General Design Principles

Regardless of heater type, it is important that the design meets the application requirements in order to achieve the best comfort levels and to maximize efficiencies.

Choosing the right heating solution is accomplished with knowledge of the facility that is to be heated. It is best to plan thoroughly and design an infrared heating layout that will ensure optimal performance. Improper equipment application can result in undesired results.

Basic Application Guidelines

1. Conduct A Building Survey

When designing an infrared system, a proper building survey will help to ensure its optimal performance. An accurate heat loss calculation with an emphasis on air changes must be conducted. The strategic location of the burners will allow for added heat in areas where it is most needed. Vent location, air intake, gas supply and operational obstacles must also be considered.

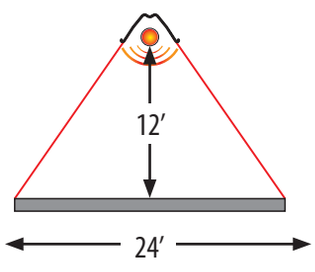
2. Discuss Performance Expectations

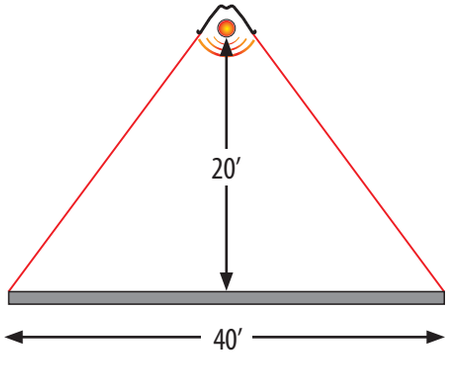
Understanding your customer's needs is paramount to the overall satisfaction of the installation. Remember that many people do not fully understand the operating characteristics of an infrared heater and it is important to help educate them. The following questions should be reviewed prior to the installation:

- What is the overall heating objective (spot heat, freeze control, etc.)?
- What are the expectations of the infrared system?
- Is the temperature differential acknowledged?
- Will the clearances to combustibles always be maintained?

3. Review Recommended Mounting Heights

While mounting heights are not mandatory to follow, they are critical in the proper application of the appliance. Mounting heights are one of the most important factors in the selection process as they are directly correlated to the radiant footprint and overall comfort levels.





Definitions

Air Change:
The introduction of new, cleansed or recirculated air into a space. The method of measuring the amount of air movement into or out of a space in terms of the number of building volumes or room volumes exchanged in unit time.

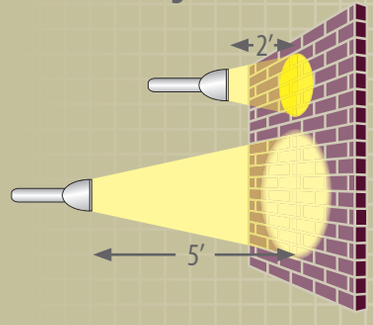
Flux Density:
The rate of radiant energy transfer across a given surface per unit area in unit interval of frequency or wavelength.

Heat Load:
The amount of heat to be generated, usually measured in BTUs. Factors for determining heat load include:

1. Floor and wall area.
2. Windows and doors.
3. Air changes.

A formal heat loss calculation will most accurately provide the necessary BTU loading requirements. For estimating purposes, however, a figure of 35 to 50 BTU's per square foot is sometimes used in the pre-planning stages. If spot heating, a figure of 100 to 200 BTU's per square foot may be used. Generally, the larger the building, the less the per square foot BTU loading requirements.

Like Visible Light



Design Tips

Additional BTU's per square foot are generally required to keep people warm in spot heating applications or small areas which quickly lose heat to the surrounding area.

Some applications can benefit from using a combination of heat types. Infrared heaters are commonly used by combining several heaters to achieve larger heated areas.

The effective infrared surface temperature of a person or object may be diminished with wind in excess of 5 mph. In this case, wind barriers may be required.

Ventilation

For proper ventilation, a positive air displacement of 4 CFM/1,000 BTU/hr (0.38 m3/min/kW) of gas consumed must be provided.

