wired into an appropriately designed power source, the normally closed thermostat will open upon reaching an overheat condition preventing electrical power from reaching the heater. The thermostat will close once the heater cools down to a safe operating temperature.

**Optional Quartz Window**

A quartz window can be ordered along with each size of the Model 5209. When installed in the heater, the quartz window protects the aluminum reflector and lamps from contaminants released in the heating process resulting in maximum efficiency of the heater.

**Optional Electrical Junction Box**

An optional electrical junction box can be ordered with the Model 5209. The junction box accommodates all of the wiring present within the removable electrical cable and is designed to accept either a 240- or 480-volt supply source.

**Optional Power Control System**

The Model 5209 can be ordered with the 'PC' option. This configuration consists of the heater, removable electrical cable wired to a junction box and a Research Inc. Model 915 (single-phase) or Model 935 (three-phase) SCR-based power control system, also wired to the junction box. This power control system is designed to match the electrical supply needs of the heater. Please see the Model 915 or Model 935 ControllIR<sup>®</sup> product data sheet for further detail.

## Standard Features

The design and functionality of the Model 5209 supplies a variety of features and related benefits:

### **Rapid Response**

The quartz halogen lamps heat up and cool down instantly in response to power control signals. They reach 90 percent of full operating temperature within three seconds of a cold start. The radiant energy dissipates to ten percent five seconds after the power supply is disconnected.

### **Continuous Operation**

The formed stainless steel and extruded aluminum construction of the Model 5209 combined with the liquid and air-cooling, allows the heater to withstand continuous high temperature operation.

### **Controllable Energy Output**

The infrared energy emitted from the heater can be adjusted to match the heating requirements of a variety of applications.

The Model 5209 ordered with the 'PC' option is a complete heating solution designed with a number of features including heater on/off control switching, potentiometer local control, and mechanically interlocked doors with main power disconnect switch. Heater over-temperature indicators, a digital voltmeter and system cooling on/off control switches with indicator lamps are also included.

The complete system allows the end user to easily install both the heater and controller within the given application. The heater is supplied with a 10-foot (3m) removable electrical cable and is terminated within Model 5209 Junction Box. A separate 30-foot (9.1 m) electrical cable connects the Junction Box to the power control system (either the Model 915 or Model 935 ControllIR®). This 'plug and play' feature simplifies installation for the end user and allows the heating system to be put into use very quickly.

## 2. Safety

### GENERAL

The Model 5209 heater is designed for safe operation. Nevertheless, installation, maintenance, and operation of the heater can be dangerous for a careless operator or maintenance person. For your safety and the safety of others, read the instructions in this Instruction Manual and follow these safety practices to help prevent accident or injury.

### **! INFRARED RADIATION – CAUTION !**

Continuous exposure to high intensity infrared radiation at close proximity could be harmful to eyes or skin. Although infrared lamps emit negligible ultra violet electromagnetic radiation, harmful burns can still result if an operator is in close contact with lamps being operated at high intensity.

Because of the brilliant light emitted by infrared lamps at full intensity, it is recommended that eyes be shielded from the glare if observing the lamps or radiant heat chamber for an extended period of time. Use suitable shaded lenses or dark glasses.

### High Temperatures

Parts of the heater may exceed 500°F (260°C). Contact with the lamps, reflectors, or metal parts near the lamps may cause severe burns. In addition, extremely hot exhaust air is generated during operation of the Model 5209. Figure 2-1 depicts areas on the heater from which the exhaust air will leave the heater.

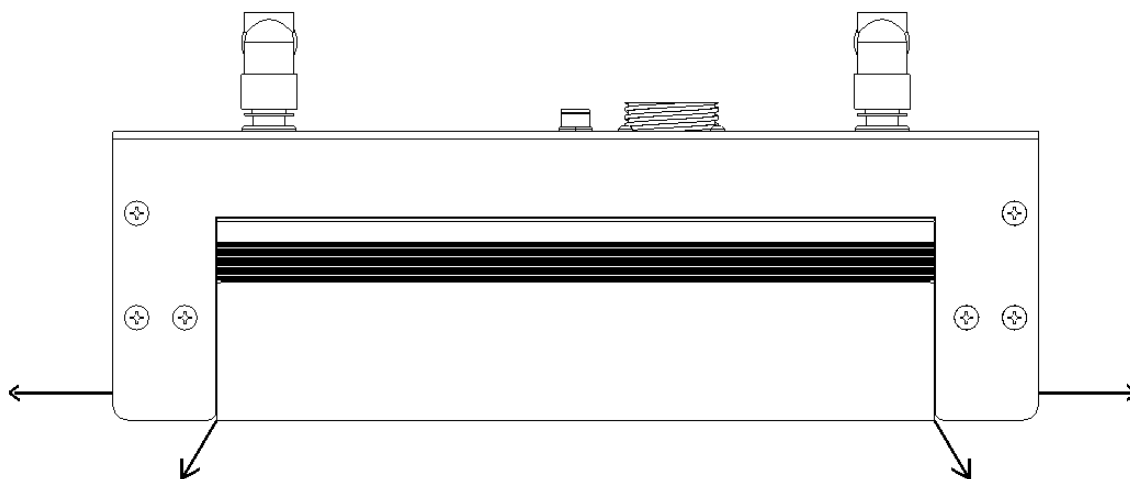


Figure 2-1



**!WARNING!**

NEVER place hands under or in front of the heating elements.

ALWAYS allow heating element to cool at least three minutes before touching the lamps or adjacent parts.

## Electrical Safety

There is danger of electrical shock when servicing the heater.

**!CAUTION!**

Observe all applicable local and national electrical codes and a safe electrical ground system is installed before attempting to operate the heater. Refer to the Section 5 for proper installation procedures.

**!WARNING!**

ALWAYS disconnect the external power lines prior to servicing the heater.

ALWAYS disconnect the power lines AND any optional interlock circuits before installing or changing lamps.

NEVER operate the heater with end covers removed.

## Fire Safety

1. Obey the same fire-safety rules you observe when working with hot plates, propane or acetylene torches, soldering irons, and other equipment that operates at extremely high heat.
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 fire from all the types of material near the heater.

## 3. Installation

### Unpack and Check for Damage

Remove the model 5209 heater from its shipping container and associated packaging. Check the unit for any potential damage due to shipping. In the unlikely event damage has occurred, keep all shipping containers and materials in order to file a damage claim with the shipping company responsible for shipping the unit.

