1. The *barometric pressure* varies inversely as the altitude of the plant above sea level. Fig. 5 gives the barometric pressure corresponding to various elevations as computed from the equation:

$$E_1 = 62{,}737 \log \frac{29.92}{B_o} \qquad (3)$$

*where*

$E_1$ = altitude of plant above sea level, feet.

In general, the barometric pressure decreases approximately 0.1 in. of mercury per 100 ft increase in elevation.

2. The *unit weight of a cubic foot* of chimney gases at 0 F and sea level barometric pressure is given by the equation:

$$W_c = 0.131 CO_2 + 0.095 O_2 + 0.083 N_2 \qquad (4)$$

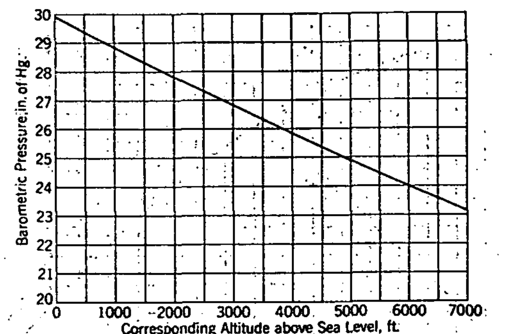


Fig. 5. Relation Between Barometric Pressure and Altitude

In this equation $CO_2$, $O_2$ and $N_2$ represent the percentages of the parts by weight of the carbon dioxide, oxygen and nitrogen content, respectively, of the gas analysis. For ordinary operating conditions, the value of $W_c$ may be assumed at 0.09.

3. The *atmospheric temperature* is the actual observed temperature of the outside air at the time the analysis of the operating chimney is made. The mean atmospheric temperature in the temperate zone is approximately 62 F.

4. The *chimney gas temperature* does not vary appreciably from the gas temperature as it leaves the breeching and enters the chimney. For average operating conditions, the chimney gas temperature will vary between 500 F and 650 F except in the case when economizers and recuperators are used, when the temperature will vary between 300 F and 450 F. If a chimney has been properly constructed, properly lined and has no air infiltration due to open joints, the temperature of the gases throughout the chimney will not differ appreciably from the foregoing figures. In most up-to-date heating plants the temperature may be read from instruments or ascertained from a pyrometer.

5. The *coefficient of friction* between the chimney gases and a sooted surface has been found to be approximately 0.016. This factor, of course, will be much less for a new unlined steel stack than for a brick or brick-lined chimney, but in time the inside surface of all chimneys regardless of the material of which they are constructed becomes covered with a layer of soot and the coefficient of friction should be the same for all types of chimneys.

6. The *length of the friction duct* is the vertical distance between the bottom of the breeching opening and the top of the chimney. Ordinarily this distance is approximately equal to the height of the chimney above the grate level.





7. The *amount of gases flowing and being discharged* is, of course, equal to the amount of gases generated in the combustion chamber of the boiler. The total products of combustion may be computed from the equation:

$$W = \frac{C_g G W_{tp}}{3600} \qquad (5)$$

*where*

$C_g$ = pounds of fuel burned per square foot of grate surface per hour.
$G$ = total grate surface of boilers, square feet.
$W_{tp}$ = total weight of products of combustion per pound of fuel.

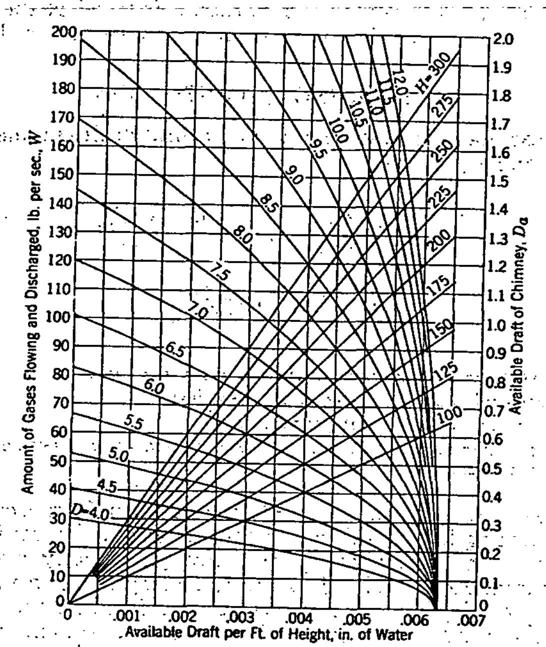


Fig. 6. Chimney Performance Chart

Fig. 6 is a typical chimney performance chart giving the available draft intensities for various amounts of gases flowing and sizes of chimney. This chart is based on an atmospheric temperature of 62 F, a chimney gas temperature of 500 F, a unit chimney gas weight of 0.09 lb per cubic foot, sea level atmospheric pressure, a coefficient of friction of 0.016, and a friction duct length equal to the height of the chimney above the grate level. These curves may be used for general operating conditions. For specific operating conditions, a new chart should be constructed from Equation 1.

It has been the usual custom, and still is to a lamentably great extent, to select the required size of a natural draft chimney from a table of