

Halogen Heaters

USHIO



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Halogen Heaters

Main Applications



Plastics Molding

■ Heating
PET material,
Aspherical lens

Application

Metal die preheating
PET bottle molding
Adhesives

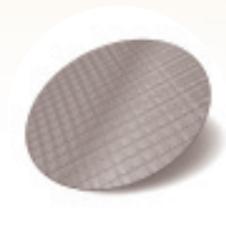


Photovoltaics

■ Heating
crystalline/thin-film silicon,
CIGS

Application

Electrode firing
CVD
RTA

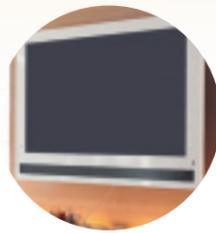


Semiconductors

■ Heating
silicon, SiC

Application

RTP
Cleaning
CVD/PVD
Epitaxial deposition

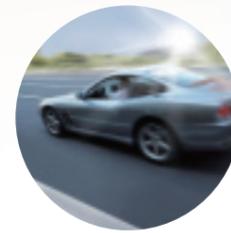


Flat-panel Displays

■ Heating
glass and film

Application

Vacuum moisture removal
Sputtering



Automobiles

■ Heating
steel plate, carbon fiber

Application

Hot pressing
Paint drying
Surface treatment



Machinery metals

■ Heating
SUS, iron, copper
graphite, nickel

Application

Baking in chambers
Soldering
Mold heating
Drying



Foodstuffs

■ Heating
Potato, chicken, etc.

Application

Foodstuff heat retention
Color rendering
Cooking
Roasting



Home appliances

Beauty applications,
room temperature control

Application

Skin care using infrared
Bathroom dryers
Heating
Infrared therapeutic devices
Ovens
Stove cookers

Clean “Light” Heating

— USHIO Halogen Heaters

Halogen heaters use the light emitted from halogen lamps as a source of heat.

Light emitted from halogen heaters is predominantly invisible infrared (heat), and is a highly efficient source of heat energy.

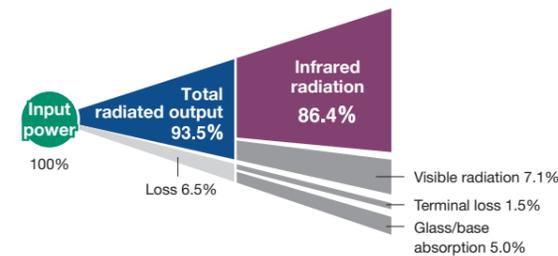
Heating using halogen heaters offers high flexibility and controllability, is clean and safe, small and light, and boasts other hidden benefits.

USHIO has pursued the potential of light as a “heat source” from very early on, in many industrial fields, offering “heating with light” solutions in a wide range of cutting-edge scientific fields, such as advanced materials and space exploration.

Halogen Heater Features

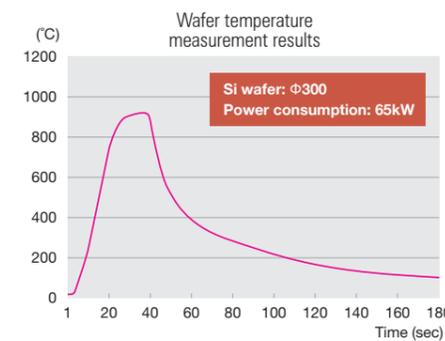
1. High-efficiency energy source

High-efficiency heat sources that convert and emit over 85% of the input power to infrared. Lamp-based heat irradiation produces high-quality infrared irrespective of the ambient temperature.



2. Non-contact heating

Heats objects without direct, physical contact.



3. High controllability due to nature of “light”

Light energy can be controlled optically using mirrors to focus and disperse the light, and hence heat, to “direct” the heat to the target. This provides high-level control over the heated area.

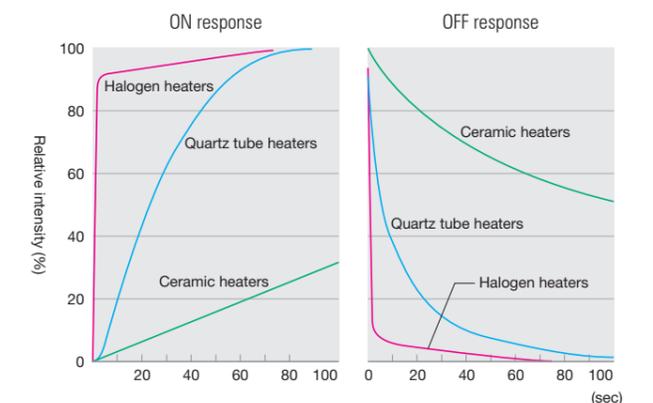


4. Clean heat source

Objects are heated by the absorbed radiant heat. Objects are heated in any environment, whether exposed to the atmosphere or in a vacuum, alleviating concerns about harming the object or the environment.

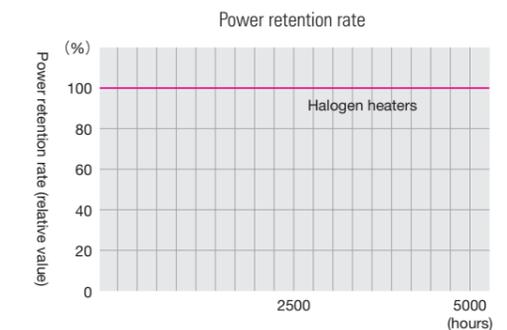
5. Quick on/off response

Radiated energy rises and falls almost simultaneously as the switch is turned on/off due to the use of filaments with low heat capacity.



6. Long life and constant energy emission

Halogen-cycle lamp for long-life design of 5,000 hours. Furthermore, the lamps maintain almost constant energy emission until the end of the rated life.

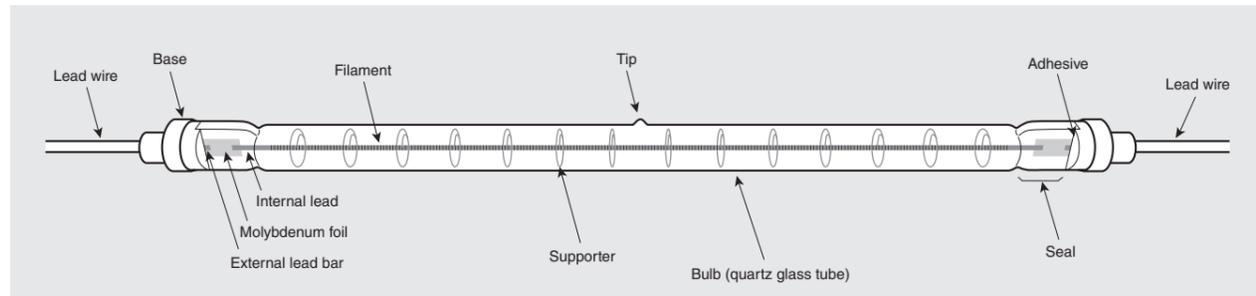


7. Heating in vacuum

Proven track record as a heat source with high reliability in vacuum equipment.

