

per hour for mechanically fired boilers when operating at *design load*. When operating at *maximum load*² these values will run between 5000 and 6000 Btu per sq ft per hour. Boilers operating under favorable conditions at the above heat transfer rates will give exit gas temperatures that are considered consistent with good practice.

TESTING AND RATING CODES

The Society has adopted three solid fuel testing codes, a solid fuel rating code and an oil fuel testing code. A.S.H.V.E. Standard and Short Form Heat Balance Codes for Testing Low-Pressure Steam Heating Solid Fuel Boilers—Codes 1 and 2—(Revision of June 1929)³, are intended to provide a method for conducting and reporting tests to determine heat efficiency and performance characteristics. A.S.H.V.E. Performance Test Code for Steam Heating Solid Fuel Boilers—Code No. 3—(Edition of 1929)⁴ is intended for use with A.S.H.V.E. Code for Rating Steam Heating Solid Fuel Hand-Fired Boilers⁴. The object of this test code is to specify the tests to be conducted and to provide a method for conducting and reporting tests to determine the efficiencies and performance of the boiler. The A.S.H.V.E. Standard Code for Testing Steam Heating Boilers Burning Oil Fuel⁵ is intended to provide a standard method for conducting and reporting tests to determine the heating efficiency and performance characteristics when oil fuel is used with steam heating boilers.

Steel Heating Boilers Ratings

The *Steel Heating Boiler Institute* has adopted a method for the rating of low pressure boilers based on their physical characteristics and expressed in square feet of steam or water radiation or in Btu per hour as given in Table 2. The following requirements are included in this Code:

1. One square foot of steam radiation is to be considered equal to the emission of 240 Btu per hour and one square foot of water radiation is to be considered equal to emission of 150 Btu per hour.
2. The rating of a boiler expressed in square feet of steam radiation in which solid fuel hand fired is used is based on the amount equal to 14 times the heating surface of the boiler in square feet.
3. The rating of a boiler expressed in square feet of steam radiation in which solid fuel mechanically fired, or in which oil or gas is burned, is based on the amount equal to 17 times the heating surface of the boiler in square feet.
4. Heating surface is to be expressed in square feet and include those surfaces in the boiler which are exposed to the products of combustion on one side and water on the other. In measuring surfaces, the outer tube areas are to be considered. When a boiler has the water leg height increased the heating surface noted in the published ratings are not to be increased.
5. A grate area is to be considered as an area of the grate surface expressed in square feet and measured in the plane of the top surface of the grate. For double grate boilers the grate surface is to be considered as the area of the upper grate plus one-quarter of the area of the lower grate.
6. The grate area of a boiler for rating as determined in No. 2 is to be not less than that determined by the following formulae:

For boilers with ratings 1800 sq ft to 4000 sq ft of steam radiation:

$$\text{Grate Area} = \sqrt{\frac{\text{Catalogue Rating (in square feet steam radiation)} - 200}{25.5}} \quad (1)$$

²For definitions of design load and maximum load see pages 251 and 252.

³See A.S.H.V.E. TRANSACTIONS, Vol. 35, 1929, p. 12. Also Chapter 45.

⁴See A.S.H.V.E. TRANSACTIONS, Vol. 36, 1930, p. 35. Also Chapter 45.

⁵See A.S.H.V.E. TRANSACTIONS, Vol. 37, 1931, p. 23. Also Chapter 45.

TABLE 2. STANDARD STEEL HEATING BOILER RATINGS^a

HAND FIRED CAPACITY RATING					MECHANICALLY FIRED CAPACITY RATING			
Steam Radiation Sq Ft	Water Radiation Sq Ft	Btu per Hr	Heating Surface Sq Ft	Grate Area Sq Ft	Steam Radiation Sq Ft	Water Radiation Sq Ft	Btu per Hr	Furnace Volume Oil, Gas or Bituminous Coal Cu Ft
1,800	2,880	432,000	129	7.9	2,190	3,500	525,600	15.7
2,200	3,520	528,000	158	8.9	2,680	4,280	643,200	19.2
2,600	4,160	624,000	186	9.7	3,160	5,050	758,400	22.6
3,000	4,800	720,000	215	10.5	3,650	5,840	876,000	26.1
3,500	5,600	840,000	250	11.4	4,250	6,800	1,020,000	30.4
4,000	6,400	960,000	286	12.2	4,860	7,770	1,166,400	34.8
4,500	7,200	1,080,000	322	13.4	5,470	8,750	1,312,800	39.1
5,000	8,000	1,200,000	358	14.5	6,080	9,720	1,459,200	43.5
6,000	9,600	1,440,000	429	16.4	7,290	11,660	1,749,600	52.1
7,000	11,200	1,680,000	500	18.1	8,500	13,600	2,040,000	60.8
8,500	13,600	2,040,000	608	20.5	10,330	16,520	2,479,200	73.8
10,000	16,000	2,400,000	715	22.5	12,150	19,440	2,916,000	86.8
12,500	20,000	3,000,000	893	25.6	15,180	24,280	3,643,200	108.5
15,000	24,000	3,600,000	1,072	28.4	18,220	29,150	4,372,800	130.2
17,500	28,000	4,200,000	1,250	30.9	21,250	34,000	5,100,000	151.8
20,000	32,000	4,800,000	1,429	33.2	24,290	38,860	5,829,600	173.5
25,000	40,000	6,000,000	1,786	37.4	30,360	48,570	7,286,400	216.9
30,000	48,000	7,200,000	2,143	41.2	36,430	58,280	8,743,200	260.3
35,000	56,000	8,400,000	2,500	44.7	42,500	68,000	10,200,000	303.6

^aAdopted by the *Steel Heating Boiler Institute* in cooperation with the Bureau of Standards, United States Department of Commerce Simplified Practice Recommendation R 167-36.

For boilers with ratings 4000 sq ft of steam radiation and larger:

$$\text{Grate Area} = \sqrt{\frac{\text{Catalogue Rating (in square feet steam radiation)} - 1500}{16.8}} \quad (2)$$

7. The volume for furnaces in which solid fuel is burned is to be considered as the cubical content of the space between the bottom of the fuel bed and the first plane of entry into or between the tubes. Volume of furnaces in which pulverized liquid fuel or gaseous fuel is burned are to be considered as the cubical content of the space between the hearth and the first plane of entry into or between the tubes. No minimum furnace volume is to be specified for mechanical fired boilers burning anthracite.

8. The furnace volume for a boiler, with a rating as determined in No. 3 in which oil, gas or bituminous coal stoker fired is burned is not to be less than one cubic foot for every 140 sq ft of steam rating.

9. The average height of furnace for the rating determined in No. 3 in which bituminous coal, stoker fired is burned is not to be less than that determined graphically in Fig. 1 or mathematically by the following formula:

$$H = \sqrt{\frac{R}{22.5}} + \sqrt{\frac{R}{A}} \quad (3)$$

where

H = average furnace height, inches as determined by the following formula;

$$H = \frac{12F}{A} = \frac{12F}{WL}$$

R = stoker fired boiler rating, square foot steam radiation.

A = plan area of firebox, square feet measured at the bottom of the fuel bed.

F = furnace volume, cubic feet.