

of the height of the discharge grille above the heating element. The published ratings are generally given in terms of Btu per hour or square feet of *Equivalent Direct Radiation*, EDR. For steam convectors, as for radiators, 240 Btu per hr may be taken as an equivalent square foot of radiation. When more than one heating unit is used, one mounted above the other in the same cabinet, the output of the upper unit or units will be materially less than that of the bottom unit.

RADIATOR AND CONVECTOR RATINGS

A standard method of testing radiators was adopted by the A.S.H.V.E. in 1927.³ This Code 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

TABLE 6. CORRECTION FACTORS FOR DIRECT CAST-IRON RADIATORS AND CONVECTORS*

STEAM PRESS. (APPROX.)		HEATING MEDIUM TEMP F STEAM OR WATER	FACTORS FOR DIRECT CAST-IRON RADIATORS							FACTORS FOR CONVECTORS						
Gage Vacuum In. Hg.	Abs Lb per Sq In.		ROOM TEMPERATURE F							INLET AIR TEMPERATURE F						
			80	75	70	65	60	55	50	80	75	70	65	60	55	50
22.4	3.7	150	2.58	2.36	2.17	2.00	1.86	1.73	1.62	3.14	2.83	2.57	2.35	2.15	1.98	1.84
20.3	4.7	160	2.17	2.00	1.86	1.73	1.62	1.52	1.44	2.57	2.35	2.15	1.98	1.84	1.71	1.59
17.7	6.0	170	1.86	1.73	1.62	1.52	1.44	1.35	1.28	2.15	1.98	1.84	1.71	1.59	1.49	1.40
14.6	7.5	180	1.62	1.52	1.44	1.35	1.28	1.21	1.15	1.84	1.71	1.59	1.49	1.40	1.32	1.24
10.9	9.3	190	1.44	1.35	1.28	1.21	1.15	1.10	1.05	1.59	1.49	1.40	1.32	1.24	1.17	1.11
6.5	11.5	200	1.28	1.21	1.15	1.10	1.05	1.00	0.96	1.40	1.32	1.24	1.17	1.11	1.05	1.00
Lb per Sq In.																
1	15.6	215	1.10	1.05	1.00	0.96	0.92	0.88	0.85	1.17	1.11	1.05	1.00	0.95	0.91	0.87
6	21	230	0.96	0.92	0.88	0.85	0.81	0.78	0.76	1.00	0.95	0.91	0.87	0.83	0.79	0.76
15	30	250	0.81	0.78	0.76	0.73	0.70	0.68	0.66	0.83	0.79	0.76	0.73	0.70	0.68	0.65
27	42	270	0.70	0.68	0.66	0.64	0.62	0.60	0.58	0.70	0.68	0.65	0.63	0.60	0.58	0.56
52	67	300	0.58	0.57	0.55	0.53	0.52	0.51	0.49	0.56	0.54	0.53	0.51	0.49	0.48	0.47

* To determine the size of a radiator or a convector for a given space, multiply the heat loss of the space in Btu per hour by the proper factor from the above table and select radiator or convector having an equivalent Btu per hour rating.

An alternate method is to divide the heat loss in Btu per hour by 240 and multiply the result by the proper factor from the above table and select radiator or convector having an equivalent square foot rating.

To determine the heating capacity of a radiator or a convector under conditions other than the basic ones with the heating medium at a temperature of 215 F, and the room temperature at 70 F in the case of a radiator, and the inlet air temperature at 65 F in the case of a convector, divide the heating capacity at the basic rating conditions by the proper factor from the above table.

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. This output divided by 240 gives the steam rating of the radiator in equivalent square feet, EDR.

Similar test methods for convectors are the A.S.H.V.E. Codes for Testing and Rating Concealed Gravity Type Radiation,⁴ (Steam Code 1932 and Hot Water Code 1933). These Codes recognize a different type of test booth, and the air temperature used is that of the air entering the convector casing instead of the temperature in the center of the room. The entering air temperature for standard test conditions is 65 F. For hot water the standard test conditions call for a mean temperature of the water in the convector of 170 F.

The method of testing and rating both ferrous and non-ferrous convectors, which is now generally accepted, is given in Commercial Standard CS140-47, Testing and Rating Convectors, which has been developed co-

operatively by the *Convector Manufacturers Association*, the *Institute of Boiler and Radiator Manufacturers*, other members of the trade, and the *National Bureau of Standards*.

The rating of a top outlet convector is established at a value not in excess of the *condensation capacity* (which is the heat extracted from the steam or water in the convector, under standard test conditions). The rating of a front outlet convector includes the *condensation capacity* plus an allowance for heating effect in the occupied zone, based on convector enclosure height from bottom of the enclosure to top of the outlet. A table of heights and heating effect allowances is given in the Commercial Standard CS140-47, and lists allowances from zero percent for a 38-in. height to 15 percent for a 20-in. height, or less.

For an inclined outlet convector the rating includes the *condensation capacity*, plus a heating effect allowance obtained by multiplying the allowance for a front outlet convector by a factor (angle of outlet to horizontal ÷ 90).

Approval of convector ratings may be obtained by the manufacturer by submitting test data to a *Convector Rating Committee* appointed by the Division of Trade Standards of the *National Bureau of Standards*. Requests should be addressed to the Division of Trade Standards.

A Testing and Rating Code for Baseboard Type of Radiation⁵ was adopted by the *Institute of Boiler and Radiator Manufacturers* in 1950. This code contains test procedures for determining steam ratings which are obtained from the condensation capacity (converted to standard conditions) by adding a maximum of 15 percent. The ratings are expressed in Btu per hour per linear foot, and may also be expressed in square feet of steam radiation per linear foot.

Water ratings are determined by applying the factors shown in Table 7 to the steam ratings, and are expressed in Btu per hour per linear foot for each average water temperature listed. A method for testing baseboard radiation with water for the purpose of determining water ratings is being considered.

Manufacturers who wish to publish baseboard radiation ratings as $I = B = R$ ratings may submit test data to the $I = B = R$ Baseboard Rating Committee and receive approval of test procedure and ratings. The following catalog information must be given for $I = B = R$ Steam Ratings: (1) rating in Btu per hour per linear foot, (2) percentage added to capacity in determining ratings, and (3) name and other type of designation.

The following information must be given for $I = B = R$ Water Ratings: (1) rating in Btu per hour per linear foot for each average water temperature listed, (2) percentage added to capacity in determining ratings, (3) name or other type of designation, and (4) a statement that the water ratings have been determined by applying to the $I = B = R$ Steam Ratings the factors (see Table 7) approved by the *Institute of Boiler and Radiator Manufacturers*.

Effect of Operating Conditions

The heat output of a radiator is proportional to the 1.3 power of the temperature difference between the air in the room at the 60 in. level and the heating medium in the radiator. The heat output of a convector is proportional to the 1.5 power of the temperature difference between the air entering the convector and the heating medium, steam or hot water, within the convector.⁶ For hot water the arithmetical average between