CHIMNEYS FOR GAS APPLIANCES

The burning of gas differs from the burning of coal in that the force which supplies the air for combustion of the gas comes largely from the pressure of the gas in the supply pipe, whereas air is supplied to a bed of burning coal by the force of the chimney draft. If, with a coal-burning boiler, the draft is poor, or if the chimney is stopped, the fire is smothered and the combustion rate reduced. Such a condition on a gas boiler or furnace would interfere with the combustion of the gas, but the gas would continue to pass to the burners and the resulting incomplete combustion would produce a dangerous condition. In order to prevent incomplete combustion from insufficient draft, all gas-fired boilers and furnaces should have a back-draft diverter in the flue connection to the chimney.

A study of the drawing of a typical back draft diverter will make it plain that a stoppage in the chimney will cause the combustion products to come out into the boiler room, but there will be no interference with

TABLE 6. HEIGHT OF STACK IN FEET FOR HORIZONTAL RETURN TUBULAR BOILERS (SEA LEVEL AND 60 DEG. FAHR. OUTSIDE TEMPERATURE)[a]

NOMINAL HORSEPOWER	DRAFT AT BASE OF STACK, INCHES	RATING—PER CENT		
		100	150	200
15	0.12	21	22	25
20	0.15	26	28	30
25	0.20	35	37	41
30	0.25	43	46	51
35	0.30	52	56	61
40	0.35	60	65	71
50	0.40	69	74	81
60	0.45	78	84	91
75	0.50	86	93	101
90	0.55	95	102	111
100	0.60	104	112	122
115	0.65	112	121	132

[a]Friction loss in stack assumed 0.1 in. per 100 ft. See also Note [a], Table 5.

the complete combustion of the gas. Another feature in the construction of the back-draft diverter is that a down draft from the chimney will have practically no effect upon the combustion of the gas, due to the baffle deflecting the draft into the boiler room.

As is the case with the complete combustion of almost all fuels, the products of combustion for gas are carbon dioxide (CO_2) and water vapor with just a trace of sulphur trioxide (SO_3). Sulphur usually burns to the trioxide in the presence of an iron oxide catalyst. The volume of water vapor in the flue products is about twice the volume of the carbon dioxide when coke oven or natural gas is burned. Because of the large quantity of water vapor which is formed by the burning of gas, it is quite important that all gas-fired central heating plants be connected to a chimney having a good draft. Lack of chimney draft causes stagnation of the products of combustion in the chimney and results in the condensation of a large amount of the water vapor. A good chimney draft draws air into the chimney through the openings in the back-draft

TABLE 7. AVAILABLE DRAFT FOR 100 FT. STEEL STACKS OF DIFFERENT DIAMETERS[a]

(Based on a stack temperature of 500 deg. fahr.[b] and 100 lb. of gas per horsepower. For other heights of stack, multiply draft by height ÷ 100)

HORSEPOWER	DIAMETER OF STACK IN INCHES														
	36	42	48	54	60	66	72	78	84	96	108	114	120	132	144
200	0.55	0.62													
400	0.21	0.46	0.56	0.61											
600		0.19	0.42	0.53	0.59										
800			0.23	0.43	0.52	0.58	0.61	0.63							
1000				0.29	0.45	0.53	0.58	0.61	0.63						
1200					0.35	0.47	0.54	0.58	0.61	0.64					
1600						0.31	0.43	0.52	0.56	0.62	0.64	0.65	0.65		
2000								0.43	0.50	0.59	0.62	0.63	0.64		
2500									0.41	0.54	0.60	0.61	0.63		
3000										0.48	0.56	0.59	0.61	0.63	0.64
3500										0.40	0.52	0.56	0.58	0.62	0.64
4000											0.48	0.52	0.56	0.60	0.62
4500											0.43	0.49	0.53	0.58	0.61
5000												0.44	0.49	0.56	0.60

[a]Data from Marks' Mechanical Engineers Handbook.

[b]For other stack temperatures add or deduct before multiplying by height ÷ 100, as follows:

For 750 deg. fahr. add 0.17 in.
For 700 deg. fahr. add 0.14 in.
For 650 deg. fahr. add 0.11 in.
For 600 deg. fahr. add 0.08 in.
For 550 deg. fahr. add 0.04 in.
For 450 deg. fahr. deduct 0.04 in.
For 400 deg. fahr. deduct 0.09 in.
For 350 deg. fahr. deduct 0.14 in.

TABLE 8. STACK SIZES BY KENT'S FORMULA

(Assuming 5 lb. of coal per horsepower per hour)

DIAM. IN.	AREA SQ. FT.	HEIGHT OF STACK IN FEET										SIDE OF EQUIVALENT SQUARE STACK, INCHES	DIAM. INCHES
		50	60	80	100	125	150	175	200	225	250		
		COMMERCIAL HORSEPOWER											
33	5.94	106	115	133	149							30	33
36	7.07	129	141	163	182							32	36
39	8.30	155	169	196	219	245						35	39
42	9.62	183	200	231	258	289	316					38	42
48	12.57	246	269	311	348	389	426	460				43	48
54	15.90	318	348	402	449	503	551	595				48	54
60	19.64	400	437	505	565	632	692	748				54	60
66	23.76	490	537	620	694	776	849	918				59	66
72	28.27	591	646	747	835	934	1023	1105				64	72
78	33.18	700	766	885	990	1107	1212	1310				70	78
84	38.48	818	896	1035	1157	1294	1418	1531				75	84
90	44.18				1338	1496	1639	1770	1893	2008	2116	80	90
96	50.27				1532	1713	1876	2027	2167	2298	2423	86	96
102	56.75				1739	1944	2130	2300	2459	2609	2750	91	102
108	63.62				1959	2190	2392	2592	2770	2939	3098	98	108
114	70.88				2192	2451	2685	2900	3100	3288	3466	101	114
120	78.54				2438	2726	2986	3226	3448	3657	3855	107	120
126	86.59				2697	3016	3303	3568	3814	4046	4265	112	126
132	95.03				2970	3321	3637	3929	4200	4455	4696	117	132
144	113.10				3554	3973	4352	4701	5026	5331	5618	128	144
156	132.73				4190	4684	5131	5542	5925	6285	6624	138	156
168	153.94				4878	5454	5974	6454	6899	7318	7713	150	168