3 ● What factors determine the dew point of the air entering the space?

The maximum dew point desired in the conditioned space, and the moisture gain in the space per unit weight of air supplied.

4 ● Why must the air leaving a dehumidifying type air washer be reheated before delivery?

The air leaves the dehumidifying air washer saturated at a relatively low temperature which in most cases is lower than the allowable delivery dry-bulb temperature. Also the air may possibly be carrying a small amount of entrained water which might settle out in the ducts near the washer and cause corrosion difficulties.

5 ● What methods are used for reheating air?

1. Passing it over reheating coils.
2. Mixing it with by-passed air at a higher temperature.

6 ● What determines the final temperature of the spray water in a dehumidifier?

Because of the effectiveness of the heat transfer between air and finely divided spray water in a well designed dehumidifier, the air will be cooled to within 1 or 2 F of the final water temperature, provided the air velocity through the washer does not exceed 600 fpm. This final temperature should then be taken as 1 or 2 F lower than the required dew point of the air leaving the washer.

7 ● What are the advantages of using counter flow of air and water in surface coolers?

Counter flow results in a higher mean temperature difference than does parallel flow for the same range of air and water temperatures, which means that less cooling surface is required. Counter flow permits higher initial water temperatures and also allows a greater temperature rise for the water. These factors combine to reduce the cost of circulating and refrigerating the cooling water.

8 ● What factors other than cost should be considered in determining whether to use a central system or another type?

a. Appearance: The equipment must be designed to harmonize with the architecture of the building.

b. Distribution: The system must maintain adequate and uniform air motion over the entire conditioned space.

c. Control: The control system must be designed to give effective partial load operation.

9 ● Can the central cooling and dehumidifying system be used as an all-year round conditioner?

By modifying the control system and adding blast coils or a water heater to the spray type system, the cooling system will function as one for heating and humidifying. The surface cooling type may be transformed by modifying the control, and adding another set of coils and a humidifier.

10 ● Will the tons of refrigeration-effect per day be the value calculated in Example 4 of this chapter times the hours of operation?

No. The tons of refrigeration-effect are functions of the load. The components of the load vary, that is, the number of people occupying the space, the outdoor conditions, and the solar radiation will change from hour to hour and from day to day. The calculated load represents the maximum required for design peak conditions.

11 ● Will the quantity of return air required in Example 4 of this chapter be used all season?

No. When the outdoor wet-bulb temperature becomes lower than the maintained wet-bulb temperature, it is more economical to use all outside air than to dehumidify the return air.

Chapter 10

COOLING METHODS

Methods of Cooling Air, Evaporative Cooling, Dehumidification, Silica Gel System, Alumina System, Design of System, Operating Methods, Steam Jet System, Compressors, Refrigerants, Methods of Cooling, Condensers

BY using any of the following four methods, or any combination of them, *effective temperature* (see Chapter 2) may be reduced.

a. Sensible cooling: Lowering of the dry-bulb temperature by the removal of sensible heat without change of the dew-point temperature.

b. Dehumidifying: Lowering of the dew-point temperature by the removal of moisture without change of the dry-bulb temperature.

c. Evaporative cooling: Lowering of the dry-bulb temperature through the evaporation of moisture without the addition or the subtraction of heat.

d. Air motion: Increasing the air motion over the body with the resulting higher evaporation from the skin.

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; this 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; this 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. This requires the evaporation of 14 grains of moisture per pound of dry air, and the effective temperature will become 78 F.

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

Method to Employ

The best method of reducing the effective temperature in any specific case will depend on the accompanying circumstances and can be determined only by a thorough analysis made by 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 of both methods upon climatic conditions beyond the engineers' control although these methods are much less expensive than the first two