

of the *National Board of Fire Underwriters* for the Installation of Heat Producing Appliances, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems.

2. Every flue-connected appliance, except an incinerator, unless its construction serves the same purpose, shall be equipped with an effective draft hood which either (a) has been approved as part of the appliance or (b) complies with nationally recognized standards for draft hoods. The draft hood shall be attached to the flue collar of the appliance as conditions permit, and in a position for which it is designed with reference to horizontal and vertical planes. The draft hood shall be so located that the relief opening is not obstructed by any part of the appliance or adjacent construction.

3. No vent pipe from a gas appliance shall be interconnected with any other vent pipe, smoke pipe, or flue, unless such gas appliance is equipped with an automatic device to prevent the escape of unburned gas at the main burner or burners. Where a gas appliance vent pipe is joined with a smoke pipe from an appliance burning some other type of fuel, for connection into a single flue opening, they shall be joined by a Y fitting located as close as practicable to the chimney. With liquefied petroleum gases, the automatic device to prevent the escape of unburned gas shall shut off the pilot light, as well as the main burner or burners.

Recent tests of masonry chimneys¹⁶ made of a variety of materials have developed additional recommendations regarding the construction of masonry chimneys that will decrease the hazard to surrounding combustible materials.

GENERAL CONSIDERATIONS FOR CHIMNEYS

The draft of domestic chimneys may be subject to a variety of influences not usually encountered in power chimneys¹⁷ because of the low available draft often supplied by a short chimney. 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 change to a positive pressure.

It is not to be assumed that increasing the cross-sectional area of a chimney will always effect a cure for poor draft. The opposite result may occur because of the cooling effect of the larger area, and the effect of recirculation of the flue gases. The flow of gases into the chimney top has been observed at low rates, and recirculation in small residential chimneys has been noted throughout the entire length of a chimney and smoke pipe, with the greater amount of recirculation occurring at the thimble. The effect of recirculation decreases with chimney height and the increase in flue-gas velocity.

It is also important to consider the course of the air supply for proper combustion. The boiler or furnace is usually located in the basement. In the majority of cases, the furnace room has windows and doors opening to the outside on two or more sides of the house. Through these enough air leaks into the furnace room to sustain combustion. In some cases, however, windows and doors are so tight as to restrict the flow of combustion air, and thereby affect the correct operation of the chimney. 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 decreased.

The surrounding of a heating appliance with a restrictive enclosure that will limit entrance of combustion air is more likely to occur in a small utility closet installation on the first floor than in a basement installation. An opening with a free area approximately twice the area of the smoke-

pipe should therefore, be provided between the utility closet and the living space or the outdoors. If the utility closet is connected to the outdoors, greater difficulty with wind pressures will be encountered. Where a draft regulator is used it should have ample communication with the same space from which the combustion air is taken. Where forced warm air furnaces are enclosed in utility closets, care should be used to make the return air connection inside the utility closet airtight so that the blower cannot reduce the pressure in the closet and cause a downdraft in the chimney.

Two or more chimneys, either large or small, should never be connected together. If connected at the bottom, hot gases in the U-tube thus formed would be in unstable equilibrium. Cold air from the top would descend through one such chimney and drive the hot gases out of the other, thus annulling the draft.

More than one device can be served by one chimney. Batteries of boilers are commonly connected to a single chimney in power plants. However, if two or more chimneys are used, each chimney should be used separately for part of the boilers, and not connected in manifold with another chimney, in order to avoid the difficulty described previously.

In domestic installations it is sometimes necessary to serve a space heater or cooking stove and a water heater with the same chimney flue. This is not desirable, especially for low chimneys, since doors left open on one device, while it is unfired, will tend to annul the draft on another device. Gas burning devices, with their draft hoods and lack of draft dampers, are especially bad in this respect. The traditional method of avoiding this with brick chimneys has been to construct multiple-flue chimneys, so that each fuel-burning device could be served by a separate opening. If two devices must be served by one flue-opening in a chimney, their connections to the chimney should not be located opposite each other. The connection from the larger device should be reasonably low, and that from the smaller, up near the ceiling, so that each device can be serviced as well as possible, regardless of the treatment of the other.

Even where such precautions are taken, there is, under unusual conditions, some possibility of flow of combustible gases from one appliance into another. Reverse flow of cooled gases has been demonstrated in a chimney at very low rates of flow.⁷ Under certain similar quiescent conditions, accidental discharge of combustible gases from a defective device into a chimney could result in flow of these gases counter current into the combustion chamber of another device attached to the same chimney. If ignition occurred in this second device, an explosion could result.

Excessive height in a chimney does no harm, but means for controlling the draft are more than ordinarily essential if the chimney is too tall. Coal-burning devices often have air leaks around the firebox, and the draft doors sometimes fit so poorly that the fire cannot be controlled at a low rate. The simplest remedy for such cases is the barometric damper which admits air into the flue pipe and thus reduces draft.

Where a chimney serves a fireplace, it is important that no other heating device be connected to it unless the fireplace is effectively sealed.

REFERENCES

- ¹ A Study of Flow Phenomena in the Wake of Smokestacks, by R. H. Sherlock and B. A. Stalker (*Department of Engineering Research, University of Michigan, Bulletin No. 29, 1941*).
- ⁷ Notes on Power Plant Design, by E. F. Miller and James Holt (*Massachusetts Institute of Technology, 1930*).