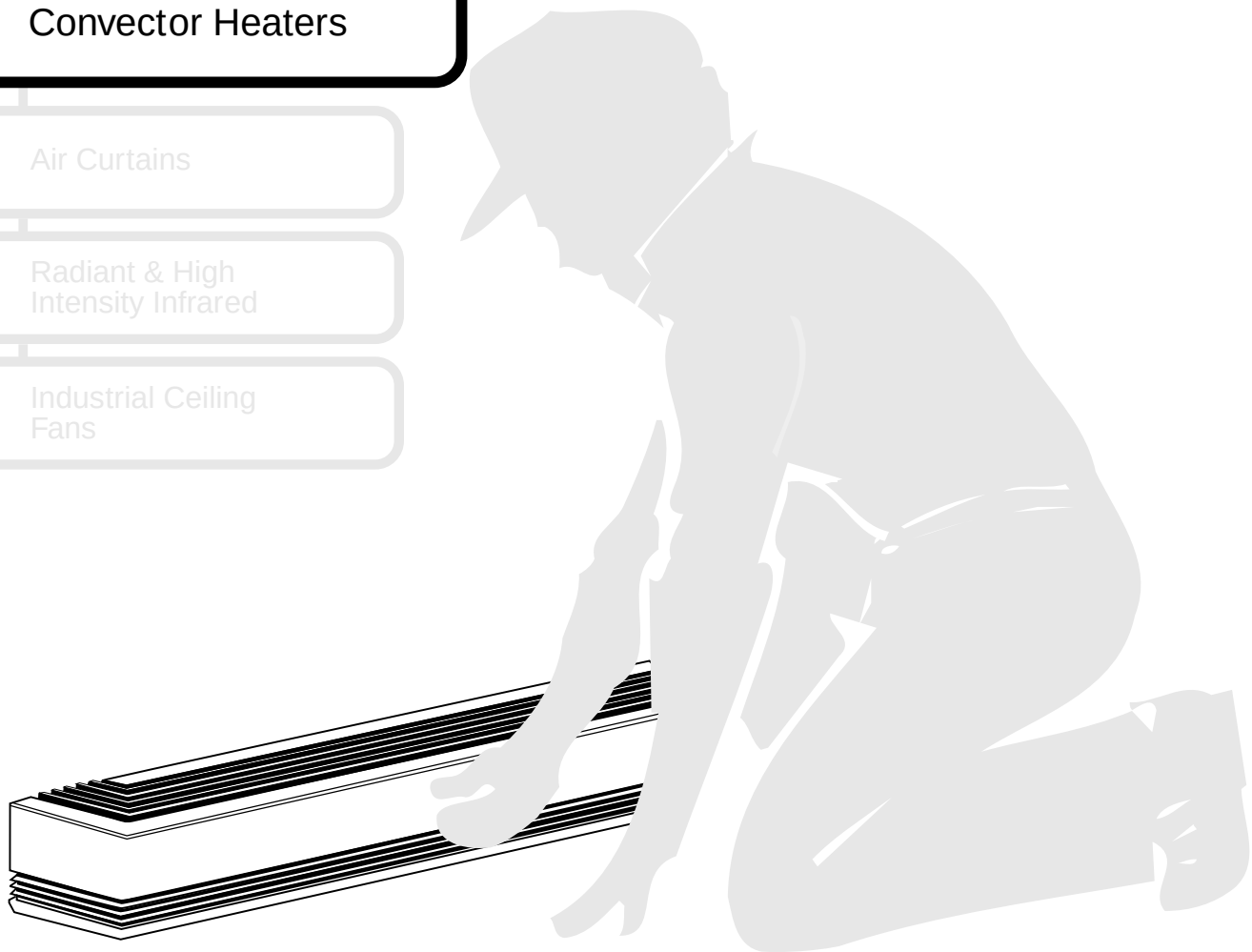
QMARK®

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 Convective Heater product line and how the eight different heater types fit a variety of residential, commercial, industrial and institutional applications.

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

Design Type	**QMark Catalog No.**
Standard-Duty Baseboards	QMK HBB
Portable Baseboards	FBE PHH LFP
Utility Convectors	WHT
Heavy-Duty Baseboards	QMKC CBD
Commercial Convectors	QDB CSH CPH DSH DPH ST
Heavy-Duty Convectors	KCJ
Architectural Convectors	DBA SHA
Explosion Proof Convectors	ICG

The scope of information in this manual is brief. For a more in depth analysis of QMark electric convective 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 CONVECTIVE HEATER DESIGN AND APPLICATION GUIDE

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ELECTRIC CONVECTIVE HEATERS

GENERAL

Electric Convective Heaters, commonly referred to as baseboards or convectors, are non-fan forced, recirculating air heaters that convert electrical energy into heat, transfer that heat to the air and use natural convection to move the heated air back into the space for increased comfort or to prevent freezing conditions.

