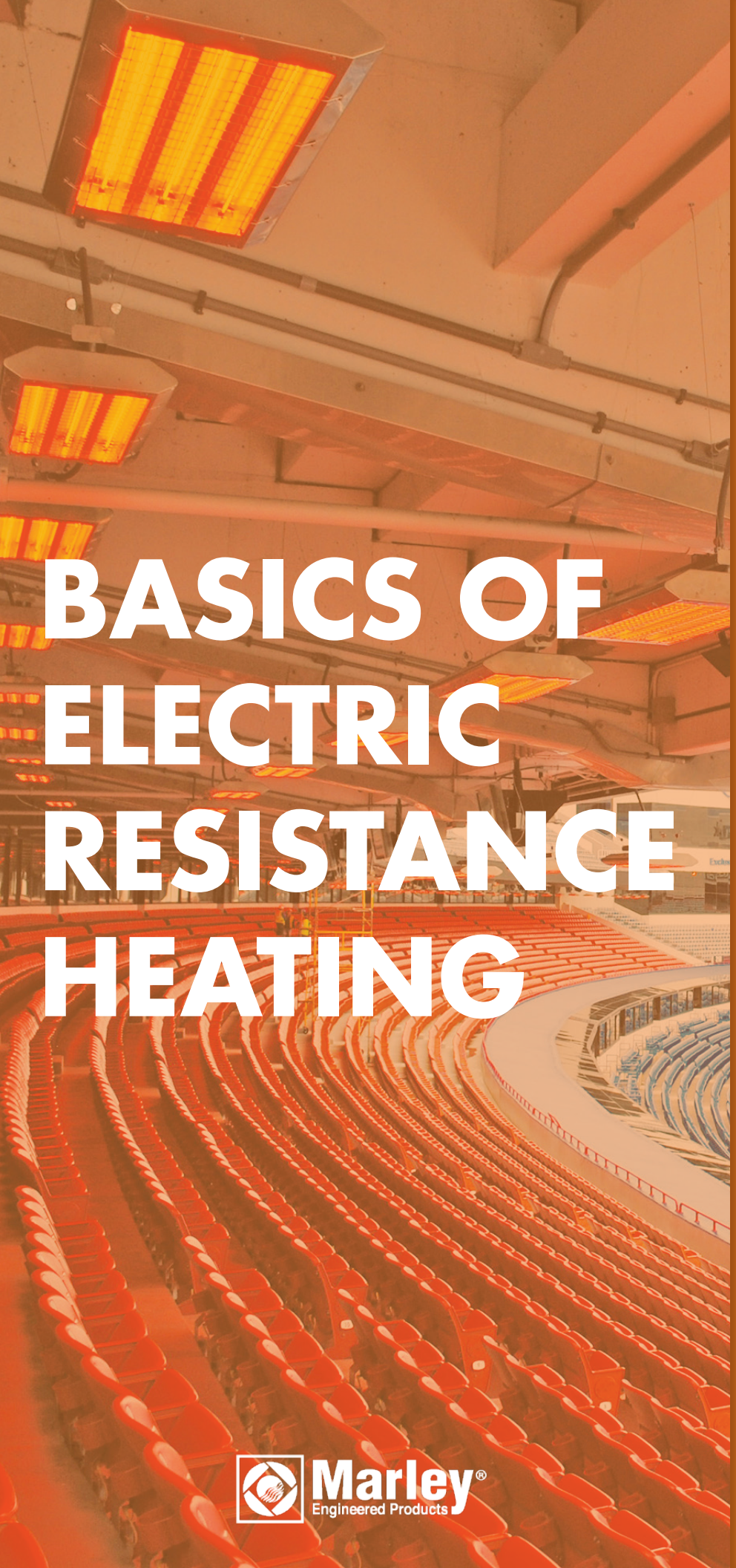

BASICS OF ELECTRIC RESISTANCE HEATING

Marley® Engineered Products

ADVANTAGES OF ELECTRIC HEATING

Clean & Safe

Electric resistance heating generates no byproducts as it operates. No vapors, fumes or odors.

Ease of Installation

Central forced-air systems need ductwork and gas-fired units need gas lines and venting, which require considerable work, space and expense. Electric resistance heating simply requires mounting the unit and connecting the wires.

Ease of Maintenance

Electric resistance heaters have few, if any, moving parts keeping maintenance at a minimum.

Easily Controlled

Individual room control is the standard with electric resistance heating. This allows for individual room comfort with better utilization of electrical energy.

