

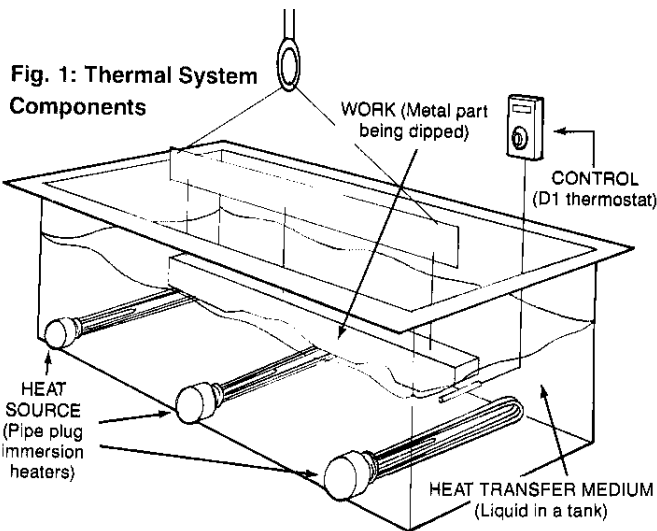
THERMAL SYSTEM DESIGN

In industrial processes, temperature is often the most important variable to control. Temperature variations cause changes in the chemical or physical state of most substances, resulting in changes in flow, viscosity, pressure, level or humidity. An arrangement of components designed to supply controlled heat is a Thermal System. The most sensitive control will not provide acceptable results if careful consideration is not given to the entire system design. As technology has focused increasingly on the application of electronics, control systems can be required to collect and retrieve data and communicate with computers or other controls. Even as industry moves toward the completely automated factory, process temperature control utilizes the same principles and theories whether accomplished by microprocessor or mechanically actuated thermostat.

THERMAL SYSTEM COMPONENTS

The four elements comprising a thermal system are:

- 1.) The work or load.
- 2.) The heat source.
- 3.) The heat transfer medium.
- 4.) The control system.



1.) The work is the material or product being processed. The heat demand may be steady, meaning that the material must be maintained at a constant temperature for a specified period of time. A bacteria culture in an incubating oven is an example of a steady system.

Often the heat demand is variable and cyclic. In this dynamic system, cold material enters the system for processing, absorbs heat, is removed, then replaced in the system by more cold material. An example of a variable or dynamic system is plastic injection molding equipment. The mold receives plastic material, heats, forms, cures then ejects the finished part. The process is repeated again and again.

2.) The heat source is the device that provides heat to the system. The source may be electric heaters, oil or gas fired systems, steam, or the process may be exothermic in that the system generates its own heat.

3.) The heat transfer medium is a solid, liquid or gas which transmits the heat generated from the heat source to the work. The transfer characteristics or conductivity of the material are significant in determining how fast temperature changes travel through the system, and thus, how close the system can be controlled.

4.) The control system includes the instrument that directs whether heat is on or off, depending on the difference between the desired temperature or control set point and the actual temperature.