

centric pipes and refrigeration through the annular space in the outer pipe. Where possible, the flow of refrigerant and condensing water should be counter flow to maintain maximum temperature differences.

The amount and temperature of the condensing water determines the condensing temperature and pressure, and indirectly the power required for compression. It is, therefore, necessary to strike a balance so that the quantity of water insures economical compressor operation. As part of the condenser, or attached to it, there must be storage space for liquid refrigerant.

The installation of all equipment should be made accessible for inspection, repair, and cleaning. Both the coolers and condensers should have space for pulling tubes.

In connection with air conditioning equipment and the refrigeration system used there is a decided tendency to conserve the water in the city mains and most large cities are restricting the use of this water. In order to use air conditioning systems and refrigeration equipment, it is often necessary to install cooling towers. The cooling towers, unfortunately, produce the highest temperature condensing water at the time when the load on the system is greatest, so that the refrigeration equipment must be designed to meet not only the maximum load at normal conditions, but the maximum load at abnormal condensing water temperatures. If properly designed with the flexibilities mentioned before, this makes little difference in the efficiency of operation throughout the year, except at those times when the condensing water temperature is highest. As this only occurs for 5 per cent of the entire cooling period it can be disregarded as a factor in establishing yearly operating costs.

The cooling tower has a certain advantage over the use of water from the city mains, in that the temperature of the condensing water varies directly with the outdoor temperature and as pointed out, the refrigeration load also varies with this temperature. Certain economies are possible when a cooling tower is used, which cannot be achieved by the use of condensing water from city mains, even where the city water temperature is extremely low. Normally, the lowest city water temperature met during the summer months is from 65 to 70 F. This temperature range takes place for the entire cooling period, regardless of what the outdoor temperatures are. With the cooling tower, the temperature of the condensing water may rise to 80 to 85 F under maximum conditions, but under less than maximum conditions, the temperature of the water off the cooling tower drops considerably, and it has been established that 50 per cent of the time the outdoor wet-bulb temperature varies from 60 to 70 F and the cooling tower water therefore, for the same periods, varies from 65 to 75 F. When the outdoor wet-bulb temperature drops below 60, which occurs approximately 30 per cent of the time, the condensing water temperature is still lower. The cost of water used for condensing is negligible as the only water required is that used for makeup due to the loss by evaporation in the cooling tower itself. See also Chapter 11.

Chapter 11

HUMIDIFYING AND DEHUMIDIFYING EQUIPMENT

Air Washers, Selection, Scrubber and Eliminator Surface, Distributing Plates, Materials of Construction, Performance, Heating Spray Water, One and Two Bank Humidifiers, Power Requirements, Nozzles and Wash Water Used, Humidifier Efficiency, Flooding Surface Type Humidifiers, Dehumidifiers, Cooling Medium, Atmospheric Water Cooling Equipment, Theory of Atmospheric Cooling, Atmospheric Cooling Reverse of Humidifying, Factors Affecting Atmospheric Water Cooling, Co-ordinating of Equipment, Wet-Bulb Temperature of Design, Quantity of Cooling Water, Cooling Ponds, Spray Ponds, Spray Retention, Growths in Spray Ponds, Spray Cooling Towers, Natural Draft Deck Cooling Towers, Wind Velocities for Towers, Mechanical Draft for Towers, Indoor Cooling Towers, Make-Up Water, Winter Freezing

AN air washer is essentially a chamber in which air is brought in intimate contact with water, the object being (a) to wash the air or (b) to regulate the moisture content of the air and at the same time wash it. The air comes in contact with the water by passing it through water sprays or by passing it over surfaces wetted by a continuous flow of water; hence the classification: spray, scrubber, and combination spray and scrubber type washers.

A washer chamber may be constructed of wood, or stone, but it is most often constructed of sheet metal. The lower portion of it is specially designed as a tank to receive the water dropping through the chamber and to serve as a reservoir from which the water may be recirculated.

It is desirable that air leaving a washer contains no water in suspension. For this reason eliminators are provided at the washer outlet. These may be in the form of plates or baffles upon which the free moisture is deposited as the air is deflected through several changes from its original direction of flow. In some washer units steel wool filter sections serve as eliminators. However, specially designed plates are used more generally than other devices because they offer the least resistance to the flow of air, while still performing effectively the function of free moisture elimination. They also have the advantage of acting as scrubber surfaces when flooded.

It is essential to uniform performance in a washer, that air enter evenly distributed over the washer inlet. To insure this, a perforated plate or eliminator plates are installed at the inlet. Eliminator plates are now more generally used. They serve a second purpose in preventing the escape of spray through the washer inlet.

Water is supplied to scrubber type units through flooding nozzles. The capacity of these nozzles varies with the manufacturer although a fair