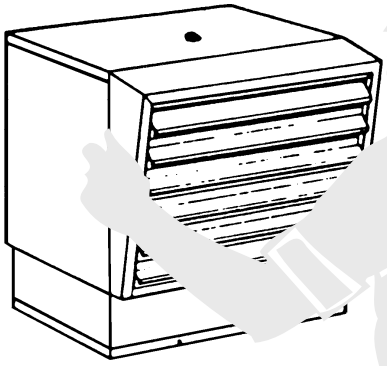
QMARK®

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 **QMARK** Electric Unit Heater product line and how the six 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.**
Commercial	MUH (Including MUH35)
Industrial	IUH (Including MWUH5004)
Wash-Down / Corrosion Resistant	JUW
Explosion Proof	GUX

The scope of information in this manual is brief. For a more in depth analysis of QMARK electric unit 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 UNIT HEATER

DESIGN AND APPLICATION GUIDE

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ELECTRIC UNIT HEATERS

GENERAL

Electric Unit Heaters are fan equipped, recirculating air heaters that convert electrical energy into heat, transfer that heat to the air and blow the heated air back into the space to increase comfort or prevent freezing conditions.

The unit heaters discussed in this publication are categorized into six general types based on their construction and their use in typical applications.

SIX TYPES OF UNIT HEATERS

MUH Series
COMMERCIAL UNIT HEATERS

Draw-through style electric unit heaters for use in commercial or industrial applications that require high air volume with low to moderate air velocity and throw.

Supplied adjustable discharge louvers and optional diffusers allow a variety of air patterns.

Heaters can be mounted for horizontal or vertical air flow.

Typical applications: Low to medium bay areas.

Factories, Warehouses, Garages, Stores, Power Stations and Aircraft Hangers, Agricultural Barns, Industrial assembly areas, Enclosed outside smoking areas.

JUW Series
WASH-DOWN / CORROSION-RESISTANT UNIT HEATERS

Heavy duty, blow-through electric unit heaters with non-adjustable louvers for use in dirty or corrosive applications.

Stainless steel case, NEMA 4X rated non-metallic control box and epoxy coated - totally enclosed motor allow heater to be hosed down for cleaning.

Stainless steel, universal type swivel mounting bracket supplied with heater.

Horizontal air flow only.

Typical applications: Low to medium bay dirty, harsh or corrosive areas.
Coal Handling Operations, Food Processing Plants, Car washes, Canneries, Dairies, Swimming Pools.

IUH Series
INDUSTRIAL UNIT HEATERS

Heavy duty, blow-through electric unit heaters for use in applications that require moderate air volume and high heat transfer (Delta “T”). Cabinet is finished with an epoxy coating for added corrosion resistance.

5 & 7.5 KW heaters equipped with a ceiling mounting bracket for horizontal or vertical air flow or any position between. Larger KW units can be mounted for horizontal air flow only.

Typical applications: Low to medium bay areas.

Garages, Service Stations, Factories.

GUX Series
EXPLOSION PROOF UNIT HEATERS

Heavy duty, blow-through electric unit heaters with adjustable louvers for use in areas classified as Class I, Groups C & D or Class II, Groups F & G, Division 1 & 2, with a T3C ignition temperature rating.

Epoxy coated heavy gauge steel cabinet surrounds a 14 gauge steel frame.

Optional brackets allow Pole, Wall or Ceiling mounting.

Horizontal air flow only.

Typical applications: Low to medium bay hazardous areas covered by the above classifications.

Oil Refineries, Petrochemical Plants, Pumping Stations, Chemical Storage areas, Coal Mines.

