

¹² A Study of Quartz-Fusing Operations with Reference to Measurement and Control of Silica Fumes by E. C. Riley and J. M. DallaValle (U. S. Public Health Reports, Vol. 54, 1939, p. 532).

¹³ Ventilation of Open Tanks, by A. C. Stern (*American Industrial Hygiene Association, Industrial Hygiene Quarterly*, Sept. 1950).

¹⁴ American Standard for Safety in Electric and Gas Welding and Cutting Operations (*American Standards Association*, Z 49.1).

¹⁵ Rules Relating to the Removal of Dust, Gases, and Fumes (*New York State Department of Labor, Industrial Code Rule No. 18*, Jan. 1931).

¹⁶ Energy Losses at Suction Hoods, by A. D. Brandt and R. J. Steffy (*A.S.H.V.E. TRANSACTIONS*, Vol. 62, 1946, p. 205).

¹⁷ Resistance Test on Pipe, by A. Nutting (*Mechanical Engineering*, May 1935).

¹⁸ Design of Injector for Low Pressure Air Flow, by G. E. McElroy (*U. S. Bureau of Mines, Technical Paper* 678).

¹⁹ American Standard Safety Code for Ventilation and Operation of Open Surface Tanks (*American Standards Association*, Z 9.1-1951).

²⁰ Design of Kitchen Range Hoods, by J. M. Dalla Valle (*Heating and Ventilating*, August 1953, p. 95).

²¹ Tabulation of Atmospheric Contaminants Released by Open Surface Tanks, by Irving Kingsley (*New York State Department of Labor, Division of Industrial Hygiene, Engineering Unit Plates* 161, 162, 163).

²² Chlorinated Solvent Exposures at Degreasing Operations, by K. M. Morse and L. Goldberg (*Industrial Medicine*, October 1943, p. 706).

²³ Ventilation of a Trichlorethylene Degreaser, by W. N. Witheridge and H. T. Walworth (*Journal of Industrial Hygiene and Toxicology*, May 1940, p. 175).

CHAPTER 46

PROCESS AND PRODUCT 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

PROCESS and product air conditioning is concerned with the design and application of equipment for obtaining proper conditions for the manufacturing, processing, and preserving of material, equipment, and commodities. 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.
6. Control of dew-point for protection of highly polished surfaces.
7. Control of humidity for static electricity elimination.
8. Control of conditions for material test laboratories.