Ratings for Hot Water Type

A standard for the rating of hot water type unit heaters has also been established by code[3] in which the following items are the basis of rating: entering water at 200 F; entering air at 60 F (29.92 in. Hg barometric pressure); and heater operating free of external resistance to air flow. This code also prescribes a method of translating the output in Btu and the temperature rise as obtained under test conditions to standard conditions of air and water temperature.

Ratings for Electric Type

Electric type unit heaters are available in sizes up to at least 60 kw capacity. They consist of resistance type heating elements combined with fan and motor, together with a suitable casing. Electric unit heaters are made in the built-in-wall model, suspension model, and free-standing or portable model.

Electric unit heaters are rated on the energy input to the heater, expressed in terms of kilowatts, Btu or EDR. Quite often all three ratings are given in parallel columns in the catalogs.

Ratings for Gas Fired Type

Gas fired unit heaters are built in both suspended and floor models with either propeller or centrifugal type fans. They are available in a wide range of sizes from about 24,000 to over 4,000,000 Btu per hr capacity and are usually rated in terms of both input and output according to the approval requirements of the *American Standards Association*. Any gas fired unit which is thermostatically controlled and has a pilot must have an element in the pilot flame which will automatically close the gas valve on pilot failure.

Ratings for Oil Fired Type

The oil fired type of unit heater is usually equipped with the centrifugal type of fan only and can be obtained in sizes ranging from 125,000 to 1,650,000 Btu per hour output capacity in standard units. It is furnished in either the floor mounted or in smaller sizes in the suspended type.

Ratings for Coal Fired Type

The stoker fired type of unit heater can be obtained in ranges of from 300,000 to 6,000,000 (or more) Btu per hour output capacity. Ratings are based upon the delivered output at the heater outlet.

Effect of Resistance Upon Capacity

Unit heaters are customarily rated as free delivery type units. If outside air intakes, air filters, or ducts on the discharge side are used with the unit, a reduction in air and heating capacity will result because of this added resistance. The percentage of this reduction in capacity will depend upon the characteristics of the heater and on the type, design and speed of the fans, so that no specific percentage reduction can be assigned for all heaters at a given added resistance. In general, however, propeller fan type units will experience a larger reduction in capacity than housed centrifugal fan units for a given added resistance and a given heater will have a larger reduction in capacity as the fan speed is lowered. The heat output to be expected under other than free delivery conditions should be secured from the manufacturer.

Inlet, Outlet and Space Temperatures with Unit Heaters

In the selection of unit heaters for any particular design, consideration should be given to the temperature of air entering the heaters as well as the temperature to be maintained in the working zone of the space. In general, the temperature differences per foot of elevation, when using unit heaters, are less than corresponding variations when using direct radiation[4]. High velocity units will maintain slightly lower temperature differences than low discharge velocity units. Correspondingly, units with lower discharge air temperature will maintain lower temperature differences than units with higher discharge temperatures. Directional control of the discharged air from a unit heater can be an important factor, added to qualities of reasonably good outlet velocity and outlet temperature, in effecting satisfactory distribution of heat and reducing floor-to-ceiling temperature difference.

Since the outlet temperature of air from a unit heater increases with the temperature of the heating medium, such as high pressure steam, heaters can be obtained with heating elements having less than the regular amount of heating surface in order to obtain, with the high temperature heating medium, approximately the same leaving air temperature as would be obtained from a lower temperature heating medium.

When some *outside air* is introduced, the temperature of the mixture of outside and recirculating air must be calculated and used as the entering air temperature at the heater. Unit heaters connected in this manner perform the function of unit ventilators. For a discussion of this function see the section of this chapter entitled *Unit Ventilators*.

For recirculating heaters located *at the floor* or with *intakes at the floor*, the temperature of air entering the heater should be assumed to be the same as that to be maintained in the room itself.

Automatic Control of Unit Heaters

Thermostatic control of unit heaters may be accomplished either by starting and stopping the fan or by controlling the flow of the heating medium to the heating element. If the fan is controlled, it is advisable to provide a temperature-operated switch to prevent the fan from starting until the heating element is heated throughout.

Unit heaters may be used in summer as a means of circulating air to give some measure of comfort due to air motion. In such cases the heating element should be shut off from the source of heat. The thermostat which prevents the fan from starting until the heating element is heated, should be provided with a by-pass switch, which, upon being closed, will permit the fan to be operated independently of the heating element.

Location of Unit Heaters

Care should be taken in the location of unit heaters to insure free air circulation to the intake. The best arrangement is to locate units so that they discharge air nearly parallel to exterior walls, and in a direction which will produce a rotational circulation around the room. This is preferable to directing the discharge against the outside walls.

Various types and makes of unit heaters are illustrated in the *Catalog Data Section* of this edition. As hot blasts of air in working zones are usually objectionable, heaters mounted on the floor should have their discharge outlets above the head line, and suspended heaters should be placed in such manner and turned in such direction that the heated air stream will