Convective heaters are normally mounted at floor level on exterior walls under windows to provide an upward movement of air to counteract cold downdrafts and minimize condensation.

Some architectural and commercial convectors can be recess, pedestal or trench mounted to increase their application versatility.

EIGHT TYPES OF CONVECTIVE HEATERS

1800, 2500, 1900, 2600& HBB Series
STANDARD DUTY BASEBOARDS

Wall surface mounted convective heater. The enclosure is constructed of phosphatized steel with a baked enamel finish.

Basic style baseboards have metal sheathed, finned element.

Designer style baseboards have electric / hydronic heating element (low unit surface temperatures) and finger-proof discharge air grille for safety.

Typical applications: For residential or light commercial applications.

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

FBE, PHH & LFP Series
PORTABLE BASEBOARDS

Portable, convective baseboard heaters. Enclosure constructed of phosphatized steel with a baked enamel finish.

These heaters operate on 120 VAC, single phase and contain: a) Built-in thermostat, single pole (single stage) or two stage “Smart Stat”. b) A 5 ft. (1524 mm) power cord with 2 prong plug. c) Built-in (easy carry).handle.

Typical Applications: Areas where permanent installed heaters are not practical.

Supplemental heat in; Game Rooms, Bedrooms, Living Rooms and Offices.

WHT Series
UTILITY CONVECTORS

Compact utility style convective heater constructed for wall surface mounting only.

Heater contains a built-in single pole single throw (single stage) thermostat (No positive off), and a metal sheathed, aluminum finned element.

Galvanized steel enclosure is finished in an baked epoxy enamel for added corrosion resistance.

Typical Applications: Areas that require a small, rugged, self contained heater.

Well Houses, Pump Stations, Utility Sheds and Work Shops.

QMKC & CBD Series
HEAVY - DUTY BASEBOARDS

Wall surface mounted convective heater with an enclosure constructed of phosphatized steel, finished in a baked enamel. The element is metal sheathed - aluminum finned with watt densities of 125, 188 or 250 w/ft.

Commercial style has a built-in wireway, 18 gauge front cover and support brackets.

Designer style heater has built-in wireway, 16 gauge front cover and heavy-duty welded steel “finger-proof” louvered discharge air grille.

Accessories - Integral Thermostats, Disconnect Switches, Receptacle Section, Transformer Relay Section, Inside and Outside Corners And Blank Sections

Typical Applications: High traffic areas that need a heavier - duty construction such as:

Restaurants, Offices, Schools, Institutions, Work Shops, Entrance Lobbies, Corridors, Stairwells and Reception Areas.

EIGHT TYPES OF CONVECTIVE HEATERS (Cont.)

QDB, CSH, CPH, DSH, DPH & ST Series COMMERCIAL CONVECTORS

Commercial convectors, with the exception of draft barrier and slope top, are not restricted to wall surface mounting. Some can be pedestal, floor, recessed (in another enclosure or in a wall) or trench mounted.

Enclosures are constructed of phosphatized steel, finished in a baked enamel, and contain one, two, three or four metal sheathed - aluminum finned elements.

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QDB Series *Draft Barrier* convectors (wall surface mounting only) have a 1-3/4" deep by 4-1/2" high (44 mm by 114 mm) cabinet, finger-proof louvered steel discharge air grille and one 100 or 188 w/ft. element.

Accessories - Single or Double Pole Thermostats and Blank Sections.

Typical Applications: Commercial areas that need a thin profile convector.

Foyers, Vestibules, Reception Areas and Restaurants.

Designed for wall surface (bottom inlet-top outlet) or floor surface (front inlet- top outlet, DSH only) mounting, **CSH & DSH Series *Sill Line*** convectors can also be recessed within another enclosure or mounted in a floor trench.

Available with a stamped louvered steel or extruded aluminum pencil proof discharge grille in three sizes; **1)** 3" deep by 5-1/2" high (76 mm by 140 mm) with one 125 to 250 watt per ft. element, **2)** 5" deep by 7" high (127 mm by 178 mm) and **3)** 5" deep by 14" high (127 mm by 356 mm) with 1, 2 or 3 elements for a total of 125 to 750 watts per ft.

Accessories - Integral SPST, DPST or 2 Stage Thermostats, Power and Transformer Relays, Disconnect Switches, Control Sections with Pneumatic/Electric Switches, Mercury Relays, SCR Controls, and Circuit Breakers, Also Inside and Outside Corners and Blank Sections.

Typical Applications: Commercial spaces that need design variety.

Lobbies, Reception Areas, Offices, Vestibules, Restaurants and Stairwells.

