

are given in Chapter 34 but should always be verified locally. In lieu of this tedious work, the average gallons per minute per ton may be taken as 80 per cent of design gallons per minute per ton with reasonable accuracy, for the condition of variable temperature of entering water obtained from rivers and lakes.

When cooling towers or evaporative condensers are used, the windage and evaporation losses are usually between 3 per cent and 5 per cent of the water circulated.

Heating

The method of estimating fuel consumption to balance the building heat loss is given in Chapter 17. It is important to include the fuel required to heat ventilation air as used in ventilating and air conditioning systems. In estimating fuel consumption for ventilation air, the tendency of the conventional control systems to use less than the estimated quantity of outside air in cold weather should be considered in its effect in lowering fuel consumption. In addition, the heat required to accomplish winter humidifying must not be neglected, when this feature is included in the equipment.

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CHAPTER 44

INDUSTRIAL AIR CONDITIONING

General Requirements for Manufacture, Processing and Preservation; Classification of Problems; Moisture Content and Regain; Conditioning and Drying; Chemical and Biochemical Reactions; Crystallization; Control for Machining, Polishing, and for Static Electricity Elimination; Laboratory Conditions; Calculations; Safeguarding Health and Maintaining Safety; Contaminant Control; Dilution Systems for Contaminants; Heat Storage; Radiation; Odors

INDUSTRIAL air conditioning is concerned with (1) the manufacture, processing and preservation of material, equipment and commodities, and (2) the atmospheric conditions required for maintaining the health, safety and efficiency of workers. The material in this chapter is treated under these two divisions.

GENERAL REQUIREMENTS FOR MANUFACTURE, PROCESSING AND PRESERVATION

Table 1 lists the temperatures and relative humidities required for storage of certain commodities, and for manufacturing and processing of others. The desirable relative humidity may range from a low of 5 per cent in certain industrial applications, such as insulation winding processes, up to a condition approaching saturation, as in processes relating to textile, tobacco and baking industries.

The most favorable temperature and relative humidity will vary according to the specific material and particular process. In some cases the temperatures and relative humidities listed in Table 1 have no direct influence upon the product itself, but do affect the efficiency of employees, and in turn affect workmanship, uniformity and the cost of production. Sometimes, a compromise between the known optimum condition for processing and that required for worker comfort is unavoidable.

In many processes, the optimum air conditions are variable according to the stage and progress of the processing cycle from the raw material to the finished product. Some materials, such as cotton textiles, begin with a low relative humidity in the carding and picking rooms, and after passing through the various intermediate steps with a gradual increase of relative humidity, are subjected to relative humidities of from 70 to 85 per cent in the final stage of weaving. Other processes encountered require the reversed procedure, starting with a high relative humidity and finishing with a low relative humidity, as in the manufacture of glue and gelatinous materials, and in making various types of gelatine capsules.

In order to apply air conditioning to industrial processes, the air conditioning engineer must have a thorough understanding of the processing problems involved. Individual processes and machines are changing rapidly, and air conditions must be revised constantly to meet the new conditions. Air conditioning for industrial processes is so extensive and