

ventilation only, or to a higher temperature if it is intended to take care of all or a part of the heat transmission losses from the room.

3. To control the temperature of the air delivered.
4. To deliver air to the room in such a manner that proper distribution is obtained without drafts.
5. To recirculate room air for the purpose of heating when ventilation is unnecessary, or partly recirculate, mixing inside and outside air.
6. To perform all its functions without objectionable noise.

In addition to these functions, unit ventilators frequently are arranged so that the air supplied may be cleaned by means of filters of the adhesive type. If filters are used, the proper allowance must be made for the increased resistance offered to the air flow. Humidifiers in unit ventilators are optional.

1. *Air Supply for Ventilation.* The out-door air supply for ventilation is brought about by motor-driven fan or fans operated at comparatively low speeds and located in the lower part of the cabinet, the back of the cabinet being connected to the outside through rust-proof louvers and screens. Air quantities may be estimated on the basis of data given in Chapter 24. In densely occupied spaces, the usual practice is to allow 30 cfm per person.

2. *Warming Incoming Air.* The air is heated by blowing it through specially designed extended heating surface. The amount of heating surface to be provided in the unit is of course determined by the volume of air to be heated and the temperature range. If the unit is to be used for supplying air for ventilation only, the heating surface must be sufficient to maintain a final air temperature of about 70 F. If the unit is to be used for heating as well as for ventilation, the heating surface must be sufficient to maintain the necessary final air temperature for the conditions involved.

3. *Control of Temperature.* This is accomplished by controlling the temperature of the air discharged from the unit in one of two ways; *first*, by the automatic operation of a mixing damper which controls the relative quantities of air being blown through the heating unit or by-passed around it, and *second*, by dividing the heating unit into two or more sections and controlling (*i.e.*, throttling) the steam so that the proper amount of steam will be supplied to as many sections as required.

The outside air inlet damper and recirculating damper (where one is provided) should be so connected that there will be an uninterrupted supply of air to the fans at all times the unit is in operation. These dampers may be operated by hand or by pneumatic or electric motors controlled from some central point such as the engineer's office, or automatically at the unit itself. Provision should be made for the inlet damper to close automatically whenever the fans are shut down. The temperature of the air from the machine should be regulated automatically by thermostats in the room which control the position of the by-pass dampers below the heating elements, or the number of sections to which steam is supplied. Thermostats for controlling by-pass dampers must be of the intermediate type to hold the dampers in intermediate positions to prevent objectionable drafts. When direct radiators are used in conjunction with unit ventilators the control is usually arranged so as

automatically to open the valves to the direct radiators when the room temperature falls about 2 deg below the setting of the thermostat for the unit ventilator. Another arrangement opens the radiator valve whenever the unit ventilator control reaches the full heating position. Further information on this subject is contained in Chapter 23.

4. *Distribution.* This function is governed by the proper selection and location of the unit. Diffusion and distribution are dependent upon a relatively high velocity air stream discharged in a generally vertical direction, and in order to insure satisfactory diffusion in the room the final temperature of the air discharged from the unit must be kept as low as possible. With a final temperature above 110 F, excessive stratification of the air may be experienced. Troublesome drafts may be eliminated to a large extent if a static pressure is built up in the room, which can be done only if the vent from the room is small.

5. *Recirculation* reduces fuel consumption and aids in heating up rooms. Certain units are designed to recirculate all air at all times, except when the admission of outside air is needed to regulate room temperatures. Under this arrangement, the outside air for ventilating purposes is obtained solely from the infiltration, but the amount thus obtained is ordinarily insufficient to meet legal ventilating requirements. Recirculation is therefore prohibited by ordinance in some communities.

6. *Quiet Operation.* The unit ventilator is generally set close to the occupants of the room where activities are being carried on which preclude the use of noisy equipment. Quiet operation is therefore imperative.

SPLIT AND COMBINED SYSTEMS

In the *split* system shown in Fig. 1, the unit is used primarily for ventilation, delivering the air to the room at very near the room temperature, sufficient separate direct heaters being placed in the room to heat it to the desired temperature, independently of the unit. With the split system the separate direct heaters tend to improve the air circulation and diffusion within the room, since they constantly pull the cold air from the floor, warm it and use it to counteract the window chill.

In some cases the unit ventilator selected may have a capacity more than sufficient to warm the air needed to meet the ventilating requirements, and a corresponding reduction may be made in the amount of direct heating surface 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 (Figs. 2 and 3) employs the unit ventilator alone, its capacity being sufficient both for ventilation and for supplying the heat loss. Direct heating surface is omitted altogether. It becomes necessary then that the fan be running whenever the room is to be heated and this also gives assurance of ventilation. With the combined system the distribution of the air within the room probably is not as perfect as with the split system, and more drafts will be encountered unless wide and rapid variations in the temperature of the air delivered by the machine