use the data of Table 2, Chapter 11, for a wind velocity of 10 mph. Note that for double-hung windows the length of crack is three times the width plus twice the height; while for metal-sash windows the crack length is the total perimeter of the movable or ventilating sections. In calculating window infiltration for an entire structure, it is not necessary to consider the total crack length on all sides of the building, for the wind would not act simultaneously on all sides at once. In no case, however, should less than half of the total crack length be figured. A knowledge of the prevailing wind direction will aid judgment in this consideration.

Cooling-load infiltration for doors[32] may be obtained from Table 3, Chapter 11. For conditions other than those covered, the notes appended to the table will provide a basis for estimates. The tabulated data may also be used as the basis of estimates for interior doors between an air-conditioned and a non-air-conditioned space.

Infiltration load must be included whenever the new air introduced through the system is not sufficient to maintain excess pressure within the enclosure to prevent the infiltration. Whenever economically feasible, it is desirable to introduce sufficient outdoor air through the air-conditioning equipment to maintain a constant outward escape of air, and thus eliminate the infiltration portion of the load. The pressure maintained must, of course, be sufficient to overcome wind pressure through cracks and door openings. When this condition prevails it is not necessary to include any infiltration load. When the quantity of new air introduced through the cooling equipment is not sufficient to build up the required pressure to offset infiltration, the entire infiltration load should be included in the cooling load calculations.

Total Outside Air Load. Many cooling coil manufacturers publish tables giving psychrometric data based on the *average* conditions of the leaving air for various coil temperatures, air velocities, and entering dry-bulb and wet-bulb conditions. When these tables are used, it is necessary to calculate the mixed air condition entering the coil, and determine from the tables what coil and air velocity will produce the desired leaving air conditions as required for the space to be conditioned. When cooling coils are listed as 80 to 95 percent efficient, the manufacturer indicates that 20 to 5 percent of the air passes through the coil without being cooled. If data of this nature are used, the uncooled portion of the air must be added to the space load before determining the effective air quantity. See later section on Apparatus Dew Point.

To determine the design cooling load caused by the introduction of outside air, the maximum rate of outside-air entry is first established. In some applications the use of special exhausters from the conditioned space may add to the outdoor-air requirements in determining the maximum rate. Once this design quantity is established, and with the design indoor and outdoor air states known, the cooling load may be computed. There are several methods in use; the more accurate of these require rather detailed calculations. Refer to Chapter 3, and also section on Apparatus Dew Point in this chapter. The following equations are considered to be of sufficient precision for use at usual design conditions, as their accuracy is within 1 percent.

$$\textit{Sensible Load}\ q_s = Q \times 60 \times 0.244 \times 0.075 \left(1 - \frac{0.00923}{0.62}\right)(t_o - t_i)$$
$$= Q \times 1.08\ (t_o - t_i),\ \text{Btu per hour} \quad (7)$$

$$\textit{Latent Load}\ q_e = Q \times 60 \times 0.075 \times 1076\ (W_o - W_i)$$
$$= Q \times 4840\ (W_o - W_i),\ \text{Btu per hour} \quad (8)$$

$$\textit{Total Load}\ q_t = q_s + q_e \quad (9)$$

where

Q = rate of entry of outside air, cubic feet per minute.
t_o = outdoor dry-bulb temperature, Fahrenheit.
t_i = indoor dry-bulb temperature, Fahrenheit.
W_o = outdoor humidity ratio, pounds moisture per pound of dry air.
W_i = indoor humidity ratio, pounds moisture per pound of dry air.
0.075 = standard air density, pounds per cubic foot.
0.244 = a constant approximating the specific heat of dry air corrected for moisture Btu per (pound) (Fahrenheit degree).
1076 = a factor approximating the average Btu released in condensing one pound of water vapor from air.

As explained later in the section on Apparatus Dew Point, some methods of load calculations break down the ventilation air into two parts: one portion which does not contact the coil surfaces (*i.e.* bypasses the coil) in passing through the coil and thus becomes a part of the room load; and a second portion, the remainder of the air which contacts the coil surfaces and is cooled down to the apparatus dew point. This detailed method explained in the literature by Ashley,[31] is believed to be very easy and accurate to use. Similar equations, therefore, can be written:

Space Sensible Ventilation Load,
$$q_{si} = Q \times 1.08(t_o - t_i) \times b \quad (10)$$
Space Latent Ventilation Load,
$$q_{ei} = Q \times 4840(W_o - W_i) \times b \quad (11)$$
Remaining Sensible Ventilation Load,
$$q_{sx} = Q \times 1.08(t_o - t_i)(1 - b) \quad (12)$$
Remaining Latent Ventilation Load,
$$q_{ex} = Q \times 4840(W_o - W_i)(1 - b) \quad (13)$$
$$q_t = q_{si} + q_{sx} + q_{ei} + q_{ex} \quad (14)$$

where

b = fraction of air passing through coil which does not contact surfaces, coil bypass factor.

Standard air weight (0.075) lb per cu ft) is recommended for use in all calculations, as this is the basis for rating fans and its consistent use keeps all parts of the calculations in conformity.

HOW OUTDOOR AIR LOAD AFFECTS ROOM LOAD

Actually, the outdoor air used for ventilation would pass through the conditioning equipment, and be cooled and dehumidified to a lower temperature and humidity ratio than room conditions before entering the room; but for heat-balance purposes the cooling load chargeable to the outdoor air is that corresponding to the difference between the outdoor and indoor air conditions.

One important purpose of the cooling load estimate is to determine the