QMARK®

A Division of Marley Engineered Products

Design & Application Guide

1. Unit Heaters
2. Convector Heaters
3. Air Curtains
4. Radiant & High Intensity Infrared
5. Industrial Ceiling Fans

Preface

The purpose of this manual is to provide a fundamental understanding of the design and application of the Aztec by **QMark** Electric Radiant/Infrared product line and how the seven different heater types fit a variety of residential, commercial, industrial and institutional applications.

Based on the heater design, we have designated the six lines as:

Design Type	**QMark Catalog No.**
Radiant Ceiling Panels	CP QTH QTM QTL
Radiant Cove Heaters	RCC
Portable Radiant	202SL
Utility Infrared	CHRR
Commercial Infrared	HRK
High-Intensity Infrared	FRP FRS
Industrial Wash-Down Infrared	BRM CRN ARL

The scope of information in this manual is brief. For a more in depth analysis of Aztec by QMark electric Radiant/Infrared heaters see the specific heater specification sheet.

INFORMATION and ASSISTANCE

If, after reviewing this guide, you require additional information or assistance on particular job applications contact your local QMark sales representative or the Technical Service Department at Marley Engineered Products.

ELECTRIC RADIANT / INFRARED HEATER DESIGN AND APPLICATION GUIDE

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ELECTRIC RADIANT and INFRARED HEATERS

GENERAL

Electric Radiant heaters and Infrared heaters, are non-fan forced heaters that convert electrical power into Infrared Radiant energy to heat people and objects, for increased comfort or to prevent freezing conditions, without directly heating the surrounding air.

Radiant and Infrared heaters are normally mounted above the objects to be heated and positioned to focus the radiant energy over an unobstructed path. Like a flash light, an infrared radiant heater will heat objects in the direct radiant path but will not heat objects hidden from view.

UNIQUE ADVANTAGES OF ELECTRIC INFRARED HEAT – Infrared radiant permits heating areas where it is impractical, either physically or economically, to heat the air – outdoor areas, high ceiling buildings, poorly insulated buildings and specific portions of an overall large area (spot heating or heating "rooms without walls"). ZONE CONTROL FLEXIBILITY – Intensity of radiation warmth can be varied between adjacent areas since air temperature is a subordinate factor. Examples include; cold areas in a room, gymnasium playing areas in contrast to spectator seating areas and isolated work stations. CLEAN and SAFE – With electric infrared there is no combustion fumes or water vapor produced, eliminating the need for additional exhaust ventilation systems.

INFRARED RADIANT HEAT ENERGY

This energy is called infrared simply because it is on the "red" side of the visible light spectrum (electro-magnetic energy of wave lengths longer than that of visible light but shorter than radio waves. Like visible light, infrared radiation will travel thru a vacuum; can be focused by optical reflectors; travels in a straight line; and is blocked (absorbed or reflected) by objects or materials opaque to light. Infrared does not itself heat air although it is absorbed to a slight degree by dust particles and carbon dioxide. When absorbed by a body infrared produces heat. Again, like light, infrared as it travels outward from its emission source spreads out and diffuses as a function of the square of the distance (intensity, therefore decreases accordingly; i.e. at twenty feet, intensity is one-fourth that at ten feet). Infrared radiation warms people though the surrounding air is cold. Transmission of warmth from the heated infrared radiant source is instantaneous.

EIGHT TYPES OF
RADIANT / INFRARED HEATERS

CP, QTH, QTM, QTL
RADIANT CEILING PANELS

Ceiling mounted radiant heater. Constructed with a steel back that overlaps the steel front cover on all four sides. The radiating front cover is coated with QMark's unique crystalline surface.

Encapsulated cassette element is uniformly attached to the front cover for even radiant heat distribution.

CP (standard) panels are 2' wide by 2' long (610mm by 610mm) or 2' wide by 4' long (610mm by 1220mm). Designed for Recess, Surface or standard Lay-In T-Bar installation.

QTH, QTM, QTL (Custom) panels are available in 10" (254mm) to 28" (711mm) widths and 24" (610mm) to 96" (2438mm) lengths with optional features such as Stainless Steel construction, seal tight flexible conduit, silicone sealed, custom color or silk screened front cover to blend with leading acoustical tile. Designed for Recessed, Surface, standard lay-In T-Bar, Standard grid Tegular (Revealed Edge) or Fine Line Tegular (Revealed Edge) mounting.

Typical Applications: For Residential or light commercial applications.

Residential Living Areas, Sun Rooms, Basements, Apartments, Meeting Rooms, Offices and Lobbies.

RCC SERIES
RADIANT COVE HEATERS

Radiant cove heaters mount on outside wall near the ceiling, above windows or glass sliding doors. Extruded aluminum front panel contains a metal sheathed element and is coated in a high temperature textured powder coat paint.

Typical Applications: For Residential or light commercial applications.

Offices, Reception rooms, Motel or Hotel rooms, game or family rooms.

202SL
PORTABLE RADIANT

Compact portable radiant heater designed for under-desk or under –counter use.

Heater contains a built-in lighted ON-OFF switch, tip-over safety switch and encapsulated cassette element and QMark's unique crystalline surface.

Typical Applications: Residential or light commercial supplemental heating.

Provides personal warmth for secretaries, bank tellers, receptionists and cashiers.

CHRR SERIES UTILITY INFRARED

Ceiling mounted plug-in infrared spot (supplemental) heater.

The heaters are constructed with either gold anodized aluminum enclosure and reflector or powder coated galvanized steel enclosure with gold anodized aluminum reflector. Heater includes cord and plug, quartz tube element and a safety wire guard to prevent accidental contact with the element.

Some heaters have multiple elements and two ON-OFF switches for full or half heat settings.

Some heaters can also be mounted on an optional cart for roll-around flexibility.

Typical Applications: Residential, Commercial or light Industrial spot heating.

Laundry areas, Pump houses, Work stations Loading docks, Assembly areas, enclosed smoking areas and parts storage areas.

HRK SERIES COMMERCIAL INFRARED

Ceiling mounted radiant heater designed for spot or total area heating.

HRK series is constructed of a galvanized steel enclosure finished in a baked on powder coat with a gold anodized aluminum 60 degree symmetrical reflector and has a quartz tube heating element.

The HRK series heaters have an optional wire safety guard to prevent accidental contact with the element.

Typical Applications: Commercial or light Industrial spot or total area heating.

Loading docks, Assembly areas, enclosed smoking areas, Aircraft hangers, storage areas and Repair stations.

FRP and FRS SERIES HIGH INTENSITY INFRARED

Designed for indoor or unprotected outdoor, spot or total area heating applications.

FRP series enclosures are constructed of galvanized steel with a baked on powder coat finish.

FRS series enclosures are constructed of 304 stainless steel with a no. 3 - fine grain finish.

Both the FRP and FRS series are available in: A) 2 element or 3 element configurations, B) 24" (610mm), 33" (838mm) or 46" (1168mm) lengths and have C) Gold anodized aluminum reflector with beam patterns of 30, 60 and 90 degree symmetrical and 60 degree asymmetrical.

Element selection includes Metal Sheath, Quartz Tube and Quartz Lamp designs.

Accessories – Gold anodized aluminum reflectors. Wire safety guard to prevent accidental contact with the element, Adjustable tilt mounting brackets to position beam pattern for optimal effectiveness, wall mounting brackets and recess mounting frame for custom applications.

Typical Applications: Commercial or Industrial indoor or outdoor spot or total area heating.

Snow melting of parking lots and walkways, Waste water treatment plants, Shipping and Loading docks, Assembly areas, Metalworking areas, Outdoor Smoking areas, Aircraft hangers, Warehouse and Maintenance and Repair stations.

BRM, CRN and ARL SERIES INDUSTRIAL INFRARED

Designed for Industrial (Dirty Location) indoor or unprotected outdoor applications these heaters are constructed with one or three metal sheathed elements, an anodized aluminum enclosure and bright anodized aluminum reflectors.

Heaters have a gasketed wiring compartment that allows them to be washed down.

BRM series infrared heaters are designed primarily for permanent mounting on the ceiling but may be used in any orientation.

There is an optional safety wire guard to prevent accidental contact with the element.

Other additional safety controls are available, such as, tip-over switches, power disconnect switches and wall mounted ground fault detection kits.

The 4.5 KW, 6.0 KW and 13.5 KW heaters have an optional roll-around cart assembly that can easily attach to the heaters to locations where permanently mounted heaters would not be practical.