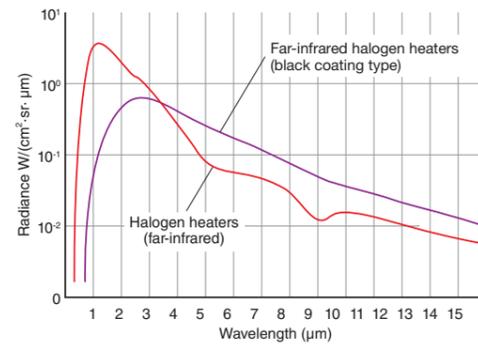
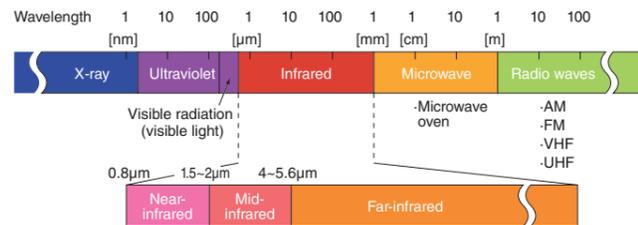
Construction

Halogen Heater Construction



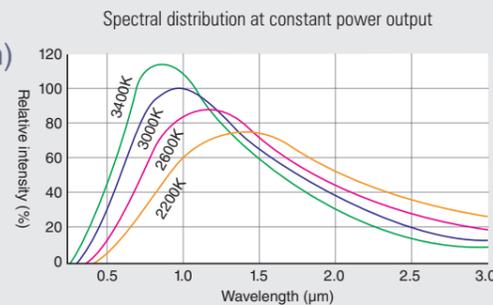
Wavelength

Radiant energy from a 2500K tungsten filament with a peak near-infrared wavelength of about 1.2μm.



Relationship Between Heater (Filament) Temperature and Wavelength (Spectral Distribution)

The relationship between the halogen heater color temperature and spectral distribution is shown in the diagram on the right. As the color temperature increases, the peak intensity occurs at shorter wavelengths, moving toward the visible spectrum. The peak wavelength is given by 2897 divided by the color temperature (K). USHIO manufactures halogen heaters that support various wavelengths by varying the filament temperature. Contact USHIO to discuss your needs.

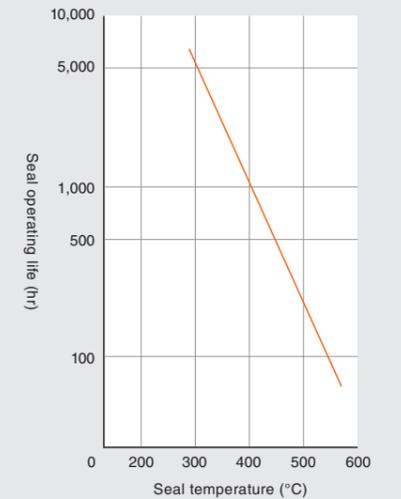
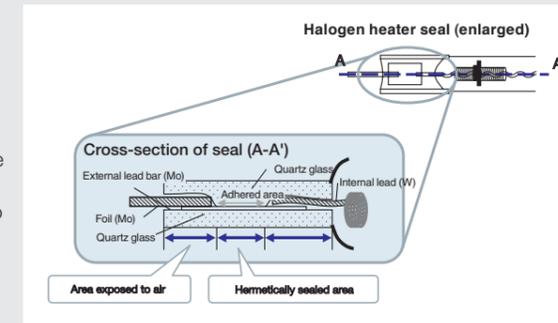


Operating Life

Fusing of the filament aside, failure of the lamp seal is also a factor in the operating life of halogen lamps.

Seal Temperature and Operating Life

The seal of the halogen heater is made using Molybdenum foil. The Molybdenum foil is not completely isolated from outside air and is in fact exposed to air via a minute gap between the external lead bar and quartz glass. Extreme oxidation of the foil will occur if this area's temperature reaches 350°C or higher. Oxidation of the Molybdenum foil will increase its volume, resulting in it pressing up against and damaging the quartz glass and damaging the foil itself. To ensure long-term stable use, be sure to keep the seal's temperature at 300°C or below.



Control Method

The typical lighting control methods for lighting halogen heaters are shown below. Recently, power supply manufacturers have been developing thyristors and SSRs that have various functions. The following table shows a comparison of general features.

	Phase control method with soft-start function	Cycle control method with zero-crossing function*
Output voltage and current waveforms		
Description	The conduction interval (firing angle) is controlled in each half-cycle of the AC power supply to control the heat produced by the halogen heater.	The ratio of the ON interval and OFF interval is adjusted within a fixed cycle (typically selectable) to control the heat produced by the halogen heater.
Advantage	The voltage can be adjusted in steps, enabling soft-start control. This helps minimize the effects of inrush current.	Little high-frequency noise is generated, making it ideal for systems susceptible to noise. Equipment is generally inexpensive.
Disadvantage	Generates high-frequency noise that may interfere with nearby electronic devices, which may require shielding.	No function to limit the inrush current, requiring the selection of large capacity devices.
	In either method, when using voltage control, the lighting conditions will have an effect on the overall heater design (filament, halogen gas design, etc.).	

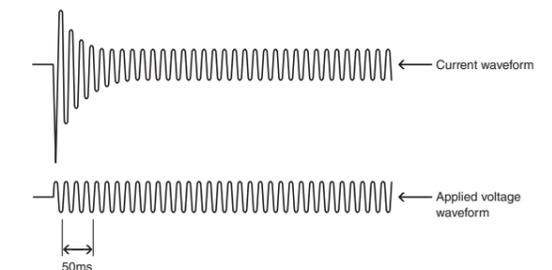
* Devices with a zero-crossing function operate with an AC load voltage of zero or thereabouts. This enables control of the inrush current flowing into the heater, mitigating the need for a protection circuit. Recently, products with thyristors featuring this function have been appearing.

Inrush Current

The resistivity of tungsten is very low at room temperatures and becomes large at high temperatures. Consequently, large current can flow momentarily when voltage is applied to the bulb. This is called the inrush current. A typical example is shown in the diagram on the right. The inrush current can theoretically be up to 13 to 16 times the normal value (depending on the color temperature), but is of the order 7 to 10 times in practice due to circuit impedance and other factors. If the bulb is preheated using a voltage lower than the rated value before turning it ON, the lamp soft-starts and the inrush current is avoided.

Inrush current example

- Current at 100V 350W 3100K
- Inrush current 6.8 times (peak-to-peak)
- 9.6 times (peak rms)

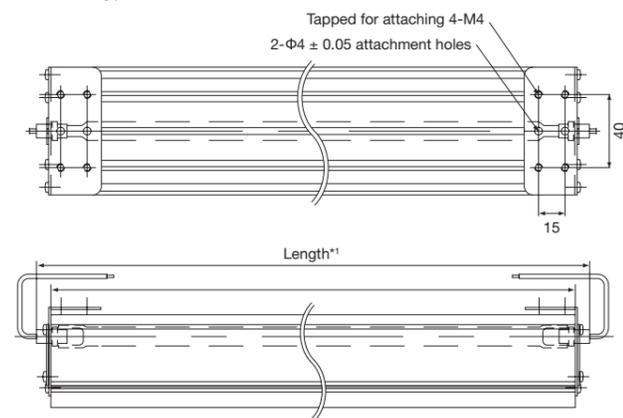


Combines halogen heater with tailored-shape reflective mirror to form a heater unit for high efficiency heating.
 USHIO develops heater units that employ reflective mirrors designed using reflected light simulation CAD software for heating linear shapes and large surface areas.