Electric Unit Heater Application Matrix

Application Suggestions - For Information Purposes Only

LOCATION	UNIT HEATER TYPE					
	COMMERCIAL	DOWN-FLOW	INDUSTRIAL	PORTABLE	WASH-DOWN	EXPLOSION PROOF
RESIDENTIAL						
Basements	◒		○	◉		
Recreation Rooms				◉		
Laundry Room				◉		
Work Room	◒		○	◉		
Storage Building	◉		◒			
Garage	◉		◒	◒		
Crawl Space	◒		◉			
INDUSTRIAL NON-HAZARDOUS						
Power Generating Stations	◒	◉	◉		◉	
Car Wash			◒		◉	
Coal Handling			◒		◉	
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 Facilities	◒	◒	◉		◉	
Assembly Lines	◉	◒	◉			
Dairies	◒		◉			
Food Processing Plant	◒		◒		◉	
Break Room	◉		◒			
Outside Smoking Areas	◒		◉			

Application Suggestions - For Information Purposes Only

LOCATION	UNIT HEATER TYPE					
	COMMERCIAL	DOWN-FLOW	INDUSTRIAL	PORTABLE	WASH-DOWN	EXPLOSION PROOF
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	◒		◉	○		
INSTITUTIONAL						
Entrances	◉		◒			
Swimming Pool Areas			◒		◉	
Correctional Facilities		◉	◒		◉	
Rest Rooms	◉		◉			
Maintenance Rooms	◉		◉			
Cafeteria	◉	◒	◉			
Hallways	◉		◉			
Outside Smoking Areas	◒		◉			
HAZARDOUS LOCATIONS						
Coal Mines						◉
Graineries						◉
Paint Storage						◉
Chemical Storage						◉
Petroleum Plants						◉

○ = GOOD, ◒ = BETTER, ◉ = BEST

UNIT HEATER DESIGN

The fan, driven by the motor, moves air through the elements. When the elements are energized they produce heat. This heat is transferred to the colder air as it passes through (or across) the elements.

The relative location of the element to the fan (how the air is passed through the heating element) is one of the basis for different unit heater designs.

Unit heaters discussed in this guide fall into two general designs;

Draw-thru (Pull-thru) heaters and **Blow-thru heaters**

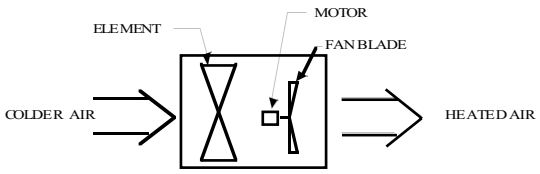


Figure A

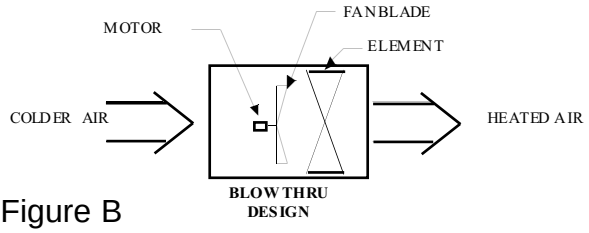


Figure B

Draw-thru units (Figure “A”) draw the colder air through the elements, while Blow-thru heaters (Figure “B”) blow the colder air through the elements.

UNIT HEATER COMPONENTS

All electric unit heaters contain components that work together to complete the task of delivering heated air to the space.

ELEMENTS convert electrical energy to heat by passing electrical current through a specifically designed resistance wire.

Elements fall into two basic groups, open coil and metal sheath, based on their construction.

Open coil elements are spiraled or weaved resistance wire that is directly exposed to the air stream.

Metal sheathed elements are constructed of spiral wound resistance wire, surrounded by an insulating power (magnesium oxide MgO), encased in a metal enclosure.

All unit heaters discussed in this manual are provided with metal sheath elements for safety and reliability.

FAN (FAN BLADE), is a propeller type device, used to move the air through the unit heater. Unit heaters discussed in this manual are directly coupled to an electric motor. They are not belt driven

Propeller type fans can move large amounts of air against a small static making them ideally suited to unit heater applications.

LOUVERS are discharge air deflectors, either adjustable or non-adjustable, that change or route the air flow.

OVER TEMPERATURE LIMIT is a normally closed temperature sensing device, located on or in close proximity to the element, designed into the heater to open if an abnormally hot condition occurs. Abnormally hot conditions are usually the result of a loss of moving air across the element.

