

have been bonded. It does not include a fin-tube type baseboard element provided with an enclosure for replacement of the conventional baseboard.

The finned-tube unit can be used with either steam or hot water systems. It has advantages for installation where it is desired to distribute the heat along the entire outside wall and thereby prevent down drafts along the walls in buildings such as schools, churches, hospitals, factories, etc.

Normal placement of finned tube is along the walls where the heat loss is greatest. If necessary, the units can be installed in two or three tiers along available wall space to meet the heating requirements. For hot water system installations where two or three tiers are required, a sinuous water flow through the heaters is recommended because a header connection with parallel flow may permit the water to short circuit along the path of least resistance.

Protection of the heating element may be provided by open type grilles fabricated of expanded metal or perforated materials covering the top and front of the finned-tube element. Covers and enclosures are also available to enhance the appearance and to increase heating efficiency.

A cover is a fabricated shield having at least a portion of the front skirt made of solid material. It can be mounted on the finned-tube element so that there is clearance between the wall and the cover, and the rear of the finned-tube element is not completely enclosed. A cover may have a top, front, or inclined outlet.

An enclosure is a shield of solid material installed so that the finned-tube element is completely enclosed at both front and rear. An enclosure may have an integral back or may be installed tightly against the wall so that the wall itself forms the back. An enclosure may have a top, front, or inclined outlet.

Finned-tube units are available in four sizes from 1 in. to 2 in. IPS. The resistance to the flow of water or steam is rather low so that a separate system of distribution piping is generally not required.

The heating capacity of finned tube varies over a wide range depending on tube size, fin size and thickness, spacing of fins, and the materials used. A major portion of the heat transferred to the room to be heated is by convection.

The heating capacity of finned-tube heat-distributing units is determined by test. The *Institute of Boiler and Radiator Manufacturers* has developed a testing and rating code for finned-tube type of radiation.²

Heat loss calculations for finned-tube heating systems are the same as those used for other types of radiation. Ratings are expressed in Btuh per linear foot or square feet Equivalent Direct Radiation per linear foot for steam, and Btuh per linear foot for water.

RATINGS OF HEAT-DISTRIBUTING UNITS

Radiators

A standard method of testing radiators was adopted by the ASHAE in 1927.⁴ This Code was withdrawn but the method is still used in industry. It provides for a standard test room, the temperature of which is to be maintained at 70 F, measured in the center of the room at an elevation of 5 ft above the floor. The steam temperature in the radiator is to be 215 F, which corresponds to 15.6 lb per sq in. absolute. The weight of condensate per hour, under these standard conditions, multiplied by the difference in the enthalpy of the steam entering the radiator and that of the

condensate leaving the radiator, gives the radiator output in Btu per hour (Btuh).

If the rating in square feet Equivalent Direct Radiation is desired, divide this output by 240 (which by definition is the Btuh equivalent of 1 sq ft EDR). Correction of output from non-standard test conditions to output at 70 F room and 215 F steam may be made by multiplying the output under test by the ratio

$$\frac{(\text{Standard temperature difference, steam} - \text{air})^{1.3}}{(\text{Test temperature difference, steam} - \text{air})^{1.3}}$$

Convectors

The generally accepted method of testing and rating both ferrous and non-ferrous convectors; is given in Commercial Standard CS140-47, Testing and Rating Convectors,⁵ which has been developed cooperatively by the *Convector Manufacturers Association*, the *Institute of Boiler and Radiator Manufacturers*, other members of the trade, and the *National Bureau of Standards*. This *Commercial Standard* contains details covering construction and instrumentation of the test booth or room and procedures for determining both steam and water ratings.

Steam ratings are expressed in square feet EDR and Btu per hour (Btuh). Water ratings are expressed in Btuh at specified water temperature drops and average water temperatures.

Under the provisions of *Commercial Standard* CS140-47 the rating of a top outlet convector is established at a value not in excess of the test capacity (which is the heat extracted from the steam or water in the convector under standard test conditions). For convectors with other types of enclosures or cabinets a percentage which varies up to a maximum of 15 percent depending on the height and type of enclosure or cabinet is added for heating effect.^{6, 7} The additions made for heating effect must be shown in the manufacturer's literature.

Baseboard

The generally accepted method of testing and rating baseboards is covered in the IBR Testing and Rating Code for Baseboard Type of Radiation.⁸ This Code contains details covering construction and instrumentation of the test booth or room, procedures for determining both steam and water ratings, and licensing provisions for the obtaining of approval of these ratings.

Baseboard ratings include an allowance for heating effect of 15 percent, which is added to the test capacity. The addition made for heating effect must be shown in the manufacturer's literature.

Steam ratings are expressed in Btuh per linear foot or square feet EDR per linear foot. Water ratings are expressed in Btuh per linear foot, at specified water flow rates and average water temperatures.

Finned-Tube

The generally accepted method of testing and rating finned-tube heat-distributing units is covered in the I=B=R Testing and Rating Code for Finned-Tube Type of Radiation.⁹ This Code contains details covering construction and instrumentation of the test booth or room, procedures for determining steam and water ratings, and licensing provisions for the obtaining of these ratings. Steam ratings are expressed in Btuh per linear foot or square feet EDR per linear foot. Water ratings are expressed in