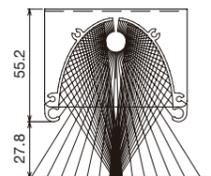
Standard Units

Model	Mirror shape	Emission length (mm)	Rated voltage (V)	Rated power (W)	Power density (W/mm)	Lamp model	Color temperature (K)	Average life (hr)	Unit length (mm)	Irradiation distance (mm)	Weight (kg)
UH-HUC-CL200	Focus type	200	100	500	2.5	QIR 100-500 HUL/CL200	2200	5000	310	27.8	0.4
UH-HUC-CL350		350	100	900		QIR 100-900 HUL/CL350	2100	5000	460		0.5
UH-HUC-CL500		500	200	1250		QIR 200-1250 HUL/CL500	2200	5000	610		0.7
UH-HUC-CL700		700	200	1750		QIR 200-1750 HUL/CL700	2100	5000	810		0.8
UH-HUC-CL850		850	200	2100		QIR 200-2100 HUL/CL850	2100	5000	960		1
UH-HUC-CL1000		1000	200	2500		QIR 200-2500 HUL/CL1000	2200	5000	1110		1.1
UH-HUD-CL200	Parabola type	200	100	500	2.5	QIR 100-500 HUL/CL200	2200	5000	310	(18.3)	0.5
UH-HUD-CL350		350	100	900		QIR 100-900 HUL/CL350	2100	5000	460		0.6
UH-HUD-CL500		500	200	1250		QIR 200-1250 HUL/CL500	2200	5000	610		0.8
UH-HUD-CL700		700	200	1750		QIR 200-1750 HUL/CL700	2100	5000	810		1
UH-HUD-CL850		850	200	2100		QIR 200-2100 HUL/CL850	2100	5000	960		1.2
UH-HUD-CL1000		1000	200	2500		QIR 200-2500 HUL/CL1000	2200	5000	1110		1.3
UH-HUM-CL200	Surface irradiation type	200	100	500	2.5	QIR 100-500 HUL/CL200	2200	5000	316	(37.4)	0.6
UH-HUM-CL350		350	100	900		QIR 100-900 HUL/CL350	2100	5000	466		0.8
UH-HUM-CL500		500	200	1250		QIR 200-1250 HUL/CL500	2200	5000	616		1.1
UH-HUM-CL700		700	200	1750		QIR 200-1750 HUL/CL700	2100	5000	816		1.4
UH-HUM-CL850		850	200	2100		QIR 200-2100 HUL/CL850	2100	5000	966		1.7
UH-HUM-CL1000		1000	200	2500		QIR 200-2500 HUL/CL1000	2200	5000	1116		1.9

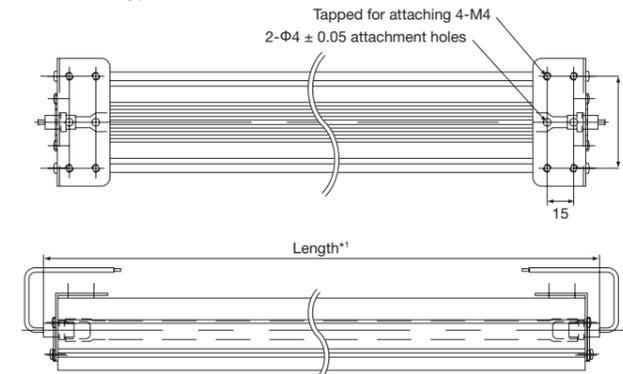
Focus type



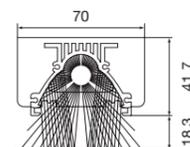
*1 Unit length is the heater length.



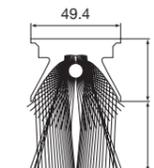
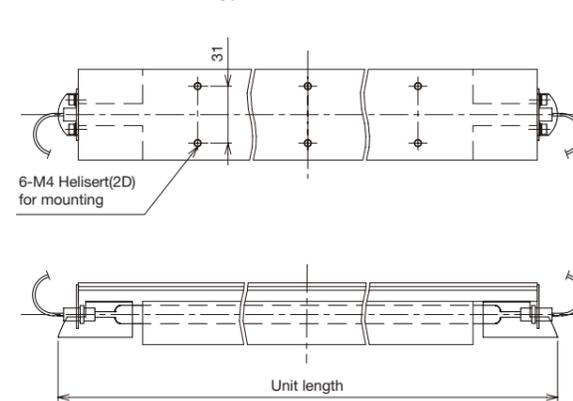
Parabola type



*1 Unit length is the heater length.



