

10 ● a. What is the heat equivalent of a boiler horsepower?

b. How many square feet of heating surface are usually required per boiler horsepower?

a. 33,471.9 Btu per hour.

b. 10 sq ft.

11 ● What is meant by equivalent evaporation?

The amount of water that a boiler would evaporate per hour, if the feed water were at 212 F and if the steam were evaporated at that temperature; this is usually spoken of as "from and at 212 F."

12 ● What loads must be considered in determining the boiler capacity required for a given installation?

Radiation load.

Hot water supply load.

Piping tax.

Warming-up allowance.

Load allowance for inefficient firing.

13 ● A boiler has 6 sq ft of grate area with a possible depth of fuel bed of 18 in. The fuel burned is bituminous coal with a heat value of 12,500 Btu per lb. The efficiency is assumed to be 50 per cent. How great a maximum load will this boiler carry if it is to be fired every 8 hours and if 20 per cent of the fuel is to be left over to kindle the next charge?

Volume of fuel bed = $6 \times 1.5 = 9.0$ cu ft.

Available volume = $0.80 \times 9.0 = 7.2$ cu ft.

Weight of available fuel = $40 \times 7.2 = 288.0$ lb.

Fuel burned per hour = $\frac{288.0}{8} = 36.0$ lb.

Heat released = $36.0 \times 12,500 \times 0.50 = 225,000$ Btu per hour.

Maximum load = $\frac{225,000}{240} = 938$ equivalent square feet.

14 ● What are the usual causes of unsteady water line and priming?

Grease and dirt in boiler.

Overload, resulting in insufficient steam liberating area.

Small outlet connections.

15 ● What type of return connection can be used for gravity steam heating systems to make the use of check valves unnecessary?

The Hartford Loop. (See Chapter 32.)

Chapter 26

CHIMNEYS AND DRAFT CALCULATIONS

Natural Draft, Mechanical Draft, Characteristics of Natural Draft Chimneys, Determining Chimney Sizes, General Equation, Chimney Construction, Chimneys for Gas Heating

THE design and construction of a chimney is so important a part of the heating engineer's work that a general knowledge of draft characteristics and calculations is essential.

Draft, in general, may be defined as the pressure difference between the atmospheric pressure and that at any part of an installation through which the gases flow. Since a pressure difference implies a head, draft is a static force. While no element of motion is inferred, yet motion in the form of circulation of gases throughout an entire boiler plant installation is the direct result of draft. This motion is due to the pressure difference, or unbalanced pressure, which compels the gases to flow. Draft is often classified into two kinds according to whether it is created thermally or artificially, viz, (1) natural or thermal draft, and (2) artificial or mechanical draft.

Natural Draft

Natural draft is the difference in pressure produced by the difference in weight between the relatively hot gases inside a natural draft chimney and an equivalent column of the cooler outside air, or atmosphere. Natural draft, in other words, is an unbalanced pressure produced thermally by a natural draft chimney as the pressure transformer and a temperature difference. The intensity of natural draft depends, for the most part, upon the height of the chimney above the grate bar level and also the temperature difference between the chimney gases and the atmosphere.

A typical natural draft system consists essentially of a relatively tall chimney built of steel, brick, or reinforced concrete, operating with the relatively hot gases which have passed through the boilers and accessories and from which all the heat has not been extracted. Hot gases are an essential element in the operation of a natural draft system, although inherently a heat balance loss.

A natural draft chimney performs the two-fold service of assisting in the creation of draft by aspiration and also of discharging the gases at an elevation sufficient to prevent them from becoming a nuisance.

Natural draft is quite advantageous in installations where the total loss of draft due to resistances is relatively low and also in plants which have practically a constant load and whose boilers are seldom operated above