NFPA 211

Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

2000 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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Standard for

Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

2000 Edition

This edition of NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, was prepared by the Technical Committee on Chimneys, Fireplaces, and Venting Systems for Heat-Producing Appliances and acted on by the National Fire Protection Association, Inc., at its November Meeting held November 14–17, 1999, in New Orleans, LA. It was issued by the Standards Council on January 14, 2000, with an effective date of February 11, 2000, and supersedes all previous editions.

This edition of NFPA 211 was approved as an American National Standard on February 11, 2000.

Origin and Development of NFPA 211

In 1906, the NFPA Committee on Chimneys and Flues presented its first report. In 1914, under the jurisdiction of the then Committee on Field Practice, recommendations on chimneys and flues were prepared as Chapter VII of the *Field Practice Manual*, presented in 1914, and adopted in 1915. In 1926, the Association adopted the Chimney Construction Ordinance of the National Board of Fire Underwriters. In 1944, the Association adopted Article XI of the 1943 edition of the *Building Code of the National Board of Fire Underwriters* to supersede the former chimney ordinance. This action was taken by the Board of Directors in the name of the Association on the recommendation of the Committee on Field Practice.

In 1948, the subject of chimneys and flues was transferred to the Committee on Building Construction. In 1950, the Association adopted Article X of the 1949 *National Building Code of the National Board of Fire Underwriters*, to supersede the 1944 standard, upon recommendation of the Committee on Building Construction and action by the Board of Directors.

In 1955, the subject of chimneys and flues was transferred to the newly appointed Committee on Chimneys and Heating Equipment. NFPA 211 was revised in 1957 to make the text consistent with the provisions on the same subject appearing in the *National Building Code of the National Board of Fire Underwriters*. NFPA 211 was revised in 1961 and completely rewritten in 1964. The 1964 edition included requirements for chimney connectors, which were previously covered in NFPA 212. This latter standard was withdrawn in 1964. Since 1964, revised editions of the standard have been adopted by the Association in 1966, 1968, 1970, 1971, 1972, and 1977. In 1969, new text was added to cover the subject of spark arresters, which had been covered in NFPA 213, a standard that was withdrawn in 1969.

In 1980, the scope of NFPA 211 was expanded to include solid-fuel appliances, and in the 1984 edition, major revisions were made to many sections, including important tables and graphs.

The 1988 edition included revisions to wall pass-through systems, including a new Table 5-7 showing four chimney connector systems. A complete revision to Table 5-5(b) and changes to upgrade test requirements for factory-built chimneys were included.

The 1992 edition included new figures to show fireplace clearance requirements and other construction details, new requirements for combustion air ducts for fireplaces, and a new maintenance chapter that addressed inspection, cleaning, and repair of chimneys, vents, and fireplaces.

Definitions for *vent* and *chimney* were revised in the 1996 edition, and the chimney and vent selection charts were moved from Chapter 1 to a new Chapter 2. The new Chapter 2 included new figures to aid in the selection of chimney types.

The 2000 edition includes new material addressing mechanical draft systems, carbon monoxide detection and alarm, and sizing of masonry chimneys. A new chapter, Chapter 11, was added to give detailed direction for the inspection of existing chimneys.

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This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on fire safety for the construction, installation, and use of chimneys, fireplaces, vents, venting systems, and solid fuel-burning appliances. It also shall be responsible for documents on clearances of heat-producing appliances from combustible materials and terms relating to chimneys, vents, and heat-producing appliances.

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 12 and Appendix B.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

A reference in parentheses ( ) following a section or paragraph indicates material that has been extracted from another NFPA document. The complete title and edition of the document the material is extracted from is found in Chapter 2. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the appropriate technical committee.

Chapter 1 General

1-1 Scope. This edition of NFPA 211 contains provisions for chimneys, fireplaces, venting systems, and solid fuel-burning appliances, including their installation. The standard applies to residential as well as commercial and industrial installations.

1-2 Purpose.

1-2.1 The primary concern of this standard is the removal of waste gases; the reduction of fire hazards associated with the construction and installation of chimneys, fireplaces, and venting systems for residential, commercial, and industrial appliances; and the installation of solid fuel-burning appliances.

1-2.2 This standard provides minimum construction and installation requirements for chimneys and vents suitable for use with fuel-burning appliances.

1-3 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard, provided technical documentation is submitted to the authority having jurisdiction to demonstrate equivalency and the system, method, or device is approved for the intended purpose.

1-4 Retroactivity. The provisions of this document are considered necessary to provide a reasonable level of protection from loss of life and property from fire and explosion. They reflect situations and the state of the art at the time the standard was issued. Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document, except in those cases where it is determined by the authority having jurisdiction that the existing situation involves a distinct hazard to life or adjacent property.

1-5 Definitions.

1-5.1 Official NFPA Definitions

1-5.1.1* Approved. Acceptable to the authority having jurisdiction.

1-5.1.2* Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

1-5.1.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

1-5.1.4* Listed. Equipment, materials, or services included in a list published by an organization acceptable to the authority having jurisdiction and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

1-5.1.5 Shall. Indicates a mandatory requirement.

1-5.2 General Definitions. Other definitions relating to chimneys, fireplaces, and venting systems are contained in NFPA 97, *Standard Glossary of Terms Relating to Chimneys, Vents, and Heat-Producing Appliances.*

1-5.2.1* Accessible (for Inspections). Capable of being exposed for inspection, maintenance or repair without damage to the chimney or building structure or finish, but which may require the removal of doors, panels or coverings using commonly available tools.

1-5.2.2* Accessible, Readily (for Inspections). Exposed, or capable of being exposed, for operation, inspection, maintenance or repair without the use of tools to open or remove doors, panels or coverings.

1-5.2.3 Air, Combustion. The air necessary to provide for the complete combustion of fuel and usually consisting of primary air, secondary air, and excess air.

1-5.2.4 Air, Dilution. The air that enters the relief opening of a draft hood or draft diverter, or the air that enters another opening in an appliance flue or venting system.

1-5.2.5 Appliance. Utilization equipment, normally built in standardized sizes or types, that is installed or connected as a unit to perform one or more functions such as clothes washing, air conditioning, food mixing, cooking, heating, or refrigeration.

1-5.2.5.1 Appliance, Automatically Lighted Fuel-Burning. A fuel-burning appliance in which fuel to the main burner is normally turned on and ignited automatically.

1-5.2.5.2* Appliance, Building Heat, Positive Pressure Capable. A residential type, building heating appliance, chimney, or both, listed for use in positive internal pressure applications.

1-5.2.5.3 Appliance, Building Heating. A fuel-burning or electric boiler operating at a gauge pressure not over 50 psig (345 kPa), a central furnace, or a heater intended primarily for heating spaces having a volume exceeding 25,000 ft^3 (708 m^3).

1-5.2.5.4 Appliance, Cooking (Floor-Mounted Restaurant-Type). A range, oven, broiler, or other miscellaneous cooking appliance, designated for use in hotel and restaurant kitchens and for mounting on the floor.

1-5.2.5.5 Appliance, Counter (Gas). Appliances such as gas-operated coffee brewers and coffee urns and any appurtenant water-heating equipment, food and dish warmers, hot plates, and griddles.

1-5.2.5.6 Appliance, Factory-Built. A manufactured appliance furnished by the manufacturer as a single assembly or as a package set of subassemblies or parts, and including all the essential components necessary for it to function normally where installed as intended.

1-5.2.5.7 Appliance, Nonresidential, 1400°F. A commercial, industrial, or institutional appliance needing a chimney capable of withstanding a continuous flue gas temperature not exceeding 1400°F (760°C).

1-5.2.5.8 Appliance, Nonresidential, High-Heat. A commercial, industrial, or institutional appliance needing a chimney capable of withstanding a continuous flue gas temperature exceeding 1800°F (982°C).

1-5.2.5.9 Appliance, Nonresidential, Low-Heat. A commercial, industrial, or institutional appliance needing a chimney capable of withstanding a continuous flue gas temperature not exceeding 1000°F (538°C).

1-5.2.5.10 Appliance, Nonresidential, Medium-Heat. A commercial, industrial, or institutional appliance needing a chimney capable of withstanding a continuous flue gas temperature not exceeding 1800°F (982°C).

1-5.2.5.11 Appliance, Residential-Type Heating. Fuel-burning and electric heating appliances, not including high-pressure steam boilers, for heating building spaces having a volume of not more than 25,000 ft^3 (708 m^3) and other heat-producing appliances of the type mainly used in residences but that might be used in other buildings, such as cooking stoves and ranges, clothes dryers, fireplace stoves, domestic incinerators, laundry stoves, water heaters, and heat pumps.

1-5.2.6 Appliance Casing (or Jacket). An enclosure forming the outside of the appliance.

1-5.2.7 Appliance Categories. See 1-5.2.51, Gas Appliance Categories.

1-5.2.8 Ash. The solid residue that remains after combustion is complete.

1-5.2.9 Ash Receptacle Door. A door below the grade level providing access to the ash receptacle.

1-5.2.10 Attic-Type Heating Appliance. A heating appliance designed specifically for installation in an attic or in a space with low headroom that normally is unoccupied.

1-5.2.11 Automatic Electric Igniter. A device for fuel burners designed to utilize electric energy for ignition of a fuel–air mixture at the burner.

1-5.2.12 Baffle. An object installed in an appliance to change the direction of, or to retard, the flow of air, air–fuel mixtures, or flue gases.

1-5.2.13 Boiler. A closed vessel in which water is heated, steam is generated, steam is superheated, or in which any combination thereof takes place by the application of heat from combustible fuels, in a self-contained or attached furnace.

1-5.2.13.1 Boiler, Combination-Fuel. A single boiler unit designed to burn more than one type of fuel (gas, oil, or solid), either separately or simultaneously, using either separate or common combustion chambers and flues.

1-5.2.13.2 Boiler, High-Pressure. A boiler for generating steam at gauge pressures in excess of 15 psi (103 kPa), or for heating water to a temperature in excess of 250°F (121°C) or at a gauge pressure in excess of 160 psi (1103 kPa).

1-5.2.13.3 Boiler, Hot Water Supply. A low-pressure hot water boiler having a volume exceeding 120 gal (454 L), or a heat input exceeding 200,000 Btu/hr (58.6 kWh), or an operating temperature exceeding 200°F (93°C) that provides hot water to be used outside the boiler.

1-5.2.13.4 Boiler, Low-Pressure. A boiler for generating steam at gauge pressures not in excess of 15 psi (103 kPa) or for furnishing water at a maximum temperature of 250°F (121°C) at a maximum gauge pressure of 160 psi (1103 kPa).

1-5.2.13.5 Boiler, Supplementary. A boiler designed to burn one type of fuel (gas, oil, or solid) that is intended for supplementing a boiler burning another type of fuel (gas, oil, or solid) by means of a common heat transfer medium.

1-5.2.14 Bond. Where referring to bricklaying and masonry chimneys, that connection between brick, stone, or other masonry units formed by lapping them upon one another in carrying up the work, thereby forming an inseparable mass.

1-5.2.15 Breeching. The conduit conveying flue gas from the appliance to the chimney.

1-5.2.16 Btu. Abbreviation for British thermal unit. The quantity of heat needed to raise the temperature of 1 pound of water 1°F.

1-5.2.17 Chimney. A structure containing one or more vertical or nearly vertical passageways for conveying flue gases to the outside atmosphere. [*See also Vent; Vent, Gas; and Venting System (Flue Gases).*]

1-5.2.17.1 Chimney, Factory-Built, Building Heating Appliance Type. A heating appliance chimney suitable for continuous use at 1000°F (538°C), composed of listed, factory-built components, designed for open, nonenclosed use at specified minimum clearances to combustibles, and assembled in accordance with the terms of the listing to form the completed chimney.

1-5.2.17.2 Chimney, Factory-Built, 1400°F Type. A chimney suitable for continuous use at 1400°F (760°C), composed of listed, factory-built components, intended for open, nonenclosed use at specified minimum clearances to combustibles and for use in noncombustible locations, and assembled in accordance with the terms of the listing to form the completed chimney.

1-5.2.17.3 Chimney, Factory-Built, Residential Type and Building Heating Appliance Type. A chimney suitable for use at 1000°F (538°C), which complies with the 10-minute 1700°F

temperature test of UL103, *Standard for Safe Chimneys, Factory-Built, Residential Type and Building Heating Appliance* and is composed of listed, factory-built components that might be fully enclosed in combustible, residential type construction, and that is assembled in accordance with the terms of the listing to form a completed chimney.

1-5.2.17.4* Chimney, Factory-Built, Residential Type and/or Building Heating Appliance Type—Type HT. A residential type and building heating appliance chimney suitable for use at 1000°F (538°C), which complies with the optional 10-minute 2100°F temperature test of UL103, *Standard for Safe Chimneys, Factory-Built, Residential Type and Building Heating Appliance*. Such chimneys are labeled as Type HT and are required for certain solid fuel- fired applications (see Section 3-1.2).

1-5.2.17.5 Chimney, Factory-Built, Medium-Heat Appliance Type. A chimney used with appliances that produce maximum flue gas temperatures of 1800°F (982°C), composed of listed, factory-built components, suitable for open, nonenclosed use at specified minimum clearances to combustibles, and assembled in accordance with the terms of the listing to form the completed chimney.

1-5.2.17.6 Chimney, Masonry. A field-constructed chimney of solid masonry units, bricks, stones, listed masonry chimney units, or reinforced portland cement concrete that is lined with suitable chimney flue liners and built in accordance with the provisions of Chapter 4 of this standard.

1-5.2.17.7 Chimney, Unlisted Metal (Smokestack). A manufactured or field-constructed chimney intended only for nonresidential applications having one or more metal walls, or made of metal with a refractory lining, and that is capable of withstanding the flue gas conditions of its use.

1-5.2.18 Chimney Cap. A protective covering or housing for the top of a chimney intended to prevent the entry of rain, snow, animals, and birds, and to prevent downdrafts.

1-5.2.19 Chimney Connector. The pipe that connects a fuel-burning appliance to a chimney.

1-5.2.20 Chimney Flue Base (Base of Flue). The lowest point of a flue within a chimney.

1-5.2.21 Cleanout Opening. An opening or hole in a chimney, usually located near its base, designed to allow access to the flue for purposes of removing ash, creosote, soot, and other extraneous matter that becomes trapped.

1-5.2.22 Clearance. The distance between a heat-producing appliance, chimney, chimney connector, vent, vent connector, or plenum and other surfaces.

1-5.2.23 Clothes Dryer. A device used to dry wet laundry by means of heat derived from the combustion of fuel or from electric heating elements.

1-5.2.23.1 Clothes Dryer, Type 1. A factory-built, mass-produced dryer, primarily used in a family living environment. It might or might not be coin-operated for public use and usually is the smallest unit both physically and in function.

1-5.2.23.2 Clothes Dryer, Type 2. A factory-built, mass-produced dryer used in a commercial business. It might or might not be operated by the public or a hired attendant. It might or might not be coin-operated and is not designed for use in an individual family living environment. It can be small, medium, or large in size.

1-5.2.24 Combustible Material. Material made of or surfaced with wood, compressed paper, plant fibers, plastics, or other material that can ignite and burn, whether flame proofed or not, or whether plastered or unplastered.

1-5.2.25 Combustion. A chemical process of oxidation that occurs at a rate fast enough to produce heat and usually light in the form of either a flow or flame.

1-5.2.26 Combustion Products. Constituents resulting from the combustion of a fuel with the oxygen of the air, including the inerts but excluding excess air.

1-5.2.27 Confined Space. A space whose volume is less than 50 ft^3/1000 Btu/hr (1.42 m^3/293 W) of the aggregate input rating of all appliances installed in that space.

1-5.2.28 Corbel. Units of masonry projecting from or projecting upward and outward from the face of a wall or chimney in courses to form a support or ledge for a beam, rafter, or other member.

1-5.2.29 Damper. A valve or plate for controlling draft or the flow of gases, including air.

1-5.2.29.1 Damper, Automatically Operated. A damper operated by an automatic control.

1-5.2.29.2 Damper, Flue Gas. A damper located on the downstream side of the combustion chamber of a fuel-burning appliance, usually in a flue passage of the appliance or in the chimney or vent connector.

1-5.2.29.3 Damper, Manually Operated. An adjustable damper manually set and locked in the desired position.

1-5.2.30 Direct Vent Appliance (Sealed Combustion System Appliance). A system consisting of an appliance, combustion air and flue gas connections between the appliance and the outside atmosphere, and a vent cap supplied by the manufacturer, and constructed so that all air for combustion is obtained from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

1-5.2.31 Draft. The pressure differential that causes the flow of air or gases through a chimney, gas vent, or venting system.

1-5.2.31.1 Draft, Mechanical. Draft produced by a fan or an air or steam jet. When a fan is located so as to push the flue gases through the chimney or vent, the draft is forced. When the fan is located so as to pull the flue gases through the chimney or vent, the draft is induced.

1-5.2.31.2 Draft, Natural. Draft produced by the difference in the weight of a column of flue gases within a chimney or vent and a corresponding column of air of equal dimension outside the chimney or vent.

1-5.2.32 Draft Hood. A device built into an appliance, or made a part of the vent connector from an appliance, that is designed (1) to provide for the ready escape of the flue gases from the appliance in the event of no draft, backdraft, or stoppage beyond the draft hood; (2) to prevent a backdraft from entering the appliance; and (3) to neutralize the effect of stack action of the chimney or gas vent upon operation of the appliance.

1-5.2.33 Draft Regulator, Barometric. A device built into a fuel-burning appliance, or made a part of a chimney connec-

tor or vent connector, that functions to reduce excessive draft through an appliance to a desired value by admitting ambient air into the appliance chimney, chimney connector, vent, or vent connector.

1-5.2.34* Engineered Venting or Chimney System. A system that has been sized and configured in accordance with approved engineering methods (1) the vent capacity tables in NFPA 54, *National Fuel Gas Code;* (2) the fuel-burning manufacturers' venting instructions; (3) drawings, calculations, and specifications provided by the venting equipment manufacturer or by a professional engineer; (4) use of calculations from the *ASHRAE Handbook, HVAC Systems and Equipment*, Chapter 31, "Chimney, Gas Vent, and Fireplace Systems"; application of the VENTII computer program, developed under Gas Research Institute sponsorship for vent design and analysis.