### Mounting the Heater

The Model 5209 heater should be mounted to a framework or structure that is designed to support the weight of the heater and provide stability to the unit. Four #10-32 threaded holes are located on the top surface of the heater cover and are designed for mounting the heater (see Figure 3-1).

Note: Vertical burn lamps are recommended when operating the Model 5209 in a vertical orientation. All PCS/Research Inc. lamps associated with the Model 5209 heater are designed for vertical operation.

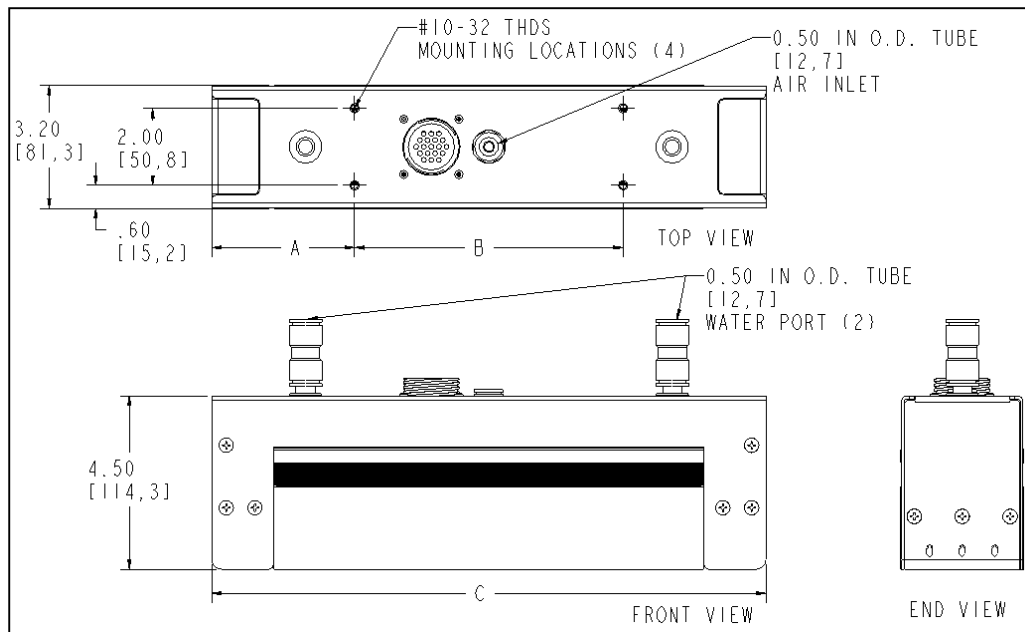


Figure 3-1

Model Number	Dimensions, Inches (mm)		
	A	B	C
5209-05	1.8 (45.7)	5.5 (139.7)	9.10 (231.1)
5209-10	3.73 (94.7)	7.00 (177.8)	14.45 (367.0)
5209-16	3.73 (94.7)	12.63 (320.8)	20.08 (510.0)

Figure 3-1. Model 5209 mounting hole and heater cooling connection locations.

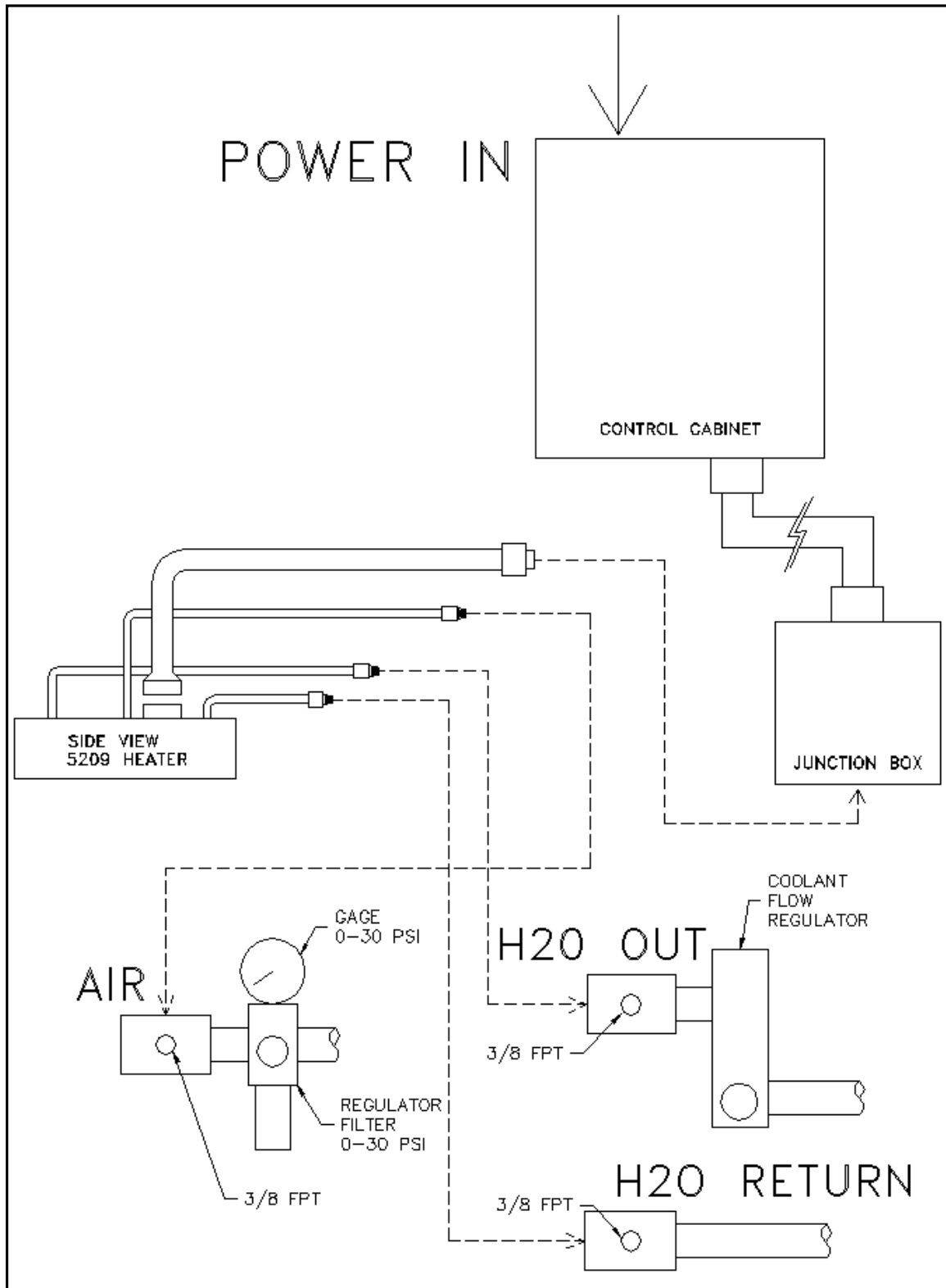


Figure 3-2

## 4. Operating Instructions

### Heater Cooling Connections

Each Model 5209 is designed with three 'quick-disconnect' fittings protruding from the top of the heater cover. The two fittings located at the outer ends of the heater are the inlet/outlet cooling water ports. The single fitting located at the center of the heater is the cooling air inlet port.

