

systems are silica gel, lithium chloride, activated alumina and calcium chloride. These systems accomplish dehumidifying entirely separate from sensible heat cooling. The air passing through the material gives up its moisture to the material and there is a conversion of latent heat energy to sensible heat energy so that the temperature of the air leaving the equipment is considerably higher than the entering air. These systems can be used for dehumidifying outside air only, or for a mixture of outside and recirculated air, or for recirculated air only. The sensible heat cooling is accomplished by directing the air over a cooling coil. For further details of this method refer to Chapter 23.

DESIGN OF SYSTEM

In designing a complete air conditioning system it is logical to consider several factors which, for convenience, may be enumerated herewith:

1. Design conditions
 - a. Outside dry-bulb temperature for winter.
 - b. Outside dry- and wet-bulb temperatures for summer.
 - c. Inside dry-bulb temperature and relative humidity.
2. Design heating load
 - a. Heat transfer through windows, walls, partitions, doors, floors, sky-lights, ceilings and roofs.
 - b. Heating capacity to warm incoming outside air.
 - c. Heat required to evaporate moisture for humidification.
 - d. Heat loss through ducts and casings.
 - e. Allowances for heat emitting sources.
3. Design cooling load
 - a. Heat transfer through windows, walls, partitions, doors, floors, sky-lights, ceilings and roofs.
 - b. The sensible and latent heat gains from occupants.
 - c. Heat emission of electrical, chemical, gas, steam, hot water or other devices, apparatus or lights.
 - d. Transfer of solar radiation through windows, walls, doors, sky-lights or roofs.
 - e. The sensible and latent heat to be removed from incoming outside air.
 - f. Heat gain through ducts, casings and fans between conditioning unit and enclosure.
4. Design of distribution system
 - a. Establish the temperature of air leaving the supply inlets.
 - b. Calculate the quantity of air to be circulated.
 - c. Estimate the temperature rise or loss in the duct system.
 - d. Calculate the heating or cooling requirements of apparatus.
 - e. Design the duct system including the air inlets and outlets.
 - f. Consider noise control problems.
 - g. Design the control system.
 - h. Calculate total static pressure of the system.
 - i. Select the air filtering equipment.
 - j. Select the fan, motor, drive and auxiliary equipment.

Design Conditions

The design outside dry-bulb temperature in various localities for use in computing the winter heating requirements may be referred to in Chapter 7. In computing the summer cooling requirements for various cities recommended design outside dry- and wet-bulb temperatures may be

found in Chapter 8. Recommended inside temperatures and relative humidities for winter and summer conditions and for various types of buildings are given in Chapters 3 and 7.

Load Calculations for Heating

Complete tabular information is given in Chapter 5 for determining the heat loss through windows, walls, partitions, doors, floors, sky-lights, ceilings and roofs.

The heating capacity required for warming the outside air which enters by uncontrolled infiltration should be calculated according to the information given in Chapter 6. Mechanical ventilation systems are frequently designed which produce either positive or negative pressures within an enclosure that are greater or less than the outside prevailing wind pressure. Under such circumstances uncontrolled infiltration is over or under balanced by the supply or exhaust ventilation system. If the rate at which air is specified to be introduced to or removed from the enclosure by positive means exceeds the estimated infiltration rate it is common practice to use the greater rate in heating capacity calculations.

The heat required for warming the outside air introduced for ventilation purposes should be calculated according to the basic data given in Chapter 3, and the methods outlined in Chapter 6. The first requirement for any air conditioning system is to provide satisfactory ventilation and the design should err on the side of being liberal in the amount of outside air introduced for the purpose of maintaining good ventilation without objectionable odors.

Code² requirements state that the assumed rate at which air is to be positively introduced into the enclosure per occupant, when the contamination of air within the enclosures results entirely from respiratory process shall not be less than 10 cfm per stated number of occupants which is indicated as being the maximum number of people within the enclosure when the sum of the remaining loads are a maximum. The Code further states that the assumed ventilation rates shall not be less than 15 cfm per stated number of occupants in enclosures where smoking is customarily permitted, and that provision shall be made for air removal from the enclosure either by natural or mechanical means at not less than the assumed ventilation rate. For the purpose of the Code air quality or purity are assumed to be met if means are provided for the positive introduction of outside air in the amounts previously mentioned and for removal of 95 per cent by count of all dust particles over 10 microns in diameter from all air delivered to the enclosure.

The heat required to evaporate the necessary water required for winter humidification and superheat the resulting vapor in order to raise the moisture content of the outside air assumed to enter the enclosure by infiltration or positively introduced for ventilation should be calculated according to the information included in Chapter 1.

The heat loss through the ducts and casings between the condition unit and the treated space may be determined from data given in Chapter 39.

The heat gain due to lights and people or other heating sources in the conditioned space may be calculated as referred to later in this Chapter.

²Loc. Cit. Note 1.