4 ● a. What are the advantages of roof ventilators?

b. How are proper sizes determined for roof ventilators?

a. Roof ventilators offer the best utilization of the inductive force of the wind, and they may be very economically fitted with built-in fans to supply the necessary circulation when the force of the wind is not sufficient.

b. Because of the many factors affecting the flow through roof ventilators no accurate formula can be given. It is usual practice to make the combined throat area of all roof ventilators between one-half area and full area of the air inlets as determined by Formula 1.

5 ● What methods of control are used in ventilating systems?

Hand control, control by a thermostat located in the ventilated space or in the ventilator, or wind velocity control designed to keep the air discharge constant regardless of wind velocity.

6 ● How is the quantity of air required for a building determined?

Sufficient air must be supplied to carry away the heat and impurities generated within a building. The temperature rise and concentration of impurities in the exhaust air must be held within specified limits. (See Example 1.)

7 ● What measurements are necessary to determine the capacity of a ventilating system?

Wind velocity and air velocities through openings, determined by suitable cup anemometers; outdoor air temperatures, measured by a shaded thermometer not near objects heated by the sun or near exhaust air openings; indoor air temperatures, measured at various heights to secure a good average.

8 ● How much air must be supplied for dissipating the heat generated in a dairy barn housing 100 cows if the outside temperature is 20 F and the inside temperature is to be maintained at 45 F?

The total heat generated is 100 × 3000 = 300,000 Btu per hour or 5,000 Btu per minute. Then from Formula 3,

$$Q = \frac{HV}{CD}$$

$$= \frac{5000 \times 13.5}{0.24 \times (45 - 20)}$$

$$= 11{,}250 \text{ cu ft per minute.}$$

This amount of air should also keep down humidity and odors.

9 ● a. What precaution is necessary in the ventilation of garages using natural ventilation?

b. How much window area is required for a garage with 50 x 100 sq ft floor area if natural ventilation is used?

a. The carbon monoxide content of the air should be kept below 1 part in 10,000 and windows should be kept open at all times.

b. The window area should aggregate 5 per cent of the floor area.

$$0.05 \times 50 \times 100 = 250 \text{ sq ft of window area.}$$

This area should be evenly distributed along two sides of the building.

Chapter 5

HEAT TRANSMISSION COEFFICIENTS AND TABLES

Heat Transfer, Calculations for Transmission Losses, Areas Where Transmission Losses Occur, Coefficients of Transmission, Table of Conductivities and Conductances, Tables of Over-all Coefficients of Heat Transfer for Typical Building Constructions

To maintain specified inside temperature conditions and determine the type of plant required, it is essential to know the transmission losses of a structure and consider them in conjunction with the infiltration losses.

Whenever a difference in temperature exists between the two sides of any structural material, such as a wall or roof of a building, a transfer of heat takes place through that material. When the inside temperature is the higher, heat reaches or enters the inside surface of the wall by radiation and convection, because the air and objects within the building are always warmer than the inside surface of the wall when the inside air temperature t is greater than the outside air temperature t_o. This heat must then pass through the material of the wall from the inside to the outside surface by conduction, and is finally given off from the outside surface by radiation and convection, provided, of course, that equilibrium has been established and all four temperatures are constant. If the outside temperature is the higher, the reverse process takes place.

CALCULATIONS FOR TRANSMISSION LOSSES

The calculations for heat transmission losses are made by multiplying the area A in square feet of wall, glass, roof, floor, or material through which the loss takes place, by the proper coefficient U for such construction or material and by the temperature difference between the inside air temperature t at the proper level (in many cases not the *breathing-line*) and the outside air temperature t_o. Therefore,

$$H_t = A\,U\,(t - t_o) \tag{1}$$

where

H_t = Btu per hour transmitted through the material of the wall, glass, roof or floor.

A = area in square feet of wall, glass, roof, floor, or material, taken from building plans or actually measured. (Use the net inside or heated surface dimensions in all cases.)

$t - t_o$ = temperature difference between inside and outside air, in which t must always be taken at the proper level. Note that t may not be the *breathing-line* temperature in all cases.