

DETERMINING BOILER CAPACITY REQUIRED FOR A PARTICULAR INSTALLATION

First determine from the boiler manufacturer whether his complete line of boilers has been tested according to the A. S. H. & V. E. Boiler Testing Code Revision of 1923 (See p. 65). Look for the evidence of such testing in his catalog also facts as to fuel capacity, evaporative power and on the smaller boilers, length of firing period, efficiency and draft requirements. The net amount of radiation should be increased by about 20 per cent for line losses to determine the total heating load on the boiler. The smaller the boiler, the greater the handicaps it usually must operate under, such as poor draft, dirty coal, sooty heating surface, incompetent attention, etc. To offset those handicaps on boilers used for residence heating, a factor of safety of 50 to 100 per cent should be figured above the total load in determining boiler capacity. In larger size installations the operating conditions are more favorable where a factor of safety of 25 to 75 per cent is ample. Under ordinary operating conditions any boiler should be able to develop at least its full rated capacity.

IMPORTANCE OF DRAFT

The capacity a boiler is capable of developing depends more upon the amount of draft available than upon any other factor. Assuming that a chimney is smoke tight and well built according to the Ordinance for Construction of Chimneys, 1921 (recommended by the National Board of Fire Underwriters and approved by the Society), the intensity of the draft depends upon the height of the chimney, and the quantity or amount of draft depends principally upon the effective area of the chimney. According to their height, heating chimneys are divided into three classes, the erratic, uncertain and reliable. Chimneys less than 36 ft. high are erratic in their action. The head produced by such a low height is so small that the least unfavorable condition or interference practically puts the chimney out of commission.

Chimneys between 36 ft. and 64 ft. in height are in the doubtful zone, sometimes good and sometimes bad. The head produced by this relatively low height is frequently offset by slight unfavorable conditions that may be difficult to locate. Chimneys over 64 ft. in height are usually reliable, because as a rule the chimney is designed by an engineer and must be well built to sustain such a heavy load and the height is such as to produce considerable head or force to offset unfavorable weather conditions, etc. Chimneys in this class produce about 0.009 in. draft per ft. of height in zero weather with 600 deg. in the stack according to the formula:

$$P = H \left(\frac{7.6}{T_o} - \frac{7.9}{T_s} \right)$$

where

P = draft pressure in inches of water.
 H = height of chimney in feet.
 T_o = absolute temperature of outside air.
 T_s = absolute temperature of stack gases.

For low pressure heating boilers, water heaters and warm air furnaces conservative modern practice in the matter of chimney sizes is in accordance with the accompanying schedule, Table 50:

TABLE 50. CHIMNEY SIZES

WARM AIR FURNACE CAPACITY IN LEADER PIPE SQ. IN.	STEAM BOILER CAPACITY SQ. FT. OF RADI- ATION	HOT WATER HEATER CAPACITY SQ. FT. OF RADI- ATION	NOMINAL DIMEN- SIONS OF FIRE CLAY LINING IN.	RECTANGULAR FLUE			ROUND FLUE		
				Actual Inside Dimensions of Fire Clay Lining In.	Actual Area Sq. In.	Effective Area Sq. In.	Inside Diameter of Lining In.	Effective Area Sq. In.	Height in Ft. from Grate
790	590	973	8½x13	7x11½	81	70			35
1000	690	1140					10	79	
	900	1490	13x13	11¼x11¼	127	99			
	900	1490	8½x18	6¾x16¼	110	100			
	1100	1820					12	113	40
	1700	2800	13x18	11¼x16¼	183	156			
	1940	3200					15	177	
	2130	3520	18x18	15¼x15¼	248	195			
	2480	4090	20x20	17¼x17¼	298	234			
	3150	5200					18	254	50
	4300	7100					20	314	
	5000	8250	24x24	21x21	441				
	4600	7590		20x24*	480	326			55
	5570	9190		24x24	576	380			60
	5580	9200					22	380	
	6980	11500					24	452	65
	7270	12000		24x28	672	468			
	8700	14400		28x28	784	531			
	9380	15500					27	573	
	10150	16750		30x30	900	616			
	10470	17250		28x32	896	635			
	11800	19500					30	707	70
	14700	24300					33	855	
	17900	29500					36	1018	

*Dimensions below are for unlined rectangular flues.

Chimneys recommended for larger boilers 15 to 250 hp. are proportioned in accordance with the report made by a joint Committee of the American Boiler Manufacturers Association and Stoker Manufacturers Association and approved by these organizations. The sizes are given in Table 51.

TABLE 51. HEIGHT OF STACK FOR AVERAGE INSTALLATIONS (SEA LEVEL)

Forced Draft Stokers

Per Cent Rating.....	100	150	200	250	300
Draft Furnace.....	0.15	0.15	0.15	0.15	0.15
Friction Loss (Boiler).....	0.18	0.4	0.65	0.9	1.20
Friction Loss (Breeching).....	0.10	0.10	0.10	0.10	0.10
Total Draft Required.....	0.43	0.65	0.90	1.15	1.45
Height of Stack (Ft.).....	80	112	145	178	220