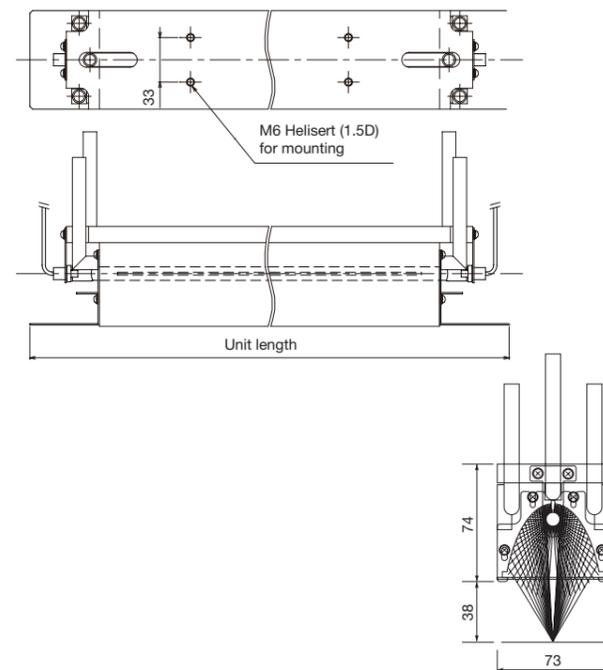
Surface irradiation type



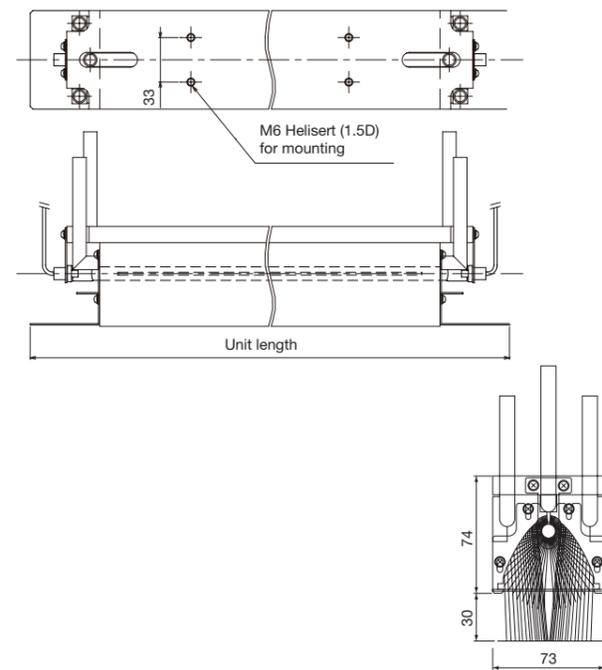
High-Output Units

Model	Mirror shape	Emission length (mm)	Rated voltage (V)	Rated power (W)	Power density (W/mm)	Lamp model	Color temperature (K)	Average life (hr)	Unit length (mm)	Irradiation distance (mm)	Weight (kg)	Cooling water flow (L/min.)	Cooling air flow (L/min.)
UH-HUF-CL200	Focus type	200	100	1200	6.0	QIR 100-1200 HUL/CL200	2400	5000	343	38	2.5	2~4	60~90
UH-HUF-CL350		350	200	2100	6.0	QIR 200-2100 HUL/CL350	2500	5000	493		3.8	2~4	60~90
UH-HUF-CL500		500	200	3000	6.0	QIR 200-3000 HUL/CL500	2300	5000	643		5.1	3~5	70~100
UH-HUF-CL700		700	400	4200	6.0	QIR 400-4200 HUL/CL700	2500	5000	843		6.8	3~5	70~100
UH-HUF-CL850		850	400	5100	6.0	QIR 400-5100 HUL/CL850	2600	4000	993		8.1	4~6	80~110
UH-HUF-CL1000		1000	400	6000	6.0	QIR 400-6000 HUL/CL1000	2500	5000	1143		9.5	4~6	80~110
UH-HUP-CL200	Parabola type	200	100	1200	6.0	QIR 100-1200 HUL/CL200	2400	5000	343	(30)	2.5	2~4	60~90
UH-HUP-CL350		350	200	2100	6.0	QIR 200-2100 HUL/CL350	2400	5000	493		3.8	2~4	60~90
UH-HUP-CL500		500	200	3000	6.0	QIR 200-3000 HUL/CL500	2300	5000	643		5.2	3~5	70~100
UH-HUP-CL700		700	400	4200	6.0	QIR 400-4200 HUL/CL700	2500	5000	843		6.9	3~5	70~100
UH-HUP-CL850		850	400	5100	6.0	QIR 400-5100 HUL/CL850	2600	4000	993		8.3	4~6	80~110
UH-HUP-CL1000		1000	400	6000	6.0	QIR 400-6000 HUL/CL1000	2500	5000	1143		9.6	4~6	80~110
UH-HUN-CL200	Surface irradiation type	200	200	1800	9.0	QIR 200-1800 HUL/CL200	2600	4000	345	(35)	3.5	2~4	60~90
UH-HUN-CL350		350	200	3150	9.0	QIR 200-3150 HUL/CL350	2500	5000	495		5.2	2~4	60~90
UH-HUN-CL500		500	400	4500	9.0	QIR 400-4500 HUL/CL500	2600	4000	645		6.9	3~5	70~100
UH-HUN-CL700		700	400	6300	9.0	QIR 400-6300 HUL/CL700	2500	5000	845		9.2	3~5	70~100
UH-HUN-CL850		850	400	7650	9.0	QIR 400-7650 HUL/CL850	2500	5000	995		10.9	4~6	80~110
UH-HUN-CL1000		1000	400	9000	9.0	QIR 400-9000 HUL/CL1000	2500	5000	1145		12.7	4~6	80~110

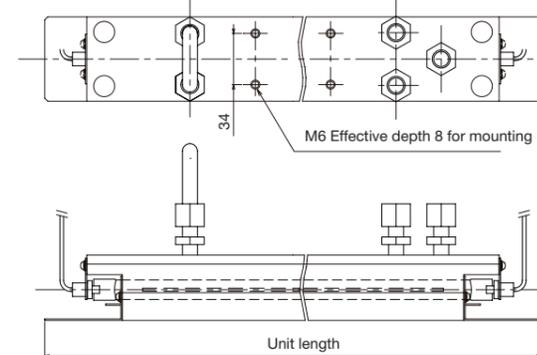
■ Focus type



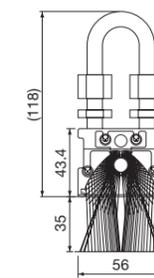
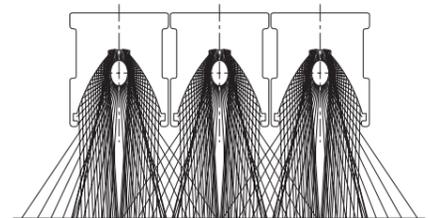
■ Parabola type



■ Surface irradiation type



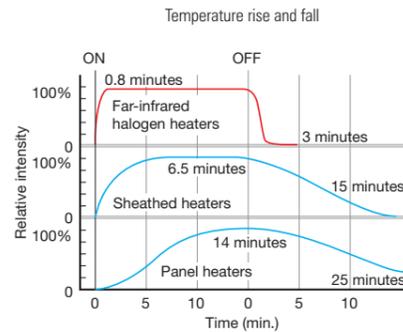
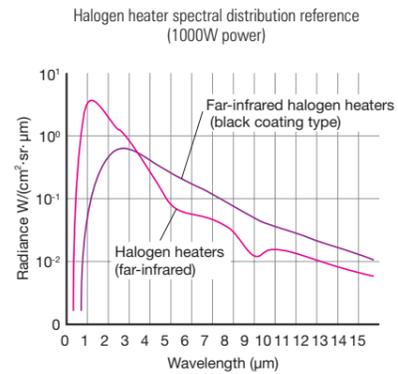
■ Surface irradiation unit attachment example



Variations According to Application

Far-infrared halogen heaters (black coating type)

Coated with a special ceramic coating that converts nearly 100% of visible light power (0.3 μ m to 0.7 μ m wavelength) and 70% to 80% of near and mid-infrared light power (0.7 μ m to 3.0 μ m wavelength) to far-infrared light (3.0 μ m to 100 μ m wavelength). Emits 2 to 3 times the far-infrared radiation of conventional halogen heaters, with an output peak wavelength of 3 to 4 μ m.



Halogen heaters for vacuum use

These heaters use parts that do not emit impure gases or particles, even when used in a vacuum, to produce clean heating. The clip base uses a nickel plate that can be freely bent or twisted, cut, and mounted with screws to suit the physical mounting location.



* When mounting with screws, it is recommended that the clip base be folded over to reduce the load on the lamp due to thermal expansion.

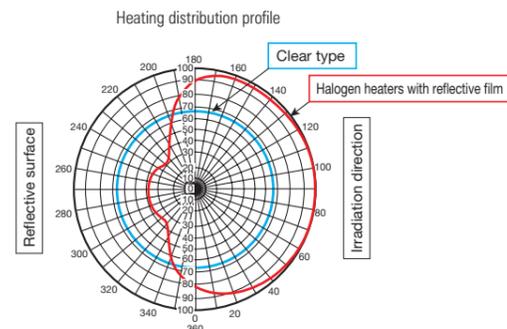
Omnidirectional lighting type

The standard models are all horizontal lighting specification. Lamps may fail or have extremely reduced life if the lamp is turned on when inclined at an angle exceeding the permitted angle (horizontal $\pm 4^\circ$). Consult USHIO if you require lighting at angles exceeding the permitted angle. The addition of dimples to the seal body during manufacture allows the lamp to emit light at any angle when attached to fixed supports.



