

which shall be used for designating the different kinds of heat emitting units as follows:

Direct Radiators are heaters which are placed directly in the room or space to be heated and impart their heat to the objects and air in this space by direct radiation, and conduction, the air then distributing the heat by convection.

Indirect Heaters are those placed outside of the room or space to be heated and so arranged as to impart their heat to air, which is passed over the surface and thence delivered to the room, without imparting any material amount of heat to the room by direct radiation. Indirect heaters are generally so designated where the movement of air over them is by gravity. When the movement of the air is by fan or other mechanical means, this type of heater is designated as blast heater, stacks or coils.

Concealed Radiators are those placed within or immediately adjoining the room or space to be heated, but separated by an enclosure, or other means, so as to be substantially hidden except for the openings or grilles for air circulation. They may have grilles over the entire front or at top and bottom only.

Recessed Radiators are those placed in a recess in the walls or partitions of the space to be heated. They may be either wholly or partially covered by grilles and thus become concealed, but it is recommended that the designation *concealed radiators* be used in such cases and that the term *recessed radiators* be confined to those set in open recesses.

Built-in or Concealed Heaters are concealed heat emitting units especially designed to be built into the walls or partitions of the space to be heated and deliver the bulk of the heat to this space by the processes of convection.

Cabinet Heaters are special heat emitting units designed for and enclosed in a cabinet to be exposed in the space to be heated. Ordinary radiators may be placed in cabinets but should be designated as radiators in cabinets.

Semi-Indirect Radiators is an indefinite term which is more or less obsolete and should be discarded in favor of the more definite terms referred to previously. It originally referred to such as the concealed, built-in or cabinet types.

Direct-Indirect Radiators are radiators designed to be set exposed in the space to be heated but equipped with integral flues, dampers and connections for taking air from the outside, from the room or both and delivering its heat and some fresh air by this means to the room.

Most of these types of radiators and heaters may be made of pipes, in which case they are spoken of as pipe coils. The other heaters are usually made from cast-iron or non-ferrous metals. Cast-iron radiators are used as column, wall, or window radiators, and in all three cases the original large columns have recently been replaced by small tubes, in a great variety of forms, for which no standard technical data are available at present. As a result of this great diversity of design and lack of engineering data, a condition has developed which an attempt has been made to meet by establishing a Code for Testing Radiators.²

In the past the unit of measure recognized in computing the heat emission was *square feet of heating surface*, which is rapidly being discarded, however, for the reason that the heat emission depends upon the design of the radiator as well as its surface area. The engineer is interested primarily in the amount of heat emitted rather than in the amount of surface in a radiator or heater. As a result, radiators or heaters are being rated on the amount of total heat given, either in B.t.u. per hour or in equivalent square feet based on 240 B.t.u. per hour.

²At a meeting of the Committee on Research of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS at New York, January 23, 1928, the following resolution was adopted:

That all manufacturers of radiators be requested by the Committee on Research to publish the ratings of their product in British heat units. Their ratings are to be certified and guaranteed, and for the present at least, are to be based on condensation performance, determined in accordance with the tentative Code of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS for testing radiators.

Recently a new development in heating practice has taken place. The effect of radiators for house heating purposes is not alone for heating up the building, but rather to obtain and secure comfort for the occupants. In this connection it cannot be denied that comfort feeling for human beings in winter calls for the delivery of warmth in the lower part of the room, in the zone of occupancy, instead of overheating the ceiling, in which latter case, a considerable amount of heat can be wasted. These investigations, the goal of which is to determine the useful heat output of a radiator or heater instead of its total output (by condensation) are still under way.³

This scheme of heating the zone of occupancy may be accomplished by radiators especially designed to give off the greater part of their heat by radiation, rather than by conduction, so that when such radiators are placed directly opposite the place of occupancy of a room most of the heat is projected out directly in this plane without unduly heating the air in the upper part of the room.

Another method for accomplishing the same result lies in the proper use and application of the principles of concealed and cabinet heaters, whereby the heat is transferred to the room by means of heated air continuously projected out in the plane of occupancy of the room and replaced by an equal volume of cooler air drawn into the base of the heater from near the floor, thus creating a local circulation within the zone of occupancy and tending to prevent overheating of the air in the upper part of the room.

TOTAL HEAT EMISSION OF CAST IRON RADIATORS

Tube radiators are not yet standardized, and it is, therefore, impossible to give standard data. Also, under the present ruling of the Committee on Research, as stated on page 66, the only recourse at present seems to be to refer to the various makers' catalogs and accept the ratings as given. However, sufficient radiation is being calculated on the old basis to warrant the inclusion of a condensed table of heat emission based on the actual number of square feet of surface presented by various types of column radiators. Table 1 has been condensed from the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS Research Laboratory Standard Data, prepared in cooperation with the U. S. Bureau of Mines at the Pittsburgh Experiment Station, and gives the heat emission per square foot for the standard steam temperature of 215 deg. fahr. and room temperature of 70 deg. fahr. The original tables were given in a report of the Research Laboratory,⁴ resulting from experiments by John R. Allen and F. B. Rowley.

Table 2 gives the heat emission of various standard types of coil radiation for steam temperature at 215 deg. fahr. and room temperature at 70 deg. fahr.

Table 3 gives the conversion factors for determining the heat emission

³See JOURNAL of AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, November 1925, November 1926, June 1927, January 1928, and also Heating and Ventilation, Rietschel-Brabbée, pp. 45 to 56, and 81 to 82.

⁴Direct Radiation Tables by F. Paul Anderson, F. C. Houghton, Louis Ebin, JOURNAL of AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, December, 1921.