Frequent causes of over temperature limit opening are; blocked inlet or discharge, motor stoppage and loose fan.

The **FAN DELAY** is a normally open device that allows the elements to get warm prior to energizing the fan. This increases occupant comfort by preventing a “blast of cold air”.

When the space heating requirements are satisfied, the fan delay will keep the motor energized after the elements are turned off to remove any residual heat which increases heater component life.

Unit heater **MOTORS** are permanently lubricated electrical devices that rotate the fan to move the heated air from the heater to the space.

When the unit heater wattage load dictates, one or more **CONTACTORS** are employed to switch the electrical current to the elements and / or the motor. Contactors referred to in this manual are 2 or 3 pole switching devices with a holding coil that is energized to close the contacts. Usually a thermostat or fan delay will control when the contactor is energized.

UNIT HEATER APPLICATION

The application of electric unit heaters requires the consideration of three factors: *Design area type* (Commercial, Industrial, Residential, Explosive atmosphere, Dirty environment, Spot heating), *Design area occupancy and use* (Large groups of settled people, Warehouse areas that are infrequently used, Large factory areas containing multiple assembly areas), *Heating load requirement*.

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

APPLICATIONS

Use unit 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.

Standard commercial and industrial unit heaters have hot and arcing or sparking parts inside, and should not be used in potentially explosive atmospheres. Explosion Proof unit heaters may be better suited for these applications.

Explosion Proof unit heaters are supplied at a T3C (320 deg. F, 160 Deg. C) temperature rating. The specifier is responsible for the heater acceptability with the gasses present in the application.

The finish of standard commercial or industrial unit heaters are not intended for direct salt spray exposure in marine applications, or the highly corrosive atmospheres of swimming pool or chemical storage bins. Wash-Down / Corrosion Resistant unit heaters may be better suited for this application.

HEATER WEIGHT

The ceiling or wall mounting structure and the anchoring provisions must be of sufficient strength to support the combined weight of the heater and the mounting bracket.

See the manual supplied with each unit heater for specific heater and accessory weights.

CLEARANCES

When locating and installing unit heaters, a minimum clear, unobstructed distance, (minimum clearance) must be maintained between the heater and any object or surface that may restrict the air entering or the air discharging the heater.

Check the manual supplied with each unit heater for specific clearance dimensions.

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.

SELECTING THE SIZE and QUANTITY OF HEATERS

STRATIFICATION

If air within the heated space is not mixed properly it will stratify with hot air at the ceiling or roof and cold air at floor level.

Stratified air increases the heat loss through the roof and reduces the comfort level of the space occupants.

When hot air is trapped at the ceiling the temperature difference between the air inside and outside the roof area increases causing a higher heat loss.

At the same time, this heated air is wasted energy since it does not improve the conditions within the heated space. Colder air settles at the floor level adding to the discomfort of any occupants.

Heater type, Discharge air volume (CFM), Mounting height, Air flow orientation and throw, as well as any louver or diffuser selected, will affect air stratification.

AIR VOLUME and VELOCITY

To reduce stratification we recommend the total volume (CFM) of all the units circulate the air approximately 2 to 4 times per hour, depending on the application.

The velocity of the discharge air and the resultant change in temperature across the heater (Delta “T”) will affect occupant comfort.

Drafty conditions, caused by directing high velocity / low Delta “T” air directly on stationary people can be avoided by using multiple lower velocity units.

TABLE 1 contains typical volume (CFM) and Delta “T” data for various types of unit heaters.

MOUNTING HEIGHT

Heaters must be mounted at least 6 to 7 ft. (1829 to 2134 mm) above the floor to prevent accidental contact with the fan blade which could cause injury.

Heaters should always be located above the minimum mounting height, as close to the ceiling as possible, but not above the maximum mounting height of the specific heater.

Heaters mounted at heights greater than recommended will result in poor heat distribution to the floor level which can cause occupant discomfort.

Heaters mounted too far below the ceiling will produce an accumulation of warm (stratificated) air at the ceiling increasing the heat loss.

TABLES 2 & 3 show the maximum mounting height requirements for typical heaters with air flow and pattern dimensions.