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CPH & DPH Series *Pedestal Convectors* are designed to be mounted, free-standing, away from walls or floor to ceiling windows, above the floor on adjustable pedestal legs. Wiring for the heater is through the pedestal legs.

Available bottom inlet-top outlet with a stamped louvered steel or extruded aluminum pencil proof discharge grille in two sizes; **1)** 3" deep by 5-1/2" high (76 mm by 140 mm) with one 125 to 250 watt per ft. element, **2)** 5" deep by 7" high (127 mm by 178 mm) with 1, 2 or 3 elements for a total of 125 to 750 w/ft.

Accessories - Integral SPST, DPST or 2 Stage Thermostats, Power and Transformer Relays, Disconnect Switches, Control Sections with Pneumatic/Electric Switches, Mercury Relays, SCR Controls, and Circuit Breakers, also Pedestal Legs and Blank Sections.

Typical Applications: Commercial areas with large floor to ceiling window areas.

Foyers, Vestibules, Lobbies, Reception Areas, Offices, Restaurants and Stairwells.

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ST Series *Slope Top Convectors* (wall surface mounting only) have an 18 gauge enclosure back panel and a stamped louvered 16 gauge steel, 45 degree sloped, top / front cover designed specifically to discourage using the heater as a shelf.

At 3-1/2" deep by 10" high (82 mm by 253 mm) slope top convectors contain one 125, 188 or 250 w/ft. element.

Accessories - Integral Single Pole and Double Pole Thermostats, Power Relays, Disconnect Switches, Transformer Relays, Splice Plates, Inside and Outside Corners

Typical Applications: Commercial locations that need heavy - duty construction.

Entrance Lobbies, Offices, Vestibules, Reception Areas, Restaurants, School Rooms, Institutions, Corridors, Foyers and Stairwells.

EIGHT TYPES OF CONVECTIVE HEATERS
(Cont.)

KCJ Series
HEAVY - DUTY CONVECTORS

Designed specifically for wall surface mounting enclosure is constructed with a 12 gauge, perforated steel, sloped top, tamper-resistant front cover.

Cabinet size is 5” deep by 16” high (127 mm by 406 mm) and contains one 250 watt per ft. element.

Standard built-in accessories; Disconnect Switch and Tamper-Proof Thermostat.

Typical Applications: Institutional or industrial locations that require low surface temperatures, heavy-duty construction and tamper-resistant controls.

Correctional, Rehabilitation Facilities And Entries, Vestibules, Reception Areas, Corridors, Restaurants, School Rooms and Stairwells of Heavy Industrial Facilities.

DBA & SHA Series
ARCHITECTURAL CONVECTORS

Designed for pedestal, wall surface (bottom inlet-top outlet) or floor surface (front inlet- top outlet) mounting with pencil proof inlet and discharge grilles.

Available in two sizes;
1) 12 gauge extruded aluminum, 3-5/8” deep by 6” high (92 mm by 152 mm) with one 100 to 250 w/ft. element
2) 10 gauge extruded aluminum, 5-3/8” deep by 7” high (143 mm by 178 mm) with 1, 2 or 3 elements for a total of 100 to 750 w/ft.

Accessories - Integral SPST, DPST or 2 Stage Thermostats, Power and Transformer Relays, Disconnect Switches, Control Sections with Pneumatic/Electric Switches, Mercury Relays, SCR Controls, and Circuit Breakers.

Also Inside and Outside Corners and Blank Sections.

Typical Applications: Commercial areas that need design variety.

Offices, Lobbies, Reception Areas, Restaurants, Foyers, Corridors, Atriums and Stairwells.

ICG Series
EXPLOSION PROOF CONVECTORS

Epoxy coated heavy 16 gauge steel, 8” deep by 23” high (203 mm by 584 mm) sloped top cabinet designed for wall or floor mounting with supplied brackets.

Single phase heaters have one element, three phase units have three elements. Element has 1.125” (29 mm) diameter steel fins brazed to 0.475” (12 mm) diameter metal sheathed rod.

Maximum temperature ratings: T3, 392 deg. F (200 deg. C) or T2B, 500 deg. F (260 deg. C).

Accessories - Thermostat (Class 1, Group C & D only) and 24 Volt Control.