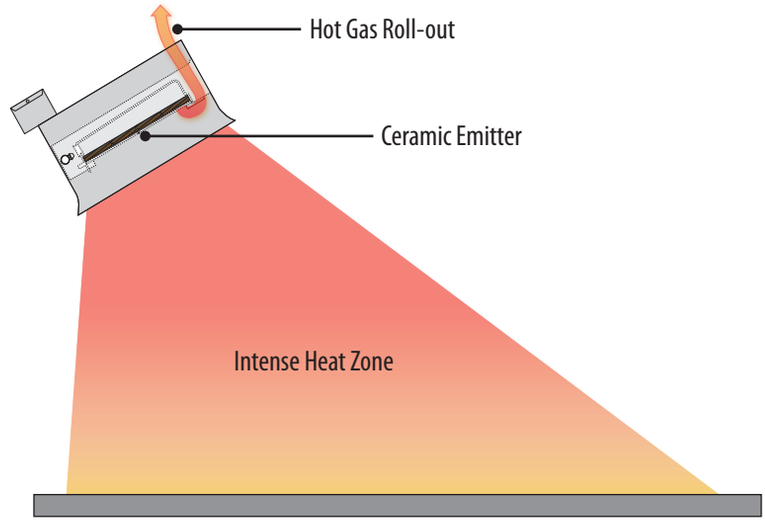
Where insufficient air movement exists, induced air displacement is required. A balanced system is essential to avoid negative building pressure which causes excessive infiltration, unfavorable drafts and effects combustion efficiency.

Consider This

Are high intensity heaters perfectly energy efficient as all of their energy is released into the space?

Let's Explore Designing with High Intensity Heaters

To better understand designing with high intensity heaters, let's first review the operating characteristics. High intensity heaters place a large amount of heat into a small area of space due to the 1600-1800°F ceramic emitter surface.



The heat output pattern of a high intensity heater is focused and intense. This intense heat output has many application advantages; however, it requires adequate mounting heights and increases the clearance to combustibles considerations. Designed as a direct fired appliance, these units cannot be directly vented and require adequate indirect building ventilation.

Frequently Asked Questions

Q: What type of applications are best suited for high intensity infrared?

A: High intensity heaters are found in a wide variety of applications but have proven themselves to be very effective in high ceiling, spot heating and retrofit applications.

Q: Do high intensity heaters have other advantages?

A: Yes, when compared to other systems these heaters tend to be lower in cost, relatively simple to install and require minimal upkeep.

Q: When would I choose a high intensity heater over a tube style heater?

A: This question is often asked and really boils down to your application and your design objectives. If your application requires a focused more intense heat signature and can withstand the height, clearance and ventilation requirements then the right choice is likely a high intensity product.

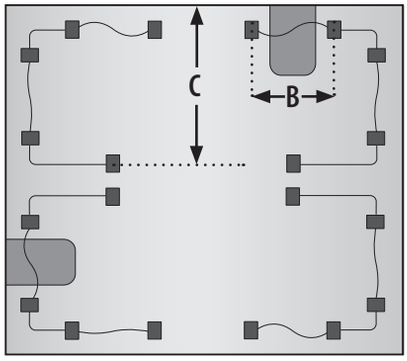
Q: When applying a high intensity heater what other considerations exist?

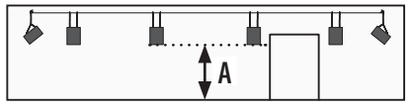
A: Higher clearances to combustibles, the need for appropriate building ventilation, protective guarding in select applications and the use of this product in windy areas are all items worthy of additional consideration.

Total Building Heat with High Intensity

Heating an overall area with infrared heaters is particularly suited for buildings with large air volumes or high rates of air movement where convection (air heating) methods are grossly ineffective.

