heater should therefore be obtained from the manufacturer and should be kept at the unit.

Fan bearings and drives must be given the lubrication and other attention specified by the manufacturer. If the unit is direct-connected, the couplings should be inspected periodically for wear and alignment. V-belt drives should have all belts replaced with a matched set if one belt shows wear.

Periodical inspections of traps, check valves, and air valves, and the replacement of worn parts are important maintenance items. Strainers should be cleaned regularly.

When filters are incorporated in the unit, they must be cleaned or replaced when dirty.

For prevention of corrosion in unit heaters, see Chapter 55, Corrosion and Water Formed Deposits, Causes and Prevention, in this edition, and also Bulletin 12, *The Care and Maintenance of Steam and Hot Water Unit Heaters*, published by the Air Moving and Conditioning Association, Inc.

REFERENCES

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[3] *Standard Code for Testing and Rating Steam Unit Heaters* (Adopted jointly by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and Industrial Unit Heater Association, *IUHA Bulletin* No. 10, January 1950, 2nd ed.).

[4] *Standard Code for Testing and Rating Hot Water Unit Heaters* (Adopted jointly by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and Industrial Unit Heater Association, *IUHA Bulletin* No. 11, April 1953, 2nd ed.).

[5] G. L. Larson, D. W. Nelson, and O. C. Cromer: ASHVE RESEARCH REPORT No. 958—Temperature gradient observations in a large heated space (ASHVE TRANSACTIONS, Vol. 39, 1933, p. 243). G. L. Larson, D. W. Nelson, and John James: ASHVE RESEARCH REPORT No. 1011—Tests of three heating systems in an industrial type of building (ASHVE TRANSACTIONS, Vol. 41, 1935, p. 185).

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CHAPTER 16

UNITARY AIR-CONDITIONING EQUIPMENT

Definitions, Classification, and Components of Unit-type Equipment, Remote and Self-contained Units, Room Air Conditioners, Ratings of Unit Air Conditioners, Application of Unitary Equipment, Unit Air Coolers

THIS chapter presents the physical characteristics of air-conditioning and air-cooling units; a suggested procedure for selection of units; and some of the factors involved in the application of unitary equipment. In general, factory-produced unit equipment can be obtained to accomplish all of the functions possible from field assemblies, but the advantages of unit equipment are most apparent in small and moderate capacities. Above 12,000 cfm capacity, or approximately 40 tons of refrigeration capacity, handling and assembly costs generally favor the use of field-assembled units. Multiple application of unitary equipment is frequently justified for large gross tonnage installations where zoning or a minimum amount of ducts is desirable.

DEFINITIONS

The term *air-conditioning* unit has been loosely used as a name for all types of factory produced air-handling, cooling, or heating units. A joint committee[1, 2, 3] on Rating Refrigerating Equipment has defined the various types of unitary equipment as follows:

1. A *Cooling Unit* is a specific air-treating combination consisting of means for air circulation and cooling within prescribed temperature limits.[1]
2. An *Air-Conditioning Unit* is a specific air-treating combination consisting of means for ventilation, air circulation, air cleaning, and heat transfer, with control means for maintaining temperature and humidity within prescribed limits.[1]
3. A *Cooling Air-Conditioning Unit* is a specific air-treating combination consisting of means for ventilation, air circulation, air cleaning, and heat transfer, with control means for cooling and maintaining temperature and humidity within prescribed limits.[1]
4. A *Self-Contained Air-Conditioning or Cooling Unit* is one in which a condensing unit is combined in the same cabinet with the other functional elements. Self-contained air-conditioning units are classified[2] according to the method of rejecting condenser heat (water-cooled, air-cooled, and evaporatively cooled), method of introducing ventilation air (no ventilation, ventilation by drawing air from outdoors, ventilation by exhausting room air to the outdoors, or ventilation by a combination of the last two methods), and method of discharging air to the room (free delivery or pressure-type).
5. A *Free Delivery Type Unit* takes in air and discharges it directly to the space to be treated without external elements which impose air resistance.[1]
6. A *Pressure-Type Unit* is for use with one or more external elements which impose air resistance.[1]
7. A *Forced-Circulation Air Cooler* is a factory encased assembly of elements by which heat is transferred from air to refrigerants.[3]

CLASSIFICATION OF UNIT-TYPE EQUIPMENT

Field assembled apparatus as described in Chapter 19 can be designed in shape, size, and capacity for any application, with the refrigeration and heating system exactly balanced to a specific load condition.

To obtain the economies of factory production, component assemblies are available in the size ranges of greatest usage. In addition to assemblies of high-side equipment in condensing units, the fan-coil units are factory made in various types as indicated by the preceding definitions.

If the condensing unit and the cooling and heating coil surfaces are carefully selected, and if proper consideration is given to reduction of piping losses, the performance of the combined system will compare favorably with field assembled apparatus. *A system in which the air handling unit is separated from the condensing unit, is called a remote system.* The conditioning unit is designated as a remote unit. Capacities of remote units usually range from 2 to 100 tons.

The self-contained air-conditioning or cooling units are widely used in capacities through 15 tons, and are available in larger sizes. Each model is designed for a specific cooling capacity and range of air delivery. Experience has demonstrated that well designed and properly applied equipment of this type produces excellent results in commercial comfort installations. In most designs of the larger self-contained units, the equipment can be adjusted to approximate the load calculations through a selection of the air quantity. An increase of air quantity in this type of equipment increases the sensible heat proportion, and a decrease of air quantity tends to provide a lower leaving dew point and a high proportion of moisture removal. However, the usual field practice is to adjust the fan speed for quietness and air distribution rather than for ratio of latent to sensible loads as indicated by a load estimate.

To meet the requirements of individual comfort in small rooms and offices, self-contained units, called room coolers, find extensive and economical application. These units are usually restricted to summer and intermediate season operation, and range from ⅓ to 1½ tons of refrigeration capacity.

A special application of remote units is found in the unit air cooler which is used extensively in refrigeration work. Its primary function is to reduce temperatures in insulated and sealed storage spaces, and humidity control is a secondary consideration. Because of the small temperature differences between the coil and room temperatures, unit coolers handle three to five times as much air per ton as remote units used in air conditioning.

The attic fan or exhaust fan is sometimes referred to as a cooling unit, but since it contains no element of heat transfer, it is treated in Chapter 22, Fans.

COMPONENTS OF UNIT-TYPE EQUIPMENT

The unitary equipment is designed for the air-conditioning loads of most common occurrence. Highly special projects and projects of infrequent occurrence may require field-assembled equipment for best results. Field modifications