Comfortable

Electric resistance heating is quiet and provides even, constant heat without high velocity air movement or moderate to zero noise.

HOW HEAT IS GENERATED

Electric resistance heating works by converting electricity into heat using metals, such as nickel chromium, as heating elements. The metals have a high resistance that permits a certain amount of current to flow through them, providing the required heat. Electrical energy is then changed into heat energy. There are two common types of heating elements:

Open wire consists of nickel chromium resistance wire which is mounted on ceramic or mica insulation.

Tubular or sheathed elements use nickel chromium resistance wire that is surrounded by a magnesium oxide powder which are then enclosed in a heat resistance steel or stainless steel tube.

Electric resistance heating is the only heat produced almost as fast as the thermostat calls for it. With no heat exchangers to warm up. The heating elements start producing heat the moment the thermostat calls for it. Can not do this with forced-air systems!! Electric resistance heating is **100% efficient** because all of the electrical energy consumed is converted into heat with no combustion losses through the combustion gas vent or chimney.

HOW TO SELECT ELECTRIC HEATERS

There are several types of electric resistance heaters, each better suited to certain types of applications than others. When selecting the type of electric resistance heater, factors that impact that decision are:

- Size of the space
- Occupancy of the space
- How the space will be used
- Air changes in the space
- Noise requirements of the space
- Available wall or ceiling surface area for installation

TYPES OF ELECTRIC HEATER

There are five general types of electric resistance heaters.

Convectors | Fan-Forced | Specialty Fan-Forced | Unit | Radiant

Each type has applications for which they are better suited that one of the other types.

CONVECTION HEATERS

This category includes residential and commercial baseboard, commercial and architectural convectors. All of these operate on the same convection principle. The units are typically mounted at floor level. Cool air, moving along the floor, is drawn into the intake of the heater. The air is heated as it passes over the elements, and is discharged out the top or front of the unit into the space. This cycle sets up a gentle airflow pattern in the room that keeps the room at the desired temperature. No fans to limit movement of air, dust and allergens.

RESIDENTIAL BASEBOARD

These are used in residential settings where the overall heat needed in the space is in the 500- to 2,500- watt range and the number of air changes in the space is low (0.5 to 1.5 per hour). These units have no moving parts so operation is quiet. These are ideal for bedrooms, offices or anywhere even, moderate air movement noise is not desirable.

COMMERCIAL BASEBOARD

Similar in construction and application to residential baseboard, commercial baseboard typically has a case that is constructed from heavier gauge material than residential baseboard to withstand the higher traffic and rougher use typical in a commercial application. These would be a good choice for a library, office, conference room or common rooms.

HYDRONIC BASEBOARDS

Rather than air being heated by elements and discharged into the room, heating elements in hydronic baseboard warms a fluid within a self-contained metal tube. Air passes over the heated tube and is discharged into the room. There are two key benefits to this heat. This energy efficiency is due to longer-lasting heat after the thermostat shuts off, providing sustained even comfort. Soft heat with lower surface temperatures and safety for children and pets. Applications would be similar to residential and commercial baseboard.

ARCHITECTURAL CONVECTORS

These are usually utilized in areas that require a higher heat output, but the advantages of convection heating is desirable. Convectors can be architecturally styled units constructed from steel or aluminum with painted or anodized finishes. They can also be constructed from extremely heavy gauge material for rough service applications. Output is in the 250-watt/foot to 750-watt/foot range and custom cabinet lengths are common. Applications would be similar to commercial baseboard, with the additions of lobbies & entrances where draft barriers & supplement contact is desire against floor to celling windows.

FAN-FORCED WALL HEATERS

This category includes residential and commercial wall heaters and cabinet unit heaters. All of these operate on the same principle. The units are typically mounted on, or recessed in, a non-exterior wall 6-12 inches above floor level. Cool air is drawn into the heater, passed over the heating elements, and warm air is discharged out the front of the unit into the space. This cycle is much faster than the cycle on a baseboard heater because of the use of a fan to assist airflow. This is well-suited for use in spaces where the number of air changes is greater than 1.5 per hour as the recovery time (the amount of time needed to "reheat" the room once the heated air has been discharged from the room) of a fan-forced unit is less than a that of a baseboard. Fan-forced wall heaters require less wall space than baseboard heaters, making them ideal for use where available wall space is limited

RESIDENTIAL FAN-FORCED WALL HEATERS

Output is typically 500 to 2,000 watts. They are used in spaces like small bedrooms, offices, laundry rooms and bathrooms. They are available with built-in thermostats or they can be used in conjunction with wall thermostats. Models are available where airflow noise is minimal, making them suitable for installation in applications where low noise is a requirement (e.g.: bedrooms or studies).

