humidistats, usually placed in rooms or in return air ducts. In ventilating systems the controlling instruments may be put in the fan discharge for results comparable with dew-point control. However, as hygroscopic elements are actuated by relative humidity they cannot be used with discharge temperatures that have been raised to supply heating effect.

Humidity control in cold weather is complicated by the danger of causing condensation or frost on windows and exterior walls, when otherwise desirable relative humidities are obtained. For satisfactory results in buildings that are not specially designed to prevent cold interior wall and glass surfaces, it is necessary to maintain lower humidities in very cold weather. This is done automatically either by an auxiliary humidistat mounted at a window to prevent condensation at that point, or by using a type of room or duct humidistat that is reset by an outdoor thermostat to maintain gradually drier conditions as the weather gets colder.

### Cooling Cycle

Although central systems are occasionally used for cooling and dehumidifying only, the control features are essentially the same as for complete air conditioning systems. Where control of room conditions is obtained by varying the quantity of cooled air, as in a trunk duct system, individual room or zone thermostats operate volume dampers. It is customary to have these installed with a stop to prevent shutting off the air supply entirely, the reduction being from 40 to 60 per cent of the maximum delivery, depending on the design of the system. Later described control of the temperature of the air prevents over-cooling with the minimum supply, and the damper variation is normally sufficient to handle the distribution of the cooling effect throughout the area supplied by the fan or trunk duct.

In cases where systems and outlets are designed for particular velocities for proper room diffusion, volume dampers tend to produce undesirable results, by changing these velocities. Partially closed dampers reduce volumes in their ducts and increase volumes elsewhere. Trouble from too little air can be reduced by having the dampers close off, in one way or another, a part of the grille openings, thus maintaining approximately the same velocity through a smaller grille area. Trouble from increase of static pressure, due to reducing air volumes delivered, can be corrected by static pressure control, as described under a separate subheading in this chapter.

In installations where constant volumes of air are desired, and individual ducts are run to each room or zone, as shown in Figs. 3 and 5, of Chapter 21, air temperatures are varied as for the heating cycle, by room thermostats operating (1) mixing dampers which take air from either or both of two chambers, one of which has been cooled to the minimum temperature ever required; (2) booster cooling coils, one for each duct, in which the refrigerating medium can be turned on or off, or modulated; (3) individual by-pass dampers around booster cooling coils which are kept at a constant temperature; or (4) reheating coils which in times of light cooling load add heat to air that has been cooled to the minimum temperature required.

All these arrangements apply where one fan supplies more than one





room, or zone, and consequently the temperature-varying devices are downstream from the fan. The remainder of the control for the system is concerned with maintenance of conditions at the fan and is similar to what is used where a fan system is treated as a single zone.

Air washer cooling and dehumidification is commonly controlled by pumping the spray water through, or around a water cooler, with a dew-point thermostat operating a mixing valve which regulates the amount of water by-passing the cooler. An alternate scheme is to put cooling coils in the air washer spray or the pan, and to control the temperature of the coil. In both cases control of relative humidity is obtained by maintaining a constant dew-point temperature and thus a constant amount of water vapor per cubic foot of air handled. On account of this humidity factor, air leaving the washer must be reheated. As explained in Chapter 21, this is done, (1) by passing uncooled air around the washer[1] with thermostatic control of the proportion of uncooled air; (2) by adding heat by means of an automatically controlled coil; or (3) by allowing the room air to provide the heat by diffusion, in which case, still assuming a constant volume of air, the only means of dry-bulb control is the raising and lowering of the dew-point temperature, and hence the relative humidity.

Heat transfer surface coils, now more frequently used for cooling and dehumidification, are of either the direct expansion or cold water type. The former may be controlled by starting and stopping or unloading the compressor, by opening and closing a valve in the liquid line, by throttling the expansion valve, by throttling the suction line, or by raising and lowering the coil pressure, and temperature, through operation of a back pressure valve. The cold water type coils are controlled by valves to regulate the flow of water. They may throttle the flow, or they may be of the three-way type that allows a uniform flow but by-passes any necessary amount around the coil. Where well water pumps are operated only for cooling coils, control is added to stop them while cooling is not needed, but if they serve other purposes, they continue to run and the water is controlled by throttling valves.

The control with all types of coils may include a damper in an air by-pass[2] around the coils, with or without one over the face of the coils. If the installation is large enough to justify the use of two or more coils, side by side, the special air by-pass may be omitted and similar results obtained by closing the coils in sequence. The controlling instrument in all these cases is a thermostat in the room, return air, or fan discharge, whether the system serves one zone or several. In the latter case, a thermostat in the return air or in the fan discharge serves as a primary control, and the final control of room conditions is obtained with the zone thermostats.

Room or zone control in the cooling cycle is commonly provided by thermostats which operate at varying points depending on the weather. This takes care of the difference in optimum temperatures for the heating and cooling seasons and also of the objection to maintaining too high a differential between indoor and outdoor temperatures in hot weather.

[1]Patents exist covering the by-pass method.
[2]Loc. Cit. Note 1.