

diverter, lowers the dew-point of the mixture, and reduces the tendency of the water vapor to condense.

A chimney for a gas-fired boiler or furnace should be constructed in accordance with the principles applicable to other boilers. Where the wall forming a smoke flue is made up of less than an 8 in. thickness of brick, concrete or stone, a burnt fire clay flue tile lining should be used. Care should be used that the lengths of flue tile meet properly with no openings at the joints. Cement mortar should be used for the entire chimney.

TABLE 9. MAXIMUM CAPACITIES OF STACKS IN BOILER HORSEPOWER FOR OIL FUELS

STACK DIAMETER INCHES	HEIGHT IN FEET ABOVE BOILER ROOM FLOOR					
	80	90	100	120	140	160
33	161	206	233	270	306	315
36	208	253	295	331	363	387
39	251	303	343	399	488	467
42	295	359	403	474	521	557
48	399	486	551	645	713	760
54	519	634	720	847	933	1000
60	657	800	913	1073	1193	1280
66	813	993	1133	1333	1480	1593
72	980	1206	1373	1620	1807	1940
84	1373	1587	1933	2293	2560	2767
96	1833	2260	2587	3087	3453	3740
108	2367	2920	3347	4000	4483	4867
120	3060	3660	4207	5040	5660	6160

*Figures represent nominal rated horsepower; sizes as given are based on 50 per cent overloads and centrally located stacks, short direct flues and ordinary operating efficiencies.

Correction for altitude may be made according to Table 10.

TABLE 10. CORRECTION FACTORS FOR ALTITUDE

HEIGHT ABOVE SEA LEVEL FEET	RATIO INCREASE IN DIAMETER	RATIO INCREASE IN HEIGHT
0	1.000	1.000
1,000	1.015	1.079
2,000	1.030	1.164
4,000	1.063	1.356
6,000	1.096	1.580
8,000	1.130	1.841
10,000	1.165	2.144

Table 11 gives the minimum cross-sectional diameters of round chimneys (in inches) for various amounts of heat supplied to the appliance, and for various chimney heights. This is in accordance with *American Gas Association* recommendations.

The flue connections from a gas-fired boiler or furnace to the chimney should be of a non-corrosive material. In localities where the price of gas requires the use of highly efficient appliances, the material used for the flue connection not only should be resistant to the corrosion of water, but should resist the corrosion of dilute solutions of sulphur trioxide in

TABLE 11. MINIMUM ROUND CHIMNEY DIAMETERS FOR GAS APPLIANCES (INCHES)

HEIGHT OF CHIMNEY FEET	GAS CONSUMPTION IN THOUSANDS OF B.T.U. PER HOUR								
	100	200	300	400	500	750	1000	1500	2000
20	4.50	5.70	6.60	7.30	8.00	9.40	10.50	12.35	13.85
40	4.25	5.50	6.40	7.10	7.80	9.15	10.25	12.10	13.55
60	4.10	5.35	6.20	6.90	7.60	8.90	10.00	11.85	13.25
80	4.00	5.20	6.00	6.70	7.35	8.65	9.75	11.50	12.85
100	3.90	5.00	5.90	6.50	7.20	8.40	9.40	11.00	12.40

water. Sheet aluminum, as well as some other materials, seems to serve this purpose very well.

CONSTRUCTION OF CHIMNEYS

For general data on the construction of chimneys reference should be made to the Standard Ordinance for Chimney Construction of the *National Board of Fire Underwriters*. Briefly summarized, these provisions are as follows for heating boilers and furnaces:

The construction, location, height and area of the chimney to which a heating boiler or warm-air furnace is connected affect the operation of the entire heating system. Most residence chimneys are built of brick and may be either lined or unlined, but in either case the walls must be air-tight and there should be only one smoke opening into the chimney. Cleanout, if provided, must be absolutely air-tight when closed.

The walls of brick chimneys shall be not less than $3\frac{3}{4}$ in. thick (width of a standard size brick) and shall be lined with fire-clay flue lining. Fire-clay flue linings shall be manufactured from suitable refractory clay, either natural or compounded, and shall be adapted to withstand high temperatures and the action of flue gases. They shall be of standard commercial thickness, but not less than $\frac{3}{4}$ in. All fire-clay flue linings shall meet the standard specification of the *Eastern Clay Products Association*. The flue sections shall be set in special mortar, and shall have the joints struck smooth on the inside. The masonry shall be built around each section of lining as it is placed, and all spaces between masonry and linings shall be completely filled with mortar. No broken flue lining shall be used. Flue lining shall start at least 4 in. below the bottom of smoke-pipe intakes of flues, and shall be continued the entire heights of the flues and project at least 4 in. above chimney top to allow for a 2 in. projection of lining. The wash or splay shall be formed of a rich cement mortar. To improve the draft the wash surface should be concave wherever practical.

Flue lining may be omitted in brick chimneys, provided the walls of the chimneys are not less than 8 in. thick, and that the inner course shall be a refractory clay brick. All brickwork shall be laid in spread mortar, with all joints push-filled. Exposed joints both inside and outside shall be struck smooth. No plaster lining shall be permitted.

Chimneys shall extend at least 3 ft. above flat roofs and 2 ft. above the ridges of peak roofs when such flat roofs or peaks are within 30 ft. of the chimney. The chimney shall be high enough so that the wind from any direction shall not strike the top of the chimney from an angle above the horizontal. The chimney shall be properly capped with stone, terra cotta, concrete, cast iron, or other approved material; but no such cap or coping shall decrease the flue area.

There shall be but one connection to the flue to which the boiler or furnace smoke-pipe is attached. The boiler or furnace smoke-pipe shall be thoroughly grouted into the chimney and shall not project beyond the inner surface of the flue lining.

The size or area of flue lining or of brick flue for warm-air furnaces depends on height of chimney and capacity of heating system. For chimneys not less than 35 ft. in height above grate line, the net internal dimensions of lining should be at least $7 \times 11\frac{1}{2}$ in. for a total leader pipe area up to 790 sq. in. Above 790 and up to 1,000 sq. in. of leader pipe area the lining should be at least $11\frac{1}{4} \times 11\frac{1}{4}$ in. inside. In case of brick flues not