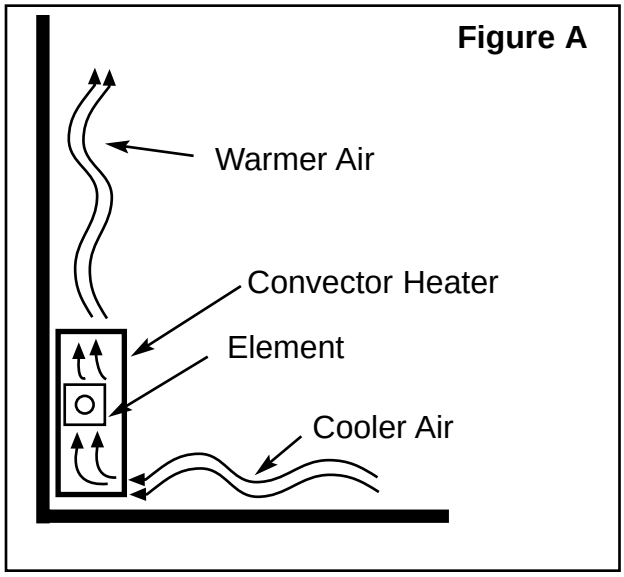
Typical Applications: Hazardous areas classified as Class 1, Groups B, C and D, Division 1 and 2 environments.

Petrochemical Plants, Oil Refineries, Chemical Storage Areas, Sewerage Treatment Facilities, Coal Mines, Gasoline Storage Facilities, Utility and Natural Gas Plants.

CONVECTIVE HEATER DESIGN

It is a common known fact that warm air rises and cold air falls. It is this phenomenon that is the basis of the convective heaters covered in this manual.

The primary component of an electric convective heater is the element. When the element is energized it produces heat that is transferred to the colder air that surrounds it. Elements supplied with all heaters covered in this manual contain fins that improve the heat transfer from the element rod to the air. This warmer air rises allowing cooler to come in contact with the element.



In convective heaters the heated air rises (exits) at or near the top of the heater and through a process called “chimney effect” draws cooler air into the heater at or near the bottom of the convector. This air is heated, rises and exits at or near the top of the heater in a continuing cycle (Figure A).

CONVECTIVE HEATER COMPONENTS

All electric convective heaters contain two components (an element and an over temperature limit) that work together to complete the task of safely delivering heated air to the space.

Some of the heater types have additional operating and / or safety features in addition to the element and over temperature limit. These standard or optional components 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 fall into two basic groups; a) open coil and b) metal sheath, based on their construction.

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

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

Fins are added to the element rod to improve heat transfer from the element rod to the air. Most convective heater types have aluminum fins pressure bonded to the rod, however, the heavy-duty and explosion proof convectors have steel fins brazed to the rod.

All convective heaters discussed in this manual are provided with metal sheath elements for safety and reliability. Electric / Hydronic elements supplied in the Designer Style Standard Baseboard is a metal sheathed element rod completely submerged in heat transfer fluid and totally sealed in a copper tube which is finned.

OVER TEMPERATURE LIMITS are normally closed temperature sensing devices that will open on a temperature rise. Located on or in close proximity to the element, they are designed into the heater to open (interrupt the flow of electricity) if an abnormally hot condition occurs. In abnormally hot conditions is usually the result of a loss of air moving across the element.

In convectors the most frequent cause of over temperature limit opening is inlet air or discharge air openings being blocked by drapery or furniture.

ELECTRIC CONVECTIVE HEATER APPLICATION MATRIX

Application Suggestions - For Information Purposes Only

LOCATION	CONVECTIVE HEATER TYPE							
	BASEBOARD				CONVECTOR			
	STANDARD-DUTY	PORTABLE	UTILITY	HEAVY DUTY	COMMERCIAL	HEAVY-DUTY	ARCHITECTURAL	EXPLOSION PROOF
RESIDENTIAL								
Basements	◉	◒		○				
Well House			◉	○				
Recreation Rooms	◉	◒		◒	○		○	
Laundry Room	◒	○		○	○			
Work Room	◉	◉		○	○			
Storage Building	○		◉	○				
Garage	◒	◒		◉	○			
Crawl Space			◉					
INDUSTRIAL								
Factories				○	◒	◉	◒	
Power Generating Stations					◒	◉		
Sewer Plants					○	◉		
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						○		
Grainery						◒		

○ GOOD, ◒ BETTER, ◉ BEST

Application Suggestions - For Information Purposes Only

LOCATION	CONVECTIVE HEATER TYPE							
	BASEBOARD				CONVECTOR			
	STANDARD-DUTY	PORTABLE	UTILITY	HEAVY DUTY	COMMERCIAL	HEAVY-DUTY	ARCHITECTURAL	EXPLOSION PROOF
COMMERCIAL								
Foyers				○	◉		◉	
Office Building				○	◉		◉	
Atrium					◉		◉	
Swimming Pool Areas						◒		
Hotel/Motel					○		◒	
Hallways				◒	◉		◉	
Stairwells				○	◒	○		
Apartments				◉	◒			
Laundry Facilities			○	1		◉		
Retail Space				◉	◉		◒	
Lobbies				◒	◉		◉	
Agricultural Barns						◉		
Hospitals				○	◒	○	◒	
Restaurants				○	◉	○		
Entrances				◒	◉		◉	
Greenhouse						◉		
Conference Rooms					◉		◉	
Outside Smoking Areas						◒		
Toll Booth		○	○	○	○			
INSTITUTIONAL								
School Rooms				◒	◉			
Entrances				◒	◉		◉	
Churches					◉		◉	
Swimming Pool Areas						◉		
Correctional Facilities						◉		
Breezeways					◒		◒	
Rest Rooms				○	○	◉		
Maintenance Rooms		○			○	◒		
Cafeteria				○	◒	○	◉	
Hallways				◒	◉		◉	
Outside Smoking Areas						◒		
HAZARDOUS LOCATIONS								
Coal Mines								◉
Graineries								◉
Paint Storage								◉
Chemical Storage								◉
Petroleum Plants								◉