1-5.2.35 Fan. A blower or exhauster assembly comprising blades or runners and housings or casings.

1-5.2.36 Fireplace. A hearth, fire chamber, or similarly prepared area and a chimney.

1-5.2.36.1 Fireplace, Factory-Built. A fireplace composed of listed, factory-built components assembled in accordance with the terms of the listing.

1-5.2.36.2 Fireplace, Masonry. A hearth and fire chamber of solid masonry units, such as bricks, stones, listed masonry units, or reinforced concrete, provided with a suitable chimney.

1-5.2.37 Fireplace Accessories. Accessories intended for field installation into or attachment to existing masonry fireplaces. These include such items as heat exchangers, door assemblies, tubular grates, and blowers.

1-5.2.38 Fireplace Insert. A factory-built, field-installed product consisting of a firebox assembly designed to be installed within or partially within the fire chamber of a fireplace that uses the fireplace flue to vent the products of combustion.

1-5.2.39 Fireplace Stove. A freestanding, chimney-connected, solid fuel-burning appliance that is designed to be operated with the fire chamber either open or closed.

1-5.2.40 Fireplace Unit, Steel. A unit consisting of a steel firebox and an air chamber adjacent to the sides and rear of the firebox, used to construct a masonry fireplace. The unit usually has ducts to circulate air to and heated air from the air chamber to the living space.

1-5.2.41 Flame Spread Rating. A relative measurement of the surface burning characteristics of building materials when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials.*

1-5.2.42 Floor Protector. A noncombustible surfacing applied to the floor area underneath and extending in front, to the sides, and to the rear of a heat-producing appliance.

1-5.2.43 Flue. The general term for a passage through which flue gases are conveyed from the combustion chamber to the outer air.

1-5.2.43.1 Flue, Appliance. The flue passage within an appliance.

1-5.2.43.2 Flue, Chimney. The passage in a chimney for conveying the flue gases to the outside atmosphere.

1-5.2.43.3 Flue, Dilution. A passage designed to effect the dilution of flue gases with air before discharge from an appliance.

1-5.2.44 Flue Collar. That portion of an appliance designed for attachment of a chimney or vent connector or a draft hood.

1-5.2.45 Flue Gases. Combustion products from fuel-burning appliances along with excess air.

1-5.2.46 Furnace, Central Warm-Air. A self-contained indirect-fired or electrically heated appliance designed to supply heated air through ducts to spaces remote from or adjacent to the appliance location.

1-5.2.46.1 Furnace, Central Warm-Air, Forced-Air-Type. A central furnace equipped with a blower that provides the primary means for the circulation of air.

1-5.2.46.2 Furnace, Central Warm-Air, Forced-Air, Attic-Type. A forced-air-type furnace designed specifically for installation in an attic or in a space with low headroom that is normally occupied.

1-5.2.46.3 Furnace, Central Warm-Air, Forced-Air, Downflow-Type. A forced-air-type furnace designed with airflow essentially in a vertical path, discharging air at or near the bottom of the furnace.

1-5.2.46.4 Furnace, Central Warm-Air, Forced-Air, Horizontal-Type. A forced-air–type furnace designed with airflow through the furnace essentially in a horizontal path.

1-5.2.46.5 Furnace, Central Warm-Air, Forced-Air, Upflow-Type. A forced-air–type furnace designed with airflow essentially in a vertical path, discharging air at or near the top of the furnace.

1-5.2.46.6 Furnace, Central Warm-Air, Gravity-Type Central Furnace. A central furnace depending primarily on circulation of air by gravity.

1-5.2.46.7 Furnace, Central Warm-Air, Gravity-Type with Booster Fan. A central furnace equipped with a booster fan that does not materially restrict free circulation of air by gravity flow when such a fan is not in operation.

1-5.2.46.8 Furnace, Central Warm-Air, Gravity Type with Integral Fan. A central furnace equipped with a fan as an integral part of its construction and operable on gravity systems only. The fan is used only to overcome the internal resistance to airflow.

1-5.2.47 Furnace, Combination-Fuel. A single furnace unit designed to burn more than one type of fuel (gas, oil, or solid), either separately or simultaneously, using either separate or common combustion chambers and flues.

1-5.2.48 Furnace, Duct. A central furnace designed for installation in a duct of an air distribution system to supply warm air for heating and that depends on a blower not furnished as part of the furnace for air circulation.

1-5.2.49 Furnace, Floor. A self-contained indirect-fired or electrically heated furnace designed to be suspended from the floor of the space to be heated. A fuel-burning floor furnace is designed to take air for combustion from outside the space being heated and is provided with means for observing the flame and lighting the appliance from such space.

1-5.2.49.1 Furnace, Floor, Fan-Type. A floor furnace equipped with a blower that provides the primary means for circulation of air.

1-5.2.49.2 Furnace, Floor, Gravity-Type. A floor furnace depending primarily on circulation of air by gravity. This clas-

sification also includes floor furnaces equipped with booster-type fans that do not materially restrict free circulation of air by gravity flow when such fans are not in operation.

1-5.2.50 Furnace, Supplementary. A furnace designed to burn one type of fuel (gas, oil, or solid) that is intended for supplementing a central warm-air furnace burning another type of fuel (gas, oil, or solid) by means of a common warm-air supply plenum.

1-5.2.51* Gas Appliance Categories. Vented gas appliances are classified for venting purposes into four categories as follows: (1) *Category I* — An appliance that operates with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent; (2) *Category II* — An appliance that operates with a non-positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent; (3) *Category III* — An appliance that operates with a positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent; (4) *Category IV* — An appliance that operates with a positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

1-5.2.52 Gas Vent. See 1-5.2.90, Vent; 1-5.2.90.1, Vent, Gas.

1-5.2.53 Header. Where referring to chimneys, a beam set at right angles to floor or roof joists to provide support and framing around the opening.

1-5.2.54 Hearth. The floor area within the fire chamber of a fireplace or a fireplace stove.

1-5.2.55 Hearth Extension. The noncombustible surfacing applied to the floor area extending in front of and at the sides of the hearth opening of a fireplace or a fireplace stove; also where applied to the floor area beneath a fireplace stove or beneath an elevated overhanging fireplace hearth.

1-5.2.56 Heat Exchanger. A chamber in which heat resulting directly from the combustion of fuel, or heat from a medium such as air, water, or steam, is transferred through the walls of the chamber to air passing through the exchanger; or a chamber in which heat from electric resistors is transferred to the air.

1-5.2.57 Heat-Producing Appliance. An appliance that produces heat by utilizing electric energy or by burning fuel.

1-5.2.58 Heat Reclaimer, Chimney Connector-Type. A heat exchanger intended to be installed in a chimney connector between a heating appliance and the chimney to transfer heat from the flue gases through metal to air or water.

1-5.2.59 Incinerator. An appliance or combustion chamber for the reduction, by burning, of rubbish, garbage, and other wastes.

1-5.2.59.1 Incinerator, Chute-Fed (Class IIA). An incinerator designed specifically to be fed refuse from one or more floors above the incinerator directly into the incinerator by a separate chute constructed with a positive means to avoid penetration by smoke or fumes and connected directly over the primary combustion chamber. The incinerator is built with a primary and secondary combustion chamber and a settling chamber. It can include a flue gas washer or scrubber. A separate chimney serves to convey the combustion gases to the outdoors. This class of incinerator is suitable for Type 1 and Type 2 wastes. It generally is used in residential and institutional buildings, including apartments, clubs, dormitories, churches, schools, and other occupancies where Type 1 and Type 2 wastes are to be incinerated.

1-5.2.59.2 Incinerator, Commercial-Industrial–Type (Classes III, IV, V, VI, and VII). An incinerator having a charging capacity in excess of 5 ft^3 (0.142 m^3) and suitable for a variety of wastes as follows: (1) Class III — Waste Type 0, Type 1, or Type 2; (2) Class IV — Waste Type 3; (3) Class V — Waste Types 0-4 (municipal incinerators); (4) Class VI — Waste Type 4; (5) Class VII — Waste Types 5 and 6.

1-5.2.59.3 Incinerator, Flue-Fed (Class II). An incinerator served by a single chimney flue that serves also as the charging chute, where refuse is fed directly to the incinerator through this chimney flue from one or more floors above the incinerator. This class of incinerator is suitable for Type 1 and Type 2 waste materials and garbage incidental to residential occupancy in single and multifamily buildings. This class of incinerator is generally used in residential and institutional buildings, including apartments, clubs, dormitories, churches, schools, and other occupancies where Type 1 and Type 2 wastes are to be incinerated.

1-5.2.59.4 Incinerator, Residential-Type. An incinerator for the burning of ordinary combustible waste material and garbage (Type 2 waste) incidental to residential occupancy and having a firebox or charging compartment not greater than 5 ft^3 (0.142 m^3) in capacity. Residential-type incinerators can be self-contained, factory-built units that do not necessitate field construction, or can be of a built-in type designed to be encased in masonry or installed in a masonry wall or chimney.

1-5.2.60 Lintel, Masonry Fireplace. The horizontal, noncombustible member, usually of masonry or steel, spanning the opening of a masonry fireplace to support the load above.

1-5.2.61 Mantel. A shelf or facing ornament above a fireplace opening.

1-5.2.62 Manufacturer. The person or persons, company, firm, corporation, partnership, or other organization responsible for turning raw materials or components into a finished product.

1-5.2.63 Masonry Unit, Solid. A masonry unit whose net cross-sectional area in every plane parallel to the bearing surface is 75 percent or more of its gross cross-sectional area measured in the same plane.

1-5.2.64 Non-Accessible, Concealed (for Inspections). Not capable of being exposed for inspection, maintenance, or repair without damage to the chimney or building structure or finish, or without the use of special tools.

1-5.2.65 Noncombustible Material. A material that, in the form in which it is used and under the conditions anticipated, does not ignite, burn, support combustion, or release flammable vapors, when subjected to fire or heat. Materials that are reported as passing ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, shall be considered noncombustible materials.

1-5.2.66 Pellet Fuel. A solid processed fuel of specified size and composition capable of being fed to the appliance combustion system at a controlled rate.

1-5.2.67 Pellet Fuel–Burning Appliance. A closed combustion pellet vent or chimney-connected solid pellet fuel–burning appliance incorporating a fuel-feed control mechanism.

1-5.2.68 Pellet Vent. *See* 1-5.2.90, Vent.

1-5.2.69 Qualified Agency. Any individual, firm, corporation, or company that, either in person or through a representative, is engaged in and is responsible for the connection, venting, installation, inspection, repair, or servicing of heat-producing appliances and who is experienced in such work, is familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction.

1-5.2.70 Range. An appliance intended primarily for cooking, including roasting, baking, or broiling or any combination of these functions.

1-5.2.70.1 Range, Built-in Residential-Type. A range designed to be recessed into, placed upon, or attached to counters, cabinets, walls, or partitions.

1-5.2.70.2 Range, Bungalow Utility-Type. A range having an additional section for gas, liquid, or solid fuel that is designed for space heating and heating a solid top section but not for oven heating.

1-5.2.70.3 Range, Residential-Type. A range intended primarily for residential cooking purposes.

1-5.2.70.4 Range, Restaurant-Type. A range of the type designed for use primarily in restaurant and hotel kitchens.

1-5.2.70.5 Range, Room Heater-Type. A range having a separate room heater section.

1-5.2.71 Roof Jack. A factory-built assembly for conveying flue gases through a roof and that includes a flue gas passageway, an insulating means, flashing, and a cap.

1-5.2.72 Room Heater. A heating appliance intended for installation in the space being heated and not intended for duct connection.

1-5.2.72.1 Room Heater, Circulating. A room heater with an outer jacket surrounding the heat exchanger, arranged with openings at top and bottom so that air circulates between the heat exchanger and the outer jacket. Room heaters that have openings in an outer jacket to allow some direct radiation from the heat exchanger are classified as a radiant type.

1-5.2.72.2 Room Heater, Radiant. A room heater designed to transfer heat primarily by direct radiation.

1-5.2.72.3 Room Heater, Solid Fuel. A chimney-connected, solid fuel-burning room heater that is designed to be operated with the fire chamber closed.

1-5.2.73 Room Heater/Fireplace Stove, Combination. A chimney-connected, solid fuel-burning room heater that is designed to be operated with the fire chamber either open or closed.

1-5.2.74 Room Large in Comparison with the Size of the Appliance. A room having a volume equal to at least 12 times the total volume of a furnace and at least 16 times the total volume of a boiler. The total volume of the furnace or boiler is determined from the exterior dimensions and is to include a fan compartment and burner vestibule, where used. Where the actual ceiling height of a room is greater than 8 ft (2.44 m), the volume of the room is to be figured on the basis of a ceiling height of 8 ft (2.44 m).

1-5.2.75 Smoke Chamber. The transitional area from the damper opening to the beginning of the flue liner in a fireplace system.

1-5.2.76 Smoke Developed Rating. The smoke developed rating of materials as determined by NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*; ASTM E 84, *Surface Burning Characteristics of Building Materials*; and UL 723, *Standard for Safety Test for Surface Burning Characteristics of Building Materials.*

1-5.2.77 Smoke Test. A procedure for ascertaining the tightness of a chimney and for detecting any cracks in a masonry chimney flue or deterioration or breaks in the integrity of a factory-built or metal chimney flue, and that involves igniting a smoke bomb or building a smoky fire in a fireplace or solid fuel-burning appliance, covering the chimney termination, and checking for smoke escapage through the chimney walls.

1-5.2.78 Solid Fuel. Wood, coal, and other similar organic materials and any combination of them.

1-5.2.79 Solid Fuel-Burning Appliance. A chimney-connected device that burns solid fuel designed for purposes of heating, cooking, or both.

1-5.2.80 Solid Masonry Construction. A bonded assembly of stones or solid masonry units.

1-5.2.81 Spark Arresters. Screening material or a screening device attached to a chimney termination to prevent the passage of sparks and brands to the outside atmosphere.

1-5.2.82 Splay. *See* 1-5.2.99, Wash.

1-5.2.83 Steel Fireplace Unit. A unit consisting of a steel firebox and an air chamber adjacent to the sides and rear of the firebox, used to construct a masonry fireplace. The unit usually has ducts to circulate air to and heated air from the air chamber to the living space.

1-5.2.84 Thimble. A fixed or removable ring, tube, or lining usually located in the hole where the chimney connector or vent connector passes through a wall or enters a chimney or vent.

1-5.2.85 Trimmer. Where referring to chimneys, the longer floor or roof framing member around a rectangular opening into which the end of a header is joined.

1-5.2.86 Type B Gas Vent. See 1-5.2.90, Vent; 1-5.2.90.1, Gas Vent.

1-5.2.87 Type BW Gas Vent. *See* 1-5.2.90, Vent; 1-5.2.90.1, Vent, Gas.

1-5.2.88 Type L Vent. *See* 1-5.2.90, Vent.

1-5.2.89 Unit Heater. A self-contained heating appliance that might or might not include an integral fan for circulating air and that can be of the floor-mounted or suspended type that is intended for the heating of the space in which it is installed. A unit heater can be an indirect-fired fuel-burning appliance or might utilize steam, hot water, or electricity.

1-5.2.90* Vent. A flue gas conveying system intended for use only with certain gas, liquid, or pellet fuel fired appliances that do not produce flue gas outlet temperatures higher than a value specified in the listing vent standards.

1-5.2.90.1 Vent, Gas. A passageway composed of listed, factory-built components assembled in accordance with the terms of listing for conveying flue gases from gas appliances or the vent connectors to the outside atmosphere.

1-5.2.90.2 Vent, Gas, Type B. A vertical or nearly vertical gas vent for venting listed gas appliances with draft hoods and other Category I gas appliances listed for use with Type B gas vents.

1-5.2.90.3 Vent, Gas, Type BW. A vertical or nearly vertical gas vent for venting listed gas-fired vented wall furnaces.

1-5.2.90.4 Vent, Gas, Special. A gas vent for venting listed Category II, III, and IV gas appliances.

1-5.2.90.5 Vent, Pellet. A venting system composed of listed, factory-built components assembled in accordance with the manufacturer's instructions for conveying flue gases from a listed pellet fuel-burning appliance to the outside atmosphere.

1-5.2.90.6 Vent, Type L. A vertical or nearly vertical composed of listed factory-built components assembled in accordance with the terms of listing for conveying flue gases from oil and gas appliances or their vent connectors to the outside atmosphere.

1-5.2.91 Vent Cap. A protective covering or housing attached to the vent termination, intended for preventing downdrafts and the entry of rain, snow, and animals.

1-5.2.92 Vent Connector. The pipe that connects a fuel-burning appliance to a gas vent or Type L vent.

1-5.2.93 Vent Gases. Products of combustion from fuel-burning appliances along with excess air, plus any dilution air in the venting system above a draft hood or draft regulator.

1-5.2.94 Vented Appliance. An indirect-fired appliance provided with a flue collar to accommodate a venting system for conveying flue gases to the outer air.

1-5.2.95 Venting. Removal of combustion products as well as noxious or toxic fumes to the outer air.

1-5.2.96 Venting System (Flue Gases). A continuous, open passageway from the flue collar or draft hood of a fuel-burning appliance to the outside atmosphere for the purpose of removing flue gases.

1-5.2.96.1 Venting System (Flue Gases), Natural Draft. Draft produced by the difference in the weight of a column of flue gases within a chimney or vent and a corresponding column of air of equal dimension outside the chimney or vent.

1-5.2.96.2 Venting System (Flue Gases), Mechanical Draft. Draft produced by a fan or an air or steam jet. When a fan is located so as to push the flue gases through the chimney or vent, the draft is forced. When the fan is located so as to pull the flue gases through the chimney or vent, the draft is induced.

1-5.2.97 Wall Furnace. A self-contained, vented appliance complete with grilles or equivalent, designed for incorporation in or permanent attachment to the structure of a building, manufactured home, or recreational vehicle, and furnishing heated air directly into the space to be heated through openings in the casing. Such appliances should not be provided with duct extensions beyond the vertical and horizontal limits of the casing proper, except that boots not exceeding 10 in. (254 mm) beyond the horizontal of the casing for extension through walls of nominal thickness can be used. Where provided, such boots should be supplied by the manufacturer as an integral part of the appliance. This definition excludes floor furnaces, unit heaters, and central furnaces.

1-5.2.97.1 Wall Furnace, Fan-Type. A wall furnace equipped with a fan for the circulation of air.