CRN series infrared heaters are lower watt density permanently installed at the ceiling but may be used in any orientation.

These heaters are designed to provide heavy-duty spot heating and is a good source of heat for use in areas where dependence on air movement is impractical. The heating element connects to a gasketed, moisture resistant terminal enclosure. This allows the heater to be washed down provided the heater is disconnected from the power supply.

ARL series infrared heaters are portable low watt density hand-carry type. These hand-carry units have a rear-mounted carrying handle and the heater is mounted on a heavy-duty, tip-resistant pedestal.

Aluminum extruded housing keeps the heating element secure while providing a focal point where a highly polished aluminum reflector emits straight-line heating.

Typical Applications: Dirty location Industrial indoor or unprotected outdoor spot heating.

Waste water treatment plants, Loading docks, Foundries, Auto or Marine repair facilities, Indoor or Outdoor storage bins, Assembly areas, Outdoor Smoking areas, Airport waiting areas, Maintenance shops, High bay metal buildings, Repair stations and Fabrication areas.

RADIANT and INFRARED HEATER DESIGN

Heat from the sun, from the fireplace or a glowing ingot of iron is infrared radiation. This heat can be optically directed making it ideally suited in spot heating applications where it can warm the person or target object. This means that heat can be directed downward, horizontally, upward or any angle between.

All radiant and infrared heaters contain two primary components; an element and a means of directing the heat flow. Elements covered in this manual range from woven resistance wire (for ceiling panels) to metal sheath, quartz tube and quartz lamps in the industrial infrared heaters. Heat direction is determined by either; A) reflective surface placement, as in ceiling panels, cove heaters and portables (see Figure A) or B) curved reflectors, as in utility, commercial, high intensity and industrial heaters (see Figure B).

In Figure A, the element is secured directly to the emitting surface. When the element is energized it produces heat that is transferred by conduction to the front cover of the emitting surface. The front cover becomes heated and radiant heat energy is emitted from this surface, traveling in a straight line to the target object.

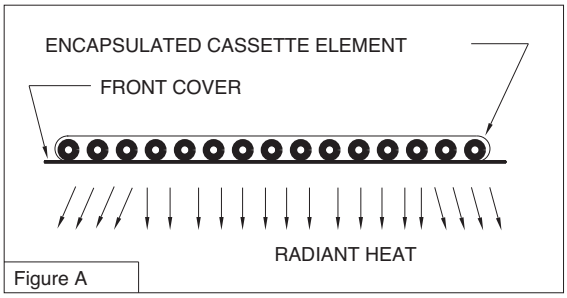


Figure A

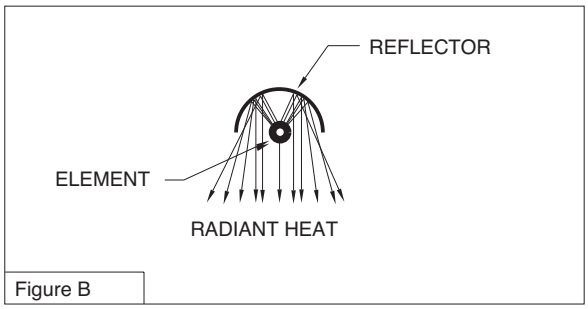


Figure B

Figure B illustrates a typical element / reflector arrangement. When the element is energized it produces heat that is emitted in all directions from the element surface. A portion of that heat energy travels directly (in a straight line to the target. The rest of the heat energy is redirected, or focused, by an aluminum reflector to add to the energy emitting directly from the front surface.

RADIANT and INFRARED HEATER COMPONENTS

All electric radiant and infrared heaters covered in this manual contain an element and a reflective surface or emitting surface to direct the radiant infrared energy.

Some heaters have additional operating and / or safety features such as wire safety guards, gasketed wiring compartments, special mounting attachments and carts that are covered in more detail in other sections of this guide or in the specific heater specification sheet.

An **Element** converts electrical energy to heat by passing electrical current through a specifically designed resistance wire.

Elements for heaters in this manual fall into four basic groups; a) Encapsulated Cassette for Radiant Ceiling Panels, b) Metal Sheath, c) Quartz Tube and d) Quartz Lamp based on their construction.

Metal Sheath, Quartz Tube and Quartz Lamp construction is discussed below.

construction	The metal sheath heater is composed of nichrome resistor wire embedded in an electrical insulating refractory encapsulated within a metal tube.	The quartz tube consists of a coiled nichrome element confined within an air filled fused quartz tube. The element is supported by the tube itself which is capped (not sealed) by porcelain or metal terminal blocks	The quartz lamp consists of a coiled tungsten filament positioned in a straight line and way from the quartz tube by tantalum spacers. The filament is sealed into the ends of the 3/8" diameter quartz tube which filled with inert gas.
watts per inch(max.)	50W	50W	100W
response time	2-5 minutes	1 minute	few seconds
operating wire temperature	1550°F	1600°F	4050°F
durability	Most rugged of the sources; stands up well against impact, vibration, and splashing.	Stands up well against splashing; medium resistance to vibration; low resistance to impact.	Stands up well against splashing; low resistance to vibration and impact.
wind limitations	Must be shielded against wind.	Little effect.	Negligible
visible light emissions	Very low (Dull red glow)	Low (Orange glow)	High—7.5 lumens per watt (White light)

Radiant/Infrared Heater Application Matrix

LOCATION	CEILING PANELS	COVE HEATERS	PORTABLE	UTILITY	COMMERCIAL	HIGH INTENSITY	INDUSTRIAL WASH-DOWN
RESIDENTIAL							
Basements	◒			◒			
Recreation Rooms	◉	◒	○	◒			
Laundry Room	◒	○		◉			
Work Room	◒	○	○	◉			
Storage Building				◉			
Garage				◉			
Crawl Space							
INDUSTRAIL NON-HAZARDOUS							
Power Generating Stations					○	◒	◉
Car Wash						◒	◉
Coal Handliing						◒	◉
Warehouse (High Bay)						◒	◉
Warehouse (Low Bay)						◉	◒
Construction Area				◉			
Aircraft Facility				◒	○	◒	◉
Petroleum Plants						○	◉
Cleaning Plants						◉	◉
Canneries						◉	◉
Cement Plants						◉	◉
Service Stations					◒	◉	
Oil Rigs					○	◉	◒
Foundries						◒	◉
Pump Rooms						◉	◒
Refineries					○	◉	◒
Steel Mills					○	◒	◉
Rest Rooms					◒	◉	
Chemical Plants						○	◒
Waste Water Facicilities						◒	◉
Assembly Lines				○	◒	◉	
Dairies						◒	◉
Food Processing Plant						◒	◉
Break Room	◒			○	◉		
Outside Smoking Areas				○	◒	◉	
Snow Melting						◉	◒

○ GOOD, ◒ BETTER, ◉ BEST

	CEILING PANELS	COVE HEATERS	PORTABLE	UTILITY	COMMERCIAL	HIGH INTENSITY	INDUSTRIAL WASH-DOWN
COMMERCIAL NON-HAZARDOUS							
Foyers	○					◒	
Atrium						○	
Swimming Pool Areas						◉	○
Hallways	◉	◒					
Stairwells	◉						
Laundry Facilities	○	○		◉			
Retail Space	◒			◉	◒	○	
Lobbies	◒						
Agricultural Barns				○		◒	◉
Hospital Maint. Area				◒	◉	◒	
Restaurants	◉	◒					
Greenhouse							◒
Outside Smoking Areas					◒	◉	
Toll Booth	◒	◒					
Snow Melting						◉	◒
INSTUTUTIONAL							
Entrances	◒	○			○		
Swimming Pool Areas						◉	○
Correctional Facilities	○						
Rest Rooms	○						
Maintenance Rooms					◉	◒	
Cafeteria	◉	○					
Hallways	◒						
Outside Smoking Areas						◉	◒
Snow Melting						◉	◒
HAZARDOUS LOCATIONS							
Coal Mines							
Graineries							
Paint Storage							
Chemical Storage							
Petroleum Plants							

RADIANT / INFRARED HEATER APPLICATION

The application of electric radiant or infrared heat requires the consideration of four factors: Design area type (Residential, Commercial, Industrial, Dirty environment), Design area occupancy and use (Large Groups of Settled People, Small One-Person Office, Stairwell, Laundry Area, Assembly Line, Outdoor Smoking Area), Line of Sight Clearance between the heater and the target object (What the heater can not see it can not heat) and Heating load requirements.