CONVECTIVE HEATER APPLICATION

The application of electric convective 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, Small One Person Office, Stairwell, Nursing Home, Atrium, Correctional Facility, Lobby Area) and *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

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 convective 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.

Electric Standard Duty, Portable and Heavy-Duty Baseboard and Utility, Commercial, Heavy-Duty and Architectural Convectors have hot and arcing or sparking parts inside and should not be used in potentially explosive atmospheres. Explosion Proof convective heaters may be better suited for these applications.

Explosion Proof convective heaters are supplied at a T3, (392 deg. F, 200 deg. C) or T2B, (500 deg. F, 260 Deg. C) temperature rating. The specifier is responsible for the heater acceptability with the gasses present in the application.

The finish of Standard Duty, Portable and Heavy-Duty Baseboard and Utility, Commercial and Architectural Convectors are not intended for direct salt spray exposure in marine applications, or the highly corrosive atmospheres of swimming pool or chemical storage bins. Heavy-Duty institutional convectors are better suited for this application.

In Institutional applications such as Hospitals, Nursing Homes, Child Day-Care Centers and Clinics it is recommended that low watt density convective heaters be used to provide optimum comfort at lowest case temperature.

Specifically designed for mounting below window areas heaters can be installed on plaster, wood paneled, metal, masonry or composition wall surfaces (but not paperboard or low-density fiberboard) with reasonable expectation of clean wall operation. Should some soiling occur, after a period of years, smooth walls may be cleaned with standard maintenance materials. For deep textured walls consideration should be given to choice of enclosure height and watt per foot capacity. Generally, the enclosure with the lowest surface temperature will have the least soiling tendency.

Do not locate convective heaters below an electrical convenience receptacle. If receptacles are required in the area occupied by the convective heater the use of optional accessory receptacle kits is recommended.

AIR THROW

The heaters discussed in this manual will maintain satisfactory comfort conditions in low traffic side entryways and vestibules However, since they provide only natural convection air throw, they are not recommended for combating cold outside air blasts through high traffic, multiple door main entryways and vestibules. Fast response, fan driven electric heaters would be preferred for these applications.

HEATER WEIGHT

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

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

CLEARANCES

When locating and installing electric convective 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 convective heater for specific clearance dimensions.

SELECTING THE TYPE 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.

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.

The colder air settles at the floor level adding to the discomfort of any occupants.

Convective heaters draw colder air from the floor area, heat it and then the heated air rises to the ceiling where it cools, falling back to the floor to complete the cycle. This cycling or rotating effect works best with low to medium ceilings of 8 to 10 ft. (2438 to 3048 mm) heights **Figure B**.

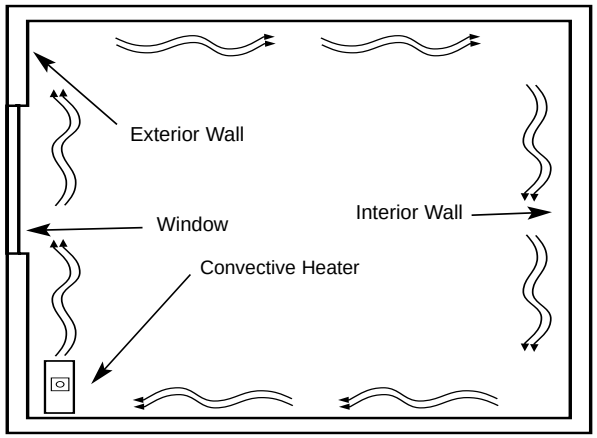


Figure B

CONSIDERATIONS

Convective heaters are primarily used in perimeter applications to block the downdrafts caused by the cold outside wall cooling the air next to it, and to counteract transmission losses.

They are usually mounted at the floor level along an outside wall.

By placing the convective heater along the outside wall, under the window, heated air rising from the top of the heater blocks the cold "down draft" air, reducing occupant discomfort.

