BOILER RATINGS

There are wide differences in the ratings of heating boilers by the various manufacturers due largely to the fact that there has never been any generally accepted code upon which to base the rating of these boilers. The AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, *the National Boiler and Radiator Manufacturers Association*, and others interested are making progress in the development of such a code.

COAL FIRED BOILER RATING

At present the word rating of coal-fired boilers may have any one of the following meanings:

1. The actual amount of equivalent direct radiator load that may be attached. It is assumed that the boiler has sufficient reserve to compensate for piping, pick-up load and other allowances.

2. The total equivalent direct radiation load plus piping load that may be attached. A boiler installed on a job with the proper amount of radiation, if selected according to this rating, will operate continuously at rating when the inside and outside temperatures are those for which the heat loss of building was figured. It is assumed that the boiler has sufficient reserve for pick-up load.

3. The output in B.t.u. at the boiler outlet when burning per hour certain percentage of the total fuel that can be fired at one time. The amount of fuel that can be fired at one time is determined by computation from firebox dimensions or by laboratory test. The output obtainable must be found by test. This method of rating has been popular for boilers burning anthracite in sizes larger than chestnut. When the length of time between successive firings is given the boiler is said to be rated upon that *firing period*, e.g. If boiler has to be fired every eight hours when delivering its rated output, the boiler is rated on an *8 hour firing period*.

4. The output in B.t.u. that can be obtained with a good grade of anthracite or bituminous coal with attention limited according to directions specified by the manufacturer. With proper specifications regarding fuels, firing, attention and operation, this method of rating is useful in that it is applicable to all types of fuels.

5. The output obtained when burning a specified fuel at a specified rate of combustion. The output must be found by test when burning the fuels selected as standard. The rate at which the fuel is burned is based upon experience and is varied according to an arbitrary rule according to kind of fuel and size of grate. The output for fuels other than standard is found by multiplying the output for standard fuel by a correction factor.

6. The output obtained when the temperature of gases leaving the boiler is not over a specified degree and the carbon dioxide is above a certain minimum.

This method has been suggested but has not been used.

7. The output obtained by multiplying the surface with which the fire and gases come in contact by the average amount of heat which a square foot of surface will deliver to the water in the boiler.

The heat transmitted per square foot of surface and used in this method of rating is established arbitrarily. The boiler is said to be rated on its heating surface,

8. A method sometimes used for estimating the approximate reasonable output of a boiler where more accurate and reliable test data are not available, is as follows:

The output in B.t.u. is obtained by multiplying together the square feet of grate surface by an assumed rate of combustion (in lb. of coal per sq. ft. of grate per hour) by the B.t.u. value of the fuel (per lb.) by the efficiency of the boiler (at the load and rate of combustion assumed).

This gives an approximate rating. For data on rates of combustion, see Table 1. Also Chapter VI on "Chimneys" and Chapter VII on "Mechanical Draft." Ordinary heating boiler efficiencies for normal rate of combustion may vary from 55 to 75 per cent.

GAS FIRED BOILER RATING

The rating of gas boilers in contrast to coal boilers is a comparatively simple matter. The following conditions of rating established by the *American Gas Association* have been generally accepted:

1. The boiler must deliver rated output without chimney connection.
2. There must be no carbon monoxide formed when the gas pressure in service line is normal, 50 per cent below normal, or 50 per cent above normal.
3. The boiler must have an efficiency of at least 75 per cent at rated output.

The maximum B.t.u. 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 B.t.u. input.

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

RATINGS OF BOILERS FOR OIL FUEL

The output of a boiler with oil fuel will depend upon the combined efficiency of the boiler and burner and the quantity of oil that can be properly burned within the space provided in the boiler.

Oil burner ratings in use at present have been obtained either from test with typical burners or have been obtained by multiplying the coal rating by a constant.

Coal boilers converted to oil may have as high or a higher rating and as high or higher efficiency than with coal.

SIZE, RATING AND CAPACITY OF A BOILER

The three words are sometimes used indiscriminately to designate any one of the three things for which they should be used.

Size may be: the physical dimensions of all or part of the boiler, the maximum output, or the manufacturers rating. This word has been used loosely so long that it would be difficult to limit it to one meaning.

Rating usually means the boiler *output* under certain conditions. It is important that the conditions be known in order to give rating a definite meaning.

Capacity is another word for output. It may be stated in terms of pounds of steam delivered, square feet of standard radiation supplied with heat, or B.t.u. delivered. The word *output* will convey the meaning better than *capacity*.

TYPES OF BOILERS

Owing to the changes which have been made in boiler design within the last six or seven years, it is no longer correct to draw general conclusions regarding the different types of boilers such as cast-iron sectional, steel fire-tube and steel water-tube boilers.

Broadly speaking, three types of heating boilers are commonly used.