1-5.2.97.2 Wall Furnace, Gravity-Type. A wall furnace dependent on the circulation of air by gravity.

1-5.2.98 Wall Protector (Shield). Noncombustible surfacing applied to a wall area for the purpose of reducing the clearance between the wall and a heat-producing appliance.

1-5.2.99 Wash. A slight slope or beveled edge on the top surface of a chimney designed to shed water away from the flue liner.

1-5.2.100 Water Heater. An indirect-fired fuel-burning or electrically heated appliance for heating water to a temperature not more than 200°F (93°C), having an input not greater than 200,000 Btu or (58.6 kW/hr), and a water-containing capacity not exceeding 120 U.S. gal (454 L).

1-5.2.101 Wythe. Where referring to masonry chimneys, a course, a thickness, or a continuous vertical section of masonry separating flues in a chimney.

1-6 Dimensions. Where used to describe building construction components, all minimum dimensions specified in this standard are actual unless otherwise stated. Nominal dimensions shall be permitted to vary from their specified dimensions by no more than $^1/_2$ in. (12.7 mm).

1-7* Sizing and Draft.

1-7.1 Minimum Performance. A chimney or vent shall be so designed and constructed to develop a flow sufficient to remove completely all flue or vent gases to the outside atmosphere. Chimneys or vents shall be evaluated to ensure proper performance with respect to draft, creosote buildup, and condensation. The venting system shall satisfy the draft requirements of the connected appliance(s) in accordance with the manufacturers' instructions or approved methods.

1-7.2 Mechanical Draft Systems. A listed mechanical draft system of either forced or induced draft design shall be permitted to be used to increase draft or capacity. Where a mechanical draft system is installed, provision shall be made to prevent the flow of fuel to an automatically fired appliance(s) when that system is not operating.

1-7.2.1 Effect on Other Equipment. The operation of a mechanical draft system shall not adversely affect the performance or safety of, or cause spillage of combustion products from, other combustion equipment operating within the same building. Proper performance and safety of other combustion equipment shall be verified by testing prior to putting the mechanical draft system into service. Such testing shall include operation of the mechanical draft system together with other exhaust equipment likely to operate simultaneously.

1-7.2.2 Manually Fired Appliances. Mechanical draft systems of either forced or induced draft shall not serve manually fired appliances.

Exception No. 1: Where the mechanical draft system is an integral part of a listed appliance.

Exception No. 2: Solid fuel cooking appliances as addressed in NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

Exception No. 3: Engineered mechanical draft systems that include the following provisions:

(a) The following detection and warning devices shall be installed and line voltage devices when installed, shall be provided with a battery backup system:

(1) A device that produces an audible and visible warning upon failure of the mechanical draft system shall be installed. The device shall be activated by both loss of electrical power supply or by operational failure of the mechanical draft system, at any time while the mechanical draft system is switched on.

(2) A smoke detector and alarm shall be installed and maintained in accordance with NFPA 72, National Fire Alarm Code®. The detector shall be installed in the same room as the appliance served by the mechanical draft system.

*(3) *A listed carbon monoxide warning device shall be installed in accordance with the manufacturers' instructions.*

(b) The mechanical draft system shall be listed in accordance with UL 378, Draft Equipment, for use with the type of appliance and range of chimney service appropriate for the application. The mechanical draft system shall not cause or permit blockage of the flue or electrical hazard after exposure to a chimney fire or over fire conditions. The mechanical draft system shall be installed in accordance with the terms of the listing and the manufacturers' instructions.

(c) The mechanical draft system shall be sized to maintain draft within the range specified by the appliance manufacturer.

1-7.3 Natural Draft Sizing. Chimneys serving incinerators, or other process equipment where the combustion process cannot be stopped completely by fuel shutoff alone, shall be sized for natural draft conditions. Where air pollution control devices or other devices in the chimney system require a mechanical draft system, the chimney system shall be so arranged that, upon a power failure, the natural draft chimney alone can satisfactorily remove the products of combustion until the combustible material is completely consumed.

1-7.4 Forced/Induced Draft Systems. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed to be gastight or to prevent the leakage of combustion products into a building.

1-7.5 Natural Draft Vent Connectors. Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.

1-8 Termination (Height). Chimneys and vents shall terminate above the roof level in accordance with the requirements of this standard and as illustrated in Figures 1-8(a) and (b).

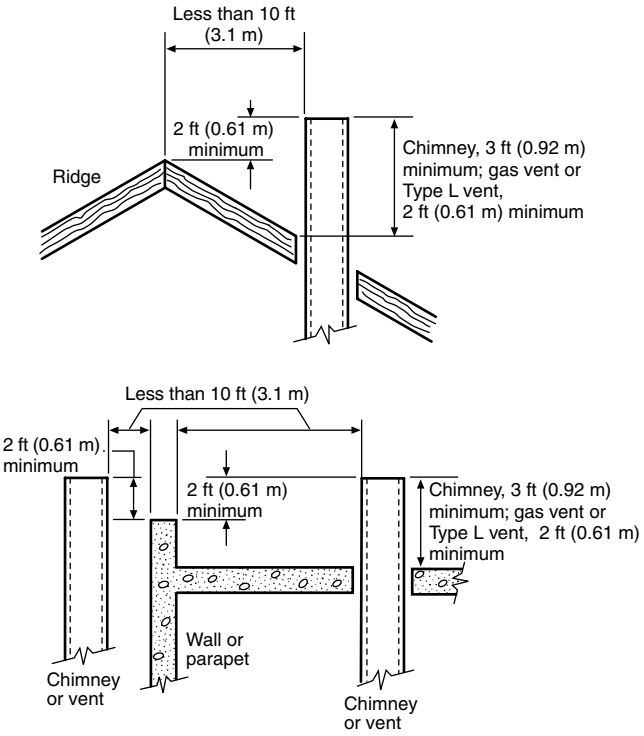
1-8.1 Masonry chimneys shall extend above the highest point at which they pass through the roof of a building by at least the distance specified in Table 4-2, column VI, and above any portion of any structure by at least the distance specified in Table 4-2, column VII, measured horizontally from the vertical chimney line.

Exception: As provided in 5-2.1, Exception, Section 7-4, and Section 7-7.

1-8.2 Natural draft chimneys and vents shall not terminate at an elevation less than 5 ft (1.53 m) above the flue collar or the highest connected draft hood outlet.

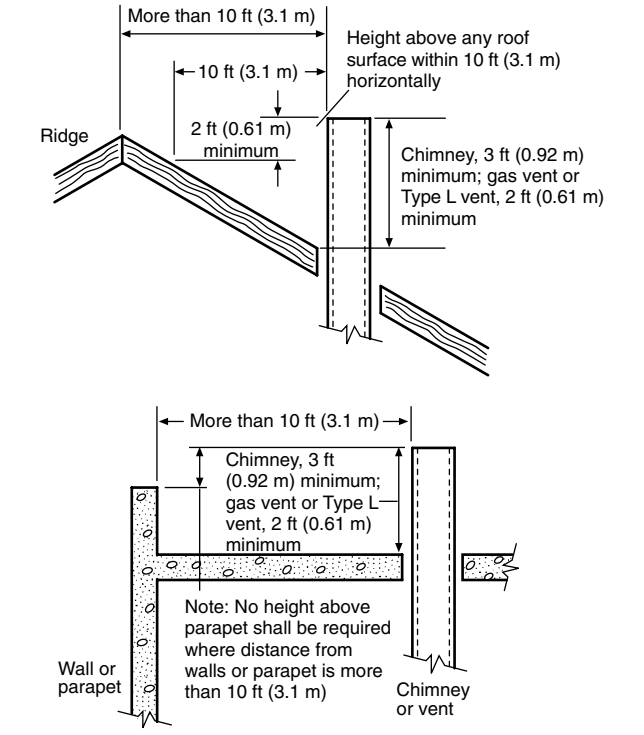
Exception: As provided in Section 7-7.

FIGURE 1-8(a) Chimney or vent termination [less than 10 ft (3.1 m)].



Termination less than 10 ft (3.1 m) from ridge, wall, or parapet

FIGURE 1-8(b) Chimney or vent termination [more than 10 ft (3.1 m)].



Termination more than 10 ft (3.1 m) from ridge, wall, or parapet

1-9 Enclosure. Interior residential chimneys shall be enclosed where they extend through closets, storage areas, or habitable spaces where the surface of the chimney could be contacted by persons or combustible materials. The space between the chimney and the enclosure shall be at least the minimum air space clearance specified in this standard *(see Table 4-2)* or the clearance specified in the manufacturer's instructions for listed chimneys.

1-10 Flue Lining.

1-10.1 Resistance Equivalency. Castable or plastic refractories used to line chimneys or connectors shall be the equivalent in resistance to heat and erosion by flue gases to that of the fireclay brick that would otherwise be specified.

1-10.2 Lining Support. Lining made of castable or plastic refractories shall be secured to the supporting walls by anchors made of corrosion-resistant steel capable of supporting the refractory load at 1500°F (816°C).

1-10.3 Space Surrounding Liner or Vent. The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a chimney flue shall not be used to vent another appliance.

1-11 Caps and Spark Arresters for Chimneys and Vents.

1-11.1 Chimney or vent caps, where required for the termination of chimneys or vents, shall be designed to prevent the entry of rain, snow, and animals, including birds.

1-11.2 Screening material attached to chimney or vent caps to prevent the entry of animals and insects shall not adversely affect the chimney or vent draft.

1-11.3 Spark arresters, where required by the authority having jurisdiction for chimneys attached to solid fuel-burning equipment, shall meet the following requirements:

(1) The net-free area of the arrester shall be not less than four times the net-free area of the outlet of the chimney flue it serves.

(2) The arrester screen shall have heat and corrosion resistance equivalent to 19-gauge [0.041-in. (1.04-mm)] galvanized steel or 24-gauge [0.024-in. (0.61-mm)] stainless steel.

(3) Openings shall not allow the passage of spheres having a diameter larger than $^1/_2$ in. (12.7 mm) or block the passage of spheres having a diameter of less than $^3/_8$ in. (9.5 mm).

(4) The spark screen shall be accessible for cleaning, and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

1-11.4 Where part of a listed chimney termination system, spark arresters shall be constructed and installed in accordance with the listing.

Chapter 2 Selection of Chimney and Vent Types

2-1 Chimney Types. Chimney selection shall be limited to three basic chimney types: factory-built, masonry, and unlisted metal chimneys *[see Figures 2-1(a), (b), and (c)]*. Each basic type is defined in Section 1-5, and the application of each is determined by Table 2-2.1, with specific construction or installation requirements in individual chapters, as follows.

2-2 Chimney or Vent Selection. The selection of a chimney or vent shall be based on the type of appliance connected thereto, the fuel used by the appliance, the temperature of the flue gases at the appliance outlet, and the pressure within the chimney or vent.

2-2.1 The chimney type shall be selected according to Table 2-2.1.

2-2.2 A vent shall be used only where appliances are listed for use with a vent. The vent type shall be selected according to Table 2-2.2.

FIGURE 2-1(a) A typical factory-built chimney installation in a single-family residence. Other applications can be determined according to the chimney selection chart, Table 2-2.1.

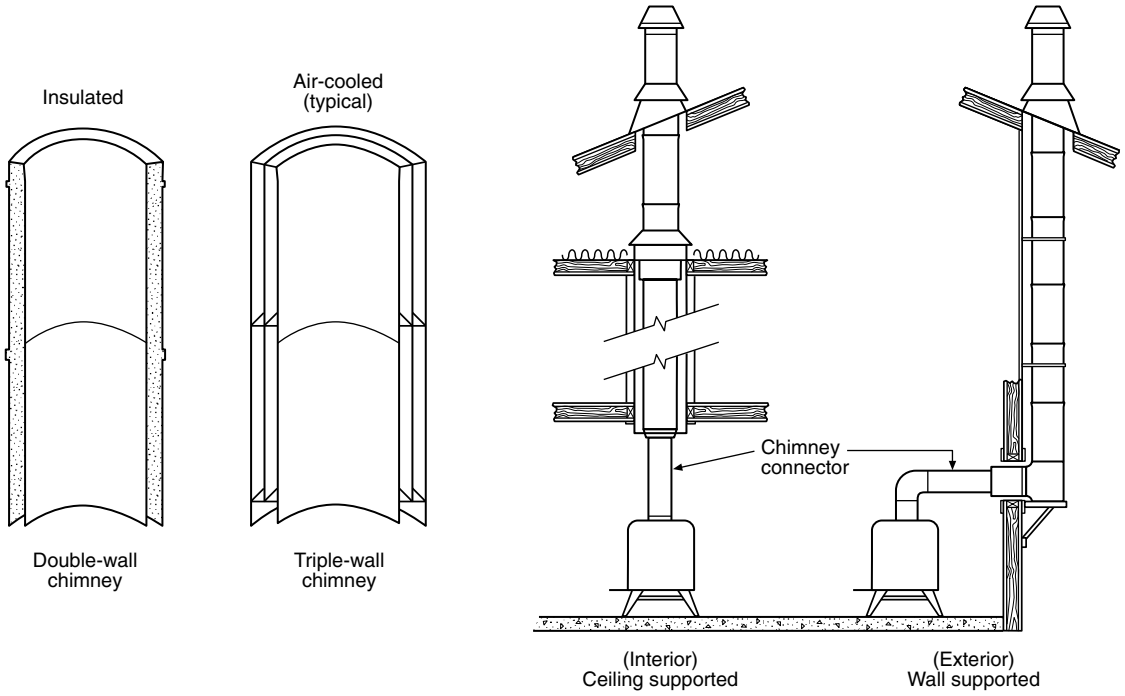


FIGURE 2-1(b) Masonry chimney.

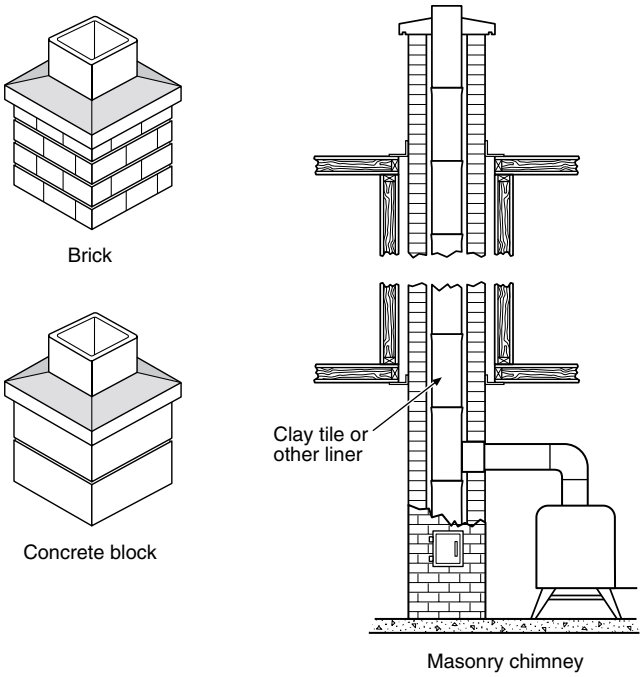


FIGURE 2-1(c) A typical unlisted metal chimney installation in a commercial or industrial application. Unlisted metal chimneys are not suitable for one- and two-family dwellings.

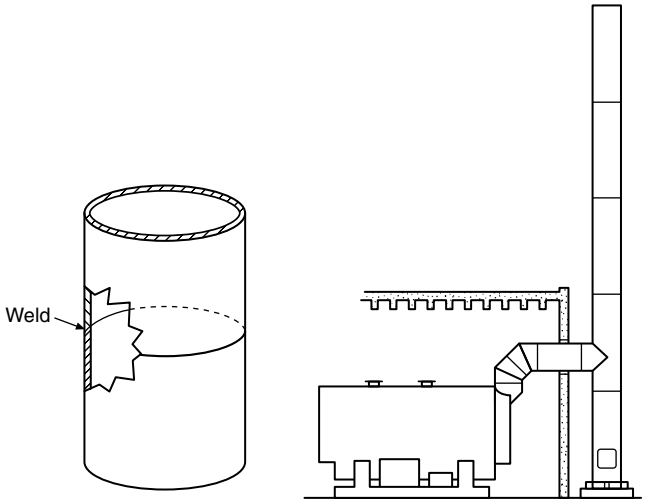


Table 2-2.1 Chimney Selection Chart

Column I	Column II	Column III	Column IV	Column V
Types of Appliances to Be Used with Each Type Chimney				
Residential-type gas, liquid, and solid fuel-burning applications such as:	All appliances shown in column I	All appliances shown in columns I and II	All appliances shown in columns I, II, and III	All appliances shown in columns I, II, III, and IV
All appliances shown in column I of Table 2-2.2	Boilers operating at not over 1000°F (538°C) flue gas temperature	1400°F (760°C) nonresidential appliances	Medium-heat nonresidential appliances	High-heat nonresidential appliances
Dual fuel furnaces				
Fireplace inserts				
Fireplace stoves	Low-heat nonresidential appliances			
Fireplace stove room heaters				
Freestanding fireplaces				
Boilers	Building heating appliance			
Masonry fireplaces				
Pellet fuel-burning appliances *(see Note 1)*				
Ranges				
Residential incinerators				
Room heaters				
Stoves				
Maximum Continuous Appliance Outlet Flue Gas Temperature Under Normal Operating Conditions				
Chimney Type [Select chimney type based on appliance type and flue gas temperature *(see Note 4)*.]				
1000°F (538°C)	**1000°F (538°C)**	**1400°F (760°C)**	**1800°F (982°C)**	**>1800°F (>982°C)**
Factory-built residential-type and building heating appliance *(see Chapter 3 and note 3)*	Factory-built residential-type and building heating appliance *(see Chapter 3 and note 3)*	Factory-built 1400°F *(see Chapter 3)*	Factory-built medium-heat appliance *(see Chapter 3)*	Engineered high-heat type *(see Section 3-2 and A-1-5.2, Chimney and Venting Sizing and Engineered Systems)*
Masonry, residential type *(see Chapter 4)*	Masonry, low-heat type *(see Chapter 4)*	Masonry, low-heat type *(see Chapter 4)*	Masonry, medium-heat type *(see Chapter 4)*	Masonry, high-heat type *(see Chapter 4)*
	Unlisted metal low-heat type *(see Chapter 5, Section 5-2, and note 2)*	Unlisted metal 1400°F type *(see Chapter 5, Section 5-2, and note 2)*	Unlisted metal medium-heat type *(see Chapter 5, Section 5-3, and note 2)*	Unlisted metal high-heat type *(see Chapter 5, Section 5-4, and note 2)*

NOTES
1. See also Table 2-2.2, Listed Pellet Vent.
2. Single-wall chimneys or unlisted metal chimneys shall not be used inside one- and two-family dwellings. *(See Chapter 5.)*
3. Factory-built listed chimneys for use with all wood-burning appliances used in one- and two-family dwellings shall meet the Type HT requirements of UL 103, *Standard for Safety Chimneys, Factory-Built, Residential Type and Building Heating Appliance,* or the requirements of CAN/ULC-S629-M87, *Standard for 650° C Factory-Built Chimney Systems for Solid Fuel-Burning Appliances*.
4. Chimneys shown in any column shall be permitted to be used on appliances that can use a chimney shown in any column to the left of that column, provided the chimney meets the provisions of notes 1, 2, and 3.
5. See text for definitions and requirements.

