Process Radiant Heaters

Overview

- **Metal Sheath, Medium Intensity & Medium Wavelength**
- **Quartz, High Intensity & Short Wavelength**
- **Quartz, Medium Intensity & Medium Wavelength**
- **Radiant Oven Assemblies**
- **Wide Area Quartz Panels**
- **Ceramic Panels**

Chromalox has been recognized as the predominate source of metal sheath radiant heaters since 1948. Since that time, radiant heat has become the preferred process heating method for a multitude of applications in various industries. This is due to the unique properties of the infrared heating process which provide a number of significant advantages over other conventional heat transfer methods.

High Efficiency — Infrared heaters create radiant energy to directly heat the product as opposed to a convection oven which is dependent on air circulation as the heat transfer medium. This results in more efficient energy usage and lower operating cost. By eliminating the air medium, radiant heating also reduces the losses associated with hot air ovens.

Shorter Oven Lengths — As a result of the greater heating rates, most products can be heated much more rapidly than in a convection oven. Due to shorter product heating cycles using radiant heat, less oven length is required to do the job. This can result in an oven length reduction of 30 to 50% as compared to convection oven designs.

Cleaner Environment — There are no dirty or contaminating products of combustion present with electric infrared heaters. Since infrared is not dependent on air as the heat transfer method, the air circulation in an infrared oven is kept at a minimum. The greater the volume of air circulated and the faster it is circulated, the greater the dirt factor and the product rejects due to dirt. Powder coatings and light weight materials can be heated rapidly due to low volume of air and low velocities.

Close Product Temperature Control — Infrared heat can be easily controlled and directed. Electric infrared heaters can be "zoned" to provide a high heating zone in one zone and a lower heating rate in another. Infrared heaters are very responsive to control changes; accurate and consistent product temperature control to within extremely close tolerances are possible.

Lower Initial Cost — Due to the simplicity of an electric infrared heating system, initial costs and maintenance costs are lower.

When infrared is the method deemed most suitable for your application, the Chromalox product line provides the largest selection of elements, fixtures and controls. There are many factors to consider: size, heater response, heater efficiency and heater pricing. Chromalox is a major supplier of INCOLOY® sheath, quartz tube, quartz lamp, ceramic, quartz panel and ceramic composite panel types of elements. Each has its own unique advantages depending on the application: **Short-Wave, High Intensity - Quartz Lamp Medium-Wave, Medium Intensity** - Quartz Tube and Quartz Panel - INCOLOY® Sheath, Ceramic and Ceramic Composite Panel.

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Technical & Application Data

Radiation is the process by which energy is transmitted through space without significant loss. Radiant energy is transferred from source (emitter) to receiver (absorber) in the form of electromagnetic waves. Heat is the result of absorption of this radiant energy by the receiver.

Radiation differs from convection and conduction because it does not require the presence of a medium (solid, liquid or gas) to transmit energy from the source to its final destination. By eliminating the heat transfer medium, radiant heating also eliminates the losses associated with other methods. Therefore, radiant heating provides maximum efficiency for your application.

The **Electromagnetic Spectrum** covers the range of wave lengths of radiant energy. The infrared portion of the spectrum (0.72 to 1000 microns) includes those wavelengths which will produce heat upon being absorbed by an object (see Figure 1). The radiant energy, or wavelength, of an infrared element depends on its temperature: the higher the temperature, the shorter the peak wavelength. Infrared wavelengths are longer than visible light but shorter than microwaves. The energy output of a radiant source depends upon the absolute temperature of the source, raised to the fourth power. As source temperature increases, heating intensity becomes very great. The useful wavelengths for industrial applications are from 1 to 10 microns.

Infrared radiation is similar to visible light. It travels through space at the speed of light (186,000 miles/sec), moves in a straight line, can be focused by optical reflectors, will travel through a vacuum, and is absorbed, transmitted or reflected by objects or materials.

In order to heat a product, the waves must be absorbed. Usually less than 10% of the waves are reflected, and the other 90% is either absorbed by or transmitted through the material. The best way to determine the absorption efficiency of the product is through testing.

Radiant heating is suitable where immersion or direct contact heating is impossible, impractical or undesirable. When infrared is the method deemed most suitable for your application, the Chromalox product line provides the largest selection of elements, fixtures and controls. You should find the exact radiant heater which will best meet your job requirement. If a specially designed heater is required, check with your Local Chromalox Sales office.