Sample Heater Layout





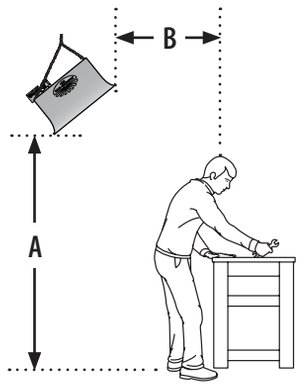
- High intensity heater
Dim A - Recommended mounting height
Dim B - Distance between heaters
Dim C - Distance between heater rows

Recommended Mounting Chart (in feet)

Model BTU/h Input	Stnd. Refl. Dim A.	Parabolic Refl. Dim A.	Dim B.	Dim C.	Distance Between Heater & Outside Wall
30,000	12 to 14	12 to 15	8 to 24	15 to 40	4 to 8
60,000	14 to 16	18 to 21	12 to 36	15 to 55	6 to 12
90,000	16 to 18	21 to 25	16 to 48	20 to 70	6 to 12
130,000	21 to 24	26 to 32	20 to 60	25 to 85	8 to 14
160,000	24 to 28	29 to 35	24 to 65	30 to 100	8 to 14

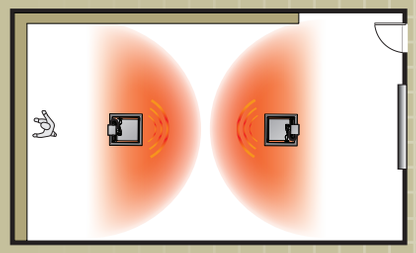
Spot Heat with High Intensity

Model BTU/h Input	Approx. Coverage	Recommended Mounting Height (Dim. A)	Distance Behind Person or Work Station (Dim. B)	Required Air Changes
30,000	12' x 12'	9' to 14'	5'	120 cfm/h
60,000	18' x 18'	12' to 18'	7'	240 cfm/h
90,000	24' x 24'	16' to 20'	10'	360 cfm/h
130,000	30' x 30'	18' to 20'	12'	520 cfm/h
160,000	35' x 35'	20' to 30'	16'	640 cfm/h

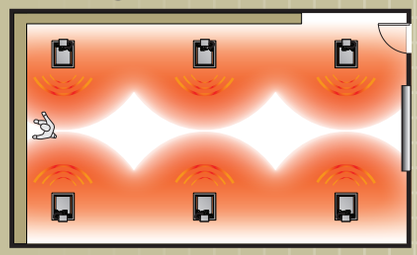


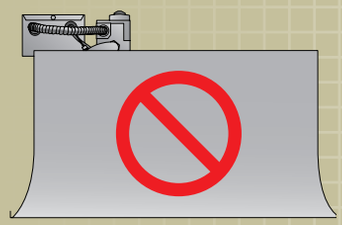
Design Scenarios

Bad Design:

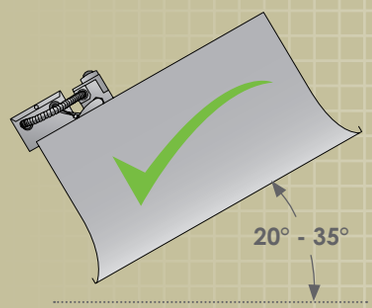


Good Design:





Wrong Installation:
Failure to place control end down will result in damaged controls.



Right Installation:
Heater must be mounted level side to side and at a 20-35° angle from horizontal with the control end down.

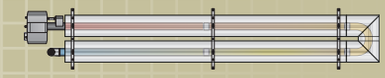
Construction Considerations

Every tube heater has a minimum and maximum length which is dictated by the BTU's of the appliance. For example a 100,000 BTU heater has a minimum 20-ft and a maximum 50-ft length.

A turbulator baffle is sometimes inserted into the last pipe(s) to increase operating efficiencies and maximize heat transfer at the end of the heater.

Temperatures on the combustion chamber may exceed 1200°F while temperatures at the exhaust end of a tube heater are often below 300°F.

"U-Tubes"



U-shaped heaters are often the best solution when heating people or when tackling a spot heat application. By design, a "U-tube" will place the hottest tube directly adjacent to the coldest tube for optimal comfort levels.

