

installation of water economizing equipment since the cost for pumping and the fixed or ownership charges may be in excess of the annual cost for once through condensing operation. If operating costs are to be the basis for selection, then fixed charges should be determined when studying application of this equipment which usually has a shorter life than the other components.

Usually the primary factors influencing the installation of water conservation equipment are the lack of an adequate water supply or local regulations intended to conserve an existing water supply.

Another factor influencing the installation of such equipment is the increasing trend toward the enactment of taxes and service charges for condensing water wasted into city sewers. Certain municipalities will remit the sewer taxes or service charge if the condensing water is submetered and discharged into a storm sewer or used for process purposes.

Heating

The method of estimating fuel consumption to balance the building heat loss is given in Chapter 18. 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.

BIBLIOGRAPHY

Modern Air Conditioning, Heating and Ventilating, by W. H. Carrier, R. E. Cherne, and W. A. Grant—Chapter IV (*Pitman Publishing Corp.*, 1950).

Predicting Operating Hours of Refrigeration Equipment Used in Air Conditioning, by W. A. Grant (*Refrigerating Engineering*, July, 1941).

Cost of Operation of Refrigeration Used for Air Conditioning, by R. E. Cherne (*Refrigerating Engineering*, December, 1943).

INDUSTRIAL AIR CONDITIONING

General Requirements for Manufacture, Processing and Preservation; Design Conditions and Application Data; 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; Local Relief and Spot Cooling; Odors

INDUSTRIAL air conditioning is concerned with the design and application of equipment for obtaining proper conditions for (1) the manufacturing, processing, and preserving of material, equipment, and commodities; and (2) maintaining the health, safety and efficiency of workers. This chapter includes a general discussion of these conditions and also a comprehensive list of specific requirements for various types of products.

GENERAL REQUIREMENTS FOR MANUFACTURE, PROCESSING AND PRESERVATION

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.

Table 1 lists the temperatures and relative humidities required for storage of certain commodities, and for manufacturing and processing of others. 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.

Air conditioning for industrial processes is so extensive and involved that a detailed treatment is beyond the scope of this chapter. It is possible to cover only a few salient points of the general subject. In many industries the exact conditions to be maintained are determined and known only by the manufacturer who specifies them. In other industries there is a wide variance between manufacturers' requirements, depending on results desired, experience, and cost considerations.

CLASSIFICATION OF PROBLEMS

In general, any industrial air conditioning problem in processing may be classified under one or more of the following:

1. Control of regain.
2. Control of rate of chemical reactions.
3. Control of rate of biochemical reactions.
4. Control of rate of crystallization.
5. Control of temperature for close tolerance machining and grinding.