

TABLE 1. STEEL HEATING BOILER STANDARD RATINGS^a

HAND-FIRED RATING						MECHANICALLY-FIRED RATING					
Catalog			Net Load			Catalog			Net Load		
Steam Radiation Sq Ft	Water Radiation Sq Ft	Btu per Hour in Thousands	Steam Radiation Sq Ft	Heating Surface Sq Ft	Grate Area Sq Ft	Steam Radiation Sq Ft	Water Radiation Sq Ft	Btu per Hour in Thousands	Steam Radiation Sq Ft	Furnace Volume, Oil, Gas or Bituminous Coal Cu Ft	
1,800	2,880	432	1,389	129	7.9	2,190	8,500	525	1,695	15.7	
2,200	3,520	528	1,702	158	8.9	2,680	4,280	643	2,089	19.2	
2,600	4,160	624	2,020	186	9.7	3,160	5,050	758	2,461	22.6	
3,000	4,800	720	2,335	215	10.5	3,650	5,840	876	2,853	26.1	
3,500	5,600	840	2,732	250	11.4	4,250	6,800	1,020	3,335	30.4	
4,000	6,400	960	3,135	286	12.2	4,860	7,770	1,166	3,830	34.8	
4,500	7,200	1,080	3,540	322	13.4	5,470	8,750	1,312	4,330	39.1	
5,000	8,000	1,200	3,945	358	14.5	6,080	9,720	1,459	4,834	43.5	
6,000	9,600	1,440	4,770	429	16.4	7,290	11,660	1,749	5,850	52.1	
7,000	11,200	1,680	5,608	500	18.1	8,500	13,600	2,040	6,885	60.8	
8,500	13,600	2,040	6,885	608	20.5	10,330	16,520	2,479	8,490	73.8	
10,000	16,000	2,400	8,197	715	22.5	12,150	19,440	2,916	10,125	86.8	
12,500	20,000	3,000	10,417	893	25.6	15,180	24,280	3,643	12,650	108.5	
15,000	24,000	3,600	12,500	1,072	28.4	18,220	29,150	4,372	15,183	130.2	
17,500	28,000	4,200	14,584	1,250	30.9	21,250	34,000	5,100	17,708	151.8	
20,000	32,000	4,800	16,667	1,429	33.2	24,290	38,860	5,829	20,242	173.5	
25,000	40,000	6,000	20,834	1,786	37.4	30,360	48,570	7,286	25,300	216.9	
30,000	48,000	7,200	25,000	2,143	41.2	36,430	58,280	8,743	30,359	260.3	
35,000	56,000	8,400	29,167	2,500	44.7	42,500	68,000	10,200	35,417	303.6	

^aAdopted by the Steel Heating Boiler Institute in cooperation with the Bureau of Standards, United States Department of Commerce Simplified Practice Recommendations R 187-35.

BOILER EFFICIENCY

The term *efficiency* as used for guarantees of boiler performance is usually construed as follows:

1. *Solid Fuels.* The efficiency of the boiler alone is the ratio of the heat absorbed by the water and steam in the boiler per pound of combustible burned on the grate to the calorific value of 1 lb of combustible as fired. The combined efficiency of boiler, furnace and grate is the ratio of the heat absorbed by the water and steam in the boiler per pound of fuel as fired to the calorific value of 1 lb of fuel as fired.

2. *Liquid and Gaseous Fuels.* The combined efficiency of boiler, furnace and burner is the ratio of the heat absorbed by the water and steam in the boiler per pound or cubic foot of fuel to the calorific value of 1 lb or cubic foot of fuel respectively.

The following efficiencies apply to current designs of boilers operated under favorable conditions at their gross output ratings. Some older boilers designed primarily for hand firing may have lower efficiencies when automatically fired.

Anthracite, hand fired.....	60 to 75 per cent
Bituminous Coal, hand fired.....	50 to 65 per cent
Stoker fired.....	60 to 75 per cent
Oil and Gas fired.....	70 to 80 per cent

Higher efficiencies for hand fired bituminous coal may be obtained by careful firing of either a regular or a smokeless boiler.

RATING OF BOILERS

In referring to boiler rating it is necessary to know the basis on which the rating has been established in order to understand the exact meaning of the term. The following example will illustrate the meaning of three ratings which might be established for the same boiler.

Assume that an installation has the following loads determined in accordance with the section *Selection of Boilers*:

Net Load.....	1000 sq ft of steam radiation
Piping Tax.....	200 sq ft of steam radiation
Design Load.....	1200 sq ft of steam radiation
Pickup Allowance.....	240 sq ft of steam radiation
Maximum or Gross Load.....	1440 sq ft of steam radiation

A boiler that is just large enough to carry this system might be said to have a *net load rating* of 1000 sq ft, a *design load rating* of 1200 sq ft, or a *gross load rating* of 1440 sq ft, depending on the basis on which the boiler is rated.

On a *net load* basis the above boiler would be rated 1000 sq ft of steam radiation and would have sufficient excess capacity to supply the *normal piping* and *pickup load*. $I=B=R$ ratings, *S.H.B.I.* Net Ratings, and Net Load Ratings of the *Heating, Piping and Air Conditioning Contractors National Association* are established on this basis.

On a *design load* basis the boiler would be rated 1200 sq ft of steam radiation and would have sufficient excess capacity to supply the *pickup load*. It would be of adequate size for a system in which the *sum* of the *net load* and the *piping heat loss* did not exceed 1200 sq ft of steam radiation. The *S.H.B.I.* Ratings shown in the first and seventh columns of Table 1 (not to be confused with *S.H.B.I.* Net Rating) are established on a *design load* basis.

On a *gross output* basis of rating the boiler would be rated 1440 sq ft of steam radiation and would be of adequate size for a system in which the *sum* of the *net load*, *piping load*, and *pickup load* did not exceed 1440 sq ft of steam radiation. Gross $I=B=R$ Output and *A.G.A.* Ratings are established on a *gross output* basis.

In the determination of boiler ratings, the *Gross Output* is the quantity of heat available at the boiler nozzle with the boiler normally insulated and when operating under limitations stipulated in the code or method by which the boiler is rated. The boiler may be capable of producing a greater nozzle output but in doing so would exceed some of these limitations.

SELECTION OF BOILERS

Factors Involved in Boiler Selection

The *Maximum Load* or *Gross Load* on the boiler is the sum of the four following items.

The *Design Load* is the sum of items 1, 2 and 3.

The *Net Load* is the sum of items 1 and 2.

1. *Radiation Load.* The estimated heat emission in Btu per hour of the connected radiation (direct, indirect, or forced convection coils) to be installed.

The connected radiation is determined by calculating the heat losses for each room in accordance with data given in Chapters 4, 5, and 6. The sum of the calculated heat losses for all the rooms represents the total required heat emission of the connected radiation expressed in Btu per hour. As practically all boilers are now rated on a Btu basis, it is unnecessary to convert the radiation load to equivalent square feet of equivalent radiation.

2. *Hot Water Supply Load.* The estimated maximum heat in Btu per hour required to heat water for domestic use.

When the hot water supply is heated by the building heating boiler, this load must be taken into consideration in sizing the boiler. A common practice is to add 240 Btu per hour to the radiation load for each gallon of storage tank capacity. For more specific information see Chapter 46.