

ignition of the gas or vapor surrounding the motor by sparks, flashes, or explosion of the gas or vapor which may occur within the machine casing.

Water Proof motors (55 C rise) are so constructed as to exclude water applied in the form of a stream from a hose.

Dust Tight motors (55 C rise) are so constructed that the enclosing case will exclude dust.

Motor Speed Classifications

A *Constant Speed Motor* is one in which the speed remains practically constant with changes in load; e.g., a d-c shunt wound motor or a-c squirrel-cage motor with low slip.

A *Varying Speed Motor* is one in which the speed varies with the load, usually decreasing when the load increases; e.g., a d-c series motor or an induction motor with large slip.

An *Adjustable Varying Speed Motor* is one in which the speed can be adjusted gradually, but when once adjusted for a given load will vary in considerable degree with change in load; e.g., a shunt wound d-c motor adjusted by armature resistance control.

An *Adjustable Speed Motor* is one in which the speed can be varied gradually over a considerable range, but when once adjusted remains practically unaffected by the load; e.g., a d-c shunt motor with field resistance control. The standard ratings for open type, adjustable speed motors, having a speed range of 3 to 1 and greater are in accordance with the following:

- (1) A standard continuous horsepower rating at 150 per cent of minimum speed with a temperature rise of 40 C.
- (2) The next higher standard continuous horsepower rating at 3 times minimum speed with a temperature rise of 40 C.
- (3) Between 150 per cent of minimum speed and 3 times minimum speed, the standard continuous horsepower rating with a temperature rise of 40 C will vary with the speed along a straight line connecting these two horsepower ratings. No further increase in horsepower is recognized above 3 times minimum speed.
- (4) Below 150 per cent of minimum speed the lower continuous horsepower rating (see preceding item 1) will apply with a temperature rise of 50 C.

Example: 20/25 hp, 400 to 1600 rpm. This motor may be rated 20 hp, 40 C at 600 rpm and 25 hp, 40 C from 1200 to 1600 rpm. Between 600 and 1200 rpm the rated horsepower increases directly with speed from 20 to 25 hp.

- (5) Motors may also be rated 1 hour with temperature rise of 50 C with the higher horsepower rating (see preceding item 2) throughout the entire speed range.

Example: 20/25 hp, 400 to 1600 rpm. This motor may be rated 25 hp, 50 C, 400/1600 rpm; 1 hour.

Mechanical Modifications

Vertical Mountings are available for such applications as pumps, agitators, and so forth. This type of application may require a special umbrella-type hood to protect against dripping liquids.

Flanged Mountings are available for use where motors are built in as part of machines. Motors may also be supplied with flush plate mountings, suitable for close coupled pump and similar applications.

UNIT AIR CONDITIONERS, UNIT AIR COOLERS

Definitions, Classification of Unit Type Equipment, Component Parts of Unit Type Equipment, Sound Isolation, Modification of Remote Units, Rating of Unit Air Conditioners, Application of Unitary Equipment, Unit Air Coolers

THIS chapter deals with the general characteristics and selection of factory produced units for air conditioning, air cooling, and attic ventilation, and with the factors involved in their application. 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 air distributing 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. The code, Standard Method of Rating and Testing Air Conditioning Equipment¹, defines the various types of unitary equipment:

1. A *Cooling Unit* is a specific air treating combination consisting of means for air circulation and cooling within prescribed temperature limits.
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.
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.
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 classified² 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 outside, ventilation by exhausting room air to the outside, 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.
6. A *Pressure Type Unit* is for use with one or more external elements which impose air resistance.
7. A *Forced-Circulation Air Cooler* is a factory encased assembly of elements by which heat is transferred from air to refrigerants³.

CLASSIFICATION OF UNIT TYPE EQUIPMENT

Field assembled apparatus as described in Chapter 43 can be designed in shape, size, and capacity for any application, with the refrigeration and heating system exactly balanced to load conditions. To obtain the economies of mass production, factory built units must be standardized in a few models per manufacturer. Each model covers a range of capacities within the capacity of its fan to deliver air against the resistance of the unit and against the system resistance. For this reason, the unit