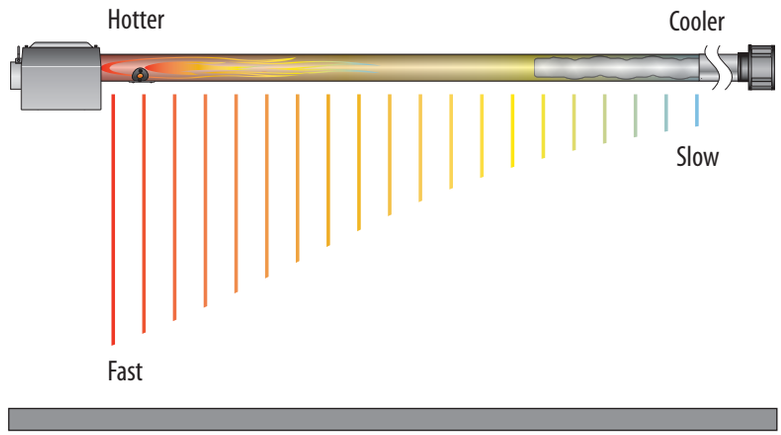
Don't be fooled...

...by the promise of a perfectly even heat output or an operating method that implies superior performance. Construction standards and efficiency guidelines as described on page 6-3 better explain why such claims can be misleading.

Let's Explore Designing with Low Intensity Heaters

To better understand designing with low intensity heaters, let's first explore its operating principles. Hot gases produced at the burner pass through a steel tube exchanger cooling as they reach the exhaust - creating a temperature differential along the tube run.

Typical flame properties & heat pattern



Tube heaters feature a burner, radiant tubes and reflectors. A flame originates from the burner and travels approximately 2-6 feet in length leaving the hot gasses to heat the remaining radiant pipe. This results in the infrared energy being directed to the floor level in a disproportionate amount. What is commonly referred to as "temperature differential" should be highly considered during the design phase.

Frequently Asked Questions

Q: What type of applications are best suited for tube heaters?

A: Tube heaters are used in a wide variety of applications and are a preferred solution for total building heat in newly constructed applications. When properly designed, tube heaters have proven effective in commercial, industrial, patio, agricultural, warehouse and spot heat applications.

Q: Do low intensity heaters have other advantages?

A: Yes, tube heaters have proven to be quite versatile and rugged. This is due to the low intensity heat signature and construction features that allow for direct ventilation and the consumption of outside combustion air.

Q: What design considerations exist when applying a tube heater?

A: When applying a tube heater, first remember the fundamentals which include heat load, coverage, clearances and mounting heights. Then account for the temperature differential by strategically locating burner boxes in the areas of the greatest heat loss or highest desired heat zone.

Low Intensity Heater Application Guidelines

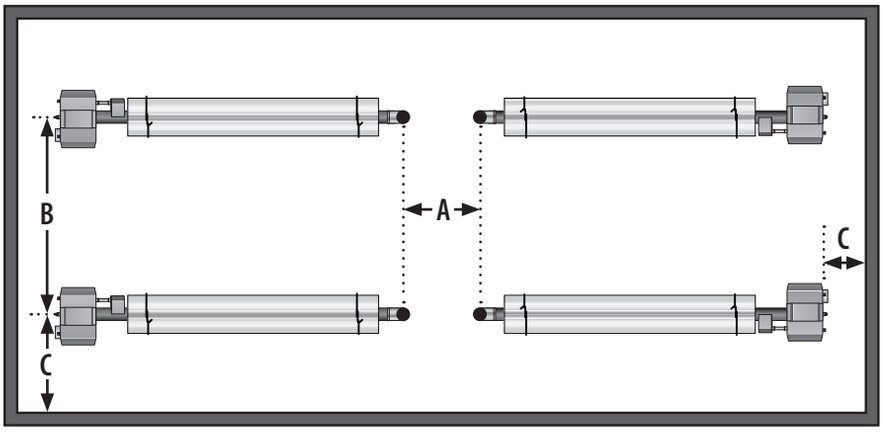
When designing for total building heat, the concern is to replace heat loss with heat input, while maintaining the most uniform heat pattern as possible.

