

and this loss must be replaced. Approximately 1 gal of water is lost for every 1000 gal of water cooled per degree of cooling range; so if 1000 gpm of water are cooled through a 10 deg range, 10 gpm of water will be required to replace evaporated water. Replacement supply is usually regulated by a float control valve. Because the evaporation of the water leaves behind the salts which the water contained, high concentration of salts may make chemical treatment of the make-up water necessary to avoid excessive deposits in the condensers.

Winter Freezing

If atmospheric water cooling equipment is operated in freezing weather, the water may be cooled below freezing temperature so ice forms and collects until its weight causes damage. To obviate freezing during continued operation, the efficiency of the apparatus may be lowered. This is done on the spray pond and the spray cooling tower by reducing the quantity of water fed to the apparatus, thereby lowering the pressure at the nozzles and increasing the size of the drops produced. On the deck

TABLE 4. COMPARISON OF VARIOUS TYPES OF ATMOSPHERIC WATER COOLING EQUIPMENT
Figures indicate order of desirability

	COOLING POND	SPRAY POND	SPRAY TOWER	DECK TOWER	MECHANICAL DRAFT	INDOOR TOWER
Cost.....	x	2	1	3	4	5
Area.....	5	4	3	2	1	x
Height.....	1	2	3	4-5	4-5	x
Weight per sq ft.....	x	x	1	3	4	2
Independence of Wind Velocity.....	6	3	4	5	1-2	1-2
Drift Nuisance.....	1	6	5	4	2-3	2-3
Make-Up Water Required.....	1	6	5	4	2-3	2-3
Pumping Head.....	1	2	3	4-5	4-5	6
Maintenance.....	2	1	3	4	5	6
Suitability for Congested Districts.....	x	5	4	3	1	2
Water Quantity Required for Definite Result.....	6	5	4	1-2	1-2	3

*Not comparable.

tower the upper system may be shut off and a secondary distribution system put in service midway down the height of the tower. The water will be kept above freezing because it will have shorter contact with the air. The mechanical draft tower can be protected by reducing the air flow through the tower, by stopping or reducing the speed of the fans, or by partially closing dampers.

If the system is operated intermittently in freezing weather, water in the basin may freeze and the expansion of the ice may do harm. Freezing during intermittent operation can be prevented only by draining the water basin when it is out of service. On small roof installations, a tank large enough to hold all the water in the system is often installed inside the building and the basin is drained into this by gravity, the pump suction being taken from this inside tank.

A comparison of various types of water cooling equipment is given in Table 4.

Chapter 12

UNIT AIR CONDITIONERS AND COOLERS

Classification of Conditioner Units, Evaporative Cooling, Dehumidifying and Cooling, Make-Up Water Required, Cooling for Summer, Calculation of Cooling Load, Air Temperatures and Volumes, Ratings and Capacities of Units, Location of Units, Commercial Types of Ceiling Units, Floor Units, Ice Units, Portable Units and Accessory Units

AIR conditioning with unit equipment has gained in popularity during the past few years and the types and styles of unit air conditioners vary widely. In selecting or specifying the unit types the results desired should be carefully determined. The essential feature is that such apparatus must *simultaneously* control the temperature, humidity, air motion and distribution within an enclosure. If complete air conditioning functions are not required the simpler and less expensive unit heaters or unit coolers can be used.

Unit air conditioners are devices of small capacity located in the space to be conditioned and may be classified according to design or service. They are not necessarily self-contained but the air treated is not removed from the room being conditioned. Strictly defined, however, the unit air conditioner is self-contained and includes the compressor and condenser.

The unit air conditioner was originally designed to supply proper atmospheric conditions in some room or section of a manufacturing plant where structural conditions or service requirements made installation of a central system un-economic. These units can be readily located in existing buildings or departments and if shifts to meet changing requirements are desirable, they can be moved or the number can be increased to meet growing demands. Because of the flexibility and mobility of the units, tenants of either old or new buildings may have air conditioning even if the building owner does not desire to furnish it. Industrial process conditioning with unit apparatus has had a wide field of application in printing plants, textile mills, candy and tobacco factories, bakeries, drug manufacturing plants, laboratories, meat packing, vegetable and fruit storage rooms.

The application of unit air conditioners for comfort in offices, stores, restaurants, shops, hospitals, hotels and homes developed rapidly and many new designs in which quietness of operation and attention to appearance were emphasized. The unit air conditioner has a distinct field of application and through its use brings the desired temperature, humidity, air circulation and cleanliness to places where a central type plant could not be used.