

approaches 40 per cent of the total heat load to be removed. If this amount is exceeded, approximately 10 per cent surface should be added.

$$\text{Surface required (S)} = \frac{H_s}{K T_d} \quad (5)$$

where

S = surface area, square feet.

H_s = sensible heat load, Btu.

K = coefficient of transmission.

The sensible heat load may be determined by subtracting the latent heat from the total heat.

Total heat removed = $6383 \times 60 = 382,980$ Btu per hour.

Latent heat at $57\frac{1}{2}$ F (dp) = 10.70 (From Table 2, Chapter 1).

Latent heat at 52 F (dp) = 8.75 (From Table 2, Chapter 1).
1.95 Btu per pound

$1.95 \times 1146 \times 60 = 134,082$

Subtracting this from the total heat = $382,980$

$- 134,082$

Sensible heat $248,898$ Btu per hour

$$S = \frac{248,898}{9.7 \times 20.2} = 1270 \text{ sq ft of surface.}$$

As the latent heat load is 35 per cent of the total heat load, it is not necessary to add 10 per cent to this surface.

For information on the control of air conditioning systems, see Chapter 14.

Chapter 10

COOLING METHODS

Methods of Cooling Air, Evaporative Cooling, Dehumidification by Adsorption and Absorption, Silica Gel Systems, Alumina Systems, Refrigeration, Air Conditioning Applications, Refrigeration Machines, Evaporators, Compressors, Condensers, Amount of Cooling Water, Refrigerants, Methods of Cooling, Air Coolers, Water Coolers, Indirect Coolers, Steam Jet System, Ice for Air Cooling

FROM a study of the data in Chapter 2 and in Chapter 8 it is apparent that a reduction of effective temperature may be produced by any one of the following methods or combinations thereof:

- Lowering of the dry-bulb temperature by the removal of sensible heat without change of the dew-point temperature (sensible cooling).
- Lowering the dew-point temperature by the removal of moisture without change of the dry-bulb temperature (dehumidifying).
- Lowering of the dry-bulb temperature through the evaporation of moisture without the addition or the subtraction of heat (evaporative cooling).
- Increasing the air motion over the body with the consequent higher rate of evaporation from the skin (air motion).

As an example let the condition be considered of 92 F dry-bulb, with a 40 per cent relative humidity, corresponding to a wet-bulb temperature of 72.8 F, and an effective temperature for still air of 81.1 F. This *effective temperature* may be reduced 3.1 F by any of the four basic methods mentioned as follows:

First, by lowering the dry-bulb temperature to 85.5 F without changing the dew-point of 64.2 which gives an effective temperature of 78 F.

Second, by reducing the moisture content of the air to 46 grains per pound of dry air without changing the dry-bulb temperature which gives an effective temperature of 78 F.

Third, by reducing the dry-bulb temperature to 83.8 F without changing the total heat of the air, requiring the evaporation of 14 grains of moisture per pound of dry air, when the effective temperature again will be 78 F.

Fourth, by increasing the air movement from still air to 460 fpm, velocity which will reduce the effective temperature 3.1 F from 81.1 F to 78 F.

Best Method to Employ

The best method of reducing the effective temperature in any specific case will always depend on the accompanying circumstances and only can be determined by the thorough analysis of a competent engineer. Generally speaking, the removal from the air of the sensible heat, or moisture, or both, by sensible cooling or dehumidifying is the most satisfactory method. Adequate results by the utilization of air motion, or by evaporative cooling, are difficult to obtain because of the dependence