Placing the hotter end of the heater in colder areas of the building helps in achieving better heat distribution. Optimize heat patterns by moving the heater toward the center of the space as it reaches perimeter walls. This avoids wasting energy through the wall.

Proper model selection and good layout practices will result in increased efficiencies and comfort levels.

Low Intensity Application Chart

Model Length	Model Input Range	Recommended Mounting Height	Coverage	Dim A	Dim B	Dim C
20 Ft.	50 to 65 MBH	10′ to 16′	20′ x 12′	8′ to 16′	16′ to 32′	16′
	75 to 100 MBH	12′ to 20′	22′ x 15′	16′ to 24′	24′ to 40′	18′
30 Ft.	50 to 65 MBH	10′ to 16′	30′ x 14′	8′ to 16′	16′ to 32′	17′
	75 MBH	12′ to 20′	33′ x 18′	16′ to 24′	24′ to 40′	20′
	100 to 125 MBH	13′ to 20′	33′ x 18′	16′ to 24′	24′ to 40′	20′
40 Ft.	50 to 65 MBH	10′ to 16′	40′ x 16′	8′ to 16′	16′ to 32′	20′
	75 to 125 MBH	12′ to 20′	44′ x 21′	16′ to 24′	24′ to 40′	20′
	150 to 175 MBH	16′ to 30′	45′ x 26′	24′ to 32′	32′ to 48′	25′
50 Ft.	100 to 125 MBH	15′ to 25′	55′ x 24′	16′ to 24′	24′ to 40′	25′
	150 to 200 MBH	16′ to 30′	56′ x 30′	24′ to 32′	32′ to 48′	25′
60 Ft.	125 MBH	16′ to 25′	66′ x 27′	16′ to 24′	24′ to 40′	25′
	150 to 200 MBH	17′ to 40′	67′ x 34′	24′ to 32′	32′ to 48′	25′
70 Ft.	175 to 200 MBH	17′ to 40′	78′ x 38′	24′ to 32′	32′ to 48′	30′
80 Ft.	200 MBH	18′ to 45′	89′ x 42′	24′ to 32′	32′ to 48′	30′

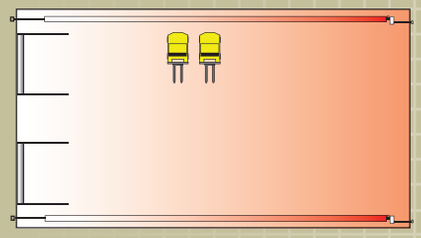


Dim A - Distance between heaters; **Dim B** - Distance between heater rows; **Dim C** - Distance between heater and wall

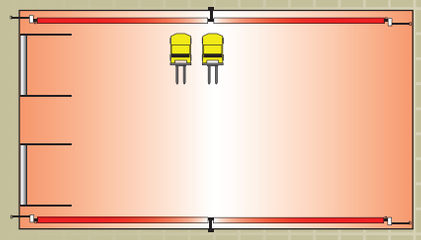
Note: This application chart is provided as a guideline. Actual conditions may dictate variation from this data. Dimensions A, B & C are based upon heaters hung at the factory recommended mounting height.

Design Scenarios

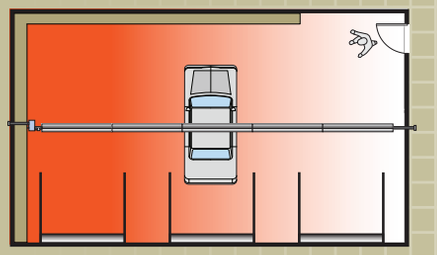
Bad Design:



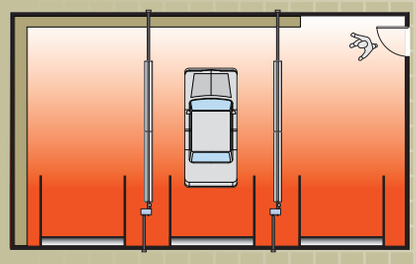
Good Design:



Wrong Installation:



Right Installation:



Heard on the Street

"...infrared heaters are well suited for a wide range of applications..."

