

In order to determine the amount of radiating surface necessary to maintain the MRT at 72 F, assume the surface temperature of the hot plates to be installed to be 200 F, which is approximately the temperature they would have if heated by steam.

The 2016 sq ft total area of the surfaces of the room multiplied by 130.9, which is the emission in Btu per square foot per hour necessary to maintain a body surface temperature of 83 F, gives a total desired emission of 263,890 Btu per hour. It is necessary to supply enough radiant heating surface to increase the total actual mean radiant heat emission by the room from 228,310, as shown in Table 2, to the 263,890 Btu desired. The additional heat needed is the difference between these figures, or 35,580 Btu. Since, from Table 1, the emission per square foot at 200 F is 309 Btu, the required radiant heating surface needed is $\frac{35,580}{309} = 115$ square feet. The effect of this surface suitably placed would be to raise immediately the mean radiant temperature to the required degree and to maintain it at that value as long as the surfaces remained at the values assumed.

In the solution of this particular example, the radiation loss from the human body was selected as 217 Btu per hour, which is that taking place under optimum comfort conditions, with a body surface temperature of 83 F in a uniform environment at 72 F. The mean radiant temperature necessarily was 72 F. If the optimum BET of 72 deg Fahr is desired, an air temperature of 72 F also must be maintained. If it is desired to maintain a lower air temperature than this, a mean radiant temperature greater than 72 F must be selected and the radiation loss from the individual must be recalculated from Equation 1.

The calculation may be simplified by preparing tables showing, at the usual temperatures, the area of hot surface required to bring each square foot of actual wall surface at various temperatures up to a general standard of from 60 F to 70 F. It would then be necessary only to multiply the respective areas by the appropriate factors, and to add the results, to obtain the required total.

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PROBLEMS IN PRACTICE

1 ● Name three ways that heat is lost from the human body.

By radiation, convection, and evaporation.

2 ● What is the mean normal surface temperature of the human body as determined for the United States?

83 F.

3 ● What is the exact purpose of radiant heating?

Radiant heating regulates the heat loss from the human body.

4 ● How is the required amount of radiant heating surface found?

By calculating the *desired emission* and the *actual emission*, and finding their difference. This is additional heat which must be supplied by the hot surface.

5 ● After finding the required heat, how is the necessary hot surface area calculated?

Having selected the hot surface temperature, find the emission per square foot from Table 1. This rate divided into the heat required gives the area of the necessary heating surface.

6 ● Is the heat generated in the body affected by action? If so, does it vary greatly?

Yes. With hard work or energetic exercise, the total heat generated in the body may be five to six times that generated when it is at rest.

7 ● When and why does the human body feel cold?

The body feels cold not only when it loses heat at a greater rate than it can generate it, but also when heat is abstracted from the body disproportionately. The human body does not require any heat from without because it generates more heat than is sufficient to maintain the correct temperature; therefore, it is only necessary to provide conditions that will maintain the correct ratio of losses.

8 ● a. Where did radiant heating derive its name?

b. What is actually meant by radiant heating?

- The term radiant heaters was introduced about 25 years ago to designate flat heating surfaces made to give off practically all their heat by radiant ether waves instead of relying on convected warm air.
- The term radiant heating now applies to methods of heating where, instead of heating the air to a predetermined temperature, flat heating surfaces are so placed in a room that the average virtual temperature of all wall, ceiling, floor, and glass surfaces exposed to the body is just sufficient to prevent the body's losing too much heat by radiation. The air temperature can be much cooler with radiant heating because radiation losses from the body are compensated.

9 ● What kind of heating surfaces are in general use?

The heating units may have flat iron surfaces heated with steam and placed under windows, or hot water pipes may be embedded in the floor, walls, or ceilings. Electrical radiant heaters are made by embedding resistance elements in porcelain or electric conductors woven into a thick paper which can be fastened to the walls or ceilings.

10 ● What kind of heat rays are commonly generated in radiant heating? Give examples.

All heat rays are generally assumed to be the same as light rays; they travel at the speed of light, but they are invisible and longer. The rays used in heating are 0.00005 to 0.0001 in. long compared with visible red rays of about 0.000027 in.