

Table 4.... Drafts Required by Typical Residential Heating Devices or Appliances

Device	Draft, in. Water	Stack Temperature ^a F
Space Heater, Oil-Burning, Pot Burner	0.06 to 0.08	1000
Warm Air Furnace, Oil-Burning, Pot Burner	0.06	860
Warm Air Furnace, Hand-Fired	0.06 ^b	900
Floor Furnace, Oil-Burning, Pot Burner	0.06	860
Mechanical Oil Burner, Less than 5 gph	0.03 ^a	—
Mechanical Oil Burner, More than 5 gph	0.05 ^a or less	—
Cooking Stove, Solid-Fuel	0.04 ^b	400
Space Heater, Coal-Burning	0.06 ^b	900

^a Draft in firebox. ^b For chestnut sized anthracite.
^c 18 in. from heater.

cast-iron boilers are specified in the $I = B = R$ Testing and Rating Code of the Institute of Boiler and Radiator Manufacturers.

Mechanically-fired devices such as oil burners and stokers are equipped with blowers, and therefore, the chimney is not required to overcome the resistance of the fuel bed or

burner. Nevertheless, a draft in the firebox, of about 0.03 in. of water, is desirable so that leakage, if any, will be into the firebox rather than outward from it.

Insufficient draft for natural-draft appliances is likely with installations in attics or in one-story basementless houses. Automatic oil-burning space heaters, floor furnaces, and warm air furnaces employing natural-draft vaporizing burners require a draft of 0.06 to 0.08 in. water for outdoor temperatures of 60 F. Coal-burning heaters and furnaces which attain design rating at 0 F outdoor temperature would require about the same draft. For such requirements, data from Figure 9 and Table 2 show that an effective chimney height, above chimney inlet, should be a minimum of 8 to 12 ft. Because temperature drop and friction loss in the flue pipe cannot be calculated accurately, and the resistance of various chimney connections is uncertain, the minimum calculated heights should have a generous factor of safety applied to allow for these and other uncertainties. Where ample height cannot be provided, forced or induced draft should be provided. Extreme care should be used in the application of forced draft to avoid producing a pressure in combustion chambers, because they are not usually designed to prevent the outward leakage of toxic gases which might result.

Induced draft by means of motor-driven fans or blowers will solve low-draft problems, but would usually be employed for residential systems only as a last resort. Operation of a blower entails some cost, introduces maintenance requirements, and may be dangerous in event of power failure unless suitable protective devices are used. Induced draft fans designed to resist effects of high temperature and corrosion are available. Fans not carefully designed or modified to meet these conditions should not be applied to this service.

GAS APPLIANCE VENTING

Gas-burning appliances approved by the American Gas Association as vented equipment must be connected to an effective gas vent or chimney. The primary function of the gas vent or chimney is to safely remove the products of combustion from the space being heated.

Factory Built Chimneys

Factory built chimneys are listed by Underwriters' Laboratories for use with all gas appliances as well as all other types of fuel-burning equipment. These should be installed according to the manufacturers' instructions and their listing.

Brick and Metal Chimneys

Masonry and metal chimneys may be used with gas appliances as well as all other types of fuel-burning equipment. Brick chimneys should be lined to aid prompt establishment of draft and to prevent damage to the chimney by the water vapor that condenses from the flue gases.

Type B Gas Vents

Type B gas vents are listed by Underwriters' Laboratories, and are recommended for venting all vented gas-burning appliances except incinerators, appliances which may be converted readily to the use of solid or liquid fuel, and combination gas-oil burning appliances.

Type B-W gas vents are listed by Underwriters' Laboratories, for use with A.G.A. approved vented recessed heaters. Specific installation clearances may be found on listed type B and B-W vents in the current *Gas & Oil Equipment List* published by Underwriters' Laboratories.

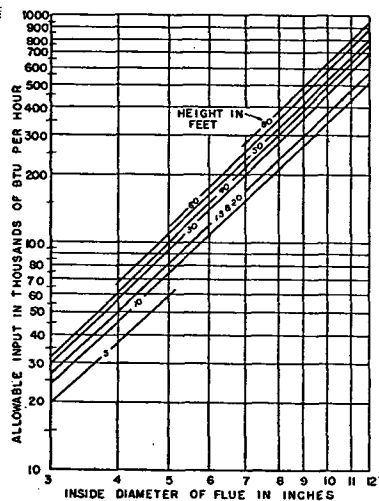


Fig. 11.... Capacity in Btu per Hour for Gas Vents or Chimneys Serving More Than One Appliance

Chimneys and Draft Calculations

Complete installation instructions for gas vents will be found in NFPA No. 54 or ASA Z21.30-1959 *Standard for the Installation of Gas Appliances and Gas Piping*, (National Fire Protection Association or American Standards Association).