Table 2-2.2 Vent Selection Chart

Types of Appliances to Be Used with Each Type Vent					
Column I	**Column II**	**Column III**	**Column IV**	**Column V**	**Column VI**
All listed gas appliances with draft hoods and other Category I gas appliances listed for use with Type B Vents, such as:	Vented wall furnaces listed for use with Type BW vents only	Listed Categories II, III, and IV gas appliances and Category I appliances listed for use with special gas vents	Low-temperature flue gas appliances listed for use with Type L Vents	Incinerators used outdoors, in open sheds, breezeways, or carports as provided in Section 5-2	Listed pellet-burning appliances listed for use with pellet vents
Central furnaces			Gas appliances shown under column I	Gas appliances shown under column I	
Duct furnaces				Listed residential and low-heat gas appliances without draft hoods and unlisted residential and low-heat gas appliances with or without draft hoods.	
Floor furnaces					
Heating boilers					
Ranges, residential and low-heat gas					
Built-in ovens					
Vented wall furnaces					
Room heaters					
Water heaters					
Horizontal furnaces					
Unit heaters					
Decorative appliances (gas fireplaces)					

Vent Type					
Listed Type B Gas Vent	**Listed Type BW Gas Vent**	**Listed Special Gas Vent**	**Listed Type L Vent**	**Unlisted Single-Wall Metal Pipe**	**Listed Pellet Vent**
				7-6.4 See for limitations on unlisted single-wall metal pipe	

Note: See Chapter 7 for requirements.

Chapter 3 Factory-Built Chimneys and Chimney Units

3-1 Type and Installation.

3-1.1 Factory-built chimneys and chimney units shall be listed and installed in accordance with the temperature and pressure conditions of the listing and the manufacturer's instructions. Flue gas temperatures and static pressures within the chimney shall not exceed the limits employed during listing tests.

3-1.2* Factory-built chimneys for use with wood-burning appliances shall comply with the Type HT requirements of UL 103, *Standard for Safety Chimneys, Factory-Built, Residential Type and Building Heating Appliance*, or the requirements of CAN/ULC-S629-M87, *Standard for 650°C Factory-Built Chimney Systems for Solid Fuel-Burning Appliances.*

Exception No. 1: Chimneys for factory-built fireplaces shall meet the requirements of UL 127, Standard for Safety Factory-Built Fireplaces.

Exception No. 2: Freestanding open combustion chamber fireplace stoves listed only to UL 737, Standard for Safety Fireplace Stoves, shall be permitted to use residential-type and building heating appliance chimneys.

Exception No. 3: Engineered appliance-venting systems that have been listed to operate without producing combustible deposits to the venting system shall be installed in accordance with the conditions of their listing and the manufacturer's instructions.

3-1.3 Factory-built chimneys that pass through floors of buildings requiring the protection of vertical openings shall be enclosed with approved walls having a fire resistance rating of not less than 1 hour where such chimneys are located in a building less than four stories in height, and not less than 2 hours where such chimneys are located in a building four or more stories in height.

3-1.4 Decorative shrouds at the termination of a factory-built chimney shall not be permitted.

Exception: Decorative shrouds listed for use with the specific factory-built chimney system.

3-2 Use. Factory-built chimneys shall be permitted to be used for exhaust systems and ducting from hoods, industrial ovens, furnaces, and process equipment of any temperature classification *(see Table 2-2.1)*, provided that the system is engineered so that gas temperatures and pressures do not exceed the applicable limit for the type of chimney.

3-3* Sizing. Factory-built chimneys shall be sized and configured in accordance with the appliance and chimney manufacturers' instructions or approved methods.

Chapter 4 Masonry Chimneys

4-1 General Requirements.

4-1.1 Support. Masonry chimneys shall be supported on properly designed foundations of masonry or reinforced portland or refractory cement concrete or on noncombustible material having a fire resistance rating of not less than 3 hours, provided such supports are independent of the building construction and the load is transferred to the ground.

4-1.2 Corbeling. Individual and maximum projections of corbels in masonry chimneys shall comply with the requirements of this section. *[See Figures 4-1.2(a), (b), (c), and (d).]*

Exception: Corbeling limitations shall be permitted to be varied for engineered reinforced brick masonry construction.

FIGURE 4-1.2(a) Corbels for supporting chimneys.

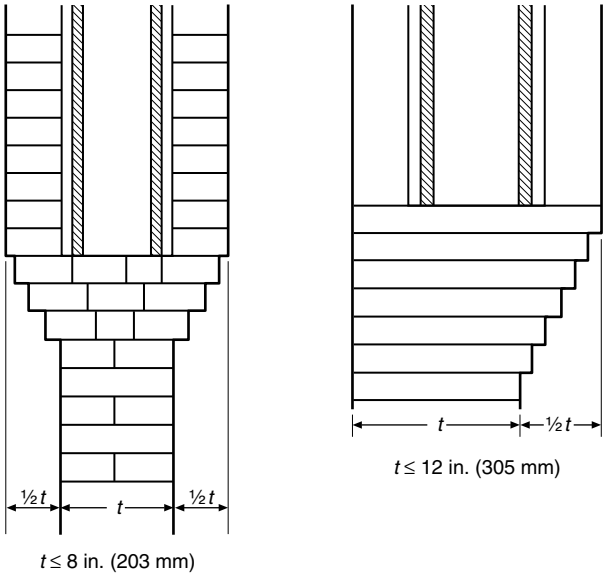
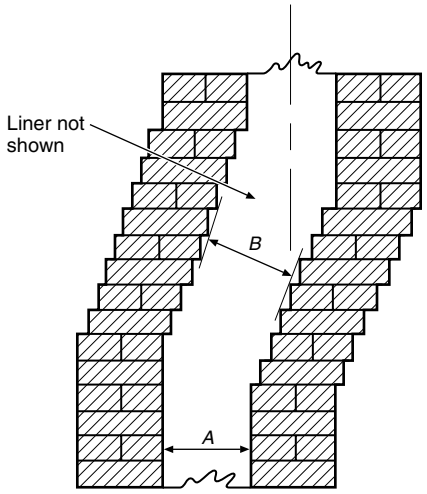


FIGURE 4-1.2(b) Corbels to change chimney direction.



Chimney offset construction — centerline of upper flue does not fall beyond center of lower flue wall. Chimney size, *A*, and offset size, *B*, are equal.

FIGURE 4-1.2(c) Corbels to increase chimney wall thickness.

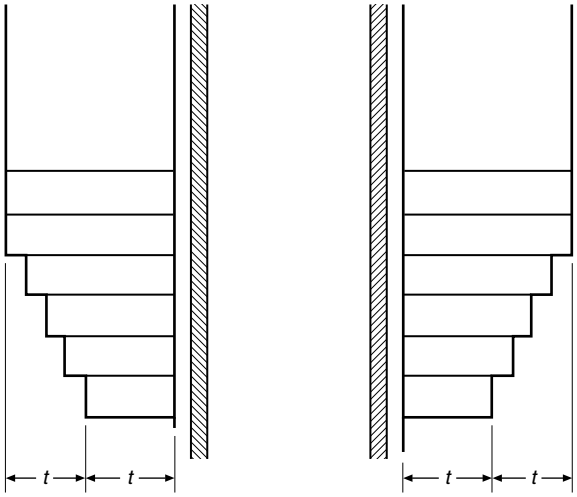
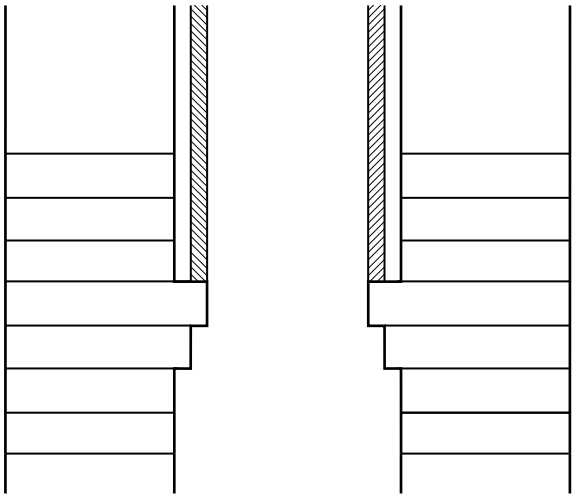


FIGURE 4-1.2(d) Corbels to support flue lining.



4-1.2.1 Individual corbels occurring at any point within a masonry chimney shall not exceed one-half ($^1/_2$) the individual masonry unit height or one-third ($^1/_3$) the thickness.

4-1.2.2 Masonry chimney support shall be permitted to be formed by corbeling from a wall that is not less than 12 in. (305 mm) in thickness to form a maximum total projection of not more than One-half ($^1/_2$) the wall thickness.

Exception: Where the corbeling projects equally on each side of the wall, the masonry chimney support shall be permitted to be formed by corbeling from a wall that is not less than 8 in. (203 mm) in thickness to form a maximum total projection on each side of the wall that is not more than one-half ($^1/_2$) the wall thickness.

4-1.2.3 Corbeling used to change the direction of a masonry chimney shall have a maximum offset so that the centerline of the upper flue does not fall beyond the center of the lower flue wall. The cross-sectional area of the flue shall not be reduced throughout the offset.

4-1.2.4 Corbeling used to increase the chimney wall thickness shall have a maximum total projection that does not exceed the thickness of the chimney wall.

4-1.2.5 Corbeled or solid masonry shall be provided in masonry chimneys to support the entire perimeter of flue liners.

Exception: Where a flue is constructed of two flue liners without a separation, three sides of each flue liner shall be supported entirely on corbeled masonry.

4-1.2.6 Corbels shall be made with solid units, and, where corbels are located on the walls of hollow masonry units, there shall be not less than three courses of solid masonry units below the corbels.

4-1.3 Change in Size or Shape of Flue at Combustible Members Not Permitted. A chimney flue shall not change in size or shape within 6 in. (152 mm) above or below any point where the chimney passes through combustible floor, ceiling, or roof components.

4-1.4 Cleanout Openings.

4-1.4.1 Cleanout openings or a means for cleaning shall be provided in all chimney flues. Cleanout openings shall be equipped with ferrous metal, precast cement, or other approved noncombustible doors and frames arranged to remain tightly closed and secured when not in use.

4-1.4.2 Interior Cleanout Openings. The lower edge of a cleanout opening inside a building shall be a minimum of 16 in. (406.4 mm) above the lowest accessible floor level.

4-1.4.3 Exterior Cleanout Openings. The lower edge of a cleanout opening located outside a building shall be a minimum of 16 in. (406.4 mm) above grade, provided the cleanout opening is below the lowest chimney connector entrance.

4-1.4.4 Cleanout openings and doors shall not be obstructed. Combustible material located or projected beyond the face of the chimney shall be kept a minimum of 18 in. (457.2 mm) away from the cleanout opening. Cleanout doors shall be permanently marked with the following message: "DO NOT OBSTRUCT. KEEP COMBUSTIBLE MATERIAL AT LEAST 18 IN. (457.2 MM) AWAY FROM THIS DOOR," or equivalent.

Exception: Listed cleanout doors shall be installed in accordance with the terms of their listing and the manufacturer's instructions.

4-1.5 The base of the chimney flue shall start at a point at least 6 in. (152 mm) but not more than 12 in. (305 mm) below the bottom edge of the cleanout door opening. Any space within the chimney below the level of the flue base shall be filled with noncombustible masonry material, mortar, concrete, or sand and topped with a wash or cap that prevents the entry of moisture or creosote.

4-1.6 Firestopping. All spaces between chimneys and the floors and ceilings through which the chimneys pass shall remain fully open but shall be firestopped with noncombustible material. The firestopping of spaces between chimneys and wood joists, beams, or headers shall be of galvanized steel not less than 26 gauge [0.019 in. (0.483 mm)] thick or of noncombustible sheet material not more than $^1/_2$ in. (12.7 mm) thick.

4-1.7 Smoke Test. Masonry chimneys shall be proved tight by a smoke test after erection and before being put into use.

4-1.8 Structural Design. Chimneys shall be designed, anchored, supported, and reinforced as required in this

standard. A chimney shall not support any structural load other than its own weight, unless designed to act as a supporting member. Chimney design shall consider seismic and wind loading.

Masonry chimneys shall be permitted to be constructed as part of the masonry or reinforced concrete walls of buildings.

4-1.9 Thimbles.

4-1.9.1 Thimbles for chimneys or vent connectors shall be of fireclay (ASTM C 315, *Standard Specification for Clay Flue Linings*), galvanized steel of a minimum thickness of 24 gauge [0.024 in. (0.61 mm)], or material of equivalent durability. Thimbles shall be installed without damage to the liner. The thimble shall extend through the wall to, but not beyond, the inner face of the liner and shall be cemented firmly to masonry.

4-1.9.2 Thimbles shall be located to provide adequate pitch or rise of chimney or vent connectors, and, where the ceiling above the appliance is constructed of combustible material, the location of the thimble shall provide the minimum clearance required for the connector as specified in Section 6-5.

4-1.9.3 The installation of thimbles through walls or partitions constructed of combustible materials shall conform with the requirements of Section 6-7.

4-1.10 Relining.

4-1.10.1 Where masonry chimneys are relined, the liner shall be listed or of approved material that resists corrosion, softening, or cracking from flue gases at temperatures appropriate to the class of chimney service. Listed liner systems shall be installed in accordance with the listing. Approved materials shall be installed in accordance with Section 4-2.

4-1.10.2 The relined chimney shall meet the requirements of the class of chimney service.

4-1.11* Sizing.

4-1.11.1 Masonry chimneys serving appliances shall be sized and configured in accordance with the appliance manufacturers' instructions, Section 9-4.4 or approved methods.

4-1.11.2 Masonry chimneys serving fireplaces shall be sized in accordance with the requirements of ASHRAE Handbook, *HVAC Systems and Equipment* (current edition), or other approved methods.

Exception: Masonry chimneys serving fireplaces that are a minimum of 8 ft (2438 mm) in height above the top of the fireplace opening and are constructed with no offsets in the flue shall be permitted to be designed in accordance with the following:

(a) Round chimney flues shall have a minimum net cross-sectional area of at least $^1/_{12}$ the fireplace opening.

(b) Square chimney flues shall have a minimum net cross-sectional area of at least $^1/_{10}$ the fireplace opening.

(c) Rectangular chimney flues with an aspect ratio of less than 2 to 1 shall have a minimum net cross-sectional area of at least $^1/_{10}$ the fireplace opening.

(d) Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of at least $^1/_8$ the fireplace opening.

4-2 Construction of Masonry Chimneys. Masonry chimneys shall be constructed as outlined in Table 4-2 and as detailed in this section.

4-2.1 Masonry chimneys shall be constructed of solid masonry or solid, waterproofed, modular concrete blocks in nominal thicknesses not less than those specified in Table 4-2, Column I, or of reinforced portland or refractory cement concrete in actual thicknesses not less than those specified in Table 4-2, Column I, or of rubble stone masonry in actual thicknesses not less than those specified in Table 4-2, Column II. Masonry shall be laid with full, push-filled, head and bed mortar joints.

Exception No. 1: Reinforced masonry chimneys for residential-type appliances shall be permitted to be constructed of hollow masonry units not less than 6 in. (152 mm) nominal thickness, with cells fully filled with mortar.

Exception No. 2: Masonry chimneys for high-heat appliances shall be constructed with double walls of solid masonry or reinforced portland or refractory cement concrete. Each wall shall be not less than 8 in. (203 mm) thick with an air space of not less than 2 in. (51 mm) between walls.

4-2.2 Masonry chimneys shall be lined. The selection of the lining material shall be appropriate for the class of chimney service and the type of appliance connected in accordance with the terms of the appliance listing and the manufacturer's instructions. Listed materials used as chimney linings shall be installed in accordance with the terms of their listings and the manufacturer's instructions. The materials specified in 4-2.2.1 through 4-2.2.6 shall be permitted for the indicated class of chimney service.