Halogen heaters with reflective film

A white coating is applied to the rear surface of the lamp which increases the efficiency and the energy emitted from the front of the lamp, and eliminates the optical components, such as the reflective mirror, reducing the cost. It also helps suppress the increase in temperature of surfaces on the side of the reflective film.



Spot Heater Units

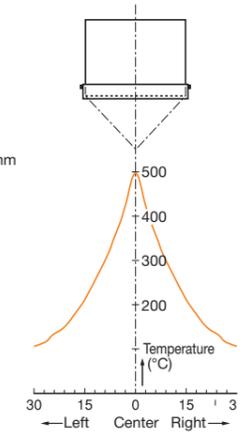
UL series

Model	Rated voltage (V)	Power consumption (W)	Irradiation distance (mm)	Irradiation shape	Unit dimensions (mm)	Unit depth (mm)	Cooling method
UL-SH-01	100	500	75	Spot	120	120	—
UL-SH-02	100	350	48	Spot	97	90	—
UL-PH-01	100	500	75	Parallel irradiation	120	120	—
UL-SH-V500 (vacuum compatible)	50	500	100	Spot	82	110	Water cooling 3L/min



Spot heater temperature measurement results

Lamp voltage: 100V
Lamp power: 350W
Focal length: 48mm
Spot diameter: Approx. 10mm



Power supplies

The output can be manually adjusted.

Model	B0301
Input voltage	AC100~220V \pm 10% 50/60Hz
Maximum output capacity	15A
Output adjustment range	0 to 95%
Control method	Phase control
Operating environment	0 to 40°C, 25 to 90% RH (no condensation)
Weight	3.8kg
Dimensions	W150×H188×D280mm

* Consult USHIO for power supplies rated at 10A or higher.



B0301

Halogen Heater Equipment Lineup

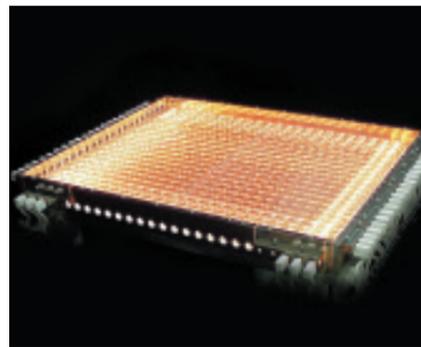
USHIO also supplies other related equipment, not just lamps. We also supply devices and equipment that can be customized to meet customer requirements. Consult USHIO to discuss your needs.



Applications:
Metal Heating (roll-to-roll)

■ Heating example

Workpiece: Aluminum (t=2mm)
Temperature rise: 200°C
Cooling method: Water cooling, Air cooling



Application:
Flat-panel display vacuum heating

■ Heating example

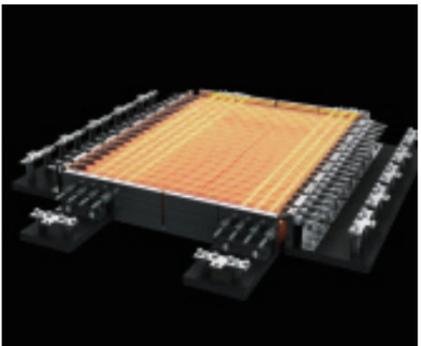
Workpiece: G5.5
Temperature rise: 250°C
Temperature distribution: ±3%
Cooling method: Water cooling



Application:
Metal component vacuum heating

■ Heating example

Workpiece: Steel plate
Temperature rise: 800°C
Cooling method: Water cooling, Air cooling



Application:
General-purpose heating (level surface heating)

■ Heating example

Feature: Various-sized workpieces can be heated using a number of units in combination.
Heating examples: Film, Glass, Steel plate, Non-woven fabrics, etc.
Heating surface area: Up to 2000 mm²

Control Panels for Halogen Heater Units

Temperature control systems that employ halogen heaters are also available.

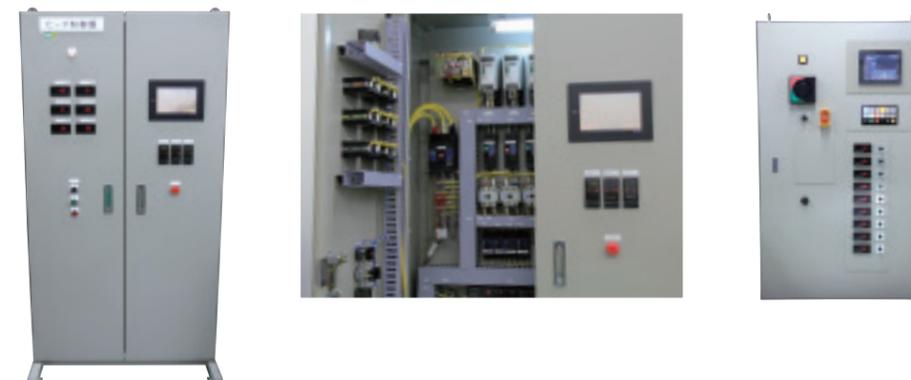
Halogen heater control system example

■ Flexible temperature control using recipe builder (sensor switching, control mode)

■ Recipe example

Time (sec)	Temperature (°C)
0	100
30	150
75	150
105	300
120	300
165	500
210	500
255	500
255	300
300	100

Control panel examples



Halogen Heater Standard Specifications

Comprehensive lineup of standard halogen heater devices.