The minimum flue or vent sizes adopted by the American Standards Association and the National Board of Fire Underwriters in 1950 for gas appliances^a are shown in Fig. 11.

Additional provisions of ASA Standard Z21.30-1959 relating to chimney size are:

1. The gas vent or chimney when connected to a single appliance shall be not less than the size of the draft hood outlet.
2. When more than one appliance is connected to a gas vent or chimney, the area of the passageway shall be not less than the area of the largest vent connector plus 50 percent of the areas of additional vent connectors.
3. Any shaped gas vent may be used provided its venting capacity is equal to the capacity of round pipe for which it is substituted and the minimum internal dimension of the gas vent is not less than 2 inches.

Since Fig. 11 has been prepared for circular flues, relative capacities for rectangular and semi-elliptical flues^a are shown in Fig. 12.

Heating appliances designed to burn gas, as well as appliances converted to gas burning, except those equipped with power-type burners and excepting conversion burner installations in excess of 400,000 Btu per hour input in large steel boilers, are always equipped with a draft hood attached to the flue outlet of the appliance. This draft hood is required if the appliance is to meet the approval requirements of the American Gas Association and the American Standards Association, and is essential for safe operation. It is designed to prevent excessive chimney draft which would lower appliance efficiency, to prevent a blocked flue or a downdraft in the chimney from impairing combustion, to provide a relief opening for the products of combustion during downdraft or blocked-flue conditions, and to prevent spillage of the products of combustion to the space surrounding the appliance, if there is a chimney draft equivalent to that provided by a 3-ft chimney. As the draft hood is designed without moving parts, the relief opening is always open, and consequently some air is drawn into the chimney. This air lowers the gas temperature in the chimney, but it also lowers the dew point of the gases and tends to prevent condensation.

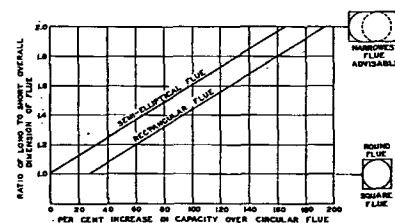


Fig. 12.... Capacity of a Rectangular Flue or a Semi-Elliptical Flue, with Semi-Circular Ends Having Its Minimum Width Equal to the Diameter of a Circular Flue, Compared with the Capacity of the Circular Flue

Table 5.... Results of Field Survey on Chimney Damage

Type of Construction	Number of Chimneys	Number Reported Damaged	Percent Damaged
Chimneys without liners	4720	562	11.9
Chimneys with sewer tile construction	8410	104	1.2
Wilder metal coated with asphalt chromate emulsion	5185	291	5.6
Steel coated with plastic	9200	1928	21.0
Vitreous enamel on steel	614	No record	—
Aluminum	50,000	228	0.45

The installation of conversion burner equipment in large boilers is usually made in accordance with regulations of the local gas company. In such installations a definite chimney draft may be required for proper combustion, and consequently the foregoing reference to the use of draft hoods would not apply.

The products of complete combustion of gas are water vapor and carbon dioxide. In the case of manufactured gas, the presence of organic sulfur compounds, generally between 3 and 15 grains per hundred cubic feet, gives rise to minute percentages of sulfur dioxide and sulfur trioxide. The volume of water vapor in the flue products from natural or coke oven gas is about twice the volume of carbon dioxide. It is extremely important that the chimney be tight and resistant to corrosion, not only from moisture, but also from dilute sulfur trioxide.

Clay linings with joints which prevent retention of moisture, and linings made of noncorrosive materials, are advantageous. The interior protection of unlined chimneys by applying an asphalt-chromate emulsion has been investigated by some gas companies but the material is not of current interest because insurance companies do not favor potentially combustible coatings.¹⁴

An investigation of damage occurring in 78,129 chimneys used for venting gas appliances in a severe climate has been made by the Minneapolis Gas Company with the results shown in Table 5 taken from Reference 15.

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.

RECOMMENDATIONS OF THE NATIONAL BOARD OF FIRE UNDERWRITERS

For general data on the construction of chimneys, reference should be made to the *National Building Code*, recommended by the National Board of Fire Underwriters, Article X, Section 1001 to 1006, in which the following are some of the important provisions listed in the 1951 edition:

1. *Flue Connections Required.* Every heating apparatus or heat producing appliance requiring a flue connection shall be connected with a flue conforming to the provisions of this article. This shall not include electric appliances; gas appliances, except as specifically required in this article; or oil fired appliances especially designed for use without flue connection.

2. *Use of Nonconforming Flues.* Flues not conforming to the requirements of this article for chimneys, metal smokestacks or