While the rising heated air is blocking the downdraft it is also providing a warm air curtain that acts as a buffer to prevents the heat loss from the space occupant to the cold wall.

Convective heaters provide the heat lost to the cold wall and the occupant feels more comfortable.

In instances where large expanses of multi-story windows are located close to groups of people that are settled and normally in the same location, a second series of convective heaters, spaced at every floor level, will prevent the cascading effect of the downdraft.

EXAMPLE: Receptionist in an Atrium lobby. Workers near the perimeter of a large office complex.

For well insulated buildings with small amounts of glass, the use of more compact convective heaters may be sufficient. These heaters would only be mounted under the window area.

Utilizing heaters in this manner reduces the initial installation cost, since fewer heaters will be installed, while still providing the dual function of counter-acting the downdraft and the transmission effect.

EXAMPLE:
Bedrooms, Small offices, Washrooms, Stairways, Corridors.

RESIDENTIAL APPLICATIONS

Basic or Designer style, Standard-Duty baseboards and Portable baseboards are most commonly used in residential applications. Since convective heaters have no moving parts and use natural air flow, rather than forced air flow, they are ideally suited to areas where air movement noise is undesirable.

In *bedrooms* and *studies,* Standard-Duty baseboards, permanently installed along the exterior wall under the window will provide quiet gentle heat. Care must be exercised to insure that there is adequate wall space remaining, after the baseboard installation, for placement of furniture. The installation of Designer Style baseboards with its electronic / hydronic element and lower surface temperatures is a good choice for a nursery or child's bedroom.

In *basements*, Standard-Duty baseboards should be installed along the *above ground* walls, to eliminate the cold downdraft, as well as under windows of other walls. Basements with interior divisions should have a heater and thermostat in each area. In large open basements several smaller heaters will produce a better heated air distribution than a singular large heater. If the area is only occasionally occupied, Portable baseboards may be the better choice. Heating the basement has the additional benefit of warming the floor of the rooms above adding to the main floor comfort level.

SELECTING THE TYPE and QUANTITY OF HEATERS (Cont.)

When installing Basic or Designer series baseboard in *living areas; family rooms, living rooms, kitchens or play rooms*, care should be exercised to insure adequate room for future furniture and drapery placement. Also the location of electrical receptacles must be taken into account.

Utility convectors, because of their rugged design and integral thermostat, are ideally suited for *well (pump) houses* and small *work shops*.

COMMERCIAL APPLICATIONS

Like residential applications, the convective heater in commercial applications should be installed on the exterior wall. The aesthetics of front inlet convection heaters mounted at floor level must be weighed against the ability of cleaning equipment to reach under bottom inlet convection heaters mounted a few inches (mm) above the floor with less damage to the heater. Recess mounted Cabinet or special application Sill-Line Commercial Convectors may provide a solution.

In *individual office* or *conference areas*, Heavy-Duty baseboards, Draft Barrier or Sill-Line Commercial convectors and Architectural convectors are the best choice. The decor of the room as well as its heat loss should be used to determine which style best suits the application. If floor to ceiling glass is present, pedestal convectors should be considered.

Large *open, multi-person, perimeter offices* are ideal applications for Heavy-Duty baseboards, Draft Barrier or Sill-Line Commercial convectors and Architectural convectors if the window area does not reach the floor. Placing the convector along the entire length of exterior wall eliminates the discomfort of the cold wall effect for people located nearby. As with individual offices, if floor to ceiling glass is present, pedestal convectors should be considered.

The application of convective heaters in *lobbies* would be the same as in large open offices above except additional consideration must be given to the fact that people tend to move about more in lobbies. Knowledge of expected traffic patterns is important in heater location, particularly at the end of pedestal runs, if floor to ceiling glass is present and pedestal convectors are considered. *Lobbies with multi-story windows* and *atriums* present a unique application for convective heaters. The amount of heated air necessary; to block the downdraft of this large expanse of window, and keep the moisture from forming on the top portion of the window, cannot be generated from floor level convection equipment alone. In these cases, Sill or Pedestal Mounted Architectural convectors mounted at floor level, working in conjunction with Architectural convectors mounted approximately every 10 to 15 feet (3 to 4.5 m) up the window, will provide sufficient heated air. Architectural convectors have slots on the bottom of the enclosure for air intake rather than the large holes of most commercial convection equipment. These slots present a finished appearance when viewed from the floor level.

Recess or surface mounted cabinet convectors and Slope top convectors are well suited for use in *hallways, cafeterias and restrooms* because of their heavy duty construction. Recess mounting is also important in these areas where space is at a premium.

INDUSTRIAL APPLICATIONS

Factories, Warehouses, Sports Complexes and similar applications require heaters that can withstand a great deal of abuse but still function properly while requiring little maintenance.

