If all of the air is recirculated, the total heat required is of course the same as the heat loss of the room, or

$$H_t = H = 0.24\ W\ (t_y - t) \qquad (5)$$

If the heat loss of the room is to be taken care of by the direct heating surface, the unit ventilators will be required to warm the air introduced for the ventilating requirements. Therefore:

$$H_v = 0.24\ W\ (t_y - t_o) \qquad (6)$$

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.

Chapter 14

TEMPERATURE AND HUMIDITY CONTROL

Definitions, Thermostats, Temperature Control Systems, Control of Automatic Fuel Devices, Zone Control, Control of Air Conditioning Systems, Control of Radiators and Convectors, Unit Heaters, Unit Ventilators, Central Fan Systems

CONTROL of a heating or cooling system may be obtained through regulation of only the dry-bulb temperature, while in an air conditioning system, the dry-bulb temperature, the wet-bulb temperature, and air movement must all be regulated. It is possible, however, that the control of only one of these may affect the other two sufficiently to give desired conditions.

This chapter contains information on the principles underlying the regulation of both temperature and humidity as well as data concerning various devices for such regulation. Specific control devices and systems are described in the Catalog Data Section of THE GUIDE.

Controls are applied for the following reasons:

1. To maintain conditions required for human comfort and efficiency.
2. To maintain conditions required for industrial processes.
3. To obtain economy in operation.
4. To provide necessary safety measures.

The proper operation of all control systems depends on the selection of the correct type of control instrument, as well as on its correct application within the complete system.

DEFINITIONS

For the purposes of this chapter the terms used shall be construed as follows:

Normally Open or Normally Closed: Used to indicate position taken by a valve or damper when the power for the control system (compressed air, electricity, etc.) is turned off, or fails.

Branch Line: The line between a thermostat, humidistat or switch and the valve or damper it operates.

Main Line: A line furnishing power to a thermostat, humidistat or switch.

Pilot: A thermostat or humidistat which acts directly on another thermostat or humidistat. The pilot may either throw the instrument it operates out of action by cutting off or throttling its source of power, or it may act as a remote adjusting device by resetting its point of control. In the former case, the branch line of the pilot becomes the main for the other instrument. In the latter case, it is necessary for each to have direct connection to the main line.