

taking into consideration the effect upon the economy of the equipment served. One or more of the following procedures are recommended for induced draft towers: (a) Run two-speed motors on low speed, or shut off some of the fans; (b) Shut down some cells completely and put all of the water over the remaining cells; (c) Reduce water flow to the tower and shut off some of the cells; (d) By-pass the cooling tower with part of the water and shut off some of the fans or cells of the tower.

If ice should form on the louvers and filling, one of the following methods of removal can be used: (a) Reversing (for not more than 10 minutes) the rotation of the motor driving the fan and thus blowing the warm air out through the louvers; (b) Shutting down fans on some sections temporarily, but not the water. When these cells have thawed out, use the same procedure on other cells.

Where intermittent operation of a system is employed, water in outside basins may cause considerable damage due to freezing. To prevent this, such basins are drained when out of service and therefore in some small roof installations a tank large enough to hold all the water in the system may be installed inside the building.

Maintenance. Well-maintained equipment provides the best operating results and the least overall maintenance cost. A regular schedule should be set up for the structural and mechanical upkeep of water-cooling towers. The life and continued utility of any cooling tower is directly dependent upon its inherent qualities, climatic environment, type of service, severity of operation, and general care and maintenance.

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CHAPTER 38

DEHUMIDIFICATION BY SORBENT MATERIALS

Definitions and Principles, Adsorbents, Dehumidification by Solid Adsorbents, Dehumidification Equipment Using Solid Adsorbents, Absorbents, Dehumidification by Liquid Absorbents, Dehumidification Equipment Using Liquid Absorbents, Calculation of Moisture Load, Vapor Transfer to Dehumidified Space

DE HUMIDIFICATION as used herein is the reduction of the water vapor content of a given volume of air or other gas. The term thus describes a special case of dehydration which covers the removal of moisture in any form from matter. The degree of dehumidification required varies greatly with different applications and is one of the prime considerations influencing the choice of a method. Dehumidification may be accomplished by latent heat removal together with sensible heat removal, as described in Chapters 7, 37, and 43, or by the use of sorbents.

Sorbents are substances which have the property of extracting and holding other substances (usually gases or vapors, e.g. water vapor), brought into contact with them. All materials are sorbents to a greater or lesser degree. The weight of water held by a substance will increase or decrease depending upon whether the vapor pressure of the water held by the substance is less or greater respectively than the partial pressure of water vapor in the surrounding atmosphere. As generally used, however, the term, sorbents, refers to those materials having a capacity for moisture which is large compared to their volume and weight. Such materials are divided into two general classifications:

1. **Adsorbent**—A sorbent which does not change physically or chemically during the sorption process. Certain solid materials, such as activated alumina, silica gel, activated bauxites, and activated charcoal have this property. The action of adsorbents, most of which adsorb some gases and condensable vapors besides water vapor, is selective. Thus, in the case of a mixture containing both water and organic vapors, silica gel would remove the water vapor in preference to the organic vapors, while the reverse would be true in the case of activated carbon. The selective property of adsorbents is made use of in some instances for the removal of objectionable and contaminating vapors from an air or gas mixture. (See Chapter 10.)

2. **Absorbent**—A sorbent which changes either physically, chemically, or both, during the sorption process. Calcium chloride is an example of a solid absorbent, while liquid absorbents include solutions of lithium chloride, calcium chloride, lithium bromide, and the ethylene glycols.

ADSORBENTS

The ability of an adsorbent to remove water vapor from a gas is explained by the fact that the vapor pressure of the water in the adsorbent (when in the reactivated condition) is less than the partial pressure of the water vapor in the surrounding atmosphere. For instance, when an active adsorbent is brought into contact with a gas of high humidity, there is a tendency for the vapor pressure of the water in the adsorbent to reach equilibrium with the partial pressure of the water in the surrounding gas, with