4-2.2.1 Low-, Medium-, and High-Heat Appliances (Table 2-2.1, Columns II, III, IV, and V). The following materials shall be permitted for low-, medium-, and high-heat appliances (Table 2-2.1, Columns II, III, IV, and V):

(1) Clay flue lining complying with the requirements of ASTM C 315, *Standard Specification for Clay Flue Linings*, or the equivalent, as specified in Table 4-2, Columns III and IV

(2) Fireclay brick complying with the requirements of ASTM C 27, *Standard Classification of Fireclay and High-Alumina Refractory Brick*, or the equivalent, as specified in Table 4-2, Columns III and IV

4-2.2.2 Residential-Type and Building Heating Appliances (Table 2-2.1, Columns I and II). The following materials shall be permitted for residential-type and building heating appliances (Table 2-2.1, Columns I and II):

(1) Clay flue lining or fireclay brick complying with 4-2.2.1, as specified in Table 4-2, Columns III and IV

(2) Listed chimney lining systems

(3) Factory-built chimneys or chimney units listed for installation within masonry chimneys

(4) Other approved materials that resist corrosion, erosion, softening, or cracking from flue gases and condensate at temperatures up to 1800°F (982°C)

4-2.2.3 Category I Gas Appliances (Table 2-2.2, Column I). The following materials shall be permitted for Category I gas appliances (Table 2-2.2, Column I):

(1) Chimney liners complying with 4-2.2.2

(2) Chimney lining systems listed for use with listed gas appliances with draft hoods and other Category I appliances listed for use with Type B vents (*See 4-2.2.7 for marking.*)

(3) Type B vents listed for installation within masonry chimneys *(See 4-2.2.7 for marking.)*

Table 4-2 Construction, Termination, and Clearances for Masonry Chimneys

Column	I		II		III	IV		V	VI		VII		VIII		IX	
	Chimney Wall Thickness				Chimney Liner (*See Note 2.*)				Termination				Minimum Air Space Clearances (*See Note 2.*)			
	Brick or Concrete		Rubble Stone			Thickness			Highest Point		Nearby Structures		Interior Chimney		Exterior Chimney	
Chimney Type	in.	mm	in.	mm	Type	in.	mm	Cement	ft	mm	ft	mm	in.	mm	in.	mm
Residential	4	102	12	305	Fireclay	5/8	16	Medium duty	3	0.91	2 within 10	0.61 3.05	2	51	1	25
Low-heat	8	203	12	305	Fireclay	5/8	16	Medium duty	3	0.91	2 within 10	0.61 3.05	2	51	2	51
Medium-heat	8	203	12	305	Fireclay brick	4.5	114	Medium duty	10	3.05	10 within 25	3.05 7.6	4	102	4	102
High-heat	*See Note 3.*				Fireclay brick	4.5	114	High duty	20	6.1	20 within 50	6.1 15.2	*See Note 4.*			
Column	I		II		III	IV		V	VI		VII		VIII		IX	

NOTES
1. See text for requirements.
2. Where masonry chimneys are lined with a listed chimney liner system, the system shall be installed in accordance with the listing.
3. Masonry chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or reinforced portland or refractory cement concrete. Each wall shall be not less than 8 in. (203 mm) thick with an air space of not less than 2 in. (51 mm) between walls.
4. Masonry chimneys for high-heat appliances shall have sufficient clearance from buildings and structures to avoid overheating combustible material, to allow inspection and maintenance operations on the chimney, and to avoid the danger of burns to persons. Clearance shall be based on good engineering practice and shall be acceptable to the authority having jurisdiction.

4-2.2.4 Categories II, III, and IV Gas Appliances (Table 2-2.2, Column III). Special gas vents listed for installation within masonry chimneys shall be permitted. *(See 4-2.2.7 for marking.)*

4-2.2.5 Pellet Fuel-Burning Appliances (Table 2-2.2, Column VI). The following materials shall be permitted for pellet-fuel-burning appliances (Table 2-2.2, Column VI):

(1) Chimney liners complying with 4-2.2.2
(2) Pellet vents listed for installation within masonry chimneys *(See 4-2.2.7 for marking.)*

4-2.2.6 Listed or Approved Materials. Other materials listed for installation within masonry chimneys for the class of chimney service and for the appliance type shall be permitted. Other approved materials that resist corrosion, erosion, softening, or cracking from flue gases and condensate at temperatures appropriate for the class of chimney service and appliance type shall be permitted.

4-2.2.7 Notice of Usage. Where a Type B gas vent, special gas vent, pellet vent, or other material not suitable for use under Columns I and II of Table 2-2.1 is used as a liner for a masonry chimney, the chimney shall be plainly and permanently identified by a label attached to the wall or ceiling or at another conspicuous location adjacent to the point where the connector enters the chimney. The label shall read: "This (type of product) Is For (type or category of appliance) Appliances that Burn (type of fuel) Only. Do Not Connect Other Types of Appliances," or Equivalent Language.

4-2.3 Fireclay flue liners shall be installed ahead of the construction of the chimney as it is carried up, carefully bedded one on the other in a medium-duty, non–water-soluble cal-

cium aluminate refractory cement mixture, or its equivalent, with close-fitting joints left smooth on the inside. Portland cement bonded mixtures shall not be used.

4-2.4 Fireclay brick flue liners shall be installed laid in full-width refractory mortar as specified in Table 4-2, Column V, or the equivalent.

4-2.5 Fireclay flue lining for residential and low-heat masonry chimneys shall be separated from the chimney wall by a minimum of $^1/_2$ in. (12.7 mm) and a maximum of 4 in. (102 mm) of air space. The air space shall not be filled, and only enough mortar shall be used to make a good joint and hold the liners in position.

Exception: Where masonry chimneys are lined with a listed chimney liner system, the system shall be installed in accordance with the listing.

4-2.6 The fireclay flue liner shall start at or below the base of the chimney flue and shall be supported by solid masonry. The lining shall be carried up as nearly vertically as possible, with a maximum slope no greater than 30 degrees from the vertical. The lining shall extend for the entire height of the chimney to a level not less than 2 in. (51 mm) above the splay or wash. The splay or wash shall be constructed to allow for unrestricted vertical movement of the flue lining due to thermal expansion without allowing the introduction of moisture into the chimney.

4-2.7 Where a chimney contains more than one flue, a separation shall be provided between adjacent flues. The separation shall be constructed of solid masonry wythes (partitions) not less than 4 in. (102 mm), nominal, in thickness or of reinforced portland or refractory cement concrete not less than 4 in. (102 mm), actual, in thickness, and the partitions shall be bonded or securely tied to the chimney walls.

Exception No. 1: Where two flues are used to vent a single fireplace or appliance, this separation shall not be required.

Exception No. 2: Multiple flues in one chimney shall not be permitted for medium-heat appliances, high-heat appliances, or commercial and industrial incinerators.

Exception No. 3: For chimney liners that have been listed for use as multiple flues installed in accordance with the terms of the listing, this separation shall not be required.

4-3 Clearance from Combustible Material.

4-3.1 The minimum air space clearance between interior masonry chimneys (where any portion of the chimney is located within the exterior wall of the building) and combustible materials shall be at least the distance specified in Table 4-2, Column VIII. The minimum air space clearance between exterior masonry chimneys (where the chimney is located completely outside the exterior wall of the building, excluding the soffit or cornice area) and combustible material shall be at least the distance specified in Table 4-2, Column IX. The air space shall not be filled; however, this shall not eliminate the firestopping requirements in 4-1.6.

Exception No. 1: For residential and low-heat chimneys, noncombustible trim shall be permitted to be used to prevent the entry of debris into the air space.

Exception No. 2: Masonry chimneys for high-heat appliances shall have sufficient clearance from buildings and structures to avoid overheating combustible material, to allow inspection and maintenance operations on the chimney, and to avoid the danger of burns to persons. Clearances shall be based on good engineering practice and acceptable to the authority having jurisdiction.

4-3.2 Chimneys constructed with listed chimney liners shall be built with clearances in conformance with the listing of the liner system.

4-4 Masonry Chimneys for Incinerators. In addition to the requirements in Sections 4-1 through 4-3, masonry chimneys for incinerators shall meet the requirements of 4-4.1 through 4-4.3.

4-4.1 Chute-fed incinerators shall meet the requirements of NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment.*

4-4.2 Masonry chimneys for commercial and industrial incinerators shall be supported on properly designed foundations of masonry or reinforced portland or refractory cement concrete or on noncombustible material having a fire resistance rating of not less than 3 hours, provided such supports are independent of the building construction and the load is transferred to the ground.

Exception: Chimneys shall be permitted to be supported on incinerator walls if the incinerator foundation and walls are built to support the load imposed. They shall be constructed to prevent excessive stress on the roof of the combustion chamber.

4-4.3 The terminus of the chimney for commercial and industrial incinerators shall be equipped with an approved spark arrester if the incinerator does not include effective means for arresting sparks and fly ash. *(See NFPA 82, Standard on Incinerators and Waste and Linen Handling Systems and Equipment.)*

Chapter 5 Unlisted Metal Chimneys (Smokestacks) for Nonresidential Applications

5-1 General Requirements.

5-1.1 Single-wall metal chimneys or unlisted metal chimneys shall not be used inside or outside of one- and two-family dwellings.

5-1.2 Unlisted metal chimneys shall be constructed of steel or cast iron. Sheet steel shall have a thickness not less than that indicated in Table 5-1.2.

5-1.3 Unlisted metal chimneys shall be properly riveted, welded or bolted, securely supported, and constructed in accordance with good engineering practice as necessary to provide the following:

(1) Strength to resist stresses due to steady or gusting wind loads

(2) Adequate anchoring, bracing, and inherent strength to withstand seismic and wind-induced vibrational stresses

(3) Proper material thickness for durability considering fuel analysis, gas temperature, and exposure

(4) Security against leakage of flue gases under positive pressure

(5) Allowance for thermal expansion of breeching and vertical sections

Table 5-1.2 Minimum Thickness of Sheet Steel Chimneys

Manufacturer Standard Gauge No.	Minimum Thickness		Area		Equivalent Round Diameter	
	in.	mm	$in.^2$	m^2	in.	mm
16	0.053	1.35	≤ 154	≤ 0.0994	≤ 14	≤ 356
14	0.067	1.70	155 to 201	0.0999 to 0.1296	> 14 to ≤ 16	> 356 to ≤ 406
12	0.093	2.36	202 to 254	0.1303 to 0.1638	> 16 to ≤ 18	> 406 to ≤ 457
10	0.123	3.12	> 254	> 0.1638	> 18	> 457

NOTE: Regardless of minimum thicknesses specified in this table, the thickness of sheet metal shall be adequate to meet the requirements of 5-1.3.

5-1.4 Unlisted metal chimneys shall not be used inside of ventilating ducts.

5-1.5 Unlisted metal chimneys shall have sufficient clearance from buildings and structures to avoid heating combustible material to a temperature in excess of 90°F (50°C) above ambient and to allow inspection and maintenance operations on the chimney. They shall be located or shielded to avoid the danger of burns to persons.

5-1.6 Unlisted metal chimneys shall be supported on properly designed foundations of masonry or reinforced portland or refractory cement concrete or on noncombustible material having a fire resistance rating of not less than 3 hours, provided such supports are independent of the building construction and the load is transferred to the ground. An unlisted metal chimney also can be supported at intervals by the building structure, in which case expansion joints shall be provided at each support level. All joints shall be liquidtight or of a design that allows liquid to drain to the interior of the chimney.

5-1.7 Unlisted metal chimneys serving residential-type or low-heat appliances and producing flue gases having a temperature below 350°F (165.5°C) at the entrance to the chimney at full load or partial load shall be lined with acid- and condensate-resistant metal or refractory material, constructed of suitable stainless steel, or otherwise protected to minimize or prevent condensation and corrosion damage.

5-1.8* Sizing. Unlisted metal chimneys shall be sized and configured in accordance with the appliance manufacturers' instructions or approved methods.

5-2 Unlisted Metal Chimneys for Residential-Type or Low-Heat Appliances.

5-2.1 Termination (Height).

5-2.1.1 Unlisted metal chimneys for residential-type or low-heat appliances shall extend at least 3 ft (0.92 m) above the highest point at which they pass through the roof of a building and at least 2 ft (0.61 m) higher than any portion of a building within 10 ft (3.1 m). *[See Figures 1-8(a) and (b).]*

Exception: The outlet of an unlisted metal chimney for residential-type and low-heat appliances equipped with a mechanical exhaust system shall be permitted to terminate at a location not less than 3 ft (0.92 m) from an adjacent building or building opening and at least 10 ft (3.1 m) above grade or walkways.

5-2.1.2 In any case, the outlet shall be so arranged that the flue gases are not directed so that they jeopardize people, overheat combustible structures, or enter building openings in the vicinity of the outlet.

5-2.2 Clearances.

5-2.2.1 Exterior.

5-2.2.1.1 Exterior unlisted metal chimneys used only for residential-type or low-heat appliances as identified in Table 2-2.1 shall have a clearance of not less than 18 in. (457 mm) from a wall of wood frame construction and from any combustible material.

5-2.2.1.2 Exterior unlisted metal chimneys over 18 in. (457 mm) in diameter shall have a clearance of not less than 4 in. (102 mm) from a building wall of other than wood frame construction.

5-2.2.1.3 Exterior unlisted metal chimneys 18 in. (457 mm) or less in diameter shall have a clearance of not less than 2 in. (51 mm) from a building wall of other than wood frame construction.

5-2.2.1.4 An unlisted metal chimney erected on the exterior of a building shall not be installed less than 24 in. (610 mm) from any door or window or from any walkway.

Exception: Where the chimney is insulated in an approved manner to avoid the danger of burns to persons.

5-2.2.2 Interior.

5-2.2.2.1 Where an unlisted metal chimney extends through any story(ies) of a building above that in which the appliances connected to the chimney are installed, it shall be enclosed in those upper stories within a continuous enclosure constructed of noncombustible materials *(see definition in Section 1-5.2.65)*. The enclosure shall comply with the following:

(1) The enclosure shall extend from the ceiling of the appliance room to or through the roof so that it maintains the integrity of the fire separations required by the applicable building code provisions.
(2) The enclosure walls shall have a fire resistance rating of not less than 1 hour where the building is less than four stories in height.

(3) The enclosure walls shall have a fire resistance rating of not less than 2 hours where the building is four stories or more in height.
(4) The enclosure walls shall provide a space on all sides of the chimney sufficient to allow inspection and repair, but it shall not be less than 12 in. (305 mm) under any circumstances.
(5) The enclosure walls shall be without openings.

Exception: Doorways equipped with approved self-closing fire doors shall be permitted to be installed at various floor levels for inspection purposes.

5-2.2.2.2 Where an unlisted metal chimney serving only residential-type or low-heat appliances as identified in Table 2-2.1 is located in the same story of a building as that story in which the appliances connected thereto are located, it shall have a clearance of not less than 18 in. (457 mm) from a wall of wood frame construction and from any combustible material.

5-2.2.2.3 Interior unlisted metal chimneys over 18 in. (457 mm) in diameter shall have a clearance of not less than 4 in. (102 mm) from a building wall of other than wood frame construction.

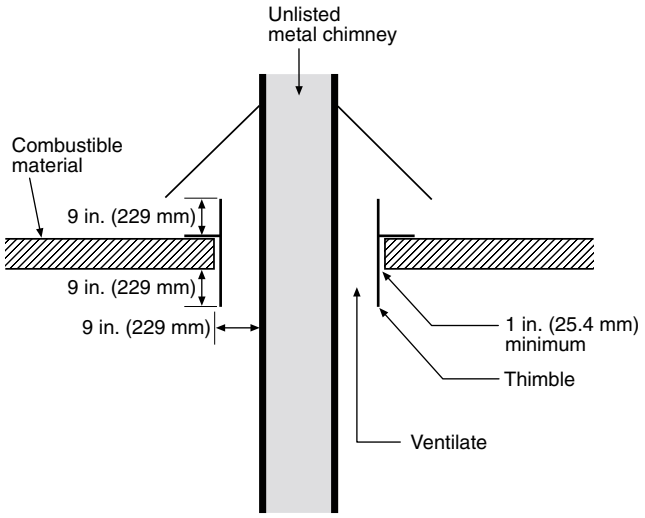
5-2.2.2.4 Interior unlisted metal chimneys 18 in. (457 mm) or less in diameter shall have a clearance of not less than 2 in. (51 mm) from a building wall of other than wood frame construction.

5-2.2.2.5 Where an unlisted metal chimney serving only residential-type or low-heat appliances as identified in Table 2-2.1 passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized steel or approved corrosion-resistant metal not less than 0.024 in. (0.61 mm) in thickness, extending not less than 9 in. (229 mm) below and 9 in. (229 mm) above the roof construction.

Exception: Where combustible material in the roof construction is cut away to provide not less than 18-in. (457-mm) clearance on all sides of the chimney, using entirely noncombustible material to close such an opening, the requirements of 5-2.2.2.5 shall not apply.

5-2.2.2.6 The ventilating thimble metal material shall be of galvanized steel not less than 24 gauge [0.024 in. (0.61 mm)] in thickness and shall provide a clearance of not less than 9 in. (229 mm) from the chimney surface to the nearest combustibles. The thimble shall provide a minimum 1-in. (25.4-mm) air space between the thimble wall and combustible material. The space between the chimney and the thimble wall shall be ventilated. *(See Figure 5-2.2.2.6.)*

FIGURE 5-2.2.2.6 Ventilating thimble.



5-3 Unlisted Metal Chimneys for Medium-Heat Appliances.

5-3.1 Construction. Unlisted metal chimneys serving medium-heat appliances as identified in Table 2-2.1 shall be lined with medium-duty fireclay brick (ASTM C 27, *Standard Classification of Fireclay and High-Alumina Refractory Brick*), or its equivalent, laid in medium-duty refractory mortar (ASTM C 199, *Standard Test Method for Pier Test for Refractory Mortars*), or its equivalent.

5-3.1.1 The lining shall be at least 2 in. (64 mm) thick for chimneys having a diameter or greatest cross-sectional dimension of 18 in. (457 mm) or less.

5-3.1.2 The lining shall have a thickness of not less than 4 in. (114 mm) laid on a full-width bed for chimneys having a diameter or greatest cross-sectional dimension greater than 18 in. (457 mm).

5-3.1.3 The lining shall start 2 ft (0.61 m) or more below the lowest chimney connector entrance and shall extend to a height of at least 25 ft (7.6 m) above the highest chimney connector entrance. Chimneys terminating 25 ft (7.6 m) or less above a chimney connector entrance shall be lined to the top.

5-3.2 Termination (Height). Unlisted metal chimneys for medium-heat appliances shall extend not less than 10 ft (3.1 m) higher than any portion of any building within 25 ft (7.6 m).

5-3.3 Clearances.

5-3.3.1 Exterior.

5-3.3.1.1 Exterior unlisted metal chimneys used for medium-heat appliances as identified in Table 2-2.1 shall have a clearance of not less than 24 in. (610 mm) from a wall of wood frame construction and from any combustible material.

5-3.3.1.2 Exterior unlisted metal chimneys over 18 in. (457 mm) in diameter shall have a clearance of not less than 4 in. (102 mm) from a building wall of other than wood frame construction.

5-3.3.1.3 Exterior unlisted metal chimneys 18 in. (457 mm) or less in diameter shall have a clearance of not less than 2 in. (51 mm) from a building wall of other than wood frame construction.

5-3.3.1.4 An unlisted metal chimney erected on the exterior of a building shall not be installed less than 24 in. (610 mm) from any door or window or from any walkway.

Exception: Where the chimney is insulated or shielded in an approved manner to avoid the danger of burns to persons.

5-3.3.2 Interior.

