the leeward side. Therefore, for determining the total heat requirements of larger buildings it is more accurate to base the total infiltration loss on the wall having the most total crack, but in no case on less than half of the total crack in the building.

Number of Air Changes to be Used for Computations

Since a certain amount of judgment is required regarding quality of construction, weather conditions, use of room and other factors in estimating infiltration by any method, some designers base infiltration upon an estimated number of air changes rather than upon the length of window cracks. Table 4 of Chapter 11 indicates air changes commonly used, but should be taken only as a guide.

When calculating infiltration losses by the air change method, Equation 5a may be used by substituting for Q the volume of the room multiplied by the number of air changes obtained from Table 4, Chapter 11. For further discussion of the method see section on Air Change Method in Chapter 11.

Latent Heat Loss

When it is intended to add moisture to air leaking into a room in order to maintain proper winter comfort conditions, it is necessary to determine the heat required to evaporate the water vapor added. This heat may be calculated by the equation

$$H_l = Qd\ (W_i - W_o)\ h_{fg} \qquad (6)$$

where

H_l = heat required to increase moisture content of air leaking into building from m_o to m_i, Btu per hour.
Q = volume of outside air entering building, cubic feet per hour.
d = density of air at temperature t_i, pounds per cubic foot.
W_i = vapor density of inside air, pounds per pound of dry air.
W_o = vapor density of outside air, pounds per pound of dry air.
h_{fg} = latent heat of vapor at m_i, Btu per pound.

If the latent heat of vapor h_{fg} is assumed to be 1060 Btu per lb, Equation 6 reduces to:

$$H_l = 79.5\ Q\ (W_i - W_o) \qquad (6a)$$

Equations 5a, 5b and 6a may also be used for determining the sensible and latent heat gains due to infiltration in cooling load computations.

SELECTION OF WIND VELOCITIES

The effect of wind on the heating requirements of any building should be given consideration for two reasons:

1. Wind movement increases the heat transmission of walls, glass, and roof, affecting poor walls to a much greater extent than good walls.
2. Wind increases materially the infiltration of cold air through the cracks around doors and windows, and even though the building materials themselves (see Tables 1 and 2, Chapter 11).

Theoretically, as a basis for design, the most unfavorable combination of temperature and wind velocity should be chosen. It is entirely possible that a building might require more heat on a windy day with a moderately

low outside temperature, than on a quiet day with a much lower outside temperature. However, the combination of wind and temperature, which is the worst, would differ with different buildings, because wind velocity has a greater effect on buildings which have relatively high infiltration losses. It would be possible to compute the heating load for a building for several different combinations of temperature and wind velocity which records show to have occurred, and to select the worst combination, but designers generally do not feel that such a degree of refinement is justified.

Therefore, since Table 1 lists the average velocity of winds occurring at temperatures equalled or exceeded $97\frac{1}{2}$ percent of the winter period for each locality, this value should be the basis for estimating infiltration losses. When using the air change method it will not be necessary to consider the wind velocities. Designers employing the crack method generally use values corresponding to a 15-mile wind. Due to the small effect of the wind velocity on the transmission coefficient, the values in

TABLE 6. HEAT EQUIVALENTS OF VARIOUS SOURCES[a]

Machinery (Motor in room = Motor Hp/efficiency x 2544	Btu/hr.
Machinery (Motor outside room) = Motor Hp x 2544	Btu/hr.
Electric Lights = Kilowatts x 3413	Btu/hr.
Gas (Producer = 150) (Manufactured = 535) (Natural = 1000)	Btu/cu ft.

[a] Additional values are given in Chapter 13, Table 26.

Chapter 9, based on a 15-mile wind may be used with sufficient accuracy for all ordinary conditions.

Exposure Factors

Many designers use empirical *exposure* factors to increase the calculated heat loss of rooms or spaces on the side or sides of the building exposed to the prevailing winds. However, the use of exposure factors is unnecessary when the GUIDE method of calculating heat losses is used. Therefore, exposure factors may be regarded as *factors of safety* for the rooms or spaces exposed to the prevailing winds, to allow for additional capacity for these rooms or spaces, or to *balance the radiation*, particularly in the case of multi-story buildings. Tall buildings may have severe infiltration heat losses, induced by their stack effect (see Chapter 11), which will require special consideration. Although the exposure allowance frequently is assumed to be 15 percent, the actual allowance to be made, if any, must to a large extent be a matter of experience and judgment of the designer, since there are at present no authentic test data available from which rules could be developed for the many conditions encountered in practice.

AUXILIARY HEAT SOURCES

The heat supplied by persons, lights, motors and machinery always should be ascertained in the case of theaters, assembly halls, and industrial plants, but allowances for such heat sources must be made only after careful consideration of all local conditions. In many cases, these heat sources should not affect the size of the heating plant at all, although they may have a marked effect on the operation and control of the system. In general, where audiences are present, the heating system must have sufficient capacity to bring the building to the stipulated inside temperature before the audience arrives. In industrial plants, quite a different condition exists, and heat sources, if always available during occupancy, may be substituted for a portion of the heating installation. In no case should the