

RSES *Journal*



HEATING, VENTILATION, AIR CONDITIONING AND REFRIGERATION



**SAVING
ENERGY**
With Infrared
Heating

Gas-fired infrared tube heaters offer several operational and design benefits not available with conventional heating units

BY MICHELLE FOX **Flying HIGH**
With Gas-Fired Infrared Heating

When designing a system for a commercial heat application, the first consideration may be to install forced-air equipment, such as the large type of unit suspended from the ceiling that blows hot air with the force of a jet engine.

While that might work in some applications, independent studies by a leading hvac trade group reveal that gas-fired infrared heating can save 20 percent to 50 percent in fuel consumption over forced-air heating.

Low-intensity, gas-fired infrared heating systems emulate the true efficiency of the sun by generating radiant heat energy. They consist of three main components: a burner control box, black-coated radiant emitter tubes and a highly polished reflector assembly.

The heaters are typically suspended from the ceiling by chains and controlled by a thermostat. They can be installed either vented or unvented, may use outside air for combustion, if necessary, and may be installed in different configurations depending on the heating requirements.

Two types of systems

There are two types of infrared heating: high intensity and low intensity. High-intensity heaters have been around since the 1950s. They require high mounting heights due to an open flame that covers a ceramic surface. High-intensity heaters, which have a reflector to help direct the heat, are used in areas that are unvented and with few workers present.

Low-intensity heaters have an enclosed flame. When heat is required, the burner control box ignites a gas/air mixture and hot gases are pushed through steel radiant tubing by an internal fan. As these gases pass through the assembly, the tubing is heated and emits infrared energy, which is then directed toward the floor by highly polished reflectors.

This energy is absorbed by objects in its path, such as the floor, machinery and people. Objects in the path of the infrared energy in turn reradiate this heat to create a com-

Infrared Heaters Are Ideal For Some Applications

Here are some typical applications where infrared heating works well:

- **HARSH ENVIRONMENTS.**
- **FIRE STATIONS.**
- **AIRCRAFT HANGARS.**
- **WOOD SHOPS OR POLE BARNs.**
- **CAR WASHES.**
- **AUTO SHOPS.**
- **RESTAURANTS.**
- **AGRICULTURAL BUILDINGS.**
- **GOLF DRIVING RANGES.**
- **WAREHOUSES.**
- **HOME GARAGES.**
- **MANUFACTURING BUILDINGS.**

fort zone at the floor level. This method of heating, as opposed to filling a room with warm air, allows the source of heat to begin at the floor level and not the ceiling.

With a forced-air system, heat escapes from spaces where doors are opened. When doors close, the system must reheat the air as if from a cold startup. With infrared heat, the floor acts as a reservoir. When doors open the slab loses little heat and when the doors close the mass acts as a huge heat sink to warm the surrounding air. This creates the most efficient and effective heating method under the diverse conditions present in most commercial and industrial applications.

System benefits

Radiant heaters offer several operational and design benefits not available with conventional heating units. For example, radiant heat:





- Saves up to 50 percent fuel savings over forced-air units.
- Does not blow dust and debris around like heaters that rely on blowers for heat distribution. This makes for a much cleaner and quieter environment.
- Offers zoned capability that allows a group of units to function together or independently.
- Offers the ability to be mounted up to 60 feet high, depending on the heater chosen for the application.
- Provides spot heat to specific areas where there are few workers.
- Features directional heating. It can be installed along a sidewall so that reflectors can be rotated to direct heat where it is needed.
- Uses outside air for combustion.
- Allows low-intensity heaters to be vented together to reduce the number of roof or wall penetrations.
- Offers flexible design. You can install the system in the middle of the shop or perhaps even in a U- or L-shaped configuration around a workstation where the heat is needed most.

There are a few important things to consider when using radiant heat. While they are easy to live with, care needs to be taken when laying out the system to maintain clearances to combustibles. Infrared radiant heaters

>> Airplane hangars are among the applications where gas-fired infrared heating is effective. The arrow points out the location of the system.

require higher clearances than forced-air units. Therefore, a mounting height of 10 feet or higher is recommended, depending on the application and the model.

Very little maintenance is required, especially when bringing in outside air for combustion. This is recommended when dust or contamination is present in a building. Periodic dusting of the reflectors is beneficial for safety and efficiency of the heater. This is easily done by vacuuming the surfaces of the unit occasionally or blowing it off with an air-compressor hose.

