Technical Overview

This technical section presents heat loss fundamentals along with basic problems and solutions. Data, charts and graphics are provided to aid in solving virtually any heating application using electric resistance type heaters.

Most materials, whether solid, liquid or gas may be readily heated with electric resistance heaters by conduction, convection or radiation. The following are three basic requirements, which when met, leave only the selection of type and number of electric heaters best suited for the application.

1. Final Temperature Desired —
Electric resistance heaters of the enclosed sheath type can be operated successfully over a wide range of temperatures from -300°F (cryogenic) to approximately 1500°F. For operating temperatures outside this range, contact the nearest Chromalox Application Engineering Sales office or factory.

2. Sheath Material Required —
Copper is commonly used as the sheath material for water applications, steel for oils, and Stainless Steel or INCOLOY® for corrosive solutions and high temperature air heating. This catalog gives considerable help in choosing the proper sheath material for many common materials. Additional help is available from the nearest Chromalox Application Engineering Sales office or factory.

3. Watt Density Permitted —
Watt density is the heat energy emanating from each square inch of heated surface of a heater or element. Some materials such as water, vegetable oils and salt baths can withstand a high watt density, while others such as petroleum oils or sugar syrups must use lower watt densities. These liquids do not readily absorb or conduct the heat being generated. If the watt density is too high, carbonization or overheating may damage the heating equipment or material being heated. Recommended maximum ratings for various materials and temperature conditions are included in this section. All heaters in this catalog have the watt density specified for standard heater ratings.

After resolving the above requirements, choose the type of heater best suited to the application. For example, a tank of water may be heated by direct immersion heaters, by clamp-on strip, ring or tubular heaters or a side-arm circulation heater. The choice will depend on the process, considerations, available space both inside and outside, economy, maintenance, etc.

General Guidelines for Heater Type, Selection & Application

Heated Media

LIQUIDS
For highest efficiency and fastest response, use direct immersion
- ☐ Flange heaters
- ☐ Screw plug heaters
- ☐ Over-the-side heaters
- ☐ Circulation heaters—side-arm, in-line or booster applications

SOLIDS
For dies, molds, platens, soft metals, use
- ☐ Clamp-on types—strips or tubular elements
- ☐ Cartridge heaters
- ☐ Cast-in heaters
- ☐ Radiant heaters
- ☐ Melting pots

LIQUIDS
When conditions do not permit direct immersion heaters, use
- ☐ Clamp-on types—strips, tubular, cast-in, heating cable
- ☐ Radiant heaters
- ☐ Heat transfer systems
- ☐ Electric hot water or steam boilers

GASES
For gases in ducts, ovens or pipelines use
- ☐ Strip or Finstrip® elements
- ☐ Tubular or Fintube® elements
- ☐ Duct heaters
- ☐ Circulation heaters
- ☐ Flange or screw plug heaters in pipeline systems

Application Design Criteria

Provide enough kW and
- ☐ Closely match connected load to application requirements for best product and process control
- ☐ Avoid installing excess capacity over the base load and required safety factor

Design for long life by
- ☐ Keeping sheath temperatures well below maximum recommendations
- ☐ Using lowest line voltage practical where choices are available

Ensure safe operating conditions by providing
- ☐ Heater equipment with suitable operating control and overheat protection devices
- ☐ Process being heated with suitable controls
- ☐ Electrical wiring in accordance with all national and local codes
- ☐ Protection for personnel by using insulation, guards, grilles and warning labels

Protect equipment from
- ☐ Physical damage
- ☐ Terminal contamination
- ☐ Corrosion
- ☐ Excessive wiring and terminal temperatures