All three fittings accept 1/2-inch outer-diameter flexible nylon tubing. A 30-ft. (9.1 m) length of tubing and three additional quick-disconnect fittings are shipped with each Model 5209 heater. The tubing should be cut to specific lengths so that both cooling water and compressed air can be supplied to the heater. The additional fittings should be used for connecting the tubing directly to the cooling water and compressed air source.

Once cut to the appropriate lengths, each individual tube length should be inserted into the appropriate fittings on both the heater and the cooling water and compressed air sources. Figure 5-2 details a typical installation for the Model 5209 heater.

*Note: Fitting plugs are placed into the two water coolant fittings as shipped from the factory. Both of these plugs must be removed from their respective fittings prior to inserting the flexible tubing. These plugs can either be kept for future use or discarded. See Figure 4-1 for detail.*

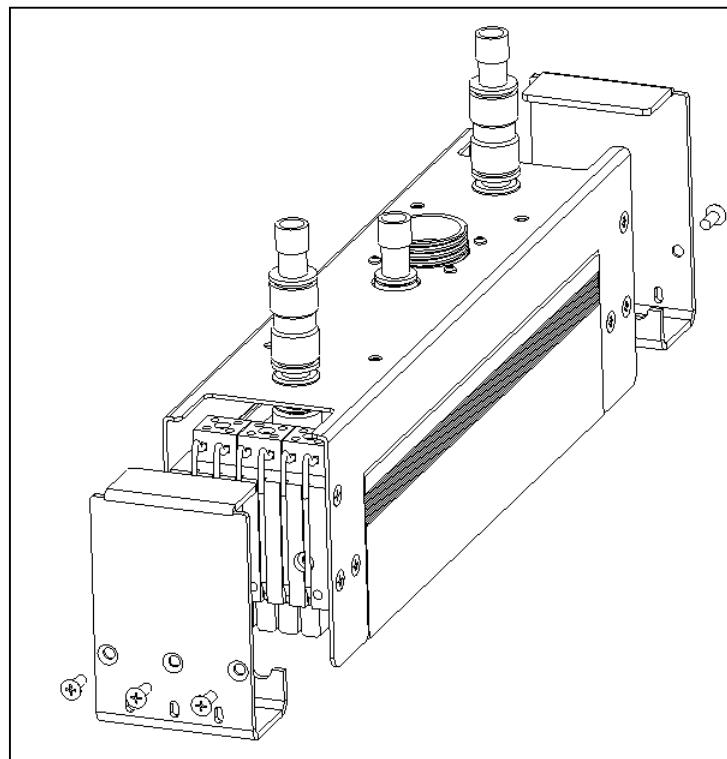


Figure 4-1

## Electrical Connections

Each of the six T3 lamps of the Model 5209 is electrically wired to intermediate, individual terminal blocks within the heater. In turn, each terminal block along with the heater safety thermostat and heater grounding wires are wired to a 19-pin connector mounted to the heater cover (see Figure 4-2).

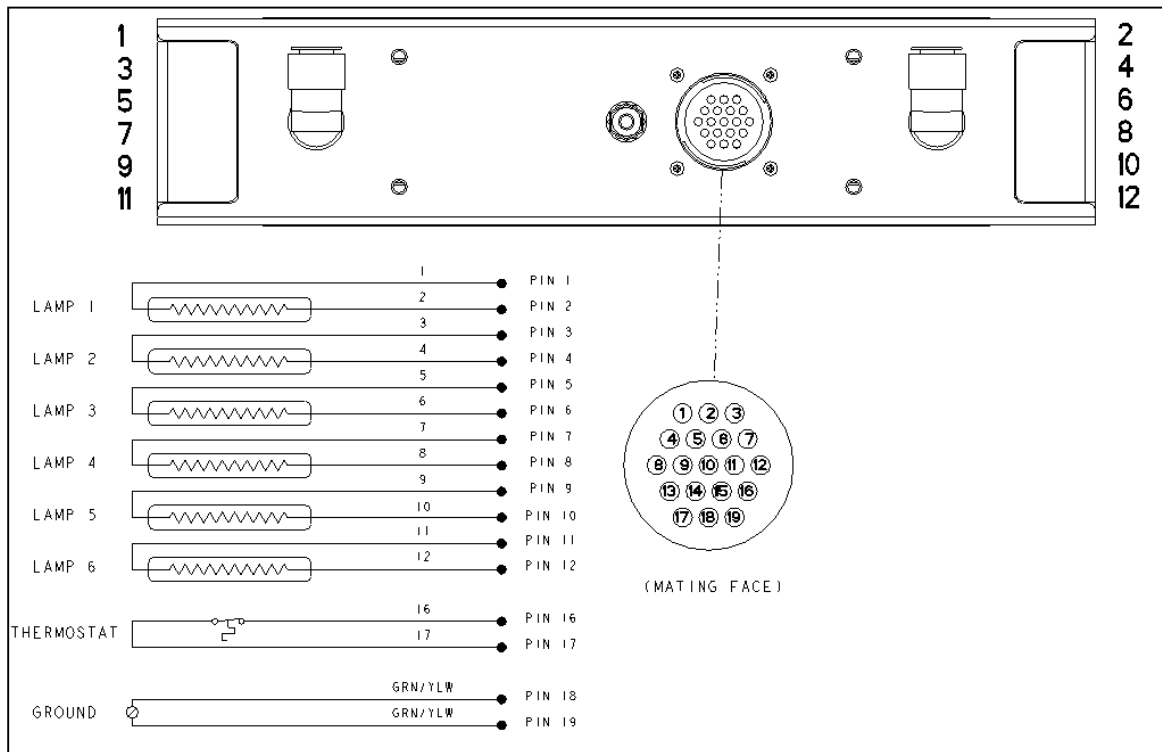


Figure 4-2

Each heater is supplied with either a 10- or 20- ft. (3- or 6 m) removable electrical cable that mates directly to the pinned connector mounted to the heater cover (see Figure 4-3). The cable length is specified within the heater model number at time of order. Each wire housed within the cable assembly extends approximately 2-ft. (0.6 m) beyond the end of the cable conduit. This extra wire length allows the cable to be installed within the optional electrical junction box or within an appropriately designed power source.