Calculate the heating loads using the NEMA handbook, the ASHRAE guide, the MARLEY ENGINEERED PRODUCTS heat loss program or consult your local electrical utility.

CAUTIONS AND LIMITATIONS

CODE REQUIREMENTS

All wiring must be in accordance with National and Local Electrical Codes.

Local codes may contain additional, specific requirements for heater installation and wiring.

APPLICATIONS

Use radiant and infrared heaters only as described in the manual supplied with the specific heater.

Any use not recommended by the manufacturer may cause fire, electrical shock or injury to persons.

All radiant and infrared heaters discussed in this manual have hot and arcing or sparking parts inside and should not be used in potentially explosive atmospheres.

The finish of Ceiling Panels, Cove Heaters, Portable, Utility, Commercial, Industrial Wash-Down and painted High-Intensity radiant and infrared heaters are not intended for direct salt spray exposure in marine applications, or the highly corrosive atmospheres of swimming pools or chemical storage bins. Stainless Steel High Intensity Infrared heaters are better suited for this application.

In Institutional applications such as Hospitals, Nursing Homes and Child Day Care Facilities the use of portable radiant and cart mounted utility heaters is not recommended because of the possible tripping hazard with the cord. Also not recommended is the use of Quartz Tube and Quartz Lamp elements because of the possibility of broken elements. The use of Radiant Ceiling Panels, Cove heaters or High Intensity Infrared heaters with Metal Sheath elements is recommended in these situations.

For Outdoor applications (Snow melting) do not use metal sheath elements. Quartz Tube or Quartz Lamp elements are best for this application. Infrared fixtures with a narrow controlled beam provide a concentrated, most effective, heating pattern.

Do not locate radiant or infrared heaters where the beam pattern is blocked by building structure or equipment. If necessary use two or more smaller units.

HEATER WEIGHT

The wall or ceiling mounting structure and the anchoring provisions must be of sufficient strength to support the weight of the heater, elements and all accessories.

See the manual supplied with each radiant or infrared heater for specific heater and accessory weights.

CLEARANCES

When locating and installing electric radiant and infrared heaters, a minimum unobstructed distance (minimum clearance) must be maintained between the heater and any object that may affect the operation or safety of the hater.

Check the manual supplied with each heater for specific clearance dimensions including but not limited to: mounting height above floor, distance to walls, distance between heaters and distance in radiant path.

SELECTING THE SIZE AND QUANTITY OF HEATERS

RADIANT CEILING PANELS

Radiant Ceiling Panels should be located to offset perimeter wall or window heat loss.

Panels should be placed in or on the ceiling approximately two feet (610 mm) from the outside wall or window, but work almost as well immediately adjacent to the perimeter.

The crystalline surface concentrates energy in the 8 – 10 micron range, a wave length that is not color selective (white absorbs as much as black) and will not pass through glass, but is absorbed instead.

RADIANT COVE HEATERS

Radiant Cove Heaters should be located to offset perimeter wall or window heat loss.

Heaters should be placed on the perimeter wall, at the ceiling, above the window or door.

SELECTING THE SIZE AND QUANTITY OF HEATERS (Cont.)

INFRARED HEATERS

Spot Heating

Indoor

Areas with length and width less than 30 ft.

1. DETERMINE DELTA T

a. Determine the coldest inside temperature the system must overcome.

If freeze protection is provided by another heating system this temperature will be around 40 deg. F.

b. Determine the operational temperature desired.

That temperature which the customer would want if conventional heating were installed. 70 deg. F. is a nominal average.

c. Subtract 1 from 2 to determine the increase in operational temperature (delta T) expected from the infrared system.

If drafts are present in the occupied area (air movement over 44 feet per minute velocity), wind shielding must be provided for the occupants.

2. DETERMINE DESIGN AREA

a. Determine the are to be heated.

For people that are standing this is a plane 4 ft. above the floor (chest high). For sitting people this is 3 ft. above the floor.

CAUTION: Insure that combustibles will not be in radiant path.

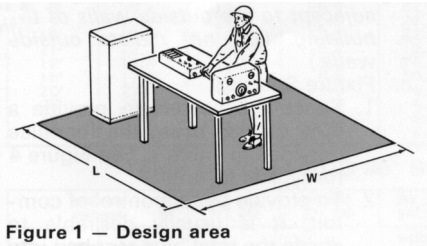


Figure 1 — Design area

3. DETERMINE THE FIXTURE MOUNTING HEIGHT

a. Allow adequate clearance for large moving equipment such as cranes and lift trucks.

CAUTION: Insure that combustibles will not be in radiant path.

4. DETERMINE THE WATT DENSITY REQUIRED

a. Install one watt for each degree of delta T as determined in step 1c.

Minimum of 12 watts per sq. ft.

b. People should be warmed from at least two directions, therefore the required watt density for each heater will be one half of the amount determined in step 4a.

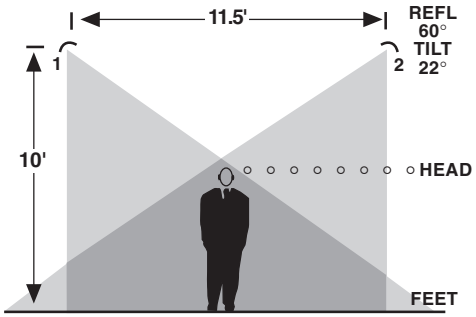


Figure 2—Tilting infrared fixtures for spot heating (typical example).

5. DETERMINE FIXTURE MOUNTING LOCATION

a. From TABLE 1 determine the beam characteristics that best fits the design area at the required mounting height.

b. Choose the specific fixture and element combination from CHART1, 2, 3, 4, 5, or 6 based on the watt density from step 4a and beam characteristics from 5a.

NOTE: People should be warmed from at least two directions, therefore the required watt density for each heater will be one half of the amount determined in step 4a.

c. Determine heater location from design area center line from TABLE 2.

Tilt heaters such that the upper limit of the beam is about six feet above the center of the design are floor.

EXAMPLE

It is desired to heat a factory work station that is 16' wide by 20' long. The mounting height is 12' and the minimum inside temperature is 40 deg. F. Supply Power is 240 volts.

1. DETERMINE DELTA T

70 - 40 = 30 deg. F

2. DETERMINE DESIGN AREA

16' x 20' = 320 sq. ft.

3. DETERMINE THE FIXTURE MOUNTING HEIGHT

12'

4. DETERMINE THE WATT DENSITY REQUIRED

1	watt
x 30	deg. delta T
30	w/sq. ft. req.

5. DETERMINE FIXTURE MOUNTING LOCATION

From Table 1 - 60 deg. reflector is best fit.

From Chart 4 - 12'	mounting
	15 w/q. ft. required
	240 volts
Option 1.	4 heaters
	46" Enclosure
	M S Element
	28 w/sq. ft. supplied
Option 2.	4 Heaters
	33" Enclosure
	Q T Element
	28 w/sq. ft. supplied
Option3.	4 Heaters
	24" Enclosure
	Q L Element
	29.6 w/sq. ft. supplied

From Table 2
Transverse Spacing
0.58 * 12 = 6.96 round to 7.0'

a. Mount 1 set of heaters @ 3'6" either side for the center line , zero degree tilt.
b mount the other set of heaters @ 6'6" either side of the center line, 30 degree tilt.
c. Check pattern overlap on graph paper.

TABLE 1
Radiation Pattern Areas
(pattern area = W x L)

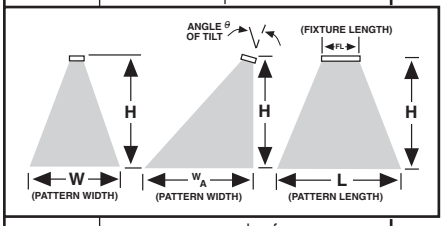
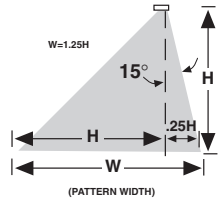
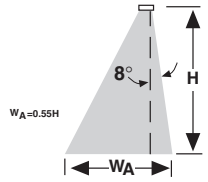
TYPE OF REFLECTOR	WIDTH OF PATTERN ON FLOOR (W) VERTICAL MOUNTING	ANGLE MOUNTING
		
90° sym.	W=2H	angle of tilt (8) 15° WA=2.3H 22° WA=2.8H 30° WA=4.0H
60° sym.	W=1.15H	15° WA=1.25H 22° WA=1.4H 30° WA=1.7H
30° sym.	W=0.54H	10° WA=0.55H 15° WA=0.57H 22° WA=0.64H 30° WA=0.73H
60° asym.		
30° asym.		