COMMERCIAL FAN-FORCED WALL HEATERS

Output is typically 1,500 to 5,000 watts. These are used in vestibules, lobbies, hallways, commercial restrooms, offices, storage rooms and stairwells. The units are capable of delivering quick heat recovery and require very minimal wall space for installation. The units are typically larger in size than the residential versions, and may have external sheet metal parts constructed from heavier gauge material to withstand the rougher use seen in commercial applications. They are also available "architecturally styled" grilles with in which case the units are typically referred to as Architectural Wall Heaters.

CABINET UNIT HEATERS

These units are designed to provide a large heat output and quick heat recovery. Output ranges from 2,000 up to 32,000 watts. The airflow is much higher than that of a commercial wall heater. These are typically used in applications that require a very quick heat recovery and/or have a very large heat loss. Entryways, schoolrooms, large meeting rooms are a few of the applications where cabinet unit heaters are ideal.

SPECIALTY FAN-FORCED HEATERS

These units are similar to the fan-forced wall heaters, but do not install in the wall. They are designed for installation in the floor, ceiling or under cabinets. Wattage output of these units range from 500 to 2,000 watts. Commercial ceiling-mounted units will have heat outputs up to 5,000 watts.

FLOOR-MOUNTED FAN-FORCED HEATERS

Installed in the floor, these units are used in residential and commercial applications where no wall space is available (e.g.: in front of a sliding glass door)

CEILING-MOUNTED FAN-FORCED HEATERS

Mounted in the ceiling because wall space is not available or to reduce the possibility of tampering. Residential models are ideal for bathrooms and laundry rooms, while commercial models are ideal for entryways, restrooms, small retail spaces, and large meeting rooms.

TOE SPACE HEATERS

These mount under cabinets or in stair risers in applications where available wall space is not available.

UNIT HEATERS

Unit heaters are similar to fan-forced wall heaters in that they use a fan to intake cool air, pass it over elements, and discharge the heated air into the space. Where unit heaters differ from wall heaters is in heat output and mounting. The heat output ranges from 3,000 to 50,000 watts. Unit heaters are typically suspended from the ceiling or a bracket that is mounted to the wall at least 8 feet above the floor. The units are designed for use in applications where air changes are very high and the total heat requirement is also very high. Most are permanently installed units, but portable units in output ranges of 3,000 to 5,000 watts are common.

SMALL UNIT HEATERS

Heat output ranges from 3,000 to 15,000 watts. These units are typically used (singularly or in multiples) in applications like garages, small storage buildings, basements, parking garages and equipment rooms.

LARGE UNIT HEATERS

Heat output ranges from 20,000 to 50,000 watts. These larger units are typically used in applications where a large amount of heat input is required. This would include warehouses, gymnasiums, factories and large storage rooms.

SPECIALTY UNIT HEATERS

These are units that are designed for a particular application or environment. Explosion-Proof unit heaters are designed to operate in hazardous atmospheres where a spark or a surface temperature in excess of a predetermined limit could cause an explosion. Washdown/Corrosion-Resistant unit heaters are designed for use in applications where the atmosphere is very corrosive (e.g.: wastewater treatment plant) or where the unit needs to be “hosed down” on a regular basis (e.g.: food processing plant). Specialty unit heaters are typically available in heat outputs ranging from 3,000 to 30,000 watts.

RADIANT HEATERS

This class of electric resistance heaters operate on a somewhat different principle than any of the units described above. Radiant heaters use radiant energy that is discharged from the heater to directly warm the persons or objects located in the area covered by the radiant heater(s). This principle is best illustrated by the example of a person standing in the shade on a 40° day will not feel as comfortable as a person standing in the sunlight. The person in the sunlight is exposed to the radiant energy that the sun discharges and is warmed by that energy. There are no moving parts on a radiant heater and most mount in or near the ceiling. The most common types of radiant heaters are ceiling panels, cove heaters, and high-intensity radiant heaters.

CEILING PANELS

These panels typically measure 24"x 24" or 24"x 48" and have a heat output ranging from 250 to 750 watts. These units mount on the ceiling or can be installed in a suspended ceiling. The panels can be finished to have the same appearance as the ceiling tile used in the suspended ceiling. Typical applications include office spaces, hospital rooms, cafeterias and school rooms.