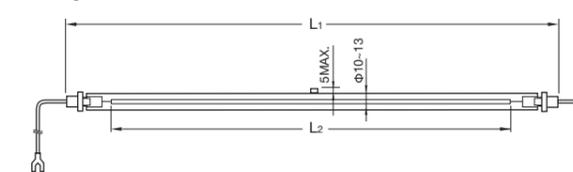
Halogen Heaters

Standard Halogen Heaters

Standard specification						Round base type /L (Fig. 1)				Rectangular base type /D (Fig. 2)			
Emission length (mm)	Power density (W/mm)	Power (W)	Voltage (V)	Color temperature (K)	Average life (h)	Length (mm)	Clear bulb	White coating	Far-infrared lamp	Length (mm)	Clear bulb	White coating	Far-infrared lamp
150	3	450	100	2300	5000	260	QIR 100-450/L/CL150	QIR 100-450/ZL/CL150	QIR 100-450/YL/CL150	251	QIR 100-450/D/CL150	QIR 100-450/ZD/CL150	QIR 100-450/YD/CL150
	7	1050	100	2500	5000		QIR 100-1050/L/CL150	QIR 100-1050/ZL/CL150	—		QIR 100-1050/D/CL150	QIR 100-1050/ZD/CL150	—
	10	1500	100	2600	4000	258	QIR 100-1500/L/CL150	—	—	—	—	—	
300	3	900	100	2200	5000	410	QIR 100-900/L/CL300	QIR 100-900/ZL/CL300	QIR 100-900/YL/CL300	401	QIR 100-900/D/CL300	QIR 100-900/ZD/CL300	QIR 100-900/YD/CL300
			200	2400	5000		QIR 200-900/L/CL300	QIR 200-900/ZL/CL300	QIR 200-900/YL/CL300		QIR 200-900/D/CL300	QIR 200-900/ZD/CL300	QIR 200-900/YD/CL300
	7	2100	200	2500	5000	408	QIR 200-2100/L/CL300	QIR 200-2100/ZL/CL300	—	QIR 200-2100/D/CL300	QIR 200-2100/ZD/CL300	—	
	10	3000	200	2500	5000		QIR 200-3000/L/CL300	—	—	—	—	—	
500	3	1500	200	2300	5000	610	QIR 200-1500/L/CL500	QIR 200-1500/ZL/CL500	QIR 200-1500/YL/CL500	601	QIR 200-1500/D/CL500	QIR 200-1500/ZD/CL500	QIR 200-1500/YD/CL500
	7	3500	200	2400	5000	608	QIR 200-3500/L/CL500	QIR 200-3500/ZL/CL500	—		—	—	
			400	2500	5000		QIR 400-3500/L/CL500	QIR 400-3500/ZL/CL500	—		—		
10	5000	400	2600	4000	—	QIR 400-5000/L/CL500	—	—	—				
700	3	2100	200	2200	5000	810	QIR 200-2100/L/CL700	QIR 200-2100/ZL/CL700	QIR 200-2100/YL/CL700	801	QIR 200-2100/D/CL700	QIR 200-2100/ZD/CL700	QIR 200-2100/YD/CL700
	7	4900	400	2500	5000	808	QIR 400-4900/L/CL700	QIR 400-4900/ZL/CL700	—		—		
	10	7000	400	2500	5000		QIR 400-7000/L/CL700	—	—		—		
1000	3	3000	200	2200	5000	1110	QIR 200-3000/L/CL1000	QIR 200-3000/ZL/CL1000	QIR 200-3000/YL/CL1000	1101	QIR 200-3000/D/CL1000	QIR 200-3000/ZD/CL1000	QIR 200-3000/YD/CL1000
			400	2100	5000	1108	QIR 400-3000/L/CL1000	QIR 400-3000/ZL/CL1000	QIR 400-3000/YL/CL1000		—		
	7	7000	400	2500	5000		QIR 400-7000/L/CL1000	QIR 400-7000/ZL/CL1000	—		—		
	10	10000	400	2700	2500	QIR 400-10000/L/CL1000	—	—	—				

Standard specification						Clip type /B (Fig. 3)			
Emission length (mm)	Power density (W/mm)	Power (W)	Voltage (V)	Color temperature (K)	Average life (h)	Length (mm)	Clear bulb	White coating	Far-infrared lamp
150	3	450	100	2300	5000	269	QIR 100-450/B/CL150	QIR 100-450/ZB/CL150	QIR 100-450/YB/CL150
	7	1050	100	2500	5000		QIR 100-1050/B/CL150	QIR 100-1050/ZB/CL150	—
	10	1500	100	2600	4000		QIR 100-1500/B/CL150	—	—
300	3	900	100	2200	5000	419	QIR 100-900/B/CL300	QIR 100-900/ZB/CL300	QIR 100-900/YB/CL300
			200	2400	5000		QIR 200-900/B/CL300	QIR 200-900/ZB/CL300	QIR 200-900/YB/CL300
	7	2100	200	2500	5000	419	QIR 200-2100/B/CL300	QIR 200-2100/ZB/CL300	—
	10	3000	200	2500	5000		QIR 200-3000/B/CL300	—	—
500	3	1500	200	2300	5000	619	QIR 200-1500/B/CL500	QIR 200-1500/ZB/CL500	QIR 200-1500/YB/CL500
	7	3500	200	2400	5000		QIR 200-3500/B/CL500	QIR 200-3500/ZB/CL500	—
			400	2500	5000		QIR 400-3500/B/CL500	QIR 400-3500/ZB/CL500	—
	10	5000	400	2600	4000		QIR 400-5000/B/CL500	—	—
700	3	2100	200	2200	5000	819	QIR 200-2100/B/CL700	QIR 200-2100/ZB/CL700	QIR 200-2100/YB/CL700
	7	4900	400	2500	5000		QIR 400-4900/B/CL700	QIR 400-4900/ZB/CL700	—
	10	7000	400	2500	5000		QIR 400-7000/B/CL700	—	—
1000	3	3000	200	2200	5000	1119	QIR 200-3000/B/CL1000	QIR 200-3000/ZB/CL1000	QIR 200-3000/YB/CL1000
			400	2100	5000		QIR 400-3000/B/CL1000	QIR 400-3000/ZB/CL1000	QIR 400-3000/YB/CL1000
	7	7000	400	2500	5000		QIR 400-7000/B/CL1000	QIR 400-7000/ZB/CL1000	—
	10	10000	400	2700	2500		QIR 400-10000/B/CL1000	—	—

Figure 1



Base holder

For rectangular base US03D

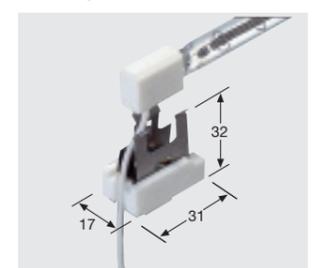
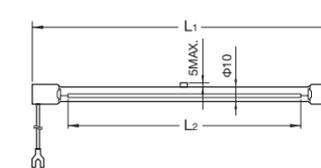


Figure 2



For round base US03L

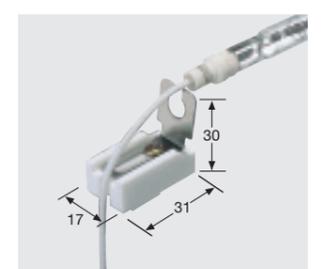
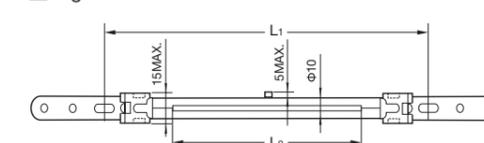


