

AMERICAN SOCIETY OF HEATING and VENTILATING ENGINEERS GUIDE, 1924-25

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

DIAMETER OF CHIMNEY IN INCHES FOR HORIZONTAL RETURN TUBULAR BOILERS				HEIGHT OF STACK IN FEET—FOR SEA LEVEL AND 60 DEG. FAHR. OUTSIDE TEMP. ASSUMED FRICTION LOSS IN STACK 0.1 IN. PER 100 FT.			
Nominal H. P.	100% Rating	150% Rating	200% Rating	Draft at Base of Stack	100% Rating	150% Rating	200% Rating
15	13	14	17	0.12	21	22	25
20	14	16	18	0.15	26	28	30
25	16	18	20	0.20	35	37	41
30	17	19	21	0.25	43	46	51
35	18	20	22	0.30	52	56	61
40	19	21	23	0.35	60	65	71
50	20	23	25	0.40	69	74	81
60	21	24	27	0.45	78	84	91
75	23	26	29	0.50	86	93	101
90	25	28	31	0.55	95	102	111
100	26	29	33	0.60	104	112	122
115	27	31	34	0.65	112	121	132
125	28	32	35	.....	.....	.....	.....
150	30	34	38	.....	.....	.....	.....
175	32	36	40	.....	.....	.....	.....
200	33	38	43	.....	.....	.....	.....
210	34	38	44	.....	.....	.....	.....
225	35	40	45	.....	.....	.....	.....
250	36	41	47	.....	.....	.....	.....

DATA ON WHICH TABLES ARE BASED							
Rating.....	100%	150%	200%	Stack Temp,			
Efficiency.....	65%	65%	63%	deg. fahr.....	450	500	550
CO ₂	8%	9%	10%	Lbs. of Gas.....	85	77	73

AVERAGE FRICTION LOSS THROUGH BOILERS						
Per Cent Rating.....	100	150	200	250	300	
Loss Ins., Water.....	0.1 to 0.3	0.2 to 0.6	0.3 to 0.9	0.5 to 1.4	0.7 to 1.9	

Friction loss through boiler varies according to construction.
 For Furnace Draft.—Allow 0.15 for forced draft. For Natural Draft 0.35 in. or higher should be used depending upon rate of combustion and fuel used.
 For Breaching Friction Loss.—Allow 0.05 in. for each right angle bend and 0.1 in. per 100 ft. of length. Cross sectional area should be 20 per cent larger than that of stack.

HEIGHT OF STACK IN FEET
 For Sea Level and 60 deg. fahr. Outside Temperature and 0.1 in. Friction Loss per 100 ft.

TOTAL DRAFT REQUIRED IN. FOR FURNACE BOILER AND BREACHING	PER CENT OF BOILER RATING				
	100	150	200	250	300
0.3	56	.....	.....	.....	.....
0.4	74	69	.....	.....	.....
0.5	93	86	81	.....	.....
0.6	111	103	97	.....	.....
0.7	130	120	113	108	.....
0.8	148	138	129	123	.....
0.9	.....	155	145	139	132
1.0	.....	172	161	154	147
1.1	.....	190	177	170	162
1.2	.....	.....	194	185	176
1.3	.....	.....	209	200	191
1.4			226	216	206
1.5				231	221
1.6					236
1.8					265
Assumed Flue Gas Temp.....	500	550	600	650	700

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CORRECTION FOR ALTITUDE

HEIGHT ABOVE SEA LEVEL (FT.)	RATIO INCREASE IN DIAMETER	RATIO INCREASE IN HEIGHT
0	1.000	1.000
1,000	1.015	1.046
2,000	1.030	1.097
4,000	1.063	1.205
6,000	1.096	1.321
8,000	1.130	1.456
10,000	1.165	1.612

An approximate rule often applied to chimneys over 64 ft. high, as regards rate of combustion is:

$$\text{Rate Combustion for Hard Coal} = 1\frac{1}{2} \sqrt{H} \text{ to } 2 \sqrt{H};$$

$$\text{Rate Combustion for Soft Coal} = 2 \sqrt{H} \text{ to } 3 \sqrt{H};$$

Where H = height of chimney in feet.

In the absence of a chimney size formula based on research data, the formula given in *Kent's Hand Book* is about the best available.

$$R = 333 E \sqrt{H}$$

where

R = steam rated capacity of boiler in square feet.

E = effective area of stack in square feet which should not extend within 2 in. of stack walls.

$\sqrt{H}$ = square root of height in feet measured from center of breeching connection to stack. The height of stacks less than 65 ft. should not be less than 30 times the diameter or width of stack.

The rate of combustion in heating boilers ranges from 5 lb. to over 20 lb. of coal per square foot of grate per hour, according to the height of the stack. Large heating boilers are being attached to stacks 100 to 300 ft. high. Small round boilers require from 0.1 to 0.2 in. of draft at the smoke outlet, according to the number of intermediate sections placed between the firepot and dome sections. Medium size boilers require from 0.15 to about 0.5 in. of draft. Smokeless boilers require from 0.4 to 1.0 in. of draft to develop their rated capacity. Such conditions as nature of fuel condition of firebed, amount of excess air used and condition of the flue travel very materially increase or decrease the draft required to develop the rated capacity of any boiler.

Small house heating boilers should be rated on a 10-hr. hard coal basis. The larger size boilers using hard coal and having a grate over 40 in. wide are rated on a 4 to 6-hr. hard coal basis. All boilers burning soft coal are rated on an hourly basis because of the tendency of soft coal to burn holes through the firebed in a relatively short time after firing. The largest size of boilers are rated on an hourly basis since a fireman is in constant attendance.