CONSIDERATIONS

In instances where large *groups of people* are settled, a number of smaller KW heaters would normally be used.

Utilizing heaters in this manner best distributes uniform heat, prevents hot drafts, reduces noise levels and balances the electrical demand.

For *warehouse areas or storage rooms*, where heat distribution and constant temperatures are less important, fewer heaters of higher capacity would normally be a better strategy.

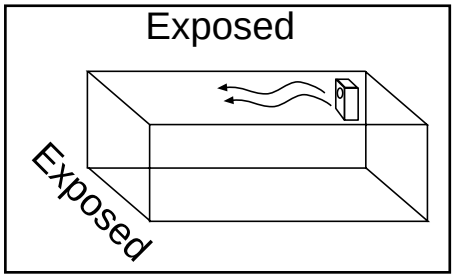
Utilizing heaters in this manner reduces the initial installation cost since fewer heaters will be installed.

MOUNTING FOR HORIZONTAL AIR THROW

Units should not be mounted for horizontal air flow in areas having ceiling heights in excess of 15 - 18 ft. (4.6 to 5.5 m)

Small rooms can be heated by one unit heater. Where two walls are exposed, the heater should be mounted as shown in **Figure 1**.

Figure 1



Locate the unit heater so that its air stream wipes the exposed wall without blowing at it.

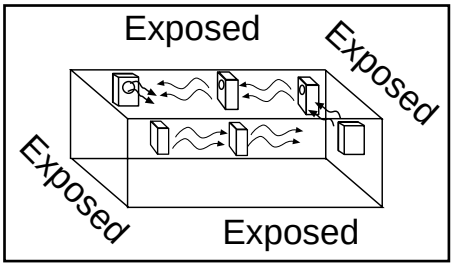
SELECTING THE SIZE and QUANTITY OF HEATERS (Cont.)

In larger rooms, multiple units should be located as shown in **Figure 2.**

Units should be located so that the air stream of one supports that of another thus setting up a circulatory air movement.

Distance between units should be approximately 1-1/2 times the published air throw.

Figure 2

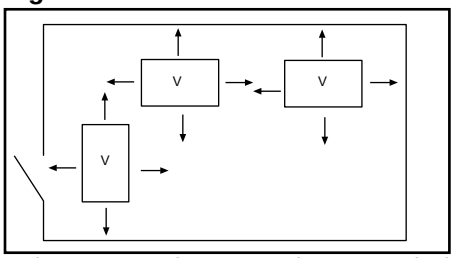


MOUNTING FOR VERTICAL AIR THROW

Units should be mounted for vertical air throw where mounting for horizontal air flow may interfere with assorted material handling equipment and in high bay areas. Size and selection should be based on recommended mounting height.

The heaters should be situated to provide free air circulation as shown in **Figure 3**.

Figure 3



In instances where people are settled or normally in the same location optional diffusers may be employed to reduce high air velocity and at the same time disperse heated air in a uniform pattern.

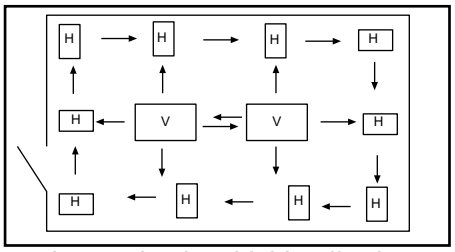
Unit heaters mounted for vertical air flow are frequently used to combat cold air inrush when *loading dock doors* are opened. Heaters should be arranged to blow heated air vertically in front of the opening as shown in **Figure 3**.

COMBINING UNITS MOUNTED FOR HORIZONTAL AND VERTICAL AIR THROW

Where square footage is large and comfort essential, both horizontal and vertical air throw unit heaters may best serve the requirements.

EXAMPLE: Large factory areas with multiple assembly areas, or aircraft hangers where people are not always working in a particular location.
Figure 4 illustrates the use of unit heaters mounted for both horizontal and vertical air flow.

Figure 4



Dual mounting is a highly effective method to eliminate stratification and increase the comfort level of the occupants.