TABLE 2
Recommended Fixture Spacing

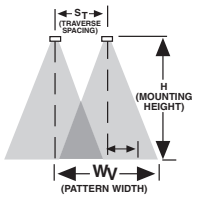
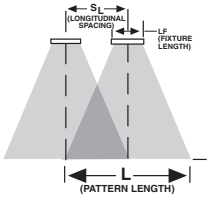
Transverse Spacing for Vertically Mounted Fixtures		Longitudinal Spacing for Vertical or Angled Mounted Fixtures	
			
REFLECTOR ANGLE	TRANSVERSE SPACING (S_T)	REFLECTOR ANGLE	LONGITUDINAL SPACING (S_L)
90°	1.0H	90°	$\frac{L}{2}$
60°	0.58H	60°	
30°	0.25H	30°	

TABLE 3
Asymmetrical * and Tilted Fixture Correction Factors

FIXTURE REFLECTOR ANGLE	DEGREE OF TILT		
	15°	22°	30°
30° sym.	.93	.83	.74
45° sym.	.90	.83	.71
60° sym.	.92	.82	.67
90° sym.	.87	.71	.50

*Correction factor for 30° asymmetrical reflector is 0.98; correction factor for 60° asymmetrical reflector is 0.92.

NOTE: When using a tilted fixture, adjust the watts per sq. ft. input before selecting a fixture from Chart 1, 2, 3 or 4. (The adjusted watts per sq. ft. input value compensates for the larger beam pattern of a tilted fixture.) This is done by dividing the required watts per square foot by the appropriate correction factor from the above table.

AREA HEATING

Consider these guidelines when heating a totally enclosed space of any size or design area with length and width each having a dimension greater than 50 feet.

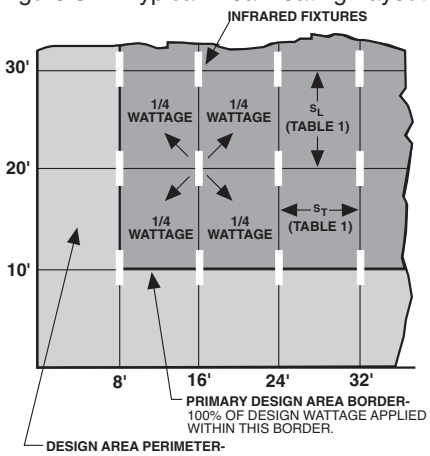
a. Computation of watt density:
Method 1 — Lowest indoor ambient temperature not known.
1. Calculate the room heat loss as if room air would be heated by conventional heating systems.
2. Divide the heat loss in watts by the design area to be heated to arrive at watt density per squared foot.
3. Multiply the watts per square foot in Step 2 by 0.85 to obtain the amount of actual watt density radiation required. *This multiplier compensates for the lower air temperature possible in comfort infrared applications.*

Method 2 — Lowest indoor ambient temperature known.
1. It has been found from practice that 1/2 watt per square foot for each degree of operational temperature increase over minimum indoor ambient temperature required is a good rule of thumb when the minimum indoor ambient is known. Heat loss calculations are not required in this instance. *For example, with a minimum indoor ambient of 20°F and a desired indoor ambient of 70°F, the temperature increase is 50°F. Simply multiply 50°F by 1/2 the watt per square foot per °F to obtained 25 watt per square foot requirement.*

b. Fixture Selection:
Select fixtures from Chart 1, 2, 3,4 or 5 based on 1/4 for the watts per square foot requirement (see Figure 4) at a given mounting height and element type. For example, if 25 watts per square foot are required; choose a fixture with an input watt density of approximately6.3 at the required mounting height. Do not install less than 12 watts per square foot. Double the watt density along areas adjacent to the outside walls of the building. (Do not radiate outside walls.)

c. Fixture Spacing:
1. Space the heaters to provide a 50% overlap using the formula provided in Table 1. See Figure 3 for typical layout.
2. To provide better control of comfort, it is usually desirable to divide the total heat required into 4 circuits. Each fixture circuit is switched in as the ambient conditions require.

Figure 3 — Typical Area Heating Layout



SNOW MELTING

Infrared fixture having a narrow controlled beam with little stray energy provides concentrated, most effective snow melting heat. **Do not use metal sheath elements in snow melting applications.**

1. Determine the design area to be heated in square feet.

2. Select the watt densities required for snow melting in your geographical area from the tables available in the "Snow Melting" chapter of the "Systems" volume of the ASHRAE "Guide and Data Book". These are the same densities used in slab heating.

3. Multiply this watt density by the design area and then multiply this product by 1.6 to correct for spill radiation and fixture efficiency . This figure becomes the amount of radiation required. Watt Density x (Design Area) x (1.6) = Installed Radiation (Watts). Normal watt density for snow melting is between 60 and 100 watts per sq. ft.

4. It is desirable to locate the fixtures so that the radiant energy is more concentrated in the interior of the design area with lower watt densities toward the edges.

Spot Heating

Outdoor

The same guidelines outlined under INDOOR SPOT HEATING should be followed except that watts per square foot for each degree of operational temperature increase should be doubled to approximately 2 watts per square foot per degree F.

Minimum of 25 watts per sq. ft.

These procedures apply to outdoor heating without wind chill effect on personnel. Increasing the radiation is never a substitute for providing a personnel wind break or shield.

CHART 1

SINGLE ELEMENT
UTILITY INFRARED & QUARTZ TUBE
COMMERCIAL INFRARED HEATERS

QUARTZ TUBE ELEMENT
RADIANT EFF. 80%

Mounting Height		AREA (W x L)		Square		1 ELEM 17" Encl.	2 ELEM 17" Encl.	2 ELEM 23" Encl.	4 ELEM 32" Encl.	1 ELEMENT 46" Encl.	1 ELEMENT 46" Encl.	1 ELEMENT 57" Encl.
Ft.	m	Ft.	m	Ft.	m	500 w w/sq.ft.	1 KW w/sq.ft.	2 KW w/sq.ft.	5.7 KW w/sq.ft.	1.5 KW w/sq.ft.	2 KW w/sq.ft.	3 KW w/sq.ft.
3	0.9	3.5 x 6	1.1 x 1.8	21	2	19	38.1	76.2	217.1	57.1	76.2	114.3
4	1.2	4.6 x 8	1.4 x 2.4	36.8	3.4	10.9	21.7	43.5	123.9	32.6	43.5	65.2
5	1.5	5.8 x 10	1.8 x 3	58	5.4	6.9	13.8	27.6	78.6	20.7	27.6	41.4
6	1.8	6.9 x 12	2.1 x 3.7	82.8	7.8	4.8	9.7	19.3	55.1	14.5	19.3	29
7	2.1	8.1 x 14	2.5 x 4.3	113.4	10.8	3.5	7.1	14.1	40.2	10.6	14.1	21.2
8	2.4	9.2 x 16	2.8 x 4.9	147.2	13.7	2.7	5.4	10.9	31.0	8.2	10.9	16.3
9	2.7	10.4 x 18	3.2 x 5.5	187.2	17.6	2.1	4.3	8.5	24.4	6.4	8.5	12.8
10	3	11.5 x 20	3.5 x 6.1	230	21.4	1.7	3.5	7	19.8	5.2	7	10.4
11	3.4	12.7 x 22	3.9 x 6.7	279.4	26.1	1.4	2.9	5.7	16.3	4.3	5.7	8.6
12	3.7	13.8 x 24	4.2 x 7.3	331.2	30.7	1.2	2.4	4.8	13.8	3.6	4.8	7.2
13	4	15 x 26	4.6 x 7.9	390	36.3	1	2.1	4.1	11.7	3.1	4.1	6.2
14	4.3	16.1 x 28	4.9 x 8.5	450.8	41.7		1.8	3.5	10.1	2.7	3.5	5.3
15	4.6	17.3 x 30	5.3 x 9.1	519	48.2		1.5	3.1	8.8	2.3	3.1	4.6