Figure 3

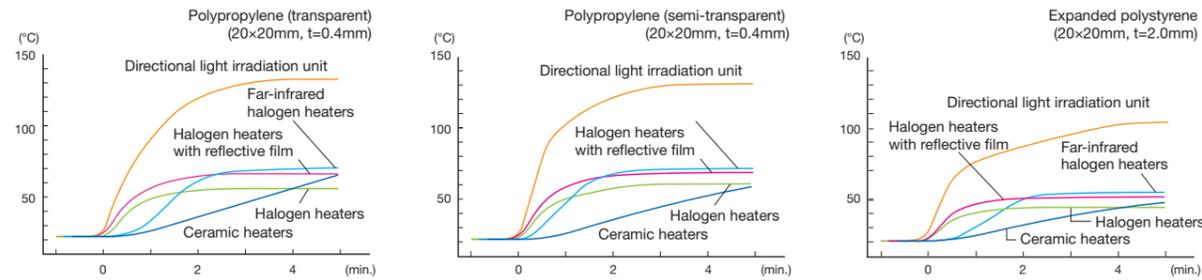


* Lighting orientation: horizontal ± 4°

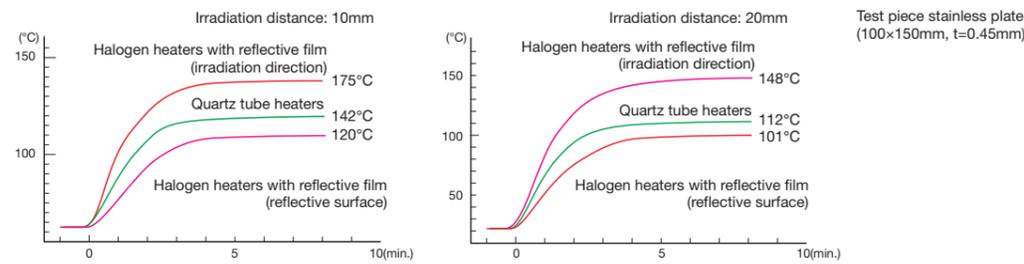
Temperature Rise Examples

Comparison of USHIO halogen heaters and various heat sources for heating various materials.

Plastics Heater output: 1.25W/mm power density (adjusted for identical power density using voltage control) Irradiation distance: 50mm



Stainless Steel Plate Heater output: 0.76W/mm power density (adjusted for identical power density using voltage control)



Iron Plate

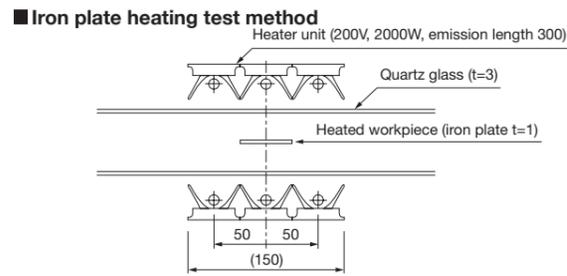
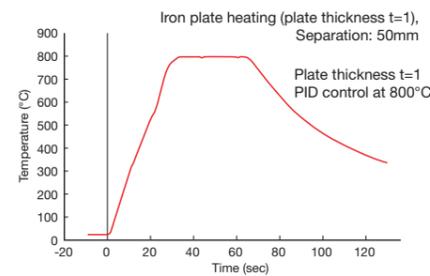
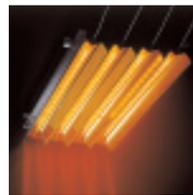
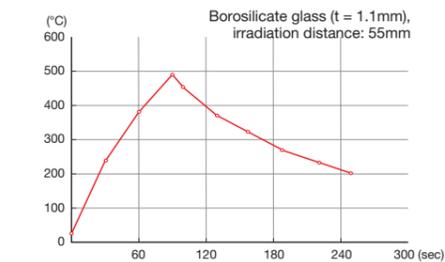
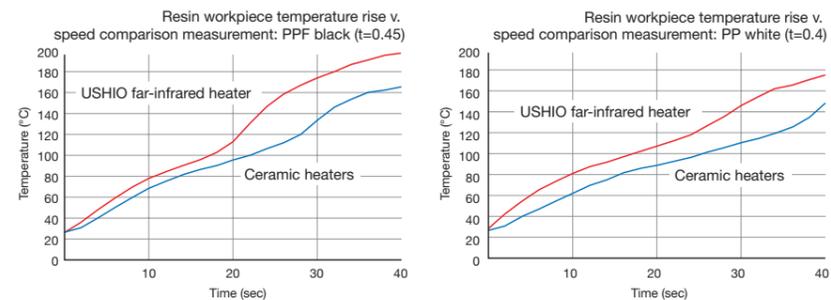


Plate Glass (SUS20 surface-illuminated heater unit) Heater output: 7000 W x 7 lamps



Comparison of Temperature Rise and Speed at Same Power Performance comparison of far-infrared heater and ceramic heater.



Precautions

Halogen Heater

Safety Precautions

- Do not cover the unit with or place paper, cloth, and other flammable materials near the unit during use. Failure to do so may result in fire.
- Always use the specified fixtures (lamp housing) and bulbs of the specified wattage for the socket (connector). Failure to do so may result in damage, fixture overheating, or shortened operating life.
- Always turn off the power before installing/uninstalling parts and cleaning fixtures (lamp housing). Failure to do so may result in electric shock.
- Be careful when handling parts that are made of glass. Failure to do so may result in injury.
- Do not drop the unit, expose the unit to shocks, apply excessive force, or otherwise damage the unit. Be especially careful when cleaning the fixtures (lamp housing). Damage to the unit may result in injury.
- Do not touch the unit directly with your bare hands. Lighting the glass bulb while it is dirty may result in degradation and damage to the bulb, shortening its operating life.
- Never touch the unit while it is lit or immediately after it is turned off, as it may be very hot. Failure to do so may result in burns.
- Always operate the unit within the specified voltage range. Failure to do so may result in damage or shortened operating life.
- Do not apply paint or other substances onto the unit. Failure to do so may result in overheating or damage.
- Do not apply excessive force to the bulb. Failure to do so may result in damage or injury.
- Do not apply excessive force to the lead wire while it is being installed or used. Failure to do so may result in electric shock or malfunction.
- Always turn off the power and make sure the bulb is cool before replacing it. Failure to do so may result in burns.
- Do not stare at the bulb at length from a close distance while it is lit. Failure to do so may result in eye pain.
- Be careful not to damage the lead wire, contact terminals, and connectors (housing). Failure to do so may result in electric shock or malfunction.
- Make sure the contact points of the socket are not damaged, and perform similar inspections. Failure to do so may result in overheating or lighting failures.
- Make sure socket connection is secure. Failure to do so may result in drops or overheating.
- Do not operate the unit in environments exposed to corrosive atmospheres and dust. Failure to do so may result in electric leak, drops, or overheating.
- Do not operate the unit in environments with combustible substances (e.g., thinner) in the atmosphere. Failure to do so may result in fire or explosion.
- Do not operate the unit outdoors, in environments where the unit may get wet, or in high-humidity environments. Failure to do so may result in damage. Consult the manufacturer when operating the unit in such environments.
- Dispose of the used bulbs without breaking them. Failure to do so may result in injury.
- Do not expose the unit to vibration or shocks. Failure to do so may result in damage or shortened operating life.
- Do not operate multiple units in a serial array or in parallel with each other. Failure to do so may result in damage or shortened operating life. Consult the manufacturer when operating units in a serial or parallel array.

Operating Precautions

- Operate contact types with a holding pressure between 14.7 and 34.3 N.
- The operating temperature of the halogen heater's seals is 300°C for 5,000-hour bulbs and 350°C for 3,000-hour bulbs. Construct the fixtures (lamp housing) and cooling measures so that the unit operates with a tube wall temperature between 250°C and 800°C.
- Operate the unit with the angle of the bulb at ±4° on its horizontal axis. Consult the manufacturer if operation of the unit beyond this angle is necessary.
- Configure the fixtures (lamp housing) so that the temperature of the lead wire, contact terminals, and connectors (housing) remains below the operating temperature limit.
- Avoid partial supercooling of the unit.