An optional electrical junction box is available and can be ordered along with the Model 5209 heater. The physical dimensions of this junction box are shown in Specifications – Section 6.

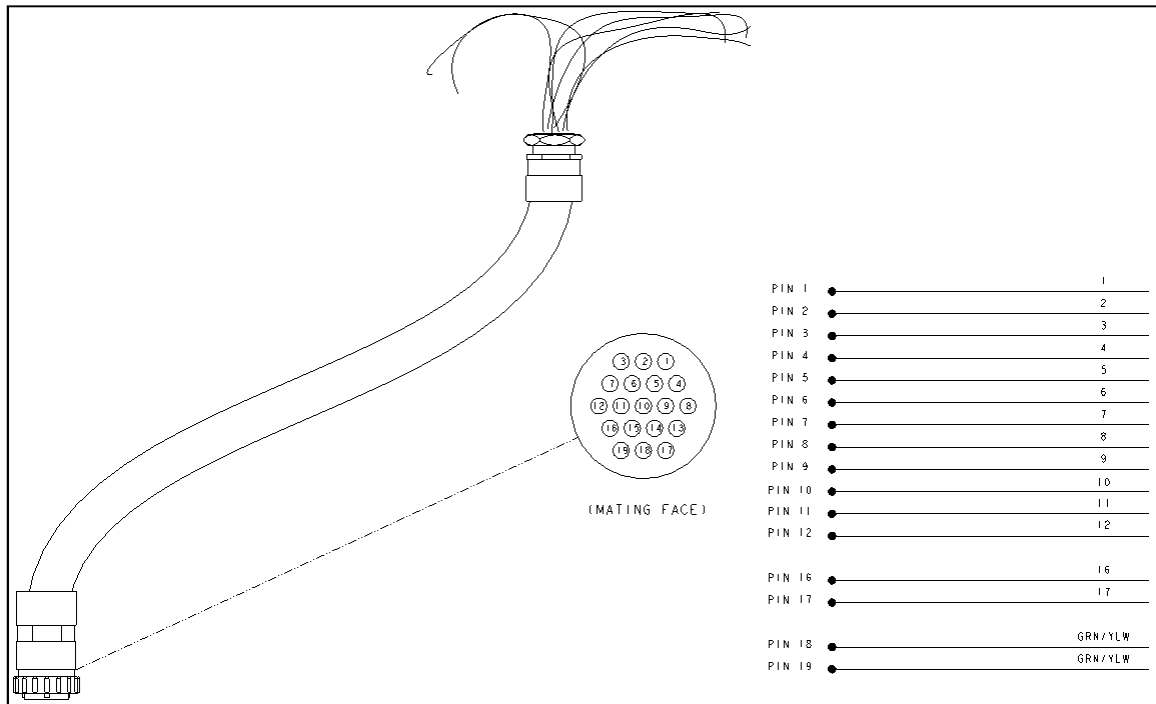


Figure 4-3

As shown in Figure 4-4, the junction box is designed to accept wiring from the removable heater cable as well as wiring from the electrical power source. Different wiring configurations are shown so that the heater wiring can be correctly connected within the junction box corresponding to a particular (supply) line voltage, i.e. since the Model 5209-05, 5209-10 and 5209-16 models use T3 lamps rated for 240-volt operation, one could install the heater wiring so that either 240-volt single- or three-phase supply power could be used.