CHART 2

90 DEG. SYMMETRICAL

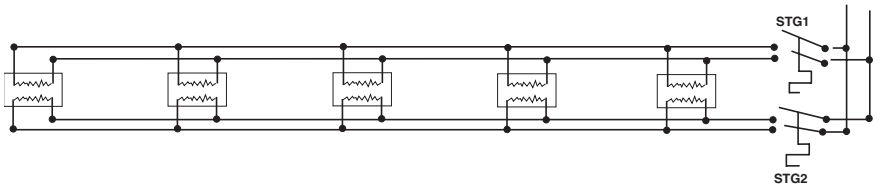
METAL SHEATH COMMERCIAL INFRARED &
INDUSTRIAL WASH-DOWN
INFRARED HEATERS

METAL SHEATH ELEMENT
RADIANT EFF. 60%

Mounting Height		AREA (W x L)		Square		COMMERCIAL INFRARED 1 ELEMENT 25" Encl 1 KW w/sq.ft.	COMMERCIAL INFRARED 1 ELEMENT 34" Encl 1.5 KW w/sq.ft.	COMMERCIAL INFRARED 1 ELEMENT 44" Encl 2 KW w/sq.ft.	COMMERCIAL INFRARED 1 ELEMENT 51" Encl 2.5 KW w/sq.ft.	INDUSTRIAL WASH-DOWN INFRARED 1 ELEM. 26" Encl 2 KW w/sq.ft.	INDUSTRIAL WASH-DOWN INFRARED 1 ELEM. 47" Encl 4.5 KW w/sq.ft.	INDUSTRIAL WASH-DOWN INFRARED 3 ELEM. 27" Encl 6 KW w/sq.ft.	INDUSTRIAL WASH-DOWN INFRARED 3 ELEM. 59" Encl 13.5 KW w/sq.ft.
Ft.	m	Ft.	m	Ft.	m								
3	0.9	6 x 6	1.8 x 1.8	36	3.2	16.7	25	33.3	41.7	33.3	75	100	225
4	1.2	8 x 8	2.4 x 2.4	64	5.8	9.4	14.1	18.8	23.4	18.8	42.2	56.3	126.6
5	1.5	10 x 10	3 x 3	100	9	6	9	12	15	12	27	36	81
6	1.8	12 x 12	3.7 x 3.7	144	13.7	4.2	6.3	8.3	10.4	8.3	18.8	25	56.3
7	2.1	14 x 14	4.3 x 4.3	196	18.5	3.1	4.6	6.1	7.7	6.1	13.8	18.4	41.3
8	2.4	16 x 16	4.9 x 4.9	256	24	2.3	3.5	4.7	5.9	4.7	10.5	14.1	31.6
9	2.7	18 x 18	5.5 x 5.5	324	30.3	1.9	2.8	3.7	4.6	3.7	8.3	11.1	25
10	3	20 x 20	6.1 x 6.1	400	37.2	1.5	2.3	3	3.8	3	6.8	9	20.3
11	3.4	22 x 22	6.7 x 6.7	484	44.9	1.2	1.9	2.5	3.1	2.5	5.6	7.4	16.7
12	3.7	24 x 24	7.3 x 7.3	576	53.3	1	1.6	2.1	2.6	2.1	4.7	6.3	14.1
13	4	26 x 26	7.9 x 7.9	676	62.4		1.3	1.8	2.2	1.8	4	5.3	12
14	4.3	28 x 28	8.5 x 8.5	784	72.3		1.1	1.5	1.9	1.5	3.4	4.6	10.3
15	4.6	30 x 30	9.1 x 9.1	900	82.8		1	1.3	1.7	1.3	3	4	9
16	4.9	32 x 32	9.8 x 9.8	1024	96		1.2	1.5	1.2	2.6	3.5	7.9	
17	5.2	34 x 34	10.4 x 10.4	1156	108.2		1	1.3	1	2.3	3.1	7	
18	5.5	36 x 36	11 x 11	1296	121				1.2		2.1	2.8	6.3
19	5.8	38 x 38	11.6 x 11.6	1444	134.6				1		1.9	2.5	5.6
20	6.1	40 x 40	12.2 x 12.2	1600	148.8						1.7	2.3	5.1

Typical Wiring Diagram—Double Element Heaters

/2Stage control



Typical Wiring Diagram—Double Element Heaters

Single Ph. Heaters - Three Ph. Supply

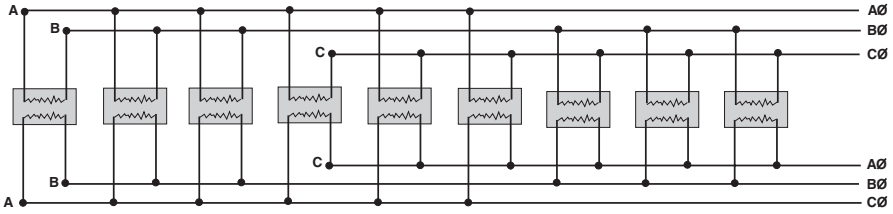


CHART 3

90 DEG. SYMMETRICAL

2 ELEMENT & 3 ELEMENT
HIGH-INTENSITY
INFRARED HEATERS

Mounting Height		Area (W x L)		Square		METAL SHEATH ELEMENT RADIANT EFF. 60%						QUARTZ TUBE ELEMENT RADIANT EFF. 80%						QUARTZ LAMP ELEMENT RADIANT EFF. 80%					
						2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem
						24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.		24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.		24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.	
Ft.	m	Ft.	m	Ft.	m	1.7 KW w/sq.ft.	2.5 KW w/sq.ft.	3 KW w/sq.ft.	4.5 KW w/sq.ft.	4 KW w/sq.ft.	6 KW w/sq.ft.	2 KW w/sq.ft.	3 KW w/sq.ft.	3 KW w/sq.ft.	4.5 KW w/sq.ft.	4 KW w/sq.ft.	6 KW w/sq.ft.	3.2 KW w/sq.ft.	4.8 KW w/sq.ft.	5 KW w/sq.ft.	7.5 KW w/sq.ft.	7.3 KW w/sq.ft.	10.95 KW w/sq.ft.
5	1.5	10 x 10	3.0 x 3.0	100.0	9.0	9.6	15.0	18.0	27.0	24.0	36.0	16.0	24.0	24.0	36.0	32.0	48.0	25.6	38.4	40.0	60.0	58.4	87.6
6	1.8	12 x 12	3.7 x 3.7	144.0	13.7	6.7	10.4	12.5	18.8	16.7	25.0	11.1	16.7	16.7	25.0	22.2	22.2	17.8	26.7	27.8	41.7	40.6	60.8
7	2.1	14 x 14	4.3 x 4.3	196.0	18.5	4.9	7.7	9.2	13.8	12.2	18.4	8.2	12.2	12.2	18.4	16.3	24.5	13.1	19.6	20.4	30.6	29.8	44.7
8	2.4	16 x 16	4.9 x 4.9	256.0	24.0	3.8	5.9	7.0	10.5	9.4	14.1	6.3	9.4	9.4	14.1	12.5	18.8	10.0	15.0	15.6	23.4	22.8	34.2
9	2.7	18 x 18	5.5 x 5.5	324.0	30.3	3.0	4.6	5.6	8.3	7.4	11.1	4.9	7.4	7.4	11.1	9.9	14.8	7.9	11.9	12.3	18.5	18.0	27.0
10	3.0	20 x 20	6.1 x 6.1	400.0	37.2	2.4	3.8	4.5	6.8	6.0	9.0	4.0	6.0	6.0	9.0	8.0	12.0	6.4	9.6	10.0	15.0	14.6	21.9
11	3.4	22 x 22	6.7 x 6.7	484.0	44.9	2.0	3.1	3.7	5.6	5.0	7.4	3.3	5.0	5.0	7.4	6.6	9.9	5.3	7.9	8.3	12.4	12.1	18.1
12	3.7	24 x 24	7.3 x 7.3	576.0	53.3	1.7	2.6	3.1	4.7	4.2	6.3	2.8	4.2	4.2	6.3	5.6	8.3	4.4	6.7	6.9	10.4	10.1	15.2
13	4.0	26 x 26	7.9 x 7.9	676.0	62.4	1.4	2.2	2.7	4.0	3.6	5.3	2.4	3.6	3.6	5.3	4.7	7.1	3.8	5.7	5.9	8.9	8.6	13.0
14	4.3	28 x 28	8.5 x 8.5	784.0	72.3	1.2	1.9	2.3	3.4	3.1	4.6	2.0	3.1	3.1	4.6	4.1	6.1	3.3	4.9	5.1	7.7	7.4	11.2
15	4.6	30 x 30	9.1 x 9.1	900.0	82.8	1.1	1.7	2.0	3.0	2.7	4.0	1.8	2.7	2.7	4.0	3.6	5.3	2.8	4.3	4.4	6.7	6.5	9.7
16	4.9	32 x 32	9.8 x 9.8	1024.0	96.0		1.5	1.8	2.6	2.3	3.5	1.6	2.3	2.3	3.5	3.1	4.7	2.5	3.8	3.9	5.9	5.7	8.6
17	5.2	34 x 34	10.4 x 10.4	1156.0	108.2		1.3	1.6	2.3	2.1	3.1	1.4	2.1	2.1	3.1	2.8	4.2	2.2	3.3	3.5	5.2	5.1	7.6
18	5.5	36 x 36	11.0 x 11.0	1296.0	121.0		1.2	1.4	2.1	1.9	2.8	1.2	1.9	1.9	2.8	2.5	3.7	2.0	3.0	3.1	4.6	4.5	6.8
19	5.8	38 x 38	11.6 x 11.6	1444.0	134.6		1.0	1.2	1.9	1.7	2.5	1.1	1.7	1.7	2.5	2.2	3.3	1.8	2.7	2.8	4.2	4.0	6.1
20	6.1	40 x 40	12.2 x 12.2	1600.0	148.8			1.1	1.7	1.5	2.3	1.0	1.5	1.5	2.3	2.0	3.0	1.6	2.4	2.5	3.8	3.7	5.5

