

Surplus or Heating Equivalent Direct Radiation for the purposes of this code shall be construed to mean difference between the total EDR at a specified inlet temperature and the EDR required to heat the air from that temperature to 70 F.

If no direct heating surface (radiation) is installed to take care of the normal heat transfer losses, and the unit ventilator is to be used for both heating and ventilation, then the combined requirements must be taken care of by the unit ventilator.

TABLE 3. TYPICAL CAPACITIES OF UNIT VENTILATORS
FOR AN ENTERING AIR TEMPERATURE OF ZERO

CUBIC FEET OF AIR PER MINUTE		TOTAL CAPACITY IN SQUARE FEET, EQUIV- ALENT DIRECT RADIATION	CAPACITY AVAILABLE FOR HEATING THE ROOM, SQUARE FEET EQUIVALENT DIRECT RADIATION	FINAL AIR TEMPERATURE F DEG.
Anemometer Rating	Condensate Rating			
750	500	214	56	95
1000	750	320	84	95
1260	1000	427	112	95
1560	1250	534	141	95

Heat Required for Ventilating Only

When all of the air handled by the unit is taken from the outside, the total heat to be supplied is obtained by means of Equations 1, 2, 3, and 4.

$$H = 0.24 W (t_y - t) \quad (1)$$

$$H_v = 0.24 W (t - t_o) \quad (2)$$

$$H_t = 0.24 W (t_y - t_o) = H + H_v \quad (3)$$

$$W = d \ 60 \ Q \quad (4)$$

From Equations 2, 3, and 4:

$$H_t = H + 0.24 \ d \ 60 \ Q \ (t - t_o) \quad (5)$$

where

d = density of air, pounds per cubic foot (0.075 lb per cu ft for Standard Air by definition).

H = heat loss of room, Btu per hour.

H_v = heat required to warm air for ventilation, Btu per hour.

H_t = total heat requirements for both heating and ventilation, Btu per hour.
 $= H + H_v$.

Q = volume of air handled by the ventilating equipment, cubic feet per minute.

t = temperature to be maintained in the room, Fahrenheit degrees.

t_o = outside temperature, Fahrenheit degrees.

t_y = temperature of the air leaving the unit, Fahrenheit degrees.

W = weight of air circulated, pounds per hour.

0.24 = specific heat of air at constant pressure (approximate value).

Example 1. The heat loss of a certain room is 24,000 Btu per hour, and the ventilating requirements are 1000 cfm. If the room temperature is to be 70 F and all air is taken from the outside at zero, what will be the total heat demand on the unit if it is required to provide for both the heating and ventilating requirements (combined system)?

Solution. Substituting in Equation 5:

$$H_t = 24,000 + 0.24 \times 0.075 \times 60 \times 1000 (70 - 0) = 99,600 \text{ Btu per hour}$$

$$t_y = \frac{24,000}{0.24 \times 0.075 \times 60 \times 1000} + 70 = 92.2 \text{ F.}$$

Heat Required for Ventilating and Recirculating

When part of the air handled by the unit is taken from the room and the remainder from the outside,

$$H_t = 0.24 W_o (t_y - t_o) + 0.24 W_i (t_y - t) \quad (7)$$

$$W_o = d_o \ 60 \ Q_o \quad (8)$$

$$W_i = d_i \ 60 \ Q_i \quad (9)$$

$$t_y = \frac{H}{0.24 (W_o + W_i)} + t \quad (10)$$

$$H_t = H + 0.24 \ d_o \ 60 \ Q_o \ (t - t_o) \quad (11)$$

where

W_o = weight of air, pounds per hour taken from out-of-doors.

W_i = weight of air, pounds per hour taken from the room.

d_o = density of air, pounds per cubic foot at temperature t_o .

d_i = density of air, pounds per cubic foot at temperature t .

Q_o = volume of air taken in from the outside, cubic feet per minute.

Q_i = volume of air taken in from the room, cubic feet per minute.

Applications of Unit Ventilators

Items to be considered in the application of unit ventilators are: (1) combination with other means of heating, (2) location of units, and (3) method of venting or exhausting.

In a *split* system the unit is used primarily for ventilation. Air is delivered to the room at or slightly above room temperature, and enough radiation is installed in the room to take care of the normal heat transfer losses. Where the unit ventilator selected has a capacity more than sufficient to warm the air needed to meet the ventilating requirements, a corresponding reduction may be made in the amount of direct radiation installed. The greater the amount of excess capacity of the unit, the more efficient will be the temperature regulation of the room. The split system permits the heating of the room during failure of electric current, since the direct radiators will furnish heat, but it permits a careless operator to avoid operating the ventilating equipment.

The *combined* system employs a unit ventilator with sufficient capacity for both ventilation and the normal heat transfer losses. In such a case no direct radiation is required. The necessary operation of the fan when the room is being heated also gives assurance that some ventilation is being provided, especially if automatic dampers are used in the air intake and in the recirculating intake. These dampers are arranged to provide a certain quantity of outside air, depending upon the weather conditions. The cost of installation of a combined system is usually less than that of a split system and there is less danger of overheating, but if the electric energy fails there will be available only the heating effect of the units acting as convectors.

Location of Unit Ventilator

The location of the unit ventilator in a room is important. Wherever possible it should be placed against an outside wall and on the center line of the room. It is difficult to obtain proper air distribution if the unit is installed either on an inside wall or in a corner of the room. Standard units discharge the air stream upward, but for special cases units may be installed to discharge air horizontally. Units may be set away from the