CONTROL GUIDELINES

Electric unit heaters can be controlled, individually by a built-in thermostat, in groups by a building automation system or any number of options between. When determining the control system consider the required degree of accuracy as well as the designed space parameters.

Unit heater control circuits are either low voltage (usually 24 VAC but occasionally 120 VAC) or line voltage (usually the heater supply voltage).

A common rule of thumb is that electronic or 24 VAC mercury bulb thermostats controls are more accurate than standard bi-metal line voltage controls.
Note: Care should be exercised when considering the location of low voltage control devices supplied from the unit heater integral control transformer. The distance from the heater to the control device should not exceed 25 feet (7.6 m). At longer distances line losses may prevent the heater integral contactors from operating reliably.

A **THERMOSTAT** is a temperature sensing device, used to control the cycling of the heater.

In most unit heaters the thermostat controls a contactor which in turn cycles the elements.

However, the standard 3 & 5 KW commercial unit heaters, with supply voltage of 208, 240 and 277 VAC do not have contactors.

If the optional contactor is not requested the thermostat will control the elements directly.

Note: 208 & 240 VAC, **3 Phase**, 3 and 5 KW - Direct Thermostat Control:

These heaters require a two stage thermostat or a two <u>simultaneous cycling</u> pole thermostat to cycle two of the three supply power legs.

Do Not Use a standard DP thermostat:

A standard DP thermostat will cycle one of the three input legs (the other pole being an on-off switch), The element will be partially energized at all times through the other two legs.

❑❑❑

Thermostats are either *integral* or *remote*.

Integral thermostats are factory or field mounted on the heater, and do not require external control wiring saving installation cost.

However since integral thermostats are on heaters, mounted above the normal occupied zone, they are best used in areas that are usually not occupied or do not require close temperature control.

Remote thermostats are located in the area to be heated and require the additional expense of wiring between the heater and the thermostat.

Their location within the designed heating space makes them best suited for areas that require higher control accuracy or that are occupied.

Locating Remote Thermostats

The selection of the thermostat location should be in the area served by the heater, on an interior wall or post.

Do not locate thermostats;
a) On exterior walls, b) In the direct discharge of the heater, c) Above any heat producing devices (coffee stations, copy machines or other machinery), d) Too far from the unit heater (poor control and over / under heating of the design space).

INDIVIDUAL HEATER CONTROL

The basic method of unit heater control is with each heater controlled by its own integral or remount mounted thermostat, based on the accuracy required.

Table 1

AIR FLOW & DELTA "T"

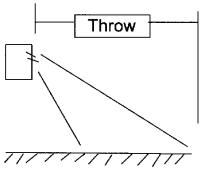
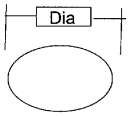
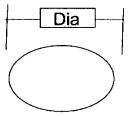
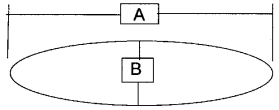
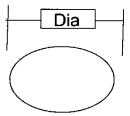
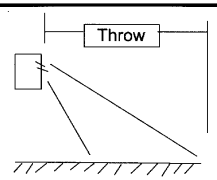
Typical Volume - CFM,
Delta "T" [Deg. F (Deg. C)]

