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CHAPTER 23

PANEL HEATING

Definitions; Application Methods: Imbedded Piping for Ceilings, Walls, or Floors; Warm Air and Electrically Heated Ceilings, Walls, or Floors; Output from Panel Surfaces: Radiation, Convection and Combined Heat Transfer; Floor Panel Design: Design Conditions, Calculation of Room Heat Loss, Determination of UMRT, Determination of Panel Output, Graphical Determination of Panel Input and Water Temperature; Ceiling and Wall Panel Design; Hot Water Piping, Installation and Control

IN this chapter the term, Panel Heating, is used to describe a method of space heating which employs large heated areas of interior room surfaces operating at relatively low surface temperatures (80 to 125 F). The heating elements usually consist of warm water piping, warm air ducts or low temperature electrical resistance elements imbedded in, or located behind, ceiling, wall, or floor surfaces.

Panel heating may be considered as another method of convenient and effective space heating. The heat loss requirements are calculated in the conventional manner, the heat release from the heated surfaces is expressed in terms of heat output per square foot of surface per hour, and the room air temperatures to be maintained are approximately the same as those maintained by heating systems employing cast-iron radiators, convectors, or warm air ducts.

This chapter does not include a separate discussion of such topics as the influence of radiation on human comfort, the mechanisms by which human beings release heat, and other similar topics that apply to all methods of heating interior spaces for human comfort. The reader is referred to Chapter 6 for a detailed discussion of this subject.

APPLICATION METHODS

The great majority of panel installations of the past 40 years (which is the period of the modern utilization of this method of heating) have used warm water as the heating medium which is circulated in imbedded piping. More recently, the use of warm air ducts, and imbedded electrical heating elements, has come into favor, especially where specific local factors have influenced such use. Steam has been used only occasionally because of the problems which result from its higher temperature.

When the heating medium is warm water, both ferrous (steel or wrought iron) or non-ferrous (generally copper or aluminum) pipe or tubing are used widely in ceiling, wall, or floor panel construction. Tubing sizes used are $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{7}{8}$ in. O.D., while piping is generally $\frac{1}{2}$, $\frac{3}{4}$ or 1 in. I.P.S. Where coils are imbedded in concrete or plaster, no screw threads should be used for ferrous pipe coils. The construction should be of all-welded type. Changes in direction should be made by bending the pipe itself, rather than by use of fittings.

For non-ferrous tubing, solder-sweated couplings are used. It is recommended that a medium temperature solder of 95 percent tin—5 percent