CHART 4

60 DEG. SYMMETRICAL

2 ELEMENT & 3 ELEMENT
HIGH-INTENSITY
INFRARED HEATERS

Mounting Height		AREA (W x L)		Square		METAL SHEATH ELEMENT RADIANT EFF. 60%						QUARTZ TUBE ELEMENT RADIANT EFF. 80%						QUARTZ LAMP ELEMENT RADIANT EFF. 80%					
						2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem
						24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.		24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.		24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.	
Ft.	m	Ft.	m	Ft.	m	1.6 KW w/sq.ft.	2.5 KW w/sq.ft.	3 KW w/sq.ft.	4.5 KW w/sq.ft.	4 KW w/sq.ft.	6 KW w/sq.ft.	2 KW w/sq.ft.	3 KW w/sq.ft.	3 KW w/sq.ft.	4.5 KW w/sq.ft.	4 KW w/sq.ft.	6 KW w/sq.ft.	3.2 KW w/sq.ft.	4.8 KW w/sq.ft.	5 KW w/sq.ft.	7.5 KW w/sq.ft.	7.3 KW w/sq.ft.	10.95 KW w/sq.ft.
5	1.5	5.8x 10	1.8 x 3.0	58.0	5.4	16.6	25.9	31.0	46.6	41.4	62.1	27.6	41.4	41.4	62.1	55.2	82.8	44.1	66.2	69.0	103.4	100.7	151.0
6	1.8	6.9x 12	2.1 x 3.7	82.8	7.8	11.6	18.1	21.7	32.6	29.0	43.5	19.3	29.0	29.0	43.5	38.6	58.0	30.9	46.4	48.3	72.5	70.5	105.8
7	2.1	8.1x 14	2.5 x 4.3	113.4	10.8	8.5	13.2	15.9	23.8	21.2	31.7	14.1	21.2	21.2	31.7	28.2	42.3	22.6	33.9	35.3	52.9	51.5	77.2
8	2.4	9.2x 16	2.8 x 4.9	147.2	13.7	6.5	10.2	12.2	18.3	16.3	24.5	10.9	16.3	16.3	24.5	21.7	32.6	17.4	26.1	27.2	40.8	39.7	59.5
9	2.7	10.4 x18	3.2 x 5.5	187.2	17.6	5.1	8.0	9.6	14.4	12.8	19.2	8.5	12.8	12.8	19.2	17.1	25.6	13.7	20.5	21.4	32.1	31.2	46.8
10	3.0	11.5 x20	3.5 x 6.1	230.0	21.4	4.2	6.5	7.8	11.7	10.4	15.7	7.0	10.4	10.4	15.7	13.9	20.9	11.1	16.7	17.4	26.1	25.4	38.1
11	3.4	12.7 x22	3.9 x 6.7	279.4	26.1	3.4	5.4	6.4	9.7	8.6	12.9	5.7	8.6	8.6	12.9	11.5	17.2	9.2	13.7	14.3	21.5	20.9	31.4
12	3.7	13.8 x24	4.2 x 7.3	331.2	30.7	2.9	4.5	5.4	8.2	7.2	10.9	4.8	7.2	7.2	10.9	9.7	14.5	7.7	11.6	12.1	18.1	17.6	26.4
13	4.0	15 x 26	4.6 x 7.9	390.0	36.3	2.5	3.8	4.6	6.9	6.2	9.2	4.1	6.2	6.2	9.2	8.2	12.3	6.6	9.8	10.3	15.4	15.0	22.5
14	4.3	16.1 x28	4.9 x 8.5	450.8	41.7	2.1	3.3	4.0	6.0	5.3	8.0	3.5	5.3	5.3	8.0	7.1	10.6	5.7	8.5	8.9	13.3	13.0	19.4
15	4.6	17.3 x30	5.3 x 9.1	519.0	48.2	1.8	2.9	3.5	5.2	4.6	6.9	3.1	4.6	4.6	6.9	6.2	9.2	4.9	7.4	7.7	11.6	11.3	16.9
16	4.9	18.4 x32	5.6 x 9.8	588.8	54.9	1.6	2.5	3.1	4.6	4.1	6.1	2.7	4.1	4.1	6.1	5.4	8.2	4.3	6.5	6.8	10.2	9.9	14.9
17	5.2	19.6 x34	6.0 x 10.4	666.4	62.4	1.4	2.3	2.7	4.1	3.6	5.4	2.4	3.6	3.6	5.4	4.8	7.2	3.8	5.8	6.0	9.0	8.8	13.1
18	5.5	20.7 x36	6.3 x 11.0	745.2	69.3	1.3	2.0	2.4	3.6	3.2	4.8	2.1	3.2	3.2	4.8	4.3	6.4	3.4	5.2	5.4	8.1	7.8	11.8
19	5.8	21.9 x38	6.7 x 11.6	832.2	77.7	1.2	1.8	2.2	3.2	2.9	4.3	1.9	2.9	2.9	4.3	3.8	5.8	3.1	4.6	4.8	7.2	7.0	10.5
20	6.1	23 x 40	7.0 x 12.2	920.0	85.4	1.0	1.6	2.0	2.9	2.6	3.9	1.7	2.6	2.6	3.9	3.5	5.2	2.8	4.2	4.3	6.5	6.3	9.5