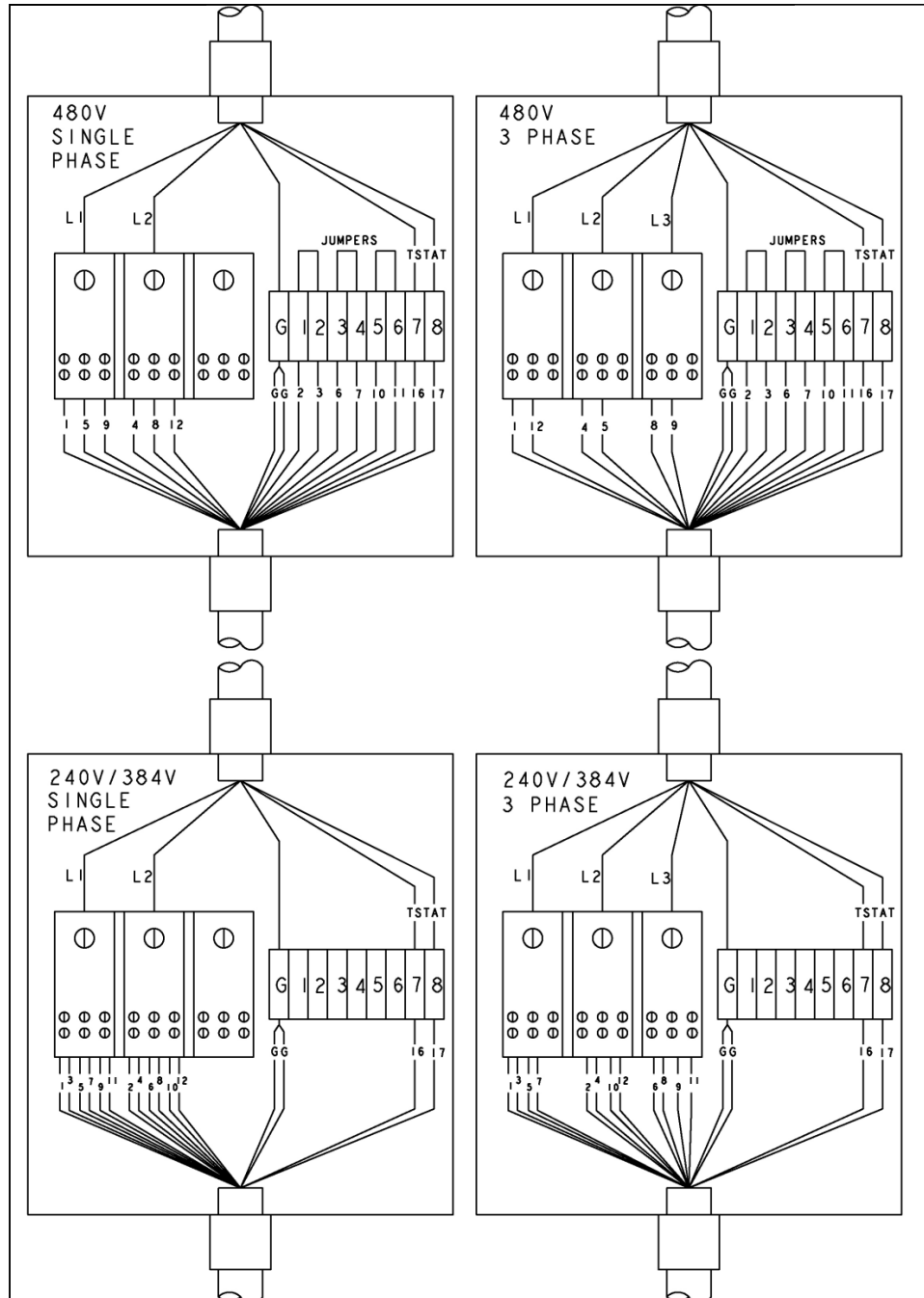
## Heater Thermostat

As stated above, a heater safety thermostat is mounted to the back of the model 5209 reflector and wired into the 19-pin connector mounted to the heater cover. Wiring for the thermostat is also integrated within the removable electrical heater cable.

When wired into an appropriately designed power source (i.e. the Model 915 ControllR Power Control System – See Appendix for detail), the normally closed thermostat will open upon reaching an overheat condition (160°F) resulting in an alarm condition to occur at the power controller. The thermostat will close once the heater cools down to a safe operating temperature (approximately 140°F).

An alarm condition signal can be configured within the power control system to alert the user that the alarm condition exists (i.e. signal light, signal horn, etc.). Additionally, the power

control system can be configured so that electrical power is removed from the Model 5209 if the thermostat reaches an overheat condition.



## 5. Maintenance & Troubleshooting

The repair and maintenance of the Model 5209 includes replacement of the T3-style lamps and quartz wind and cleaning of the reflector.

### Lamp Removal, Replacement, Installation

The six T3-style lamps are installed into the Model 5209 heater when shipped from the factory. The following procedure details the process to replace the lamps in the Model 5209 (reference Figure 5-1, 5-2, & 5-3):

#### Note:

- Remove all power from the heater **BEFORE** attempting to install/replace the lamps.
- Allow a minimum of 1/2-inch (12 mm) of slack in the lamp lead so that the lead is not taut when inserted into the lamp terminal block.
- Always take care to handle all lamps by the ceramic end seals and use clean cotton or latex gloves to prevent contamination of the quartz lamp envelope.

1. Remove End Cover Screws (3 per end cover).
2. Remove End Covers on both ends of the heater.
3. If installed in the heater, remove the quartz window from the heater by sliding the window out of the slots machined into the reflector body. Take this opportunity to clean the window using non-abrasive cleaning solvent and clean, soft cotton cloth (see Section 6).

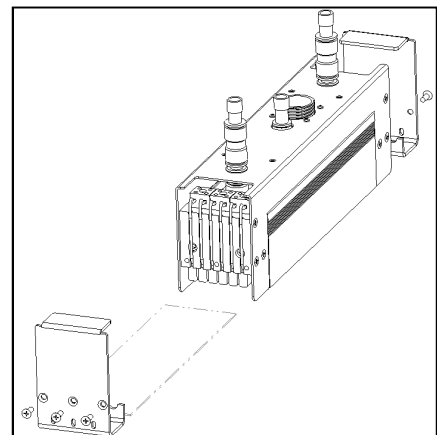
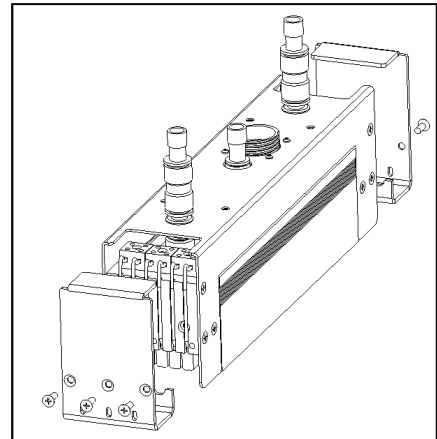


Figure 5-1



4. Loosen (do not remove) the setscrews in the ceramic terminal blocks on each end of the heater corresponding to the lead wires of the lamp to be replaced.
5. While holding the lamp, gently pull the lead wires out of the ceramic terminal blocks and set the old lamp aside for disposal.
6. Both lead wires of the lamp need to be trimmed prior to installation into the heater. Figure 5-3 details the proper lengths to which the lead should be trimmed and stripped.
7. While holding the replacement lamp by the ceramic end seals, place the lamp into the groove machined into each

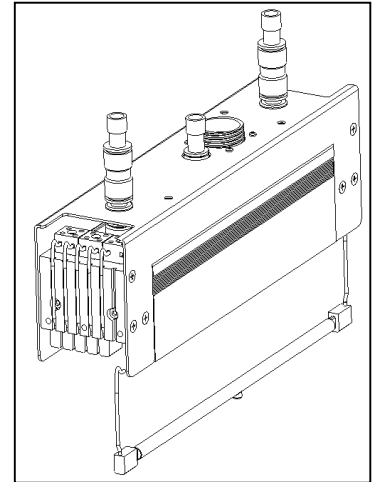


Figure 5-2

lamp bracket plate located on each end of the heater. Orient the lamp so that the gas fill tip, formed into the quartz tube of the lamp, points out away from the reflector.

8. Insert the bare wire of each insulated lamp lead into the ceramic terminal block position that previously held the old lamp. Push each lead wire into the terminal block far enough so, that when tightened, the setscrew will hold the lead securely.
9. Tighten the setscrews in each terminal block so the lead wires are held securely. Note: tighten the terminal block set screws to a torque of 0.6 feet – lbs. (0.82 N-m).

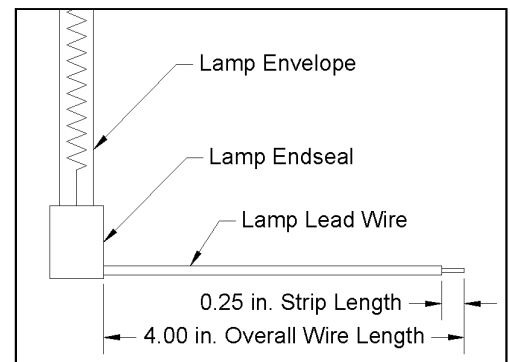


Figure 5-3

10. Arrange the lead wire on each end of the lamp into the groove machined into each of the aluminum cooling manifolds located at either end of the heater. Each groove corresponds to each of the individual lamps of the heater.
11. Form a loop within each lead along its length from the top of the cooling manifold and the ceramic terminal block. This loop will act as a strain relief within the lead during normal operation of the heater.
12. Reinstall the quartz window within the heater by carefully sliding the window into the grooves machined into the heater reflector.
13. Reinstall both end covers and secure each to the heater with the three screws per end cover.  
Note: tighten the end cover screws to a torque of 1.7 ft.-lbs. (2.3 N-m).



