In this case t_y should be equal to or slightly higher than t. If the unit ventilator were of such capacity as to exactly provide for the ventilating requirements, the direct radiation would be selected on the usual basis. However, it is necessary to employ a unit which may not exactly meet the ventilating requirements, since standard units are usually rated in terms of the volume of air that will be delivered at a certain temperature t_y for an initial temperature of t_o. Therefore a certain amount of heat (H_h) may be available from the unit ventilator for heating purposes, as previously stated, and the amount of equivalent direct heating surface may, if desired, be deducted from the amount required for heating the room.

Example 2. Assume the same data as in example 1, for a split system, and select the unit and direct heating surface, making allowance for any excess capacity of the unit above that required to warm the air introduced for ventilation purposes.

Solution. The amount of equivalent direct heating surface required, disregarding the unit ventilator, is equal to $\frac{24{,}000}{240} = 100$ sq ft. A unit having an air capacity of 1050 cfm is selected, the excess heating capacity of this unit for an entering air temperature of zero being 82 sq ft. The theoretical net direct heating surface required with the fan in operation is therefore 18 sq ft. However, it is not likely that this or any other unit contains enough indirect heating surface to heat the average size classroom when the fan is inoperative. The maximum deduction should not exceed 75 sq ft of equivalent direct heating surface, and as previously stated, the best results are obtained when no deduction is made for the excess capacity of the unit.

SYMBOLS USED IN THIS CHAPTER

d = density of air, pounds per cubic foot.
H = heat loss of room, Btu per hour.
H_h = heating capacity of unit ventilator in excess of that required to warm air introduced for the ventilating requirements, Btu per hour.
H_t = total heat requirements for both heating and ventilation, Btu per hour $= H + H_v$.
H_v = heat required to warm air for ventilation, Btu per hour.
Q = volume of air introduced for the ventilating requirements, cubic feet per hour.
t = temperature to be maintained in the room.
t_o = outside temperature.
t_y = temperature of the air leaving the unit.
W = weight of air circulated, pounds per hour.
0.24 = specific heat of air at constant pressure.

Chapter 37

UNIT AIR CONDITIONERS AND COOLERS

Unit Air Conditioners—Advantages and Disadvantages; Description and Operation; Evaporative and Non-Evaporative Cooling; Water Required: Cooling Units—Functions; Types; Cooling Media; Heat Absorption; Temperature of Air Circulated; Ratings and Capacities; Location of Units; Compressor Capacity; Automatic Control; Defrosting.

UNIT AIR CONDITIONERS

THE unit air conditioner is a self-contained apparatus performing the same functions as the larger so-called central station equipment. It may be used for the air conditioning of printing plants, textile mills, candy manufacturing, packing and storage departments, cigar and cigarette making and seasoning departments, bakeries, process rooms necessary in the manufacture of pharmaceuticals and related products, and for any industrial plant or department in which production depends on, or quality is improved by, positive and accurate control over atmospheric conditions.

The unit air conditioner provides for humidification or dehumidification, air washing, heating or cooling, and uniform distribution of air, either with or without ducts, depending on the location of the units. Each unit is a complete air-conditioning plant in itself including spray nozzles, air re-heater, fan, pump, automatic control, etc. They are usually built in graduated standard sizes ranging in capacity up to 10,000 cfm each.

Advantages of Unit Air Conditioners

The principal advantages of such equipment are that the desirable results of the indirect humidification system can be applied to old buildings without installing duct work. Also where manufacturing processes are changed and departments are sub-divided or enlarged the units are easily moved or increased in number to suit the new requirements. Because of their portability they are useful for tenants of rented buildings.

Disadvantages of Unit Air Conditioners

Frequent cleaning and adjustment of controls of air-conditioning units, used where dust and lint occur, may be objectionable. A multiple unit installation, therefore, involves a great deal more attention than does a single unit located in the basement. In dehumidifying plants, especially, the expense of piping required for connection of separate air-conditioning units to the refrigerating apparatus, must be considered. The central station system generally is recommended where more than three unit conditioners are required.