

lowers the dew-point of the gases and tends to prevent condensation of moisture.

Since a gas designed appliance must be able to operate at rated input (plus 10 or 15 per cent) without chimney connection, and without producing carbon monoxide, the only function of the chimney is to remove the products of combustion from the room. The chimney provides draft to overcome the friction in the flue pipe and chimney, but does not draw air into the appliance.

Chimneys for venting gas burning appliances can therefore be low in height, but must have adequate area. The height is usually established by the building height. Chimney sizes are usually selected on the basis of Btu input to the appliance from a table similar to Table 5 which represents good practice.

While it is true that the chimney height is not required when the area is sufficient, it is extremely important that the chimney be tight and

TABLE 5. MINIMUM ROUND CHIMNEY DIAMETERS FOR GAS APPLIANCES (INCHES)

HEIGHT OF CHIMNEY FEET	GAS CONSUMPTION IN THOUSANDS OF BTU 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

resistant to corrosion not only of moisture, but also of dilute sulphur trioxide.

The products of complete combustion of gas are water vapor (H_2O) and carbon dioxide (CO_2) with a trace of sulphur trioxide (SO_3). Sulphur usually burns to the trioxide in the presence of an iron catalyst. The volume of water vapor in the flue products from natural or coke oven gas is about twice the volume of carbon dioxide.

Vitreous tile linings with joints which prevent retention of moisture and linings made of non-corrosive materials are advantageous. The protection of unlined chimneys has been investigated and the results indicate that after the loose material has been removed, the spraying with a water emulsion of asphalt chromate will provide excellent protection.

Advice regarding recommended practice and materials for flue connections and chimney linings can usually be obtained from the local gas company and should be given careful consideration.

CONSTRUCTION DETAILS

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. A brief summary of these provisions are given for heating boilers and furnaces.

The walls of brick chimneys shall be not less than $3\frac{1}{4}$ in. thick (width of a standard size brick) and shall be lined with fire-clay flue lining meeting 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 the chimney top to allow for a 2 in. projection of lining.

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, but no such cap or coping shall decrease the flue area.

GENERAL CONSIDERATIONS FOR CHIMNEYS

The draft of domestic chimneys may be subject to a variety of influences not usually encountered in power chimneys⁵. Horizontal winds have an aspirating effect as they cross the chimney and are an aid to draft. However, surrounding objects, such as trees or other buildings, may affect the direction of the wind at the chimney top and may even direct it down the chimney, tending to reduce the draft or even to cause it to be negative. Although the chimney should extend well above the highest part of the roof, it is impracticable to carry it much beyond this point.

It is also important to consider the source of the air supply for proper combustion. Usually the boiler or furnace is located in the basement. When the furnace room has windows or doors opening to the outside on two or more sides of the house, the leakage of air will be sufficient for combustion, even though the windows and doors may be shut. However, if the leakage is not sufficient to prevent an appreciable drop of pressure in the furnace room below that of the air outside, the chimney draft will be reduced by the difference between the atmospheric pressure outside and that inside the boiler room. In case the boiler room is fairly tight and is open to the outside on only one side of the house, then the draft will be affected in windy weather even with windows or doors open. If the wind is blowing toward the boiler room the draft will be increased, but if blowing in the opposite direction the draft may be seriously decreased.

It is not to be assumed that increasing the cross-section area of a chimney will always effect a cure for poor draft. The opposite result may be experienced because of the cooling effect of the larger area. This reduces the theoretical draft and the velocity of the gases, and affords a greater opportunity for counter currents in the chimney. Sometimes the only practical remedy for a chimney with bad draft, when the chimney is of the proper size and is affected by conditions beyond control, is to resort to mechanical draft. This can often be done at small expense and the arrangement can be such that the fan or blower need be operated only when conditions are bad.

⁵Chimneys and Draft (Chapter 32 in Winter Air Conditioning, by S. Konzo, published by National Warm Air Heating and Air Conditioning Association, 1939).