COVE HEATERS

Are perfect where wall space is limited and the unit needs to be out of the reach of occupants. These units are approximately 3" W x 4" H and range in length from 2 to 12 feet. Heat output ranges from 450 to 1,800 watts. The cove heaters mount on the wall, approximately 3 inches below the ceiling (the cove area). Typical applications are residential, using cove heaters instead of baseboard and fan forced wall heaters. A commercial application where the cove heater takes the place of a commercial baseboard or small commercial fan-forced wall heater is also common.

HIGH-INTENSITY RADIANT HEATERS

These units use quartz tubes, quartz lamps or metal sheath elements to deliver a high level of radiant heat in a small space. These units have a heat output that ranges from 1,000 to 13,000 watts. They are used almost exclusively in commercial and industrial applications, and are typically suspended from the ceiling for spot heating or snow melting applications. Spot heating is where a unit is stationed above an area where heating is required. The radiant energy is then directed at that area only, warming persons or objects in that area. Typical applications would be over assembly lines, loading dock doors and over entryways to melt snow and ice.

HEATER APPLICATION/SELECTION CHART

	BEDROOM	BATHROOM	BASEMENT/ PLAYROOM	WORKSHOP/ GARAGE	GAME ROOM	FAMILY ROOM	OFFICE	MEETING ROOM	WAREHOUSE	FACTORY	ENTRYWAY	HAZARDOUS/ CORROSIVE AREA
BASEBOARD												
Residential	3	2	3	0	1	3	1	1	0	0	0	0
Commercial	1	3	3	0	3	1	3	3	0	0	1	0
Commercial Convectors	0	1	0	0	0	0	3	3	0	0	2	0
FAN-FORCED												
Residential	1	3	3	1	3	2	2	1	0	0	0	0
Commercial	0	3	1	3	1	1	3	3	0		3	0
Cabinet Unit Heater	0	0	0	0	0	0	0	3	1	1	3	0
SPECIALTY FAN-FORCED												
Floor-Mounted	1	1	0	0	3	3	2	2	0	0	0	0
Ceiling-Mounted	0	3	3	3	3	1	1	3	2	2	3	0
Toe Space	0	3	0	0	0	2	0	1	0	0	0	0
UNIT HEATERS												
Small (3 15 KW)	0	0	1	3	1	0	0	0	3	3	2	0
Large (20 – 50 KW)	0	0	0	0	0	0	0	0	3	3	1	0
Specialty	0	0	0	0	0	0	0	0	0	0	0	3
RADIANT HEATERS												
Ceiling Panels	3	3	3	1	3	3	3	3	0	0	1	0
Cove Heaters	3	3	3	2	3	3	3	3	0	0	1	0
High Intensity	0	0	0	3	0	0	0	0	3	3	2	0

3 = Excellent application, 2 = Good application, 1 = Fair application, 0 = Poor application

ELECTRIC HEAT ESTIMATOR

To properly heat an area, the amount of heat required must be determined. Use the following formula to estimate the "Heat Loss" in watts. Then size heating equipment as close as possible to recommendations. Size unit(s) to next size over if unit(s) is not available for exact size.

HOW TO CALCULATE HEAT LOSS

Door: square ft. of doors x 8 watts/ft^2 = watts loss | Windows: square ft. of windows x 15 watts/ft^2 = watts loss
Room: with 1 outside wall: cubic feet of room x 0.9 watts/cu. ft. = watts loss
Room: with 2 outside walls: cubic feet of room x 1.0 watts/cu. ft. = watts loss
Room: with 3 outside walls: cubic feet of room x 1.2 watts/cu. ft. = watts loss
Fireplace: # of fireplaces x 500 = watts loss

EXAMPLE: 12′ x 20′ x 8′ room with 3 outside walls, 1 outside door, and 40 /ft^2 of windows.

20 sq. ft. of door x 8 watts/sq. ft. =	160 watts
40 sq. ft. of windows x 15 watts/sq. ft. =	600 watts
12′ x 20′ x 8′ = 1,920 cu. Ft. of room x 1.2 watts/cu. Ft. =	2304 watts
Total Watts of Electric Heat Needed =	**3,064 watts**

The above calculations are based on a minimum insulation standard of :
Ceilings = R19 Floors = R13 Framed Walls = R11 Masonry Walls = R7

This estimator can be used for residential and small commercial projects only. Contact your electric heat supplier for assistance with other applications.