TABLE 2. STANDARD RATING CONDITIONS FOR AIR COOLERS

GROUP NO.	ENTERING DRY-BULB TEMPERATURE, DEG F	ENTERING RELATIVE HUMIDITY, PER CENT	EVAPORATING TEMPERATURE, DEG F
I	45	85	30
II	35	85	25
III	35	85	15
IV	0	85	−10
V	0	85	−20

freezing of the condensation on the coils and this accumulation of frost builds up to such an extent that there is a loss of capacity. This deposit is removed from the coils by the process known as defrosting which may be accomplished by several methods:

1. Where the room temperature is above the freezing point, the flow of refrigeration to the coils is halted and the fan continued in operation until the coils are defrosted.

2. The hot gas defrosting method is accomplished by a valving arrangement whereby hot compressed gases from the compressor are pumped directly into the evaporator. This operation is continued until defrosting is complete, when the system is returned to normal operation.

3. Where brine is used as a refrigerant, hot brine may be circulated through the coils.

Where the frosting is particularly heavy it is sometimes more advisable to apply the source of heat externally. This principle of defrosting is accomplished by:

4. Defrosting by warm air is accomplished by dampering arrangements which permit the cooler fan to draw warm air from a source outside of the refrigerated space, pass it over the coils and discharge it outside of the refrigerated space.

5. Constant wetting of the coils with a brine or eutectic solution prevents the formation of frost. This is accomplished on a vertical unit air cooler as shown in Fig. 10.

6. Electric heating elements, placed in such a manner that the fan forces the heated air over the coils.

7. A simple means of defrosting is by means of water sprays placed so the coil is thoroughly wetted during the defrosting process. City water at ordinary pressures is used. The fan is not running during this operation.

Those systems using method 5 have the problem of removing condensation from the eutectic solution. One way is to waste the entire charge when dilution has rendered it ineffective. Another method employs a device which boils off the water and returns the eutectic solution to the system for further use.

ECONOMICS

In the planning and designing of a unit system or in comparing units with central plant application, a systematic approach to the problem should be made from the economic viewpoint.

First Costs. The question of first cost is but one factor in the economic approach of a skillful designer or an intelligent buyer.

1. *Equipment.* The use of a large percentage of factory fabricated equipment to maintain installation costs at a minimum, as represented by self-contained units, should

be contrasted with the use of systems with a large percentage of installation labor and material, such as a central station system. The remote unit offers a compromise between these two.

2. *Installation costs.* The influence of existing codes and ordinances, and installation conditions, involving new construction or treating an existing structure deserve careful consideration. Methods which are suitable for new construction often may not be applied on buildings erected in the past. Sprinkler system rearrangements, fire doors and dampers, restrictions on multiple direct expansion units, rewiring or increasing service, cutting or reinforcing of ceilings and roofs are some items which should receive attention in this respect.

Operation and Maintenance. Tenants or occupants usually operate the self-contained equipment, which also lends itself readily to contract service for maintenance. Central plants require operating engineers in attendance who also frequently service the equipment. The remote units require a combination of these two methods of operation with maintenance by building personnel.

Water and power costs per season can be tabulated and compared for the various systems and an estimate of the costs of replacement material such as filters, belts, oil, refrigerant and wearing parts should be included on an annual basis.

Such questions as obsolescence, depreciation and return on investment are subjects for special study and investigation. Due consideration should be given to the value of resale of equipment and its portability in the event of removal to new locations.

ATTIC FANS

Attic fans are used during the warm months of the year to draw large volumes of outside air through a house and offer a means of using the comparative coolness of outside evening and night air to lower the inside temperature.

Because the low static pressures involved are usually less than ⅛ in. of water, disc or propeller fans are generally used instead of the blower types. The fans should have quiet operating characteristics, and they should be capable of giving about 20 to 30 air changes per hour in northern areas. In the South the usual specification requires one air change per minute which provides appreciable air movement in addition to lowering the inside air temperatures[10].

Types

Open attic fans are units in which the fan is installed in a gable or dormer of the attic and one or more grilles are provided in the floor of the attic, permitting air to flow from the hall below. Outdoor air, which enters the house through open windows, is drawn into the attic through the grilles, and is discharged outside by the fan. An attic stairway may

[10]Comfort Cooling with Attic Ventilating Fans, by G. B. Helmrich and G. H. Tuttle (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 155). A.S.H.V.E. RESEARCH REPORT No. 979—Study of Summer Cooling in the Research Residence for the Summer of 1933, by A. P. Kratz and S. Konzo (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 167). A.S.H.V.E. RESEARCH REPORT No. 1198—The Effect of Attic Fan Operation on the Cooling of a Structure, by W. A. Hinton and A. F. Poor (A.S.H.V.E. TRANSACTIONS, Vol. 48, 1942, p. 145). The Installation and Use of Attic Fans, by W. H. Badgett (Agricultural and Mechanical College of Texas, *Bulletin*, No. 52, 1940).