Figure 1 — Electromagnetic Spectrum

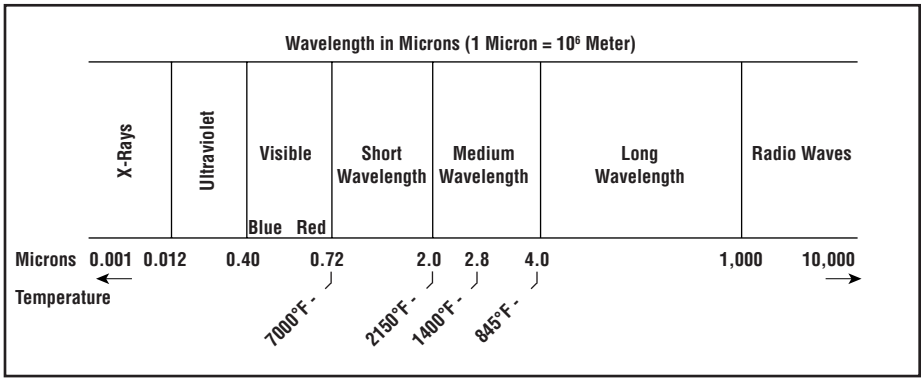
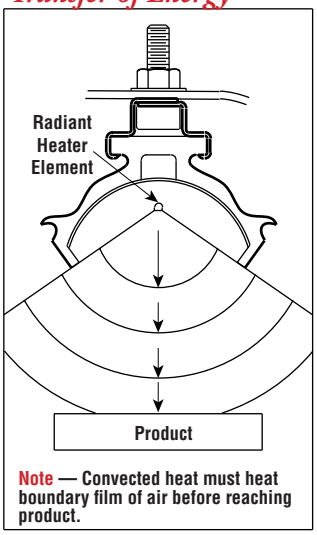
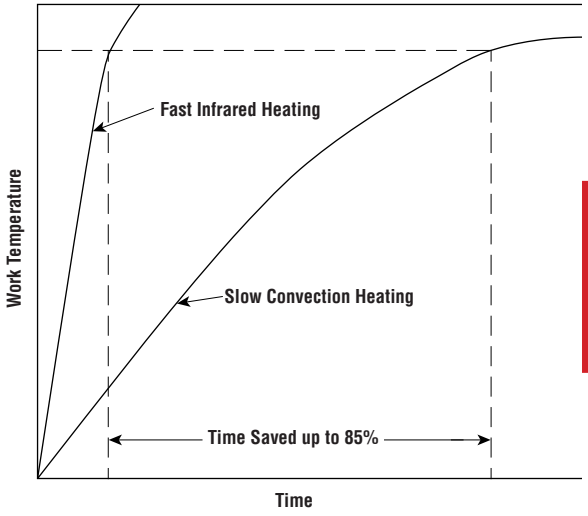


Figure 2 — Transfer of Energy



Note — Convected heat must heat boundary film of air before reaching product.

Figure 3 — Work Temperature Vs. Time



Radiation Vs. Convection — Convection and radiation are capable of transferring energy from a source to the work material without contact. They are naturally considered together when contact-free heating must be performed (see Figure 2). Due to the insulating effect of the boundary film of air which adheres tightly to all surfaces, gravity convection heating becomes exceedingly slow and more and more inefficient as production speeds increase (see Figure 3).

Forced convection of heated air directed at the work assists in breaking up the boundary film, but has the disadvantage of requiring enclosures and air handling equipment. If not recirculated, the spent heating medium must be discharged with consequent heat loss. The desire for faster heating by this means tends toward higher velocities which may lead to higher oven losses and possible damage to delicate surfaces or contamination of the work by airborne dust.

One factor promoting efficiency of application in radiant heating is that radiation falling on an opaque surface is immediately absorbed and transformed into heat. The surface (and by thermal conduction, the internal body) is frequently heated above the surrounding ambient temperature. Where exhaust ventilation must be provided to remove volatiles, noxious fumes or moisture, lower ambient temperatures reduce the amount of heat carried away by the exhaust air and the necessity for extensive oven insulation.