

The maximum Btu input or gas that can be burned may be determined by the manufacturer but is checked by the *American Gas Association* laboratory before being approved. An arbitrary efficiency of 80 per cent is assumed in computing the output rating from the Btu input.

The actual Btu delivered by any gas boiler when burning gas at the rated Btu input will vary from the A.G.A. output rating in the direct proportion of the actual efficiency with the gas being burned to the assumed efficiency of 80 per cent.

Rating of Steel Boilers

The *Steel Heating Boiler Institute* suggests a single number dimensional rating in the *S.H.B.I.* Code for the Rating of Low Pressure Heating Boilers. (See Rating of Heating Boilers by Their Physical Characteristics, by C. E. Bronson, A.S.H.V.E. TRANSACTIONS, Vol. 36, 1930).

TABLE 1. PRACTICAL COMBUSTION RATES FOR RELATIVELY SMALL COAL-FIRED HEATING BOILERS OPERATING ON NATURAL DRAFT OF FROM $\frac{1}{4}$ IN. TO $\frac{1}{2}$ IN. WATER^a

Sq. Ft. GRATE	KIND OF COAL	LB. OF COAL PER SQ. FT. GRATE PER HOUR
Up to 4	No. 1 Buckwheat Anthracite	3
5 to 9	No. 1 Buckwheat Anthracite	3½
10 " 14	No. 1 Buckwheat Anthracite	4
15 " 19	No. 1 Buckwheat Anthracite	4½
20 " 25	No. 1 Buckwheat Anthracite	5
Up to 9	Anthracite Pea	5
10 to 19	Anthracite Pea	5½
20 " 25	Anthracite Pea	6
Up to 4	Anthracite Nut and Larger	5
5 to 9	Anthracite Nut and Larger	6
10 " 14	Anthracite Nut and Larger	7
15 " 19	Anthracite Nut and Larger	8
20 " 25	Anthracite Nut and Larger	9
Up to 4	Bituminous	4
5 to 14	Bituminous	7
15 and above	Bituminous	10

^aSteel boilers usually have higher combustion rates for grate areas exceeding 15 sq ft than those indicated in this table.

SELECTION OF BOILERS

The character of the load, the space available, the fuels to be used and the adaptability to changes in fuels, are some of the important factors determining the type of boiler or boilers to be selected. The size and nature of the load determines the number of boilers conducive to greatest economy. A boiler installation that will permit carrying the peak heating load on an overload and make possible the carrying of normal load at, or near, rating results in maximum economy and flexibility and reduces the first cost to a minimum. Selecting boilers for carrying peak loads on overloads is only advisable in the case of horizontal return tubular boilers and water-tube boilers and the amount of overload advisable is then dependent on the character of furnace and setting.

Selection of Solid Fuel Boilers

The estimated connected load of the boiler or boilers is the sum of the following items (1) to (4), which are taken from the A.S.H.V.E. Code of Minimum Requirements for the Heating and Ventilation of Buildings:

1. The estimated heat emission in Btu per hour of the connected radiation (direct, indirect or blast) to be installed, as previously determined by calculations given in Chapters 2, 3 and 4 of THE GUIDE.
2. The estimated maximum heat in Btu per hour required to supply water heaters or other apparatus to be connected to the boiler.
3. The estimated heat emission in Btu per hour of the piping connecting the radiation and other apparatus to the boiler.
4. The estimated increase in the normal load in Btu per hour due to starting up cold radiation, etc. This percentage of increase to be based on the sum of items (1), (2) and (3) shall not be assumed less than the following:

Sum of (1), (2) and (3):

Up to 100,000 Btu add 65 per cent.
100,000 to 200,000 Btu add 60 per cent.
200,000 to 600,000 Btu add 55 per cent.
600,000 to 1,200,000 Btu add 50 per cent.
1,200,000 to 1,800,000 Btu add 45 per cent.
Above 1,800,000 Btu add 40 per cent.

Other things to be considered are:

5. The kind and amount of attention available. Attention is least skillful and least frequent for owner-operated residence installations and generally increases in skill as well as frequency as size of boiler increases. Local fuels and types of firing service must be considered carefully in this connection.
6. The kind of fuel to be used, including size and characteristics.
7. Size and height of the available chimney.

The boiler performance data may be obtained from A.S.H.V.E. Performance Test Code for Steam Heating Solid Fuel Boilers (Code No. 3). The boiler or boilers should be capable of supplying at the boiler outlets the total Btu per hour as calculated from items (1) to (4), inclusive, when the following conditions of operation are stated specifically:

A. Steam Boilers:

1. Gage pressure in pounds per square inch.
2. Assumed temperature of returns in degrees Fahrenheit.
3. Description of fuel to be employed with calorific value per pound of dry fuel stated (state size, etc., if solid fuel is to be employed).
4. Firing period for solid fuel.
5. Inside dimensions and height of chimney to which boiler or boilers are to be connected, and to which no other openings are to be provided except the cleanout.

B. Hot Water Boilers:

1. Temperature of water leaving boiler outlets in degrees Fahrenheit.
2. Assumed temperature of return water entering boiler in degrees Fahrenheit.
3. Description of fuel to be employed with calorific value per pound of dry fuel stated (state size, etc., if solid fuel is to be employed).
4. Firing period for solid fuel.
5. Inside dimensions and height of chimney above the grate to which boiler or boilers are to be connected and to which no other openings are to be provided except the cleanout.