Figure 5-4

## Quartz Window Cleaning and Replacement

The optional quartz window can be replaced or removed from the Model 5209 for periodic cleaning. Use the following procedure to remove/reinstall/clean the quartz window.

1. Remove the three end cover screws and the end cover from one end of the heater.
2. Gently slide the quartz window out of the grooves within the heater reflector. Take care so that the quartz window does not bind and subsequently chip or crack as it is removed.
3. If cleaning the window, use a non-abrasive glass cleaner and a clean, dry, lint-free cloth. After cleaning, do not touch the inside surface of the window unless wearing gloves.
4. Reinsert the edges of the window into the grooves machined into both sides of the reflector body.
5. Gently push the window into the reflector until it is completely seated against the end cover mounted to the heater.
6. Reinstall the other end cover and secure with the three end cover screws.

## Cleaning the Reflector

A clean reflector provides the greatest radiant efficiency. If the reflector surface becomes contaminated, it reflects less energy. The energy that is not reflected is absorbed by the reflector, and removed by the cooling water and air. This energy is lost energy.

The following procedure should be used to clean the Model 5209 reflector:

1. Remove the lamps as described in Section 5
2. Clean the reflector with a mixture of warm water and common household ammonia followed by a thorough wipe-down using a clean-water-dampened flannel cloth.
3. Depending on the type of contamination present on the reflector, a suitable solvent may be required to remove the contamination. The solvent must be selected based on this inability to adversely affect the aluminum reflector.
4. Replace the lamps, quartz window (if so desired), and the heater end covers as outlined in Section 5 – Lamp Removal/Replacement/Installation.

## 6. Dimensions and Specifications

Specifications	5209-05	5209-10	5209-16
Weight, pounds (kg)	7.5 (3.4)	10 (4.5)	12.8 (5.8)
Lamp Type	QIH240-1000R12	QIH240-2000R12	QIH384-3200R12
Lighted length, Inches (mm)	5 (127)	11 (280)	16 (406)
Rated Voltage	240	240	384
Total Power Dissipated at Rated Voltage, kW	6	12	19.2
Cooling Water Flow, GPM (1/min.)	1.0 (3.8)	1.5 (5.7)	2.25 (8.5)
Cooling Air Flow, SCFM (M/P/min.) (see also fig. 3-2)	4 (0.11) @ 3.0 PSI	4 (0.11) @ 1.0 PSI	4 (0.11) @ 1.0 PSI
With a Regenerative blower CFM (M/P/min) @ 6.2 PSI	20 (0.57)	20 (0.57)	20 (0.57)

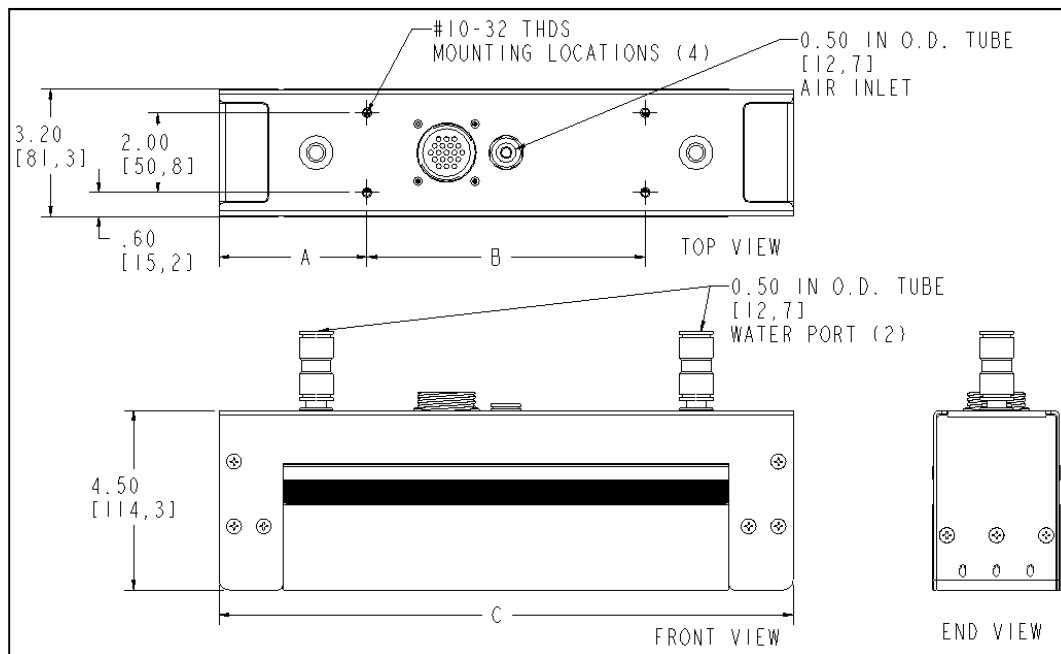


Figure 6-1

Model Number	Dimensions, Inches (mm)		
	A	B	C
5209-05	1.8 (45.7)	5.5 (139.7)	9.10 (231.1)
5209-10	3.73 (94.7)	7.00 (177.8)	14.45 (367.0)
5209-16	3.73 (94.7)	12.63 (320.8)	20.08 (510.0)

Note: The height and width dimensions are identical on all three sizes of the Model 5209.