Heater KW	UNIT HEATER TYPE											
	Commercial		Down-Flow		Industrial		Portable		Wash-Down		Exp. Proof	
	Volume (CFM)	Delta T Deg. F (Deg. C)	Volume (CFM)	Delta T Deg. F (Deg. C)	Volume (CFM)	Delta T Deg. F (Deg. C)	Volume (CFM)	Delta T Deg. F (Deg. C)	Volume (CFM)	Delta T Deg. F (Deg. C)	Volume (CFM)	Delta T Deg. F (Deg. C)
3.0	350	27 (15)	---	---	---	---	---	---	700	14 (8)	700	14 (8)
4.0	---	---	---	---	---	---	145	86 (30)	---	---	---	---
4.8	---	---	---	---	---	---	149	101 (38)	---	---	---	---
5.0	350	45 (25)	---	---	270	60 (33)	---	---	700	24 (13)	700	23 (13)
5.6	---	---	---	---	---	---	156	112 (44)	---	---	---	---
7.5	650	37 (21)	---	---	270	85 (47)	---	---	700	35 (19)	800	30 (17)
10.0	650	49 (27)	750	46 (26)	500	63 (35)	---	---	1450	22 (12)	800	40 (22)
12.0	---	---	---	---	---	---	---	---	1450	26 (14)	---	---
15.0	910	52 (29)	1330	39 (22)	750	63 (35)	---	---	2400	21 (12)	1228	40 (22)
20.0	1320	48 (27)	1330	51 (28)	1000	63 (35)	---	---	2400	28 (16)	1825	35 (19)
25.0	2100	44 (24)	1980	43 (24)	1300	61 (34)	---	---	2400	35 (19)	2735	30 (17)
30.0	2100	53 (29)	1980	52 (29)	1800	53 (29)	---	---	2400	42 (23)	2735	35 (19)
35.0	---	---	---	---	---	---	---	---	2500	48 (27)	---	---
38.4	---	---	---	---	---	---	---	---	2400	54 (30)	---	---
40.0	3000	49 (27)	1980	69 (38)	---	---	---	---	---	---	---	---
50.0	3000	61 (34)	2500	69 (38)	---	---	---	---	---	---	---	---

Mounting Height & Air Delivery

Table 2

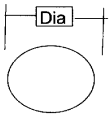
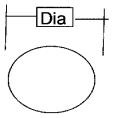
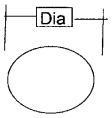
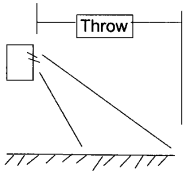
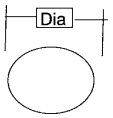
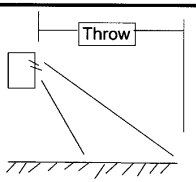
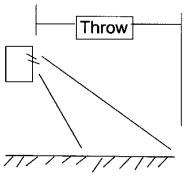
Typical Maximum Mounting Height [ft. (mm)] and Air Delivery (Throw and Patterns) [ft. (mm)]

Heater KW	UNIT HEATER TYPE: Commercial – Horiz. Air Flow – Std. Adjustable Louvers		Commercial – Vertical Air Flow – Std. Adjustable Louvers		Commercial – Vertical Air Flow – Anemostat Diffuser		Commercial – Vertical Air Flow – Louver Diffuser			Commercial – Vertical Air Flow – Radial Diffuser		Portable – Horiz. Air Flow	
													
	Maximum Mounting Height	Air Throw	Maximum Mounting Height	Pattern Diameter	Maximum Mounting Height	Pattern Diameter	Maximum Mounting Height	Pattern Dimention A	Pattern Dimention B	Maximum Mounting Height	Pattern Diameter	Maximum Mounting Height	Air Throw
3.0	8 (2439)	12 (3658)	9 (2743)	18 (5486)	8 (2439)	18 (5486)	9 (2743)	25 (7620)	12 (3658)	9 (2743)	20 (6096)	--------	--------
4.0	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	8 (2438)	12 (3658)
4.8	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	8 (2438)	12 (3658)
5.0	8 (2439)	12 (3658)	9 (2743)	18 (5486)	8 (2439)	18 (5486)	9 (2743)	25 (7620)	12 (3658)	9 (2743)	20 (6096)	--------	--------
5.6	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	8 (2438)	12 (3658)
7.5	9 (2743)	18 (5486)	14 (4267)	26 (7925)	12 (3658)	26 (7925)	14 (4267)	39 (11887)	19 (5791)	14 (4267)	31 (9495)	--------	--------
10.0	9 (2743)	18 (5486)	14 (4267)	26 (7925)	12 (3658)	26 (7925)	14 (4267)	39 (11887)	19 (5791)	14 (4267)	31 (9495)	--------	--------
15.0	11 (3353)	35 (10668)	20 (6096)	35 (10668)	15 (4572)	35 (10668)	18 (5486)	50 (15240)	25 (7620)	18 (5486)	40 (12192)	--------	--------
20.0	12 (3658)	41 (12497)	23 (7010)	40 (12192)	17 (5182)	40 (12192)	20 (6096)	56 (17069)	28 (8534)	20 (6096)	45 (13716)	--------	--------
25.0	13 (3962)	50 (15240)	23 (7010)	63 (19202)	19 (5791)	60 (18288)	23 (7010)	68 (20726)	32 (9754)	23 (7010)	69 (21031)	--------	--------
30.0	12 (3658)	50 (15240)	20 (6096)	55 (16764)	17 (5182)	55 (16764)	20 (6096)	72 (21946)	36 (10973)	20 (6096)	60 (18288)	--------	--------
40.0	15 (4572)	60 (18288)	28 (8534)	70 (21336)	22 (6706)	77 (23470)	24 (7315)	88 (26822)	44 (13411)	24 (7315)	75 (22860)	--------	--------
50.0	15 (4572)	60 (18288)	25 (7620)	63 (19202)	20 (6096)	70 (21336)	22 (6706)	80 (24384)	40 (12192)	22 (6706)	68 (20726)	--------	--------