5-3.3.2.1 Where an unlisted metal chimney extends through any story(ies) of a building above that story in which the appliances connected to the chimney are installed, it shall be enclosed in those upper stories within a continuous enclosure constructed of noncombustible materials *(see definition in Section 1-5.2.65)*. The enclosure shall comply with the following:

(1) The enclosure shall extend from the ceiling of the appliance room to or through the roof so that it maintains the integrity of the fire separations required by the applicable building code provisions.

(2) The enclosure walls shall have a fire resistance rating of not less than 1 hour where the building is less than four stories in height.
(3) The enclosure walls shall have a fire resistance rating of not less than 2 hours where the building is four stories or more in height.
(4) The enclosure walls shall provide a space on all sides of the chimney to allow inspection and repair, but it shall not be less than 12 in. (305 mm) under any circumstances.
(5) The enclosure walls shall be without openings.

Exception: Doorways equipped with approved self-closing 1-hour fire doors shall be permitted to be installed at various floor levels for inspection purposes.

5-3.3.2.2 Where an unlisted metal chimney serving a medium-heat appliance as identified in Table 2-2.1 passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized steel or approved corrosion-resistant metal extending not less than 9 in. (229 mm) below and 9 in. (229 mm) above the roof construction and shall be of a size that allows a minimum clearance of 18 in. (457 mm) on all sides of the chimney.

5-3.3.2.3 Where an unlisted metal chimney serving medium-heat appliances as identified in Table 2-2.1 is located in the same story of a building as that story in which the appliances connected thereto are located, it shall have a clearance of not less than 36 in. (914 mm) from a wall of wood frame construction and from any combustible material.

5-3.3.2.4 Interior unlisted metal chimneys over 18 in. (457 mm) in diameter shall have a clearance of not less than 4 in. (102 mm) from a building wall of other than wood frame construction.

5-3.3.2.5 Interior unlisted metal chimneys 18 in. (457 mm) or less in diameter shall have a clearance of not less than 2 in. (51 mm) from a building wall of other than wood frame construction.

5-4 Unlisted Metal Chimneys for High-Heat Appliances.

5-4.1 Construction.

5-4.1.1 Unlisted metal chimneys for high-heat appliances as identified in Table 2-2.1 shall be lined with high-duty fireclay brick (ASTM C 27, *Standard Classification of Fireclay and High-Alumina Refractory Brick),* or its equivalent, not less than 4 in. (114 mm) thick, laid on a full-width bed in high-duty refractory mortar (ASTM C 199, *Standard Test Method for Pier Test for Refractory Mortars),* or its equivalent.

5-4.1.2 The lining shall start 2 ft (0.61 m) or more below the lowest chimney connector entrance and shall extend to a height of at least 25 ft (7.6 m) above the highest chimney connector entrance. Chimneys terminating 25 ft (7.6 m) or less above a chimney connector entrance shall be lined to the top.

5-4.2 Termination (Height). Unlisted metal chimneys for high-heat appliances shall extend not less than 20 ft (6.1 m) higher than any portion of any building within 50 ft (15.3 m).

5-4.3 Clearance from Combustible Material. Unlisted metal chimneys for high-heat appliances shall have sufficient clearance from buildings and structures to avoid heating combustible material to a temperature in excess of 90°F (50°C) above ambient and to allow inspection and maintenance operations on the chimney. They shall be located or shielded to avoid the danger of burns to persons.

Chapter 6 Chimney Connectors and Vent Connectors

6-1 Connectors Required. Connectors shall be used to connect appliances to the vertical chimney or vent unless the chimney or vent is attached directly to the appliance.

6-2 Materials.

6-2.1 Connectors shall be made of noncombustible, corrosion-resistant material capable of withstanding the flue gas condensate and temperatures produced by the appliances and shall be of sufficient thickness to withstand physical damage.

6-2.2 Connectors for residential-type appliances shall conform to the requirements of this chapter.

6-2.2.1 Appliances Installed in Attics. Vent connectors for listed gas appliances and appliances listed for use with Type B gas vents that are installed in attics shall be of Type B or Type L vent material or shall be of listed vent connector material having at least an equivalent insulating value.

6-2.2.2 Appliances Not Installed in Attics.

6-2.2.2.1 Vent connectors for appliances that are listed for use with Type B gas vents and for appliances with draft hoods and equipped with listed conversion burners and that are not installed in attics shall be of Type B or Type L material or other material listed for use as connectors, or smooth interior-wall metal pipe having strength and resistance to heat and corrosion equivalent to that of galvanized sheet steel not less than 0.018 in. (0.46 mm) thick, aluminum (1100 or 3003 alloy or the equivalent) not less than 0.027 in. (0.69 mm) thick, or stainless steel not less than 0.012 in. (0.31 mm) thick.

6-2.2.2.2 Listed vent connectors shall be installed in accordance with the terms of their listing and the connector manufacturer's installation instructions.

6-2.2.3 Connectors for oil appliances, solid fuel-burning appliances, domestic-type incinerators, and gas appliances other than those specified in 6-2.2.1 and 6-2.2.2 shall be of factory-built chimney material, Type L vent material, or steel pipe having resistance to corrosion and heat not less than that of galvanized pipe specified in Table 6-2.2.3.

Table 6-2.2.3 Metal Thickness for Galvanized Steel Pipe Connectors

Diameter of Connector		Galvanized Sheet Gauge No.	Minimum Thickness	
in.	mm		in.	mm
<6	<152	26	0.019	0.48
≥6 to ≤10	≥152 to ≤254	24	0.024	0.61
>10 to ≤16	>254 to ≤406	22	0.029	0.74
>16	>406	16	0.056	1.42

6-2.3 Connectors for low-heat appliances shall be of listed factory-built chimney material or of steel pipe having resistance to corrosion and heat not less than that of galvanized pipe specified in Table 6-2.2.3.

6-2.4 Connectors for medium-heat appliances and commercial and industrial incinerators shall be constructed of listed medium-heat chimney sections or of steel not lighter than that designated for unlisted metal chimneys in Table 5-1.2 and shall conform to the requirements of 6-2.4.1 through 6-2.4.2.2.

6-2.4.1 Connector sections of listed medium-heat chimneys shall be joined together using continuous welds, flanges, or couplings.

6-2.4.2 Steel connectors shall be lined with medium-duty fireclay brick (ASTM C 27, *Standard Classification of Fireclay and High-Alumina Refractory Brick*) laid in medium-duty refractory mortar (ASTM C 199, *Standard Test Method for Pier Test for Refractory Mortars*) or the equivalent.

6-2.4.2.1 The lining shall be at least 2 in. (64 mm) thick for connectors having an inside diameter or greatest inside cross-sectional dimension of 18 in. (457 mm) or less.

6-2.4.2.2 The lining shall be at least 4 in. (114 mm) thick laid on the 4-in. (114-mm) bed for connectors having an inside diameter or greatest inside cross-sectional dimension greater than 18 in. (457 mm).

6-2.5 Metal connectors for high-heat appliances shall conform to the requirements of 6-2.5.1 and 6-2.5.2.

6-2.5.1 Metal connectors for high-heat appliances shall be made of steel not lighter than that designated for chimneys in Table 5-1.2.

6-2.5.2 The connectors shall be lined with high-duty fireclay brick (ASTM C 27, *Standard Classification of Fireclay and High-Alumina Refractory Brick*) or its equivalent having a thickness of not less than 4 in. (114 mm) laid on the 4-in. (114-mm) bed in high-duty refractory mortar (ASTM C 199, *Standard Test Method for Pier Test for Refractory Mortars*) or its equivalent.

6-2.6 Masonry connectors or breeching shall be made of refractory material equivalent in resistance to heat and corrosion to high-duty fireclay brick (ASTM C 27, *Standard Classification of Fireclay and High-Alumina Refractory Brick*) not less than 4 in. (114 mm) thick.

6-3 Length. A connector shall be as short and straight as practicable. The appliance shall be located as close as practicable to the chimney or vent.

6-3.1* The horizontal length of a connector to a natural draft chimney or vent serving a single appliance shall be not more than 75 percent of the height of the vertical portion of the chimney or vent above the connector.

Exception No. 1: Where part of an engineered venting system.

Exception No. 2: The horizontal length of a connector for a single Category I or draft hood-equipped gas appliance shall be in accordance with the applicable table in Part 11 of NFPA 54, National Fuel Gas Code, for the type of vent or chimney material, or in accordance with other approved engineering methods. The horizontal length of the connector shall be permitted to exceed 75 percent of the vertical height above the connector where so indicated by the applicable table or engineering method.

6-3.2 The horizontal length, design, and construction of combined connectors, or connectors to a manifold joining two or more appliances to a chimney or vent, shall be determined in accordance with approved engineering methods.

6-4 Size.

6-4.1 The connector shall be sized for its entire length in accordance with approved engineering methods.

6-4.2 As an alternative to 6-4.1, the requirements of 6-4.2.1 through 6-4.2.3 shall be permitted to be applied.

6-4.2.1 The effective area of a connector for a single appliance shall be not less than the area of the appliance flue collar.

6-4.2.2 A connector or manifold serving two or more appliances shall have an effective area equivalent to the combined areas of the appliance flue collars or individual connectors.

6-4.2.3 Linings, if used, shall not reduce the required effective area of the connector.

6-5 Clearance.

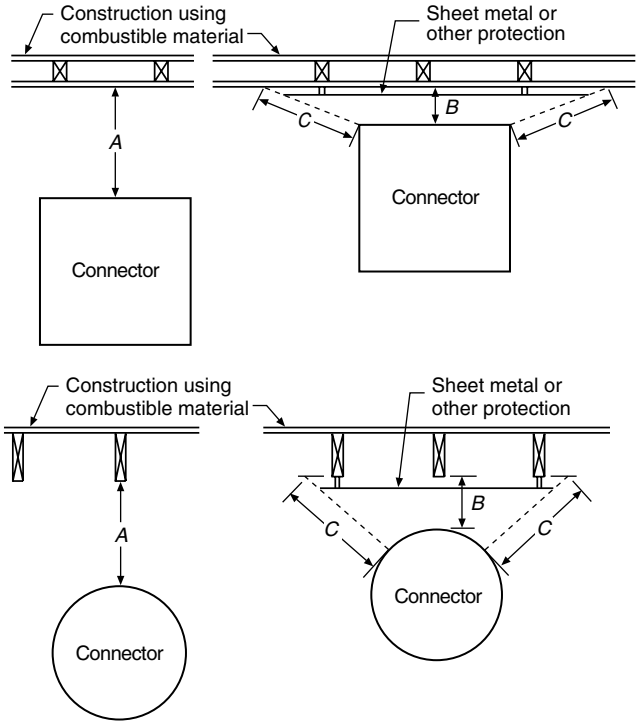
6-5.1 Clearances from connectors to combustible material shall be in accordance with the requirements of 6-5.1.1 through 6-5.6 for both unprotected and protected installations.

6-5.1.1 Clearances from connectors to unprotected combustible material shall be in accordance with Table 6-5.1.1 and Figure 6-5.1.1.

6-5.1.2 Clearances from connectors to combustible material shall be permitted to be reduced, provided the combustible material is protected by an engineered protection system acceptable to the authority having jurisdiction, by the use of materials or products listed for protection purposes, or in accordance with Table 6-5.1.2 and Figure 6-5.1.1 chimney or vent connectors.

6-5.2 Engineered systems installed for the protection of combustible materials shall reduce the temperature rise of such materials to 90°F (50°C) above ambient. The system design shall be based on applicable heat transfer principles, taking into account the geometry of the system, the heat loss characteristics of the structure behind the combustible material, and the possible abnormal operating conditions of heat-producing sources.

FIGURE 6-5.1.1 Extent of protection required to reduce clearances from chimney or vent connectors.



A equals the required clearance with no protection.
B equals the reduced clearance permitted.
The protection applied to the construction using combustible material shall extend far enough in each direction to make *C* equal to *A*.

Table 6-5.1.1 Chimney Connector and Vent Connector Clearances from Combustible Materials

Description of Appliance	Minimum Clearance *(see Note 1)* in.	mm
Residential-Type Appliances		
Single-Wall Metal Pipe Connectors		
Gas appliances without draft hoods	18	457
Electric, gas, and oil incinerators	18	457
Oil and solid-fuel appliances	18	457
Unlisted gas appliances with draft hoods	9	229
Boilers and furnaces equipped with listed gas burners and with draft hoods	9	229
Oil appliances listed as suitable for use with Type L vents	9	229
Listed gas appliances with draft hoods and other Category I gas appliances listed for use with Type B vents *(see Note 3)*	6	152
Type L Vent Piping Connectors		
Gas appliances without draft hoods	9	229
Electric, gas, and oil incinerators	9	229
Oil and solid-fuel appliances	9	229
Unlisted gas appliances with draft hoods	6	152
Boilers and furnaces equipped with listed gas burners and with draft hoods	6	152
Oil appliances listed as suitable for use with Type L vents	*(See Note 2)*	
Listed gas appliances with draft hoods and other Category I gas appliances listed for use with Type B vents	*(See Note 3)*	
Type B Gas Vent Piping Connectors		
Listed gas appliances with draft hoods and other Category I gas appliances listed for use with Type B vents	*(See Note 3)*	
Low-Heat Appliances		
Single-Wall Metal Pipe Connectors		
Gas, oil, and solid-fuel boilers, furnaces, and water heaters	18	457
Ranges, restaurant-type	18	457
Oil unit heaters	18	457
Unlisted gas unit heaters	18	457
Listed gas unit heaters with draft hoods	6	152
Other low-heat nonresidential appliances	18	457
Medium-Heat Appliances		
Single-Wall Metal Pipe Connectors		
All gas, oil, and solid-fuel appliances	36	914
High-Heat Appliances		
Masonry or Metal Connectors		
All gas, oil, and solid-fuel appliances	*(See Note 4)*	

NOTES
1. These clearances apply, except if the listing of an appliance specifies a different clearance, in which case the listed clearance takes precedence.
2. If listed Type L vent piping is used, the clearance shall be permitted to be in accordance with the vent listing.
3. If listed Type B or Type L vent piping is used, the clearance shall be permitted to be in accordance with the appliance and vent listing.
4. Clearances shall be based on good engineering practice and acceptable to the authority having jurisdiction. The clearances from connectors to combustible materials shall be permitted to be reduced, provided the combustible material is protected in accordance with Table 6-5.1.2.

6-5.3 All clearances shall be measured from the outer surface of the connector to the combustible material, disregarding any intervening protection applied to the combustible material. However, in no case shall the clearance interfere with the requirement for accessibility.

6-5.4 Materials and products listed for the purpose of reducing clearance to combustibles shall be installed in accordance with the conditions of the listing and the manufacturer's instructions.

6-5.5 For clearance reduction systems using an air space between the combustible wall and the wall protector, adequate air circulation shall be provided by one of the methods specified in 6-5.5.1 through 6-5.5.3.

6-5.5.1 Adequate air circulation can be provided by leaving all edges of the wall protector open with at least a 1-in. (25.4-mm) air gap.

6-5.5.2 If the wall protector is mounted on a single flat wall away from corners, adequate air circulation can be provided by leaving only the bottom and top edges or only the side and top edges open with at least a 1-in. (25.4-mm) air gap.

6-5.5.3 Wall protectors that cover two walls in a corner shall be open at the bottom and top edges with at least a 1-in. (25.4 mm) air gap.

6-5.6 All clearances shall be measured from the outer surface of the combustible material to the nearest point on the surface of the connector, disregarding any intervening protection applied to the combustible material.

6-6 Location. Where the connector used for a gas appliance having a draft hood or for Category I appliances is located in or passes through an attic, crawl space, or other cold area, that portion of the connector shall be of listed Type B or Type L vent material or be listed vent connector material having at least an equivalent insulating value.

6-7 Installation.

6-7.1 A connector to a masonry chimney shall extend through the wall to the inner face or liner, but not beyond, and shall be firmly cemented to masonry.

Exception: A thimble shall be permitted to be used to facilitate removal of the chimney connector for cleaning, in which case the thimble shall be permanently cemented in place with high-temperature cement.

6-7.2 A chimney connector or vent connector shall not pass through any floor or ceiling or through a fire wall or fire partition.

6-7.3 Connectors for listed gas appliances with draft hoods, other listed Category I gas appliances (Table 2-2.2, Column I), and oil appliances listed for Type L vents (Table 2-2.2, Column III) shall be permitted to pass through walls or partitions constructed of combustible material provided:

(1) They are made of listed Type B or Type L vent material for gas appliances or of listed Type L vent material for oil appliances and are installed with not less than listed clearances to combustible material; or

(2) They are made of single-wall metal pipe and guarded by a ventilated metal thimble not less than 4 in. (102 mm) larger in diameter than the vent connector.