Halogen Heater Unit

Safety Precautions

- Do not cover the unit with paper or cloth. Failure to do so may result in fire.
- Do not alter the construction of the unit. Failure to do so may result in malfunction, electric shock, smoke emission, combustion, etc.
- Always turn off the power before cleaning the unit or replacing bulbs. Failure to do so may result in electric shock.
- Do not damage the wiring and insulation with sharp objects. Failure to do so may result in electric leak, electric shock, fire, etc.
- Some products require grounding. Refer to the instruction manuals to perform grounding.
- Do not operate the unit outdoors. Failure to do so may result in electric leak, electric shock, fire, etc.
- Never touch the lamp fitting while it is lit or immediately after it is turned off, as it may be very hot. Failure to do so may result in burns.
- Never touch the bulb while it is lit or immediately after it is turned off, as it may be very hot. Failure to do so may result in burns.
- Irradiation at excessively close distances may result in burnout and discoloration of surfaces, or smoke emission and fire.
- Do not operate the unit if it has been dropped. Failure to do so may result in malfunction, electric shock, smoke emission, combustion, etc.
- Do not apply tensile force to the wiring connectors and the power supply cable. Failure to do so may result in malfunction, smoke emission, combustion, etc.
- Do not carry the unit by its power supply cable or its lead cables. Failure to do so may result in malfunction, smoke emission, combustion, etc.
- Operate the unit periodically during periods of prolonged disuse. Ambient humidity may result in degradation of the insulation, which may result in electrical fire, etc.
- Do not operate a unit after 10 years of normal use, as the insulation may have degraded. Failure to do so may result in electric leak, electric shock, fire, etc.
- Always use bulbs the specified bulbs for the unit. Failure to do so may result in overheating or combustion.

Operating Precautions

- Operate the unit with an ambient temperature between 0°C and 40°C.
- Do not apply excessive shocks, especially while the lamp is lit.
- Refer to the instruction manuals to perform periodic inspections of the lamp fittings.

Halogen Spot Heater Unit

Safety Precautions

- Do not point the spot light toward your body, as it is very hot. Failure to do so may result in burns.
- Do not cover the unit with paper or cloth. Failure to do so may result in fire.
- Do not touch the irradiation window directly with your bare hands. The window may be very hot during or immediately after irradiation and may cause burns. In addition, the oils from your hands may cause the window to crack.
- Do not start irradiation while the case is open. Failure to do so may result in electric shock.
- Do not alter the construction of the unit. Failure to do so may result in malfunction, electric shock, smoke emission, combustion, etc.
- Make sure wiring is secure when performing connections to prevent loose connections and disconnections. Failure to do so may result in electric leak, electric shock, fire, etc.
- Do not damage the wiring and insulation with sharp objects. Failure to do so may result in electric leak, electric shock, fire, etc.
- Always turn off the power before installing/uninstalling parts. Failure to do so may result in malfunction or electric shock.
- Always turn off the power before cleaning the unit or replacing bulbs. Failure to do so may result in malfunction or electric shock.
- Do not operate the unit outdoors. Failure to obey may result in electric leak, electric shock, fire, etc.
- Always ground the unit. If using the unit within Japan, the grounding work must comply with Japanese laws and regulations. Failure to do so may result in electric shock.
- Never touch the bulb case while it is lit or immediately after it is turned off, as it may be very hot. Failure to obey may result in burns.
- Do not look directly at the spot light, as it emits intense light. Failure to obey may result in visual impairment.

- Make sure that objects other than the object for heating are not exposed to the irradiation, as the irradiation area of the spot light is very hot. Failure to do so may result in burns or fire.
- Never touch the bulb while it is lit or immediately after it is turned off, as it may be very hot. Failure to do so may result in burns.
- Do not operate the unit with cracked bulbs. Failure to do so may result in fire.
- Be sure to refer to the instruction manuals for details on operation and maintenance.
- Do not damage the wiring with sharp objects. Failure to do so may result in damage to the wiring.
- Do not operate the unit if it has been dropped. Failure to do so may result in malfunction, smoke emission, combustion, etc.
- Ensure sufficient slack in the wiring and cables, and do not pull on them during operation. Failure to do so may result in malfunction, smoke emission, combustion, etc.
- Do not carry the unit by its power supply cable or its lead cables. Failure to do so may result in fire.
- Do not drop the unit, expose the unit to shocks, or apply excessive force to the unit. Failure to do so may result in malfunction, electric shock, smoke emission, combustion, etc.
- Make sure wiring is secure using the securement screws when performing connections to prevent loose connections and disconnections. Incomplete or faulty connections may result in malfunction, overheating, etc.
- Do not cover the unit or place paper, cloth, and other flammable materials near the unit during use. Failure to do so may result in fire.
- Always use the specified bulbs as indicated on the unit. Using bulbs other than those specified may result in overheating and combustion.
- Be sure to refer to the instruction manuals for details on switch operations. Failure to do so may result in malfunction.
- Be sure to store the instruction manuals after reading them carefully.

Operating Precautions

- Operate the unit with an ambient temperature between 0°C and 60°C.
- Always use the specified irradiation unit and power supply.
- Operate the unit in an environment without voltage fluctuations in the power supply.

Halogen Heater Power Control Box

Safety Precautions

- Always turn off the power before installing/uninstalling parts. Failure to do so may result in malfunction or electric shock.
- Do not alter the power supply configuration or open the case. Failure to do so may result in malfunction, electric shock, smoke emission, combustion, etc.
- Always ground the unit using a 3-prong outlet. Failure to do so may result in electric shock.
- Do not connect and operate the unit with equipment other than those specified. Failure to do so may result in overheating, damage, or shortened operating life.
- Do not drop the unit, expose the unit to shocks, or apply excessive force to the unit. Failure to do so may result in malfunction, electric shock, smoke emission, or combustion.
- Ensure sufficient slack in the wiring and cables, and do not pull on them during operation. Incomplete or faulty connections may result in malfunction, overheating, etc.
- Do not cover the unit or place paper, cloth, and other flammable materials near the unit during use. Failure to do so may result in fire.
- Always use the specified irradiation unit. Failure to do so may result in overheating, smoke emission, damage, electric shock, or shortened operating life.
- Make sure cables is secure when performing connections to prevent loose connections and disconnections. Incomplete or faulty connections may result in malfunction, overheating, etc.

Operating Precautions

- Verify the power supply voltage of the location before installation. Operate the unit within a voltage fluctuation range of ±10%.
- Operate the unit with an ambient temperature between 0°C and 40°C (even when operating the unit while it is inside the box).
- Operate the unit with an ambient humidity between 0% and 90% Rh. Do not operate the unit when condensation is present or when the unit is otherwise wet.
- Irradiation may vary in environments with fluctuations in the power supply. In such cases, use a power supply with constant voltage.
- If bulbs do not light, turn off the power and refer to the instruction manuals for details on malfunctions.