CHART 5

30 DEG. SYMMETRICAL

Table 3

2 ELEMENT & 3 ELEMENT HIGH-INTENSITY INFRARED HEATERS

Mounting Height		AREA (W x L)		Square		METAL SHEATH ELEMENT RADIANT EFF. 60%						QUARTZ TUBE ELEMENT RADIANT EFF. 80%						QUARTZ LAMP ELEMENT RADIANT EFF. 80%					
						2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem
						24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.		24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.		24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.	
Ft.	m	Ft.	m	Ft.	m	1.6 KW	2.5 KW	3 KW	4.5 KW	4 KW	6 KW	2 KW	3 KW	3 KW	4.5 KW	4 KW	6 KW	3.2 KW	4.8 KW	5 KW	7.5 KW	7.3 KW	10.95 KW
						w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.
5	1.5	2.7 x 10	0.8 x 3.0	27.0	2.4	35.6	55.6	66.7	100.0	88.9	133.3	59.3	88.9	88.9	133.3	118.5	177.8	94.8	142.2	148.1	222.2	216.3	324.4
6	1.8	3.2 x 12	1.0 x 3.7	38.4	3.7	25.0	39.1	46.9	70.3	62.5	93.8	41.7	62.5	62.5	93.8	83.3	125.0	66.7	100.0	104.2	156.3	152.1	228.1
7	2.1	3.8 x 14	1.2 x 4.3	53.2	5.2	18.0	28.2	33.8	50.8	45.1	67.7	30.1	45.1	45.1	67.7	60.2	90.2	48.1	72.2	75.2	112.8	109.8	164.7
8	2.4	4.3 x 16	1.3 x 4.9	68.8	6.4	14.0	21.8	26.2	39.2	34.9	52.3	23.3	34.9	34.9	52.3	46.5	69.8	37.2	55.8	58.1	87.2	84.9	127.3
9	2.7	4.9 x 18	1.5 x 5.5	88.2	8.3	10.9	17.0	20.4	30.6	27.2	40.8	18.1	27.2	27.2	40.8	36.3	54.4	29.0	43.5	45.4	68.0	66.2	99.3
10	3.0	5.4 x 20	1.6 x 6.1	108.0	9.8	8.9	13.9	16.7	25.0	22.2	33.3	14.8	22.2	22.2	33.3	29.6	44.4	23.7	35.6	37.0	55.6	54.1	81.1
11	3.4	5.9 x 22	1.8 x 6.7	129.8	12.1	7.4	11.6	13.9	20.8	18.5	27.7	12.3	18.5	18.5	27.7	24.7	37.0	19.7	29.6	30.8	46.2	45.0	67.5
12	3.7	6.5 x 24	2.0 x 7.3	156.0	14.6	6.2	9.6	11.5	17.3	15.4	23.1	10.3	15.4	15.4	23.1	20.5	30.8	16.4	24.6	25.6	38.5	37.4	56.2
13	4.0	7 x 26	2.1 x 7.9	182.0	16.6	5.3	8.2	9.9	14.8	13.2	19.8	8.8	13.2	13.2	19.8	17.6	26.4	14.1	21.1	22.0	33.0	32.1	48.1
14	4.3	7.6 x 28	2.3 x 8.5	212.8	19.6	4.5	7.0	8.5	12.7	11.3	16.9	7.5	11.3	11.3	16.9	15.0	22.6	12.0	18.0	18.8	28.2	27.4	41.2
15	4.6	8.1 x 30	2.5 x 9.1	243.0	22.8	4.0	6.2	7.4	11.1	9.9	14.8	6.6	9.9	9.9	14.8	13.2	19.8	10.5	15.8	16.5	24.7	24.0	36.0
16	4.9	8.6 x 32	2.6 x 9.8	275.2	25.5	3.5	5.5	6.5	9.8	8.7	13.1	5.8	8.7	8.7	13.1	11.6	17.4	9.3	14.0	14.5	21.8	21.2	31.8
17	5.2	9.2 x 34	2.8 x 10.4	312.8	29.1	3.1	4.8	5.8	8.6	7.7	11.5	5.1	7.7	7.7	11.5	10.2	15.3	8.2	12.3	12.8	19.2	18.7	28.0
18	5.5	9.7 x 36	3.0 x 11.0	349.2	33.0	2.7	4.3	5.2	7.7	6.9	10.3	4.6	6.9	6.9	10.3	9.2	13.7	7.3	11.0	11.5	17.2	16.7	25.1
19	5.8	10.3 x 38	3.1 x 11.6	391.4	36.0	2.5	3.8	4.6	6.9	6.1	9.2	4.1	6.1	6.1	11.3	8.2	12.3	6.5	9.8	10.2	15.3	14.9	22.4
20	6.1	10.8 x 40	3.3 x 12.2	432.0	40.3	2.2	3.5	4.2	6.3	5.6	8.3	3.7	5.6	5.6	8.3	7.4	11.1	5.9	8.9	9.3	13.9	13.5	20.3

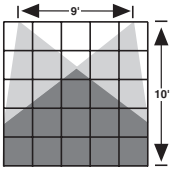
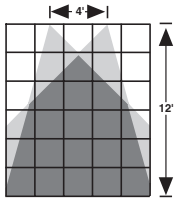
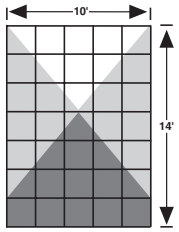
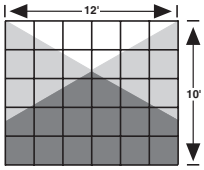
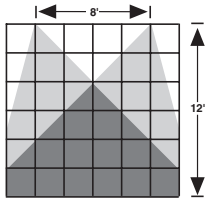
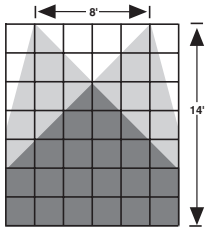
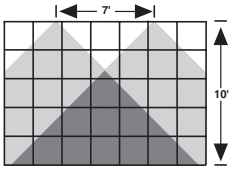
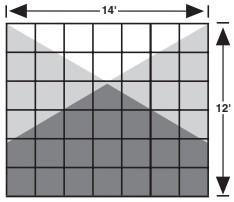
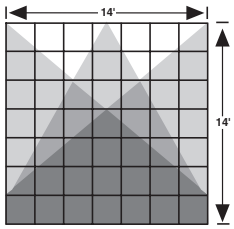
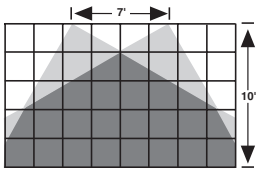
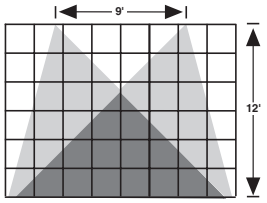
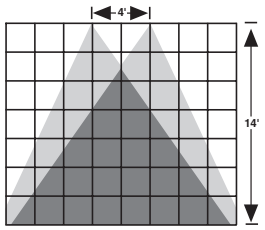
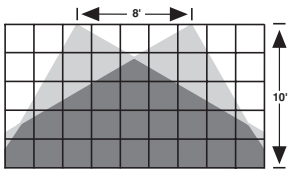
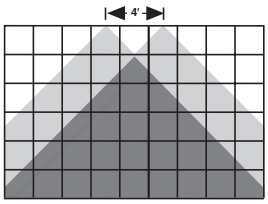
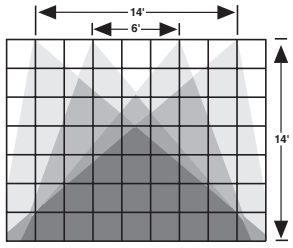
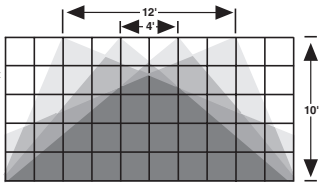
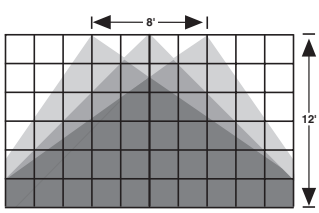
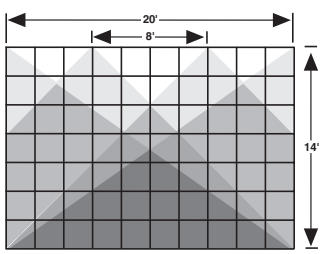
CHART 6