Table 6-5.1.2 Reduction of Connector Clearance with Specified Forms of Protection

Clearance Reduction Applied to and Covering All Combustible Surfaces within the Distance Specified as Required Clearance with No Protection *(See 6-5.1 and Table 6-5.1.1.)*	Maximum Allowable Reduction in Clearance (%)		Where the required clearance with no protection is 18 in. (457 mm), the following clearances are the minimum allowable clearances. For other required clearances, calculate minimum allowable clearance from maximum allowable reduction. *(See Note 8.)*			
			As Wall Protector		As Ceiling Protector	
	As Wall Protector (%)	As Ceiling Protector (%)	in.	mm	in.	mm
$3^1/_2$-in. (90-mm) thick masonry wall without ventilated air space	33	—	12	305	—	—
$^1/_2$-in. (13-mm) thick noncombustible insulation board over 1-in. (25.4-mm) glass fiber or mineral wool batts without ventilated air space	50	33	9	229	12	305
0.024-in. (0.61-mm), 24-gauge sheet metal over 1-in. (25.4-mm) glass fiber or mineral wool batts reinforced with wire, or equivalent, on rear face with ventilated air space	66	50	6	152	9	229
$3^1/_2$-in. (90-mm) thick masonry wall with ventilated air space	66	—	6	152	—	—
0.024-in. (0.61-mm), 24-gauge sheet metal with ventilated air space	66	50	6	152	9	229
$^1/_2$-in. (13-mm) thick noncombustible insulation board with ventilated air space	66	50	6	152	9	229
0.024-in. (0.61-mm), 24-gauge sheet metal with ventilated air space over 0.024-in.(0.61-mm), 24-gauge sheet metal with ventilated air space	66	50	6	152	9	229
1-in. (25.4-mm) glass fiber or mineral wool batts sandwiched between two sheets 0.024-in. (0.61-mm), 24-gauge sheet metal with ventilated air space	66	50	6	152	9	229

1. Spacers and ties shall be of noncombustible material. No spacers or ties shall be used directly behind appliance or connector.
2. With all clearance reduction systems using a ventilated air space, adequate air circulation shall be provided as described in 6-5.5. There shall be at least 1 in. (25.4 mm) between the clearance reduction system and combustible walls and ceilings for clearance reduction systems using a ventilated air space.
3. Mineral wool batts (blanket or board) shall have a minimum density of 8 lb/ft^3 (128.7 kg/m^3) and have a minimum melting point of 1500°F (816°C).
4. Insulation material used as part of clearance reduction system shall have a thermal conductivity of 1.0 (Btu-in.)/(ft^2-hr-°F) or less. Insulation board shall be formed of noncombustible material.
5. If a single-wall connector passes through a masonry wall used as a wall shield, there shall be at least $^1/_2$ in. (13 mm) of open, ventilated air space between the connector and the masonry.
6. There shall be at least 1 in. (25.4 mm) between the connector and the protector. In no case shall the clearance between the connector and the wall surface be reduced below that allowed in the table.
7. All clearances and thicknesses are minimum; larger clearances and thicknesses shall be permitted.
8. To calculate the minimum allowable clearance, the following formula can be used: $C_{pr} = C_{un} \times (1 - R/100)$, where C_{pr} is the minimum allowable clearance, C_{un} is the required clearance with no protection, and R is the maximum allowable reduction in clearance.

6-7.4 Connectors for residential-type appliances (Table 2-2.1, Column I) shall be permitted to pass through walls or partitions constructed of combustible material if the connector either is listed for wall pass-through or is routed through a device listed for wall pass-through and is installed in accordance with the conditions of the listing.

6-7.5 Connectors for residential-type appliances (Table 2-2.1, Column I) with inside diameters less than or equal to 10 in. (254 mm) shall be permitted to pass through walls or partitions constructed of combustible material to a masonry chimney, provided the connector system selected or fabricated is installed in accordance with the conditions and clearances specified in Figure 6-7.5. Any unexposed metal that is used as part of a wall pass-through system and is exposed to flue gases shall be constructed of stainless steel or other equivalent material that resists corrosion, softening, or cracking from flue gases at temperatures up to 1800°F (982°C).

6-7.6 A connector for a medium- or high-heat appliance (Table 2-2.1, Columns IV and V) shall not pass through walls or partitions constructed of combustible material.

6-7.7 Connectors shall maintain a pitch or rise of at least $^1/_4$ in./ft (6.4 mm/305 m) of horizontal length of pipe from the appliance to the chimney.

6-7.8 Connectors shall be installed to avoid sharp turns or other construction features that would create excessive resistance to the flow of flue gases.

6-7.9 A device, other than a damper, that can obstruct the free flow of flue gas shall not be installed in a connector, chimney, or vent. For requirements regarding dampers, see Section 6-9.

Exception No. 1: This requirement shall not be construed to prohibit the use of devices specifically listed for installation in a connector in accordance with the fuel-burning appliance listing, such as heat reclaimers, draft regulators, and safety controls.

Exception No. 2: Approved economizers, heat reclaimers, and recuperators in venting systems of equipment that are not required to be equipped with draft hoods in accordance with the fuel-burning appliance listing, provided performance is in accordance with Section 1-7.

6-7.10 Connectors shall be supported securely and joints fastened using sheet metal screws, rivets, or other approved means.

6-7.11 The entire length of a connector shall be readily accessible for inspection, cleaning, and replacement.

6-7.12 A connector serving a gas or oil appliance shall not be connected to a chimney flue serving a factory-built fireplace.

Exception: Where the gas or oil appliance is listed for such installation and is installed in accordance with the listing.

6-7.13 A connector serving a gas or oil appliance shall be permitted to be connected to a masonry fireplace flue, provided the fireplace opening is sealed or the chimney flue that vents the fireplace is permanently sealed below the connection.

Exception: Listed gas or oil appliances shall be installed in accordance with the listing.

6-7.14 Vent and chimney connectors shall not be covered with insulation.

Exception: Listed insulated vent and chimney connectors shall be installed in accordance with the terms of their listing.

6-8 Interconnection.

6-8.1 Connectors serving appliances operating under natural draft shall not be connected into any portion of a mechanical draft system operating under positive pressure.

6-8.2 Unless listed for such connection, solid fuel-burning appliances shall not be connected to a chimney flue serving another appliance.

6-8.3 Gas utilization appliances and appliances burning liquid fuel shall be permitted to be connected to one chimney flue through separate openings or shall be permitted to be connected through a single opening, provided they are joined by a suitable fitting located as close as practicable to the chimney and provided both of the following apply:

(1) Sufficient draft is available for the safe combustion of each appliance and for the removal of all products of combustion.

(2) The appliances so connected are equipped with primary safety controls and all appliances are located in the same room.

6-8.4 If two or more openings are provided into one chimney flue, they shall be at different levels, and the smaller connector shall enter at the highest level consistent with available head room or clearance to combustible material.

6-9 Dampers.

6-9.1 Manually operated dampers shall not be placed in chimneys, vents, or connectors of stoker-fired, liquid, or gas-burning appliances. Fixed baffles on the appliance side of draft hoods and draft regulators shall not be classified as dampers. Manually operated dampers shall be permitted to be installed in the chimney connector of hand-fired solid fuel-burning appliances, provided such dampers do not obstruct more than 80 percent of the connector area.

6-9.2 Automatically operated dampers shall be listed and shall be installed by a qualified agency in accordance with the terms of the damper and appliance listings. The installation of dampers on gas appliances shall be in accordance with NFPA 54, *National Fuel Gas Code*.

6-10 Draft Hoods. For information concerning the use and installation of draft hoods, see NFPA 54, *National Fuel Gas Code*.

6-11* Draft Regulators.

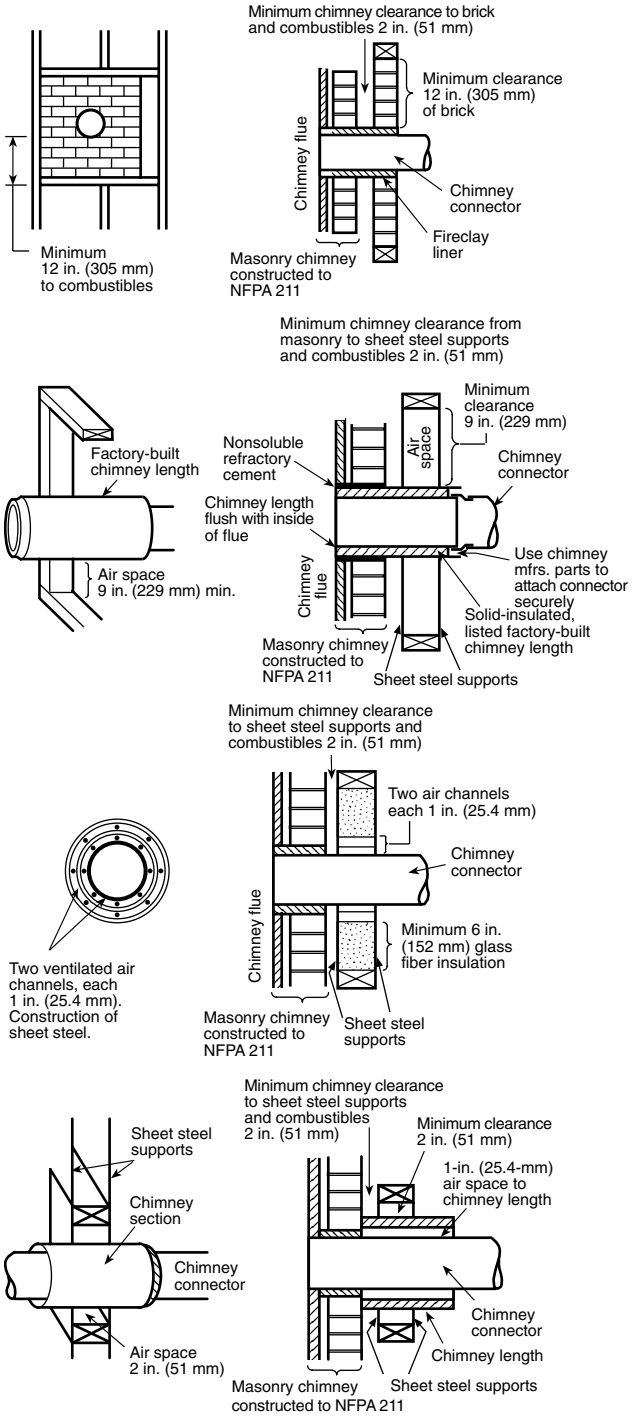
6-11.1 Gas appliances connected to chimneys, other than those required to be installed with draft hoods by NFPA 54, *National Fuel Gas Code*, shall be permitted to be installed with draft regulators if in accordance with the appliance manufacturer's instructions.

6-11.2 Solid fuel-burning appliances shall be permitted to be installed with draft regulators to reduce draft intensity. Such regulators shall be installed and set in accordance with the instructions furnished with the appliance or the draft regulator.

6-11.3 A barometric draft regulator, if used, shall be installed in the same room or enclosure as the appliance in such a manner that no difference in pressure between the air in the vicinity of the regulator and the combustion air supply will be permitted.

FIGURE 6-7.5 Chimney connector systems and clearances from combustible walls for residential heating appliances.

System		Clearance (in.)/(mm)
A	Minimum 3.5 in. (90 mm) thick brick masonry wall framed into combustible wall with a minimum of 12-in. (305-mm) brick separation from clay liner to combustibles. Fireclay liner (ASTM C 315, *Standard Specification for Clay Fire Linings*, or equivalent), minimum ⅝-in. (16-mm) wall thickness, shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.	12/305
B	Solid-insulated, listed factory-built chimney length of the same inside diameter as the chimney connector and having 1 in. (25.4 mm) or more of insulation with a minimum 9-in. (229-mm) air space between the outer wall of the chimney length and combustibles. The inner end of the chimney length shall be flush with the inside of the masonry chimney flue and shall be sealed to the flue and to the brick masonry penetration with non-water-soluble refractory cement. Supports shall be securely fastened to wall surfaces on all sides. Fasteners between supports and the chimney length shall not penetrate the chimney liner.	9/229
C	Sheet steel chimney connector, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness, with a ventilated thimble, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness, having two 1-in. (25.4-mm) air channels, separated from combustibles by a minimum of 6 in. (152 mm) of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gauge [0.024 in. (0.61 mm)] in thickness. Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.	6/152
D	Solid-insulated, listed factory-built chimney length with an inside diameter 2 in. (51 mm) larger than the chimney connector and having 1 in. (25 mm) or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24 gauge [0.024 in. (0.61 mm)] thickness, with a minimum 2-in. (51-mm) air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12 in. (305 mm). Chimney section concentric with and spaced 1 in. (25.4 mm) away from connector by means of sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports of minimum 24 gauge [0.024 in. (0.61 mm)] thickness. Supports shall be securely fastened to wall surfaces on all sides and shall be sized to fit and hold chimney section. Fasteners used to secure chimney section shall not penetrate chimney flue liner.	2/51



Additional requirements:

1. Insulation material used as part of wall pass-through system shall be of noncombustible material and shall have a thermal conductivity of 1.0 Btu-in./hr-ft^2-°F (4.88 kg-cal/hr-m^2-°C) or less.
2. All clearances and thicknesses are minimums; larger clearances and thicknesses shall be permitted.
3. Any material used to close up an opening for the connector shall be of noncombustible material.
4. A connector to a masonry chimney, except for System B, shall extend in one continuous piece through the wall pass-through system and the chimney wall to the inner face of the flue liner, but not beyond.

Chapter 7 Vents

7-1 Types and Uses. See Table 2-2.2.

7-1.1 Type B gas vents shall be used to vent only listed gas appliances with draft hoods and other Category I gas appliances listed for use with Type B gas vents. Type B gas vents shall not be used for venting the following:

(1) Vented wall furnaces listed for use with Type BW gas vents only
(2) Incinerators
(3) Appliances that can be converted readily to the use of solid or liquid fuels
(4) Combination gas/oil-burning appliances
(5) Appliances listed for use with chimneys only
(6) Listed Categories II, III, and IV gas appliances

7-1.2 Type BW vents shall be used only with listed vented gas wall furnaces having a capacity not greater than that of the listed Type BW gas vent.

7-1.3 A Special Gas Vent shall be listed and used in accordance with the terms of its listing and the appliance and vent manufacturers' instructions.

7-1.4 Type L vents shall be used only with appliances listed as suitable for such use and with gas appliances listed as suitable for use with Type B gas vents.

7-1.5 Single-wall metal pipe other than Special Gas Vents used to vent Categories II, III, and IV gas appliances shall conform to the requirements of 7-1.5.1 through 7-1.5.4.

7-1.5.1 Single-wall metal pipe shall not be used to vent incinerators.

7-1.5.2 The pipe shall be of sheet copper with a thickness not less than 24 B & S gauge [0.0201 in. (0.51 mm)] or of galvanized steel with a thickness not less than 20 gauge [0.036 in. (0.914 mm)].

7-1.5.3 Single-wall metal pipe shall be used only for runs directly from the space in which the appliance is located through the roof or exterior wall to the outer air.

7-1.5.4 Single-wall metal pipe shall not originate in any unoccupied attic or concealed space and shall not pass through any attic, inside wall, concealed space, or any floor or ceiling.

7-2 Size.

7-2.1 General. Vents shall be sized and configured in accordance with approved methods and the appliance and vent manufacturers' instructions.

7-2.2 Gas Vents. Gas vents shall be sized in accordance with Chapter 10 of NFPA 54, *National Fuel Gas Code*, or other approved methods and the appliance and vent manufacturers' instructions.

7-3 Location. Single-wall outside vents for appliances used in cold climates shall not be permitted.

7-4 Termination (Height).

7-4.1 All vents shall terminate above the roof surface.

Exception: Pellet vents and other vents as provided in 7-4.5 and Section 7-7.

7-4.1.1 Vents installed with mechanical exhausters shall terminate not less than 12 in. (305 mm) above the highest point where they pass through the roof surface.

7-4.1.2 Vents installed with a listed cap shall terminate in accordance with the terms of the cap's listing.

7-4.1.3 Vents installed without listed caps or mechanical exhausters shall extend 2 ft (0.61 m) above the highest point where they pass through the roof surface of a building and at least 2 ft (0.61 m) higher than any portion of a building within 10 ft (3.1 m). *[See Figures 1-8(a) and (b).]*

7-4.2 Natural draft vents for gas appliances shall terminate at an elevation not less than 5 ft (1.53 m) above the highest connected appliance outlet.

Exception: As provided in 7-4.3 and 7-7.2.

7-4.3 Natural draft gas vents serving vented wall furnaces shall terminate at an elevation not less than 12 ft (3.7 m) above the bottom of the furnace.

7-4.4 Vents passing through roofs shall extend through the roof flashing.

7-4.5 Mechanical draft systems shall not be required to comply with 7-4.1 and 7-4.3, provided they comply with the following:

(1) The exit terminal of a mechanical draft system other than a direct vent appliance (sealed combustion system appliance) shall be located in accordance with the following:
   a. Not less than 3 ft (0.91 m) above any forced air inlet located within 10 ft (3 m)
   b. Not less than 4 ft (1.2 m) below, 4 ft (1.2 m) horizontally from, or 1 ft (305 mm) above any door, window, or gravity air inlet into any building
   c. Not less than 2 ft (0.61 m) from an adjacent building and not less than 7 ft (2.1 m) above grade where located adjacent to public walkways
(2) The exit terminal shall be so arranged that flue gases are not directed so that they jeopardize people, overheat combustible structures, or enter buildings.
(3) Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed to be gastight or to prevent leakage of combustion products into a building.
(4) Through-the-wall vents for gas appliances shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment.

7-5 Notice of Usage.

7-5.1 In those localities where solid and liquid fuels are used extensively, gas vents shall be plainly and permanently identified by a label attached to the wall or ceiling at a point where the vent connector enters the gas vent. The label shall read: "This Gas Vent Is for Appliances That Burn Gas. Do Not Connect to Solid or Liquid Fuel-Burning Appliances or Incinerators."

7-5.2 Where a Type B gas vent, Special Gas Vent, or pellet vent is used as the liner for a masonry chimney, the chimney shall be plainly and permanently identified by a label attached to the wall or ceiling or conspicuous location adjacent to the point where the connector enters the chimney and that reads as follows: "This Chimney Liner Is for (name type; category of appliance) Appliances that Burn (type of fuel) Only. Do Not Connect Other Types of Appliances."

7-6* Installation.

7-6.1 Type B, Type BW, and Type L vents shall be listed and installed in full compliance with the terms of their listing and the manufacturer's installation instructions.

7-6.2 Vents installed through insulation or areas to be insulated shall be separated by a physical barrier to establish and maintain the minimum air space clearance required by the vent manufacturer.

7-6.3 Vents that pass through the floors of buildings requiring the protection of vertical openings shall be enclosed within an approved enclosure.

7-6.3.1 The enclosure walls shall have a fire resistance rating of not less than 1 hour where a vent as described in 7-6.3 is located in a building less than four stories in height.

7-6.3.2 The enclosure walls shall have a fire resistance rating of not less than 2 hours where a vent as described in 7-6.3 is located in a building four or more stories in height.

7-6.4 Unlisted single-wall metal pipe shall be installed as specified in 7-6.4.1 through 7-6.4.3.

7-6.4.1 Unlisted single-wall metal pipe shall be installed with minimum clearances from combustible material as follows:

(1) Unlisted gas appliances without draft hoods — 18 in. (457 mm)
(2) Unlisted gas appliances equipped with draft hoods — 9 in. (229 mm)
(3) Boilers and furnaces equipped with listed conversion gas burners and with draft hoods — 9 in. (229 mm)
(4) Listed gas appliances with draft hoods and other Category I gas appliances listed for use with Type B vents — 6 in. (152 mm)

Exception: Residential incinerators.