For *restrooms, lunchrooms, small to medium workshops and assembly areas with low to medium ceilings* Slope Top, or Cabinet style Commercial or Heavy-Duty convectors provide even heating, yet are constructed to withstand normal daily industrial abuse.

Used on exterior walls, the slope top design of the Heavy-Duty and Slope Top convectors prevents them being used as shelves or step stools. The Cabinet Convector can be recessed on applications where space is limited and the wall that the heater is recessed into is a non-exterior wall.

In some industrial applications , there is the potential of hazardous gasses being present. Explosion Proof convectors may be better suited for these applications.

INSTITUTIONAL APPLICATIONS

The tamper resistant Heavy-Duty convector with its 12 gauge perforated steel, sloped top cover and low operating temperature was specifically designed for use in common areas of *correctional and rehabilitational facilities* where safety is a major concern.

These heaters also work well in *shop classrooms, locker rooms and restrooms* of *High Schools, Colleges and Vocational Technical Schools*.

Placed along the exterior wall, under windows they provide quiet, even heating in low to medium ceilings.

CONTROL GUIDELINES

Electric convective 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.

Electric convective 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.

THERMOSTAT

A thermostat is a temperature sensing device used to control the cycling of the heater.

Convective heaters discussed in this manual employ three different style thermostats; Single Pole Single Throw (SPST), Double Pole Single Throw (DPST) and Two Stage (2ST).

a) Single Pole Single Throw (SPST) thermostats have only one set of contacts and can only break one leg of the power supply. When applied in the supply line of single phase convectors they will cycle (energize and de-energize) the heating element as the space temperature fluctuates. SPST thermostats will not disconnect the element from the supply source since only one side of the supply is opened. SPST thermostats supplied with our heaters are not positive off.

SPST Pilot Duty (PDT) thermostats are simply SPST thermostats that control a relay or contactor holding coil. The relay or contactor, in turn, controls the heating element.

b) Double Pole Single Throw (DPST) thermostats have two sets of contacts. However, on the more common DPST thermostats, only one set cycles as the space temperature fluctuates, the other is simply an on-off switch. These thermostats have a positive off position. When set to the normal temperature range the thermostat will complete the circuit on one leg of a single phase supply line (the switch) and cycle the other leg. At this point this thermostat acts the same as a SPST thermostat in that the one side of the thermostat will cycle the heater but, since the other side is closed, the element is not disconnected. If the thermostat is in the “OFF” (full counterclockwise) position both legs will be open and the element will be disconnected.

A specific type DPST thermostat has two simultaneous cycling poles. In this case there usually is no on-off switch and both sides of the thermostat cycle at the same time.

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

Do Not Use a standard DP thermostat on three phase heaters:

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.

c) Two stage (2ST) thermostats are an extension of the specific type DPST two simultaneous cycling thermostat but there is a temperature set point difference causing one side to open and close at a different temperature than the other.

❑❑❑

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 at or near floor level, 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 usually occupied.

Locating Remote Thermostats

Locate thermostats
a) In the area served by the heater,
b) 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 machinery), d) Too far from the heater (poor control, over / under heating of the design space).

❑❑❑

Individual Heater Control

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

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Multi-Heater Control

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

CONTROL GUIDELINES (Cont.)

A location in the center of the heated space is best but, be aware of the distance between the heaters and the thermostat. If the thermostat is located too far from the heaters, or at one end of a long narrow room, it will result in over and under heated pockets within the design space.

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(es) may be located on the 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 circuit) and it may be necessary to locate more than one disconnect switch to completely disconnect the heater from all electrical power.

POWER RELAY

Power relays are used to control electrical loads that may be greater than a thermostat rating. Heaters with supply voltage over 277 vac , heaters with amperage ratings in excess of the thermostat rating or heaters where low voltage control is required use power relays to control the supply power to the heater.

In most cases the power relays used in convective heaters are single pole single throw devices with contacts rated to 600 vac and holding coil rated from 24 to 277 vac.

The holding coil is normally controlled by a thermostat, building automation system or other control device.

TRANSFORMER RELAY

Similar to power relays, transformer relays are used to control electrical loads that may be greater than a thermostat rating. But they are usually used when quiet operation and low voltage control is required.

These relays are a combination of a current relay and supply power to 24 volt transformer. There is a time delay of about 45 to 60 seconds between thermostat closure and relay contact closure.

The advantage of transformer relays is their quiet operation and the fact that only one device is required. There are two notable disadvantages; 1) more than one relay can be controlled by one thermostat, but since each is energized by the preceding relay, the time delays add from relay to relay, and 2) because of the transformers small VA rating, the distance between the transformer rating and the thermostat is limited (maximum recommended distance = 25 ft., 7.6m).

Transformer relays can not be used on three phase heaters.