60 DEG. ASYMMETRICAL

2 ELEMENT & 3 ELEMENT HIGH-INTENSITY INFRARED HEATERS

Mounting Height		AREA (W x L)		Square		METAL SHEATH ELEMENT RADIANT EFF. 60%						QUARTZ TUBE ELEMENT RADIANT EFF. 80%						QUARTZ LAMP ELEMENT RADIANT EFF. 80%					
						2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem	2 Elem	3 Elem
						24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.		24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.		24" (610mm) Encl.		33" (838mm) Encl.		46" (1168mm) Encl.	
Ft.	m	Ft.	m	Ft.	m	1.6 KW	2.5 KW	3 KW	4.5 KW	4 KW	6 KW	2 KW	3 KW	3 KW	4.5 KW	4 KW	6 KW	3.2 KW	4.8 KW	5 KW	7.5 KW	7.3 KW	10.95 KW
						w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.	w/sq.ft.
5	1.5	6.3 x 10	1.9 x 3.0	63.0	5.7	15.2	23.8	28.6	42.9	38.1	57.1	25.4	38.1	38.1	57.1	50.8	76.2	40.6	61.0	63.5	95.2	92.7	139.0
6	1.8	7.5 x 12	2.3 x 3.7	90.0	8.5	10.7	16.7	20.0	30.0	26.7	40.0	17.8	26.7	26.7	40.0	35.6	53.3	28.4	42.7	44.4	66.7	64.9	97.3
7	2.1	8.8 x 14	2.7 x 4.3	123.2	11.6	7.8	12.2	14.6	21.9	19.5	29.2	13.0	19.5	19.5	29.2	26.0	39.0	20.8	31.2	32.5	48.7	47.4	71.1
8	2.4	10 x 16	3.0 x 4.9	160.0	14.7	6.0	9.4	11.3	16.9	15.0	22.5	10.0	15.0	15.0	22.5	20.0	30.0	16.0	24.0	25.0	37.5	36.5	54.8
9	2.7	11.3 x 18	3.4 x 5.5	203.4	18.7	4.7	7.4	8.8	13.3	11.8	17.7	7.9	11.8	11.8	17.7	15.7	23.6	12.6	18.9	19.7	29.5	28.7	43.1
10	3.0	12.5 x 20	3.8 x 6.1	250.0	23.2	3.8	6.0	7.2	10.8	9.6	14.4	6.4	9.6	9.6	14.4	12.8	19.2	10.2	15.4	16.0	24.0	23.4	35.0
11	3.4	13.8 x 22	4.2 x 6.7	303.6	28.1	3.2	4.9	5.9	8.9	7.9	11.9	5.3	7.9	7.9	11.9	10.5	15.8	8.4	12.6	13.2	19.8	19.2	28.9
12	3.7	15 x 24	4.6 x 7.3	360.0	33.6	2.7	4.2	5.0	7.5	6.7	10.0	4.4	6.7	6.7	10.0	8.9	13.3	7.1	10.7	11.1	16.7	16.2	24.3
13	4.0	16.3 x 26	5.0 x 7.9	423.8	39.5	2.3	3.5	4.2	6.4	5.7	8.5	3.8	5.7	5.7	8.5	7.6	11.3	6.0	9.1	9.4	14.2	13.8	20.7
14	4.3	17.5 x 28	5.3 x 8.5	490.0	45.1	2.0	3.1	3.7	5.5	4.9	7.3	3.3	4.9	4.9	7.3	6.5	9.8	5.2	7.8	8.2	12.2	11.9	17.9
15	4.6	18.8 x 30	5.7 x 9.1	564.0	51.9	1.7	2.7	3.2	4.8	4.3	6.4	2.8	4.3	4.3	6.4	5.7	8.5	4.5	6.8	7.1	10.6	10.4	15.5
16	4.9	20 x 32	6.1 x 9.8	640.0	59.8	1.5	2.3	2.8	4.2	3.8	5.6	2.5	3.8	3.8	5.6	5.0	7.5	4.0	6.0	6.3	9.4	9.1	13.7
17	5.2	21.3 x 34	6.5 x 10.4	724.2	67.6	1.3	2.1	2.5	3.7	3.3	5.0	2.2	3.3	3.3	5.0	4.4	6.6	3.5	5.3	5.5	8.3	8.1	12.1
18	5.5	22.5 x 36	6.9 x 11.0	810.0	75.9	1.2	1.9	2.2	3.3	3.0	4.4	2.0	3.0	3.0	4.4	4.0	5.9	3.2	4.7	4.9	7.4	7.2	10.8
19	5.8	23.8 x 38	7.3 x 11.6	904.4	84.7	1.1	1.7	2.0	3.0	2.7	4.0	1.8	2.7	2.7	4.0	3.5	5.3	2.8	4.2	4.4	6.6	6.5	9.7
20	6.1	25 x 40	7.6 x 12.2	1000.0	92.7	1.0	1.5	1.8	2.7	2.4	3.6	1.6	2.4	2.4	3.6	3.2	4.8	2.6	3.8	4.0	6.0	5.8	8.8

MOUNTING HEIGHT

PATTERN WIDTH	10 FT	12 FT	14 FT
10 FT	REFL 60º • TILT 22º • TRANSVERSE SPACING 9' 	REFL 60º • TILT 15º • TRANSVERSE SPACING 4' 	REFL 60º • TILT 10º • TRANSVERSE SPACING 10' 
12 FT	REFL 60º • TILT 30º • TRANSVERSE SPACING 12' 	REFL 60º • TILT 15º • TRANSVERSE SPACING 8' 	REFL 60º • TILT 15º • TRANSVERSE SPACING 8' 
14 FT	REFL 90º • TILT 0º • TRANSVERSE SPACING 7' 	REFL 60º • TILT 30º • TRANSVERSE SPACING 14' 	CENTER REFL 60º • TILT 0º ON CENTER LINE REFL 60º • TILT 20º • TRANSVERSE SPACING 14' 
16 FT	REFL 90º • TILT 15º • TRANSVERSE SPACING 7' 	REFL 60º • TILT 15º • TRANSVERSE SPACING 9' 	REFL 60º • TILT 5º • TRANSVERSE SPACING 4' 
18 FT	REFL 90º • TILT 15º • TRANSVERSE SPACING 8' 	REFL 90º • TILT 0º • TRANSVERSE SPACING 4' 	INSIDE PAIR REFL 60º • TILT 10º • TRANSVERSE SPACING 6' OUTSIDE PAIR REFL 60º • TILT 20º • TRANSVERSE SPACING 14' 
20 FT	INSIDE PAIR: REFL 90º • TILT 5º • TRANSVERSE SPACING 4' OUTSIDE PAIR: REFL 90º • TILT 22º • TRANSVERSE SPACING 12' 	CENTER UNIT REFL 90º • TILT 0º ON CENTER LINE OUTSIDE PAIR REFL 90º • TILT 10º • TRANSVERSE SPACING 8º 	INSIDE PAIR REFL 90º • TILT 0º • TRANSVERSE SPACING 8' OUTSIDE PAIR REFL 90º • TILT 10º • TRANSVERSE SPACING 20' 

NOTES:

CONTROL OPTIONS

There are a wide variety of methods available to control electric radiant and infrared heaters.

For radiant ceiling panel, cove heater and total area infrared heating applications the most common method of control is a **Thermostat**, either built-in (Cove Heaters) or remote wall mounted.

Remote wall mounted thermostats can be either single or double pole, but should include a heat anticipator to reduce the temperature swing within the heated space between heat off and heat on cycles.

Remote wall mounted thermostats should be located on interior walls or columns away from drafts or heat producing items. Because of the radiant heat wave length of ceiling panels and cove heaters no shielding is required around the thermostat since the radiant heat will not go through the thermostat cover but will be absorbed and reflected by it. However a heat shield is recommended for infrared applications to keep the thermostat out of the direct rays of the heater.

If multiple panels or heaters will be required (long walkways or lobbies in commercial facilities) and the amperage rating of the thermostat will be exceeded a combination of a thermostat and a Contactor would be an suitable alternative.

Power Control Panels consist of a line voltage primary to 120 volt (or 24 volt) secondary control transformer and one or more 3 pole contactors.

They are used in applications where a large number of radiant heaters, or multiple high KW infrared heaters, are utilized.

The contactor holding coils can be wired in parallel for single stage operation where all the heaters are energized at the same time, or they can be wired individually or in groups for multi-stage operation or to control sections of a large grid.

These power control panels can be used with Metal Sheath, Quartz Tube or Quartz Lamp elements.
Power control panels are usually mounted near the branch circuit distribution panel.

Percentage Timer Type Control (For use with metal sheath type element heaters only.) DO NOT USE PERCENTAGE TIMERS WITH QUARTZ TUBE OR QUARTZ LAMPS. This single contactor control panel is a continuing controller that turns ON and OFF according to a preset time period. The time period for these controllers is two minutes. Dial is set by choosing a percentage of ON time. OFF time will then be the remainder of time on the two minute cycle. This allows control to a comfort level when 100% of the heat is not required.

The two minute cycling of the percentage timer will only come ON during such times that the thermostat is calling for heat.

The use of percentage timers to control radiant ceiling panels or cove heaters is not recommended.

Time Delay Controller. This single panel is provided with a time delay timer that energizes a specific load in an area for intermittent periods of time. It comes with a momentary push-button switch, which activates the heating load for a preset cycle (adjustable between 1 and 30 minutes). The system is de-energized once the timer has cycled. Once the cycle has started, any push of the button will no longer affect the timing. The cycle has to finish, the system has to come off, and only then, can the system restart for another cycle with the push of the button.

The timer has the facility to be able to adjust its time period in the field. It is preset from the factory at the maximum 30 minute delay.

HOW TO ORDER REPAIR PARTS

In order to obtain any needed repair or replacement parts, warranty service or technical information, please contact Marley Engineered Products Service Center toll-free by calling 1-800-642-HEAT.

When ordering repair parts, always give the information listed as follows:

1. The Part Number
2. The Model Number
3. The Part Description
4. Date of Manufacture

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