Mounting Height & Air Delivery

Table 3

Typical Maximum Mounting Height [ft. (mm)] and Air Delivery (Throw and Patterns) [ft. (mm)]

Heater KW	Down-Flow / Vertical Air Flow / Std. No Diffusers		Down-Flow / Vertical Air Flow / Adj. Vane Diffuser		Down-Flow / Vertical Air Flow / Cone Diffuser		Industrial / Horiz. Air Flow / Std. Adjustable Louvers		Industrial / Vertical Air Flow / Std. Adjustable Louvers		Wash-Down / Horiz. Air Flow / Std. Fixed Louvers		Exp. Proof / Horiz. Air Flow / Std. Adjustable Louvers	
														
	Maximum Mounting Height	Pattern Diameter	Maximum Mounting Height	Pattern Diameter	Maximum Mounting Height	Pattern Diameter	Maximum Mounting Height	Air Throw	Maximum Mounting Height	Pattern Diameter	Maximum Mounting Height	Air Throw	Maximum Mounting Height	Air Throw
3.0	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	8 (2439)	26 (7925)	8 (2439)	15 (4572)
5.0	---------	---------	---------	---------	---------	---------	8 (2438)	16 (4877)	11 (3353)	18 (5486)	8 (2439)	26 (7925)	8 (2439)	15 (4572)
7.5	---------	---------	---------	---------	---------	---------	8 (2438)	18 (5486)	11 (3353)	18 (5486)	8 (2439)	26 (7925)	8 (2439)	20 (6096)
10.0	14 (4267)	25 (7620)	18 (5486)	28 (8534)	12 (3658)	31 (9449)	9 (2743)	20 (6096)	---------	---------	10 (3048)	43 (13106)	10 (3048)	20 (6096)
12.0	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	10 (3048)	43 (13106)	---------	---------
15.0	20 (6096)	25 (7620)	25 (7620)	25 (7620)	18 (5486)	35 (10668)	11 (3353)	28 (8534)	---------	---------	11 (3353)	50 (15240)	11 (3353)	33 (10058)
20.0	18 (5486)	22 (6706)	23 (7010)	23 (7010)	16 (4877)	30 (9144)	13 (3962)	32 (9754)	---------	---------	12 (3658)	50 (15240)	12 (3658)	49 (14935)
25.0	22 (6706)	45 (13716)	28 (8534)	40 (12192)	19 (5791)	50 (15240)	14 (4267)	34 (10363)	---------	---------	13 (3962)	50 (15240)	13 (3962)	73 (22250)
30.0	20 (6096)	43 (13106)	26 (7925)	38 (11582)	16 (4877)	48 (14630)	15 (4572)	38 (11582)	---------	---------	15 (4572)	50 (15240)	15 (4572)	73 (22250)
35.0	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	15 (4572)	50 (15240)	---------	---------
38.4	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	15 (4572)	50 (15240)	---------	---------
40.0	18 (5486)	35 (10668)	24 (7315)	35 (10668)	15 (4572)	43 (13106)	---------	---------	---------	---------	---------	---------	---------	---------
50.0	28 (8534)	40 (12192)	28 (8534)	40 (12192)	18 (5486)	45 (13716)	---------	---------	---------	---------	---------	---------	---------	---------

Control Guidelines (Cont.)

