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CHAPTER 35

SPRAY APPARATUS

Air Washers, Humidification with Air Washers, Dehumidification and Cooling with Air Washers, Well and Water Main Temperatures, Apparatus for Direct Humidification, Unit Humidifiers, Water-Cooling Towers, Water Use and Conservation, Rivers and Lakes, Spray Cooling Ponds, Atmospheric and Mechanical Draft Cooling Towers, Mechanics of Atmospheric Water-Cooling, Design Conditions, Water-Cooling Tower Design, Selection of Water-Cooling Towers, Operation and Maintenance

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AIR humidification is effected by the vaporization of water, and always requires heat from some source. This heat may be added to the water prior to the time vaporization occurs, or it may be secured by a transformation of sensible heat of the air being humidified to latent heat as the vapor is added to the air. The thermodynamics of the process are discussed in Chapter 3. The removal of moisture from air may, or may not, involve the removal of heat from the air-vapor mixture. With spray equipment, dehumidification of air always necessitates the removal of heat.

AIR WASHERS

An air washer consists essentially of a chamber or casing in which is provided a spray nozzle system, a tank at the bottom of the chamber for collecting the spray water as it falls, and an eliminator section at the leaving end of the chamber for removal of drops of entrained moisture from the delivered air. Air is drawn through the casing of the washer, where it comes into intimate contact with the spray water. A heat transfer takes place between the air and water, resulting in either humidification or dehumidification of the air, depending upon the method of operation and the relative temperatures of air and spray water.

To prevent backlash of spray ahead of the washer chamber, and to aid in more uniform air distribution, inlet diffusion plates or eliminator baffles, where necessary, are provided in the air entrance end of the air washer. Inlet diffusion plates are used when the air flow and water spray are in the same direction; eliminator baffles of special design are used where one or more of the water sprays opposes the air flow. At the outlet end of the washer suitable flooded eliminator plates are used. These plates, for the removal of entrained moisture, usually cause four to six changes in direction of the air flow.

Figs. 1 and 2 show the essential construction features of conventional air washers. Intimate contact between the air and the water is secured (1) by breaking the water into fine drops; (2) by passing the air over surfaces continuously wetted by water; or (3) by a combination of the two.

The wetted surfaces in an air washer may be of fiber glass, metal or scrubber plate construction. Scrubber plate types of washers are generally used to wash reclaimable products from the air, and are composed of several baffle type plates located across the air stream. Water is supplied at the top of the washer to spray over these plates. In the case of the fiber glass or metal surfaces, the water spray is usually rather coarse and at