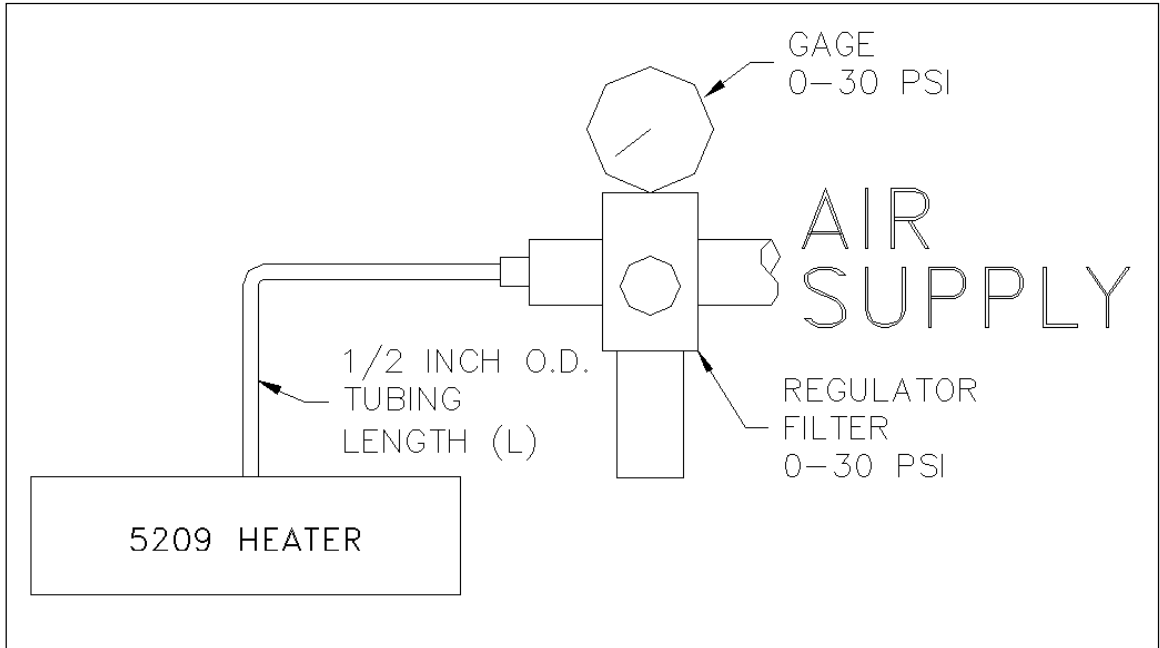


Figure 6-2

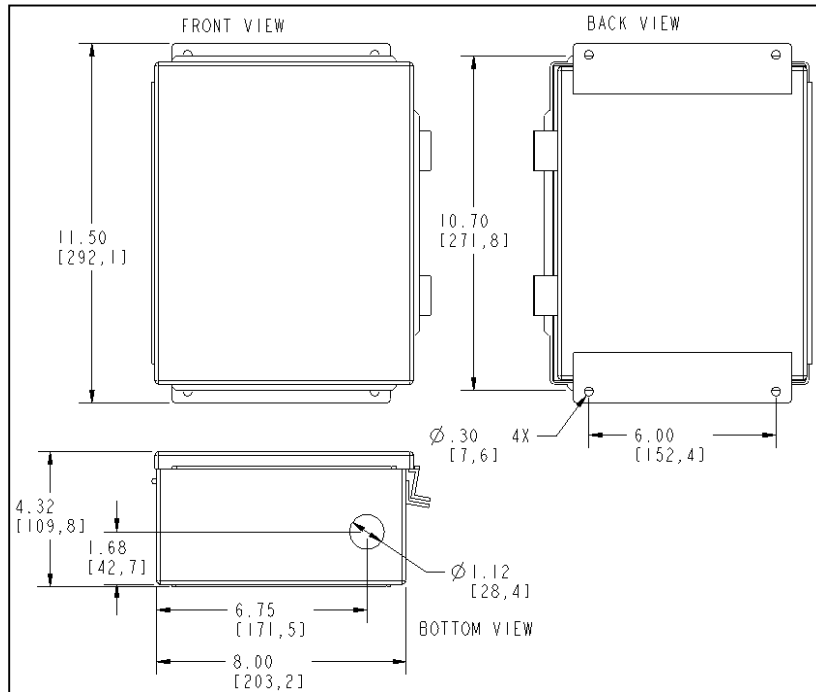


Figure 6-3

Model	Product Description
5209	High Temperature Infrared Heater
Code	Lighted Length
05	5 Inches (127 mm)
10	10 Inches (254 mm)
16	16 Inches (406 mm)
Code	Electrical Cable Length
10	10 Feet (3 m)
20	20 Feet (6 m)
N	None
Code	Optional Equipment
W	Quartz Window
JB	Electrical Junction Box
PC-TCP <sup>(1)</sup>	Power Control System with Pyrometer Input
PC-TCT <sup>(1)</sup>	Power Control System with Thermocouple Input
PC-VM <sup>(1)</sup>	Power Control System with Digital Volt Meter

(1) Model 5209 heater supplied with Model 915 ControllIR Power Control Systems. Must specify electrical cable length (either 10- or 20-feet (3- or 6m) when ordering any of the PC Option choices.

	Model	Lighted Length	Electrical Cable Length	Optional Equipment
Typical Model Number:	5209	16	10	W PC-TCT

Accessories, Spare & Replacement Parts – Model 5209

<b>Model</b>	<b>Description</b>
106580-003	Quartz Window, 5-inch (127 mm) lighted length heater
106580-001	Quartz Window, 10-inch (254 mm) lighted length heater
106580-002	Quartz Window, 16-inch (406 mm) lighted length heater
103390-002	Quartz, Halogen Infrared Lamp, Ceramic end-seal, 5-inch (127 mm) lighted length
103390-004	Quartz, Halogen Infrared Lamp, Ceramic end-seal, 10-inch (254 mm) lighted length
103390-006	Quartz, Halogen Infrared Lamp, Ceramic end-seal, 16-inch (406 mm) lighted length
106513-001	Electrical Junction Box, accepts Model 5209 Removable Electrical Cable
106514-001	10-ft. (3 m) Electrical Cable Assembly
106514-002	20-ft. (6 m) Electrical Cable Assembly
106617-001	Cooling Air Regulation Kit
106618-001	Cooling Water Plumbing Hardware Kit

## 7. Spare & Replacement Parts

Replacement parts for the Model 5209 are listed below. Reference Figure 7-1 when using this list.