INFINITE (SCR) CONTROL

When thermostats or thermostat relay (power or transformer) combinations are used to control convective heaters, the space temperature is maintained by cycling the heater element full on until the thermostat is satisfied and then full off until the thermostat again calls for heat. This leads to some over and under heating.

For more accurate control, convective heaters can use SCRs (basically electronic switches) to maintain the space temperature by modulating the element between zero and one hundred percent. This method allows the heater to supply only the amount of heat necessary to keep the space at the temperature selected on the thermostat.

SCRs generate a fair amount of heat and are therefore mounted on heat sinks. Because of the size of the heat sinks they are supplied only in control sections of Sill Line and Pedestal series Commercial type and Architectural type convectors.

A specific use electronic (Remote mount / Integral mount) thermostat is normally used to control the SCRs supplied with these heaters. If a standard modulating controller is used for space temperature control an Interface is available.

CONTROL SYSTEMS

A control system in its most basic form can contain only one device such as a thermostat, a disconnect switch, a power relay or a transformer relay.

However, most control systems are more complicated because it is often necessary to combine multiple controls into a system to accomplish a specific task of maintaining the comfort level of a design area.

Multi level control systems can be applied to any convective heater but are normally only used with Sill Line and Pedestal series Commercial type and Architectural type convectors.

The design of the control system starts with the desired results and works backwards to the components necessary and in most cases there will be several combinations of controls that will produce the same results. While specifier preference and ease of installation will dictate which system to use, the following examples illustrate some possible choices for common convective heater applications.

CONTROL GUIDELINES (Cont.)

Control System Example A

An internal control is required for three 1,500 watt, 240 volt, single phase Sill Line, Commercial convectors mounted below a large window in a lobby.

The amp draw for the total 4,500 watts at 240 volt, single phase is 18.8 which is below the maximum rating of the integral convector thermostat.

Control Option A1:

The three heaters (elements) are wired in parallel.

1 ea. SPST thermostat is mounted in first unit to control all heaters.

Heaters two and three contain no optional controls.

Control Option A2:

If it is determined that a “Positive Off” is required.

The three heaters (elements) are wired in parallel.

1 ea. Disconnect Switch is mounted in first unit to control all heaters.

1 ea. SPST thermostat is mounted in first unit to control all heaters.

Heaters two and three contain no optional controls.

Control System Example B:

An internal control is required for three 2,500 watt, 240 volt, single phase Pedestal series heaters mounted along an expanse of glass in a lobby.

Since the 31.3 amps for the total of 7,500 watts at 240 volt, single phase exceeds the rating of the integral convector thermostat the load will have to be divided.

Control Option B1:

The three heaters (elements) are wired in parallel.

1 ea. pilot duty thermostat mounted in first unit to control all heaters.

1 ea. power relay (with 240 volt holding coil) mounted in each heater to control the element(s) in that heater.

Relay holding coils wired in parallel, controlled by pilot duty thermostat. Control voltage received from supply power.

Control Option B2:

The three heaters (elements) are wired in parallel.

1 ea. pilot duty thermostat mounted in first unit to control all heaters.

1 ea. transformer relay (with 240 volt holding coil) mounted in each heater to control the element(s) in that heater.

Transformer relay mounted in first unit controlled by pilot duty thermostat, second relay power received from first relay (time delay starts when first relay is energized), third relay power received from second relay (time delay starts when first relay is energized).

Control System Example C:

An internal control with night set back, 24 volts from BAS for day operation, is required for three 1,500 watt, 240 volt, single phase Sill Line, Commercial convectors mounted below a large window in a lobby.

The amp draw for the total 4,500 watts at 240 volt, single phase is 18.8 which is below the maximum rating of both the integral convector thermostat and night set back relay.

Control Option C1:

The three heaters (elements) are wired in parallel.

1 ea. SPST thermostat is mounted in first unit to control all heaters.

1 ea. SPST power relay, with 24 volt holding coil, is mounted in first unit to act as night set back relay. This relay controls all three heaters. It is energized for day operation by the 24 volts from the business automation system.

Heaters two and three contain no optional controls.

Control Option C2:

If it is determined that a “Positive Off” is required.

The three heaters (elements) are wired in parallel.

1 ea. Disconnect Switch is mounted in first unit to control all heaters.

1 ea. SPST thermostat is mounted in first unit to control all heaters.

1 ea. SPST power relay, with 24 volt holding coil, is mounted in first unit to act as night set back relay. This relay controls all three heaters. It is energized for day operation by the 24 volts from the business automation system.

Heaters two and three contain no optional controls.

NOTES

A Division of Marley Engineered Products
470 Beauty Spot Road East
Bennettsville, SC 29512
1-800-642-HEAT
Visit our website at www.qmarkmep.com