In large areas where more than one unit heater (each with its own thermostat) is employed, care must be exercised to insure that the thermostat of one heater is not affected by the discharge air of another heater.

MULTI-HEATER CONTROL

In many cases it may be necessary to control multiple unit heaters with one thermostat.

As stated above the selection of a thermostat and its location should be based on the desired accuracy requirements. However, in this case thermostat location is more critical.

A location in the center of the heated space is best but, be aware of the distance between the unit heaters and the thermostat. If the thermostat is located too far from the heaters it will result in over and under heated pockets within the design space.

Care must be taken to locate the thermostat in an area not in the direct air flow of any heater.

Note: If each of the unit heaters to be controlled is supplied with its own control transformer, these control transformers must be connected in phase with each other to prevent serious damage to the heater and the thermostat.

HEAT RECOVERY THERMOSTAT

A heat recovery thermostat is an energy savings device that allows the heater to deliver "hot" air to the design area without the elements heating it.

There are two methods of heat recovery control.

With the first - If the temperature at the space thermostat falls below its set point its contacts will close.

If the heat recovery thermostat, which is located at the heater, senses air temperature above its set point, it prevents the elements from energizing and energizes the fan motor to blow the "hot" air into the design area.

If the air temperature at the heat recovery thermostat falls below its set point but the space thermostat is still not satisfied, the heater elements will energize in the normal sequence.

When the space thermostat is satisfied its contacts will open and the heater will be deenergized.

On the second type - the heat recovery thermostat is not connected into the space thermostat circuit.

In these heaters the heat recovery thermostat will energize the fan motor delivering heated air to the design space any time the ambient air, at the heat recovery thermostat, is above its set point even if the space thermostat is satisfied.

SUMMER FAN SWITCH

(Fan Auto - On Switch)
(Fan Only Switch)

A Summer Fan Switch, more accurately called a Fan Auto - On Switch or Fan Only Switch, gives the space occupant the ability to use the unit heater for air circulation and a cooling effect.

With the switch in the *Fan Auto* position, fan operation is controlled in the normal manner by the space thermostat in conjunction with the heater elements.

When the switch is in the *Fan On* position some heaters discussed in this manual are designed for continuous fan operation, while others are designed for fan only operation.

Continuous Fan:

Some unit heaters have a Fan Auto - On Switch which is not connected to the space thermostat circuit.

In these heaters the fan motor will be energized any time the switch is in the "ON" position.

If the space thermostat is satisfied (not calling for heat) the elements will remain off.

However, if the space temperature falls below the set point of the space thermostat, the heater elements will be energized in the normal sequence.

The Fan Auto - On switch can be placed in the Fan On position for year round operation.

In the summer the fan will provide circulating air movement.

During the heating season, the consistently moving air will reduce stratification, provide an even air distribution and, since the elements may cycle less often, reduce operating cost.

Fan Only:

If the unit heater is equipped with this type Fan Auto - On Switch the fan will be energized any time the switch is in the "ON" position but, the thermostat circuit will be disabled, keeping the elements deenergized.

❑❑❑

DISCONNECT SWITCH

The primary purposes of a disconnect switch is to completely shut down the heater and provide an additional level of safety from electrical shock and personal injury hazards for the personnel working on the heater.

The disconnect switch opens (disconnects) the sources of electrical power to the unit.

The disconnect switch(s) may be located on the unit heater or at a remote location.

Note: There may be more than one source of electrical power supplied to the heater (i.e. a separate control or motor circuit) and it may be necessary to locate more than one disconnect switch to completely disconnect the heater from all electrical power.

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