Item	Part Number	Part Description
1	054979-020	SCREW-PH 4-40X3/8 SST PH
2	054979-042	SCREW-PH 6-32X1/4 SST PH
3	054979-052	SCREW-PH 6-32X5/8 SST PH
4	054979-105	SCREW-PH 10-32X1/4 SST PH
5	054982-001	NUT-KEP 4-40 NC ZINC
6	055020-087	SCREW-FH, 10-32X1/2,SST, PH(100)
7	055296-037	SCREW-SOCKET 10-32 X 1-1/2 SS
8	055298-013	SCREW-SET2-56X1/4 ALNCUP SST
9	070025-015	THERMOSTAT-SURF NC 160F
10 <sub>A</sub>	106514-013	Wire Harness, W/Receptical, -- Model 5209-05
10 <sub>B</sub>	106514-011	Wire Harness, W/Receptical, -- Model 5209-10
10 <sub>C</sub>	106514-012	Wire Harness, W/Receptical, -- Model 5209-16
11	100571-001	TERMINAL BLOCK CERAMIC 2P 10A
12	103390-004	LAMP-QIH240-2000/V CER.END
12 <sub>A</sub>	103390-002	LAMP-240V-1000W, 5-inch (127 mm) Lighted Length
12 <sub>B</sub>	103390-004	LAMP-240V-2000W, 10-inch (254 mm) Lighted Length
12 <sub>C</sub>	103390-006	LAMP-384V-3200W, 16-inch (406 mm) Lighted Length
13	103830-001	FITTING-POLY, 1/8NPT,INSTANT
14	104358-001	FITTING-ELBOW, 3/8NPT
15	104358-002	FITTING-POLY, 1/8NPT-.250OD TUBE, 90 ELBOW
16	104399-001	FITTING-POLY, 3/8NPT, 1/2TUBE, INSTAN
17	105083-001	COUPLING-TUBING, 1/2"
18	106176-001	FITTING-PLUG, 1/2 TUBE
19 <sub>A</sub>	106502-001	COVER, 5209-10
19 <sub>B</sub>	106502-002	COVER, 5209-16
19 <sub>C</sub>	106502-003	COVER, 5209-05
20	106503-001	END COVER, 5209-XX
21	106504-001	BRKT, LAMP, POS, 5209-XX
22	106505-002	MANIFOLD, 5209-XX
23	106506-001	FITTING-PLUG, 1/4NPT,BRASS
24 <sub>A</sub>	106508-001	REFLECTOR, 5209-10 in
24 <sub>B</sub>	106508-002	REFLECTOR, 5209-16 in
24 <sub>C</sub>	106508-003	REFLECTOR, 5209-5 in
25	103843-001	TUBING-POLY, FLO, 1/4"ODX0.04"WT
26	104431-001	TUBING, 1/2" DIA X 2.5L
27	106511-001	BUSHING-SNAP, .50"ID, .75"DIA PNL
28	106518-001	FITTING-RED, 3/8FPT, 1/8FPT, BRS
29	106519-001	FITTING-NIPPLE, 1/8X1/8, 3/4L, BRS
30 <sub>A</sub>	106580-001	WINDOW-QUARTZ, 5209-10 in (OPTIONAL)
30 <sub>B</sub>	106580-002	WINDOW-QUARTZ, 5209-16 in (OPTIONAL)
30 <sub>C</sub>	106580-003	WINDOW-QUARTZ, 5209-5 in (OPTIONAL)

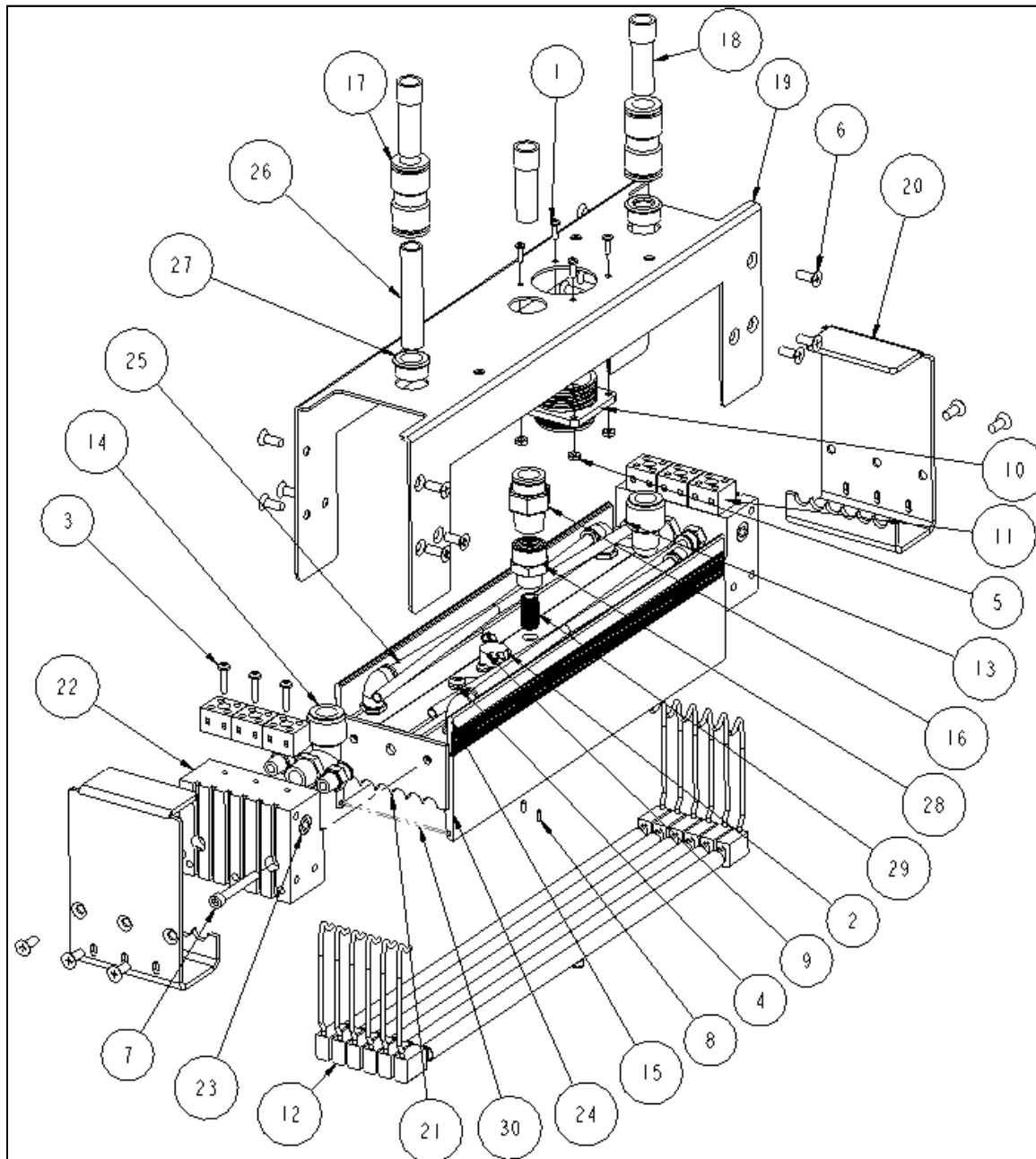


Figure 7-1