"...designing with infrared is more of an art and less of a science..."

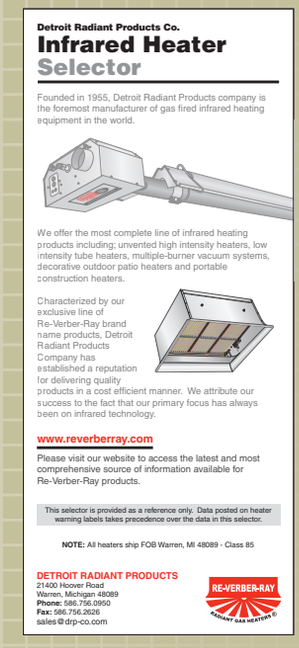
"...there are no absolute right ways to apply an infrared heater; however, there are absolute wrong ways..."

"...a well designed infrared system is one not even noticed during its operation..."

"...I should have put this type of heating system in years ago..."

Design Tools

The Infrared Heater Selector slide chart will help determine the best heater selection for the application.


Detroit Radiant Products Co.

Infrared Heater Selector

Founded in 1955, Detroit Radiant Products company is the foremost manufacturer of gas fired infrared heating equipment in the world.

We offer the most complete line of infrared heating products including; unvented high intensity heaters, low intensity tube heaters, multiple-burner vacuum systems, decorative outdoor patio heaters and portable construction heaters.

Characterized by our exclusive line of Re-Verber-Ray brand name products, Detroit Radiant Products Company has established a reputation for delivering quality products in a cost efficient manner. We attribute our success to the fact that our primary focus has always been on infrared technology.

www.reverberray.com

Please visit our website to access the latest and most comprehensive source of information available for Re-Verber-Ray products.

This selector is provided as a reference only. Data posted on heater warning labels takes precedence over the data in this selector.

NOTE: All heaters ship FOB Warren, MI 48089 - Class 85

DETROIT RADIANT PRODUCTS
21400 Hoover Road
Warren, Michigan 48089
Phone: 586.756.0950
Fax: 586.756.2626
sales@drp-co.com

RE-VERBER-RAY

Ten Steps to Designing an Infrared Heating System

1. **Contact your local factory representative.** Local representatives are factory trained and will provide a complete no-charge design analysis.

2. **Determine the type of application.** Infrared heaters are ideal for use in fire stations, warehouses, auto body shops, sporting facilities, pole barns, garages and much more. Infrared heaters are not explosion-proof and may not be placed in a Class 1 or Class 2 Explosive Environment, such as a paint booth.

3. **Discuss performance expectations.** Discuss the customer's expectations. What temperature do they wish to maintain? What is the environment used for? Where are the work and storage areas? Do they seek even heat distribution? What are the available mounting heights?

4. **Calculate the heat loss.** Determine the heat loss of the building using standard ASHRAE guidelines. Determine design temperature and desired temperature rise. Pay particular attention to the air changes per hour.

5. **Determine the heater type.** There are a variety of heater types. Select high or low intensity heaters. If selecting low intensity, determine whether it is to be in a straight or "U-shaped" configuration, negative or positive pressure, unitary or system design. Multiple heaters of lower BTU's are preferred over single, large BTU models.

6. **Review the minimum and maximum mounting heights.** CRITICAL! All infrared heaters have a minimum and maximum recommended mounting height. This is established to ensure effective and comfortable heat patterns at the floor levels.

7. **Observe clearances to combustibles.** WARNING! Clearance to combustibles distances must be maintained at all times. Pay particular attention to storage areas, overhead doors and car lift areas. Signs are recommended for safety and also in accordance with the NFPA-54 Guidelines.

8. **Review coverage.** Infrared heaters are best applied in an outer perimeter design pattern. Place burners in the areas of greatest heat loss, opposite of each other and spaced equally.

9. **Make heater selections.** Select single or two-stage models. Specify heater inputs, gas type and voltage. Utilize upgrade options based on the application. Review construction features and pricing of each model to make the best selection.

10. **Other related considerations** include venting, controls, guards, signs and whether to utilize outside combustion air.