Safety considerations

A critical safety factor to consider before installing an infrared heating system is clearance to combustibles, which is defined as the minimum distance that must be maintained between the radiant tube heater surface and the combustible item. Consideration also must be given to the danger of placing objects and materials around the infrared heater that have lower temperature ratings, such as plastics. Shielding of these items may be necessary.

Additional examples of combustibles include lights,

Weighing the Benefits Of Infrared Heating

If you can live with a small initial investment, radiant heating might be a wise choice over a forced-air system.

The initial cost of a standard, unitary tube heater 40 feet long will cost approximately \$1,100. Therefore, upfront costs are higher than traditional heating methods. Gas line connections must be considered and hanging the unit is at least a two-person job.

However, this investment will pay for itself over a short period of time due to the energy-saving benefits of radiant heaters. Interested in even more fuel savings? Install a system that incorporates two-stage technology, which can offer an additional 12 percent fuel savings over a standard single-stage radiant heater.

Although the installation may be fairly easy, system design and layout can be more difficult. It is critical that the equipment is installed properly to assure a safe and effective heating system.

Most companies sell product via local manufacturer's representatives. This allows a professional to review the desired needs and select the proper equipment for a specific application. A local representative also may provide guidance in suggesting a contractor familiar with installing infrared heating systems.

In the end, it comes down to whether building owners and managers as well as the installing contractor wish to provide a good heat source for their application. Gas-fired infrared heaters offer the option of placing heat where and when it is needed. — *Michelle Fox*

overhead doors, gas and electrical lines, parked vehicles, cranes, and any other obstructions or hazards. Unless otherwise indicated, infrared heaters are not certified for residential use or where flammable gases or vapors are present, such as spray booths.

It is important to provide warnings to alert individuals about potential hazards and safety actions. Signs must be posted to specify maximum stacking heights in order to maintain clearances to combustibles, especially in storage areas.

Observing recommended mounting heights will optimize comfort conditions in the space. If infrared heaters are mounted too high or too low, they may result in a lack of heat or discomfort. Some applications — freeze protection, outdoor patio heating or spot heating — may require the heaters to be mounted at other than the traditional recommended heights.

The two-stage option

An advanced feature of low-intensity infrared tube heaters is the use of two-stage controls. A two-stage infrared heater can operate in preset high- and low-fire modes.

Because infrared heating systems are typically designed around worst-case scenarios (which only occur 10 percent to 20 percent of the time), a single-stage system becomes oversized on milder days, resulting in more short cycling.

With two-stage technology, fuel usage is reduced by 35



Infrared two-stage heating system

Forced-air heating system

>> An infrared system (above left) heats objects in its path, allowing the source of heat to begin at floor level. With forced-air systems, the heat source is at the ceiling.

percent overall. Field reports as well as studies performed by RDM Engineering in Ontario, Canada, have proven a minimum fuel savings of 12 percent and a reduction up to 30 percent in short cycles when heater operation is mostly in low-fire mode. A two-stage heater allows application design flexibility based upon possible worst-case changes in the environment.

Additional benefits of two-stage heaters include faster heat recovery, higher downstream tube temperatures, longer flame and longer equipment life. A two-stage heater provides a softer and more comfortable heat source for occupants when compared to a single-stage heater that operates at full output (generating too much heat) or cycles off (not producing enough heat).

Multiple burner, low-intensity, vacuum infrared heating systems have been a part of mainstream product offerings for over 40 years. As the infrared heating industry has evolved through the development of unitary heaters featuring equal or superior energy efficiency, multiple-burner, low-intensity vacuum infrared heating systems sometimes are viewed as old technology.

The main difference between a vacuum-style heater and a positive-pressure tube heater is that now the burner box is under negative pressure instead of positive pressure. There is a pump located at the end of the system that pulls the gases down the tube. This type of infrared heating system offers some application benefits not found in other infrared equipment.

Vacuum style infrared heaters may have up to six burners common vented by a single vacuum pump. Fewer roof or sidewall penetrations are the resulting application benefit. The vacuum style may be installed as a condensing or noncondensing system.

A condensing system allows for longer system lengths and higher system thermal efficiency. A noncondensing system more efficiently utilizes the highly emissive black coating on the radiant tubes at a more reasonable equipment cost over the condensing system.◆

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