7-6.4.2 Where a single-wall metal pipe passes through an exterior wall constructed of combustible material, it shall be guarded at the point of passage by a ventilating metal thimble not smaller than the following:

Exception: Where all combustible material in the wall is cut away from the pipe a sufficient distance to provide the clearance required by 7-6.4.1 from such pipe to combustible material, with entirely noncombustible material used to close such an opening.

(1) For listed gas-burning appliances with draft hoods and other Category I gas appliances listed for use with Type B vents, the thimble shall be 4 in. (102 mm) larger in diameter than the pipe.

Exception No. 1: Residential incinerators.

Exception No. 2: Where there is a run of not less than 6 ft (1.8 m) of pipe in the open between the draft hood outlet or flue collar and the thimble, the thimble shall be permitted to be 2 in. (51 mm) larger in diameter than the pipe.

(2) For unlisted gas-burning appliances with draft hoods, the thimble shall be 6 in. (152 mm) larger in diameter than the pipe.
(3) For unlisted gas appliances without draft hoods, the thimble shall be 12 in. (305 mm) larger in diameter than the pipe.

7-6.4.3 Where an unlisted single-wall metal pipe passes through a roof constructed of combustible material, it shall be guarded at the point of passage as follows:

(1) As specified for passage through a combustible exterior wall by 7-6.4.2; or
(2) With listed gas appliances that can be connected to Type B gas vents by a noncombustible, nonventilating thimble not less than 4 in. (102 mm) larger in diameter than the vent pipe and extending not less than 18 in. (457 mm) above and 6 in. (152 mm) below the roof with the annular space open at the bottom and closed only at the top.

7-7 Special Venting Arrangements.

7-7.1 Direct Vent Appliances (Sealed Combustion System Appliances).

7-7.1.1 Direct vent appliances (sealed combustion system appliances) shall be listed and installed in accordance with their listing and the manufacturer's instructions.

7-7.1.2 The vent terminal of a direct vent appliance with an input of 10,000 Btu/hr (2930 W) or less shall be located at least 6 in. (152 mm) from any opening into a building, and such an appliance with an input of over 10,000 Btu/hr (2930 W) but not over 50,000 Btu/hr (14650 W) shall be located not less than 9 in. (229 mm) from any opening through which vent gases could enter a building, and the vent terminal of such appliance having an input over 50,000 Btu/hr (14650 W) shall be located not less than 12 in. (305 mm) from the opening. The bottom of the vent terminal and the air intake shall be located at least 12 in. (305 mm) above grade.

7-7.2 Ventilating Hoods and Exhaust Systems.

7-7.2.1* Where ventilating hoods and exhaust systems serving commercial cooking appliances are used to vent gas-burning appliances installed in commercial applications, the connector from the appliance shall terminate under the hood not less than 18 in. (457 mm) from any grease filter or screen installed in the hood.

7-7.2.2 Where automatically operated appliances, such as water heaters, are vented through natural draft ventilating hoods, dampers shall not be installed in the ventilating system.

7-7.2.3 Where automatically operated appliances, such as water heaters, are vented through a ventilating hood or exhaust system equipped with a mechanical exhaust system, the appliance control system shall be interlocked to allow appliance operation only when the mechanical exhaust system is in operation. *[See 7-4.5(3).]*

7-7.2.4 A ventilating hood shall be installed above an open-top broiler in a residence.

7-7.2.4.1 The hood shall be made with tight joints and shall be constructed of copper with a thickness not less than 24 B & S gauge [0.0201 in. (0.51 mm)] or of galvanized steel with a thickness not less than 28 gauge [0.016 in. (0.406 mm)].

7-7.2.4.2 A clearance of not less than $^1/_4$ in. (6.4 mm) between the hood and the underside of combustible material or metal cabinets shall be provided.

7-7.2.4.3 The vertical clearance above the broiler to the underside of combustible material or a metal cabinet protected by the hood shall be not less than 24 in. (610 mm).

7-7.2.4.4 The width and breadth of the hood shall be not less than that of the open-top broiler unit.

7-7.2.4.5 The hood shall be centered over the unit.

7-7.2.4.6 The hood shall be exhausted directly through an outside wall to the outside or connected to a suitable chimney flue used for no other purpose. The connecting duct shall conform to the following:

(a) Connecting ducts shall be made of galvanized steel not less than 28 gauge [0.016 in. (0.406 mm)].

(b) A clearance of not less than 6 in. (152 mm) shall be provided between the exhaust duct and unprotected combustible material.

Exception: This clearance shall be permitted to be reduced where the combustible material is protected in accordance with Table 6-5.1.2.

7-7.3 Clothes Dryers.

7-7.3.1 All ducts expelling lint shall be provided with a lint collector.

Exception: Where the dryer is so equipped.

7-7.3.2 Requirements for Type 1 gas-fired clothes dryer exhaust shall be in accordance with NFPA 54, *National Fuel Gas Code.*

7-7.3.3 Type 2 clothes dryers shall be exhausted to the outside air.

7-7.3.4 Provision for makeup air shall be provided for Type 2 clothes dryers, with a minimum free area of 1 in.^{2} (645.2 mm^2) for each 1000 Btu/hr (1055 kJ/hr) total input rating of the dryer(s) installed.

7-7.3.5 A clothes dryer exhaust duct shall not be connected into any chimney connector, vent connector, chimney, or vent.

7-7.3.6 Ducts for exhausting clothes dryers shall not be put together with sheet metal screws or other fastening means that extend into the duct, thereby catching lint and reducing the efficiency of the exhaust.

7-7.3.7 Exhaust ducts for Type 2 clothes dryers shall be constructed of sheet metal or other noncombustible material. Such ducts shall be of adequate strength to meet the conditions of service with a minimum thicknesses equivalent to No. 24 galvanized steel gauge [0.024 in. (0.61 mm)].

7-7.3.8 Exhaust ducts for Type 2 clothes dryers shall have a clearance of at least 6 in. (152 mm) to combustible material. If such a duct passes through a wall, floor, or partition constructed of combustible material, all such material in the wall, floor, or partition shall be cut away from the duct for a sufficient distance to provide a clearance of at least 6 in. (152 mm) and the opening shall be closed in accordance with 7-7.3.9.

Exception: Exhaust ducts for Type 2 clothes dryers shall be permitted to be installed with reduced clearances to combustible material, provided the combustible material is protected as described in Table 6-5.1.2.

7-7.3.9 Where ducts pass through walls, floors, or partitions, the space around the duct shall be sealed with noncombustible material.

7-7.3.10 Multiple installations of Type 1 and Type 2 clothes dryers shall be made in a manner to prevent adverse operation due to back pressures that might be created in the exhaust. Common exhaust vents that pass through floors of buildings requiring the protection of vertical openings shall be enclosed with approved walls having a fire resistance rating of not less than 1 hour where such chimneys are located in a building less than four stories in height, and not less than 2 hours where such chimneys are located in a building four or more stories in height.

7-7.4 Equipment with Integral Vents. Gas utilization appliances incorporating integral venting means shall be considered properly vented where installed in accordance with the terms of their listing.

Chapter 8 Fireplaces

8-1 Factory-Built Fireplaces.

8-1.1 Factory-built fireplaces shall be listed and shall be installed in accordance with the terms of the listing. Hearth extensions shall be provided in accordance with the manufacturer's instructions or shall be of masonry on noncombustible construction in accordance with Section 8-3.

8-1.2 Factory-built fireplaces shall be secured to the floor or structural framing of the building in order to prevent shifting.

8-1.3 Decorative shrouds at the termination of a factory-built fireplace chimney shall not be permitted.

Exception: Decorative shrouds listed for use with the specific factory-built fireplace.

8-2 Masonry Fireplaces.

8-2.1 Construction.

8-2.1.1 Fireplaces shall be constructed of solid masonry units or of reinforced portland or refractory cement concrete. Masonry fireplaces shall be supported on properly designed foundations of masonry or reinforced portland or refractory cement concrete or on other noncombustible constructions having a fire resistance rating of not less than 3 hours, provided such supports are adequate for the load.

8-2.1.2 Where a lining of low-duty fireclay brick (ASTM C 27, *Standard Classification of Fireclay and High-Alumina Refractory Brick*), firebox brick (ASTM C 1261, *Standard Specification for Firebox Brick for Residential Fireplaces*), or the equivalent, at least 2 in. (51 mm) thick laid in medium-duty refractory mortar (ASTM C 199, *Standard Test Method for Pier Test for Refractory Mortars*), or the equivalent, or other approved lining is provided, the total thickness of back and sides, including the lining, shall be not less than 8 in. (203 mm).

8-2.1.3 Where the lining described in 8-2.1.2 is not provided, the thickness of back and sides shall be not less than 12 in. (305 mm).

8-2.1.4 Where the masonry supporting a fireplace is designed to support vertical loads from the building and corbels are used to support beams or girders, corbeling shall be as described in 4-1.2 for masonry chimneys. The lintel spanning the fireplace shall be designed and constructed to support safely the additional concentrated load transferred by the member.

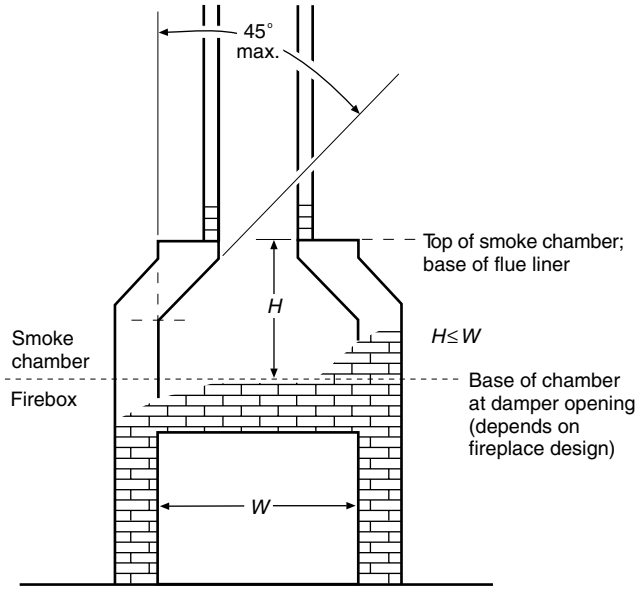
8-2.1.5 Where a lining of low-duty fireclay brick (ASTM C 27, *Standard Classification of Fireclay and High-Alumina Refractory Brick*), firebox brick (ASTM C 1261, *Standard Specification for Firebox Brick for Residential Fireplaces*), or the equivalent, at least 2 in. (51 mm) thick laid-in medium-duty refractory mortar (ASTM C 199, *Standard Test Method for Pier Test for Refractory Mortars*), or the equivalent, or other approved lining is provided, the total thickness of the smoke chamber walls, including the

lining, shall be not less than 6 in. (152 mm). Where unlined, the smoke chamber wall thickness shall be not less than 8 in. (203 mm).

The smoke chamber height shall not be greater than the inside width of the fireplace room opening. The smoke chamber depth shall not be greater than the depth of the fireplace fire chamber, as shown in Figure 8-2.1.5.

The inner surfaces of the smoke chamber shall be smooth and not inclined more than 45 degrees from vertical.

FIGURE 8-2.1.5 Sectional view of fireplace showing smoke chamber.



8-2.1.6 Masonry fireplaces shall be provided with chimneys designed and constructed in accordance with the requirements for construction of masonry chimneys *(see Section 4-2)* or, where permitted by the individual listing, with approved factory-built chimneys having approved adapters in accordance with the requirements for factory-built chimneys *(see Chapter 2)*.

8-2.2 Steel Fireplace Units.

8-2.2.1 Steel fireplace units incorporating a firebox liner of not less than $^1/_4$ in. (6.4 mm) thick steel and an air chamber shall be installed with masonry to provide a total thickness at the back and sides of not less than 8 in. (203 mm), not less than 4 in. (102 mm) of which shall be solid masonry.

Exception: Listed firebox liners shall be installed in accordance with the terms of the listing.

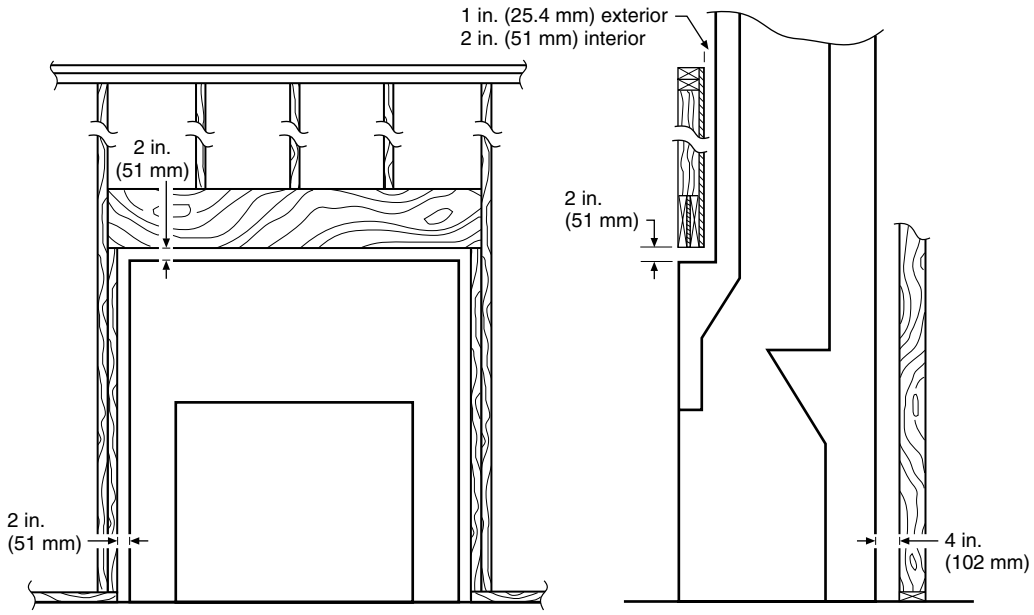
8-2.2.2 Warm-air ducts employed with steel fireplace units of the circulating air type shall be constructed of metal or masonry.

8-2.3 Clearance.

8-2.3.1 All wood beams, joists, studs, and other combustible material shall have a clearance of not less than 2 in. (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 in. (102 mm) from the back faces of masonry fireplaces, as shown in Figure 8-2.3.1.

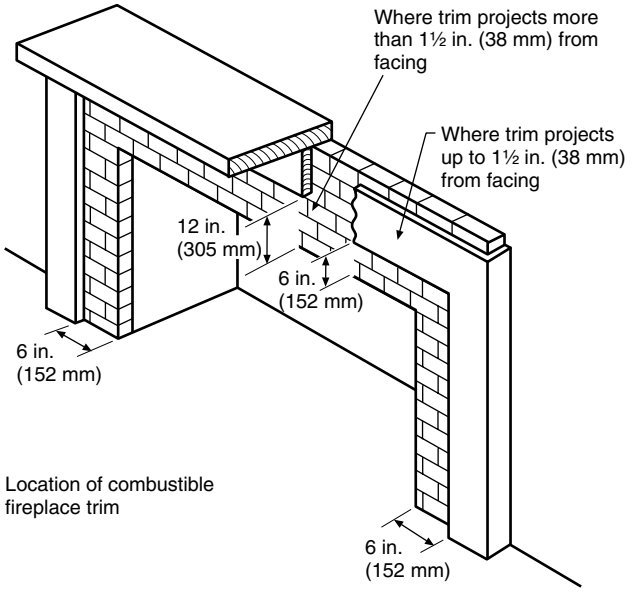
8-2.3.2 Spaces between headers or trimmers of combustible material and masonry fireplaces shall be firestopped with noncombustible material. The material used for firestopping shall be galvanized steel not less than 26 gauge [0.19 in. (0.483 mm)] in thickness or noncombustible sheet material not more than $^1/_2$ in. (12.7 mm) thick.

FIGURE 8-2.3.1 Fireplace clearance to combustible material.



8-2.3.3 Woodwork, such as wood trim, mantels, and other combustible material, shall not be placed within 6 in. (152 mm) of a fireplace opening. Combustible material above and projecting more than $1^1/_2$ in. (38 mm) from a fireplace opening shall not be placed less than 12 in. (305 mm) from the top of the fireplace opening, as shown in Figure 8-2.3.3.

FIGURE 8-2.3.3 Fireplace clearance to combustible material.



8-2.4 Accessibility. For cleaning purposes, means shall be provided for access to the venting area above and immediately behind any movable damper valve plate in masonry fireplaces and steel fireplace units.

8-3 Hearth Extensions.

8-3.1 Masonry fireplaces shall have hearth extensions of brick, concrete, stone, tile, or other approved noncombustible material properly supported and with no combustible material against the underside thereof. Wooden forms used during the construction of hearth and hearth extension shall be removed when the construction is completed.

8-3.2 Where the fireplace opening is less than 6 ft^2 (0.56 m^2), the hearth extension shall extend at least 16 in. (406 mm) in front of the facing material and at least 8 in. (203 mm) beyond each side of the fireplace opening, as shown in Figure 8-3.2.

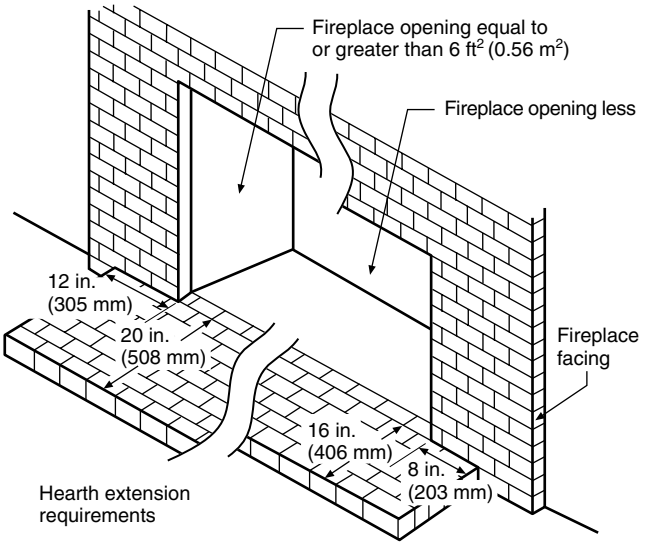
8-3.3 Where the fireplace opening is 6 ft^2 (0.56 m^2) or larger, the hearth extension shall extend at least 20 in. (508 mm) in front of the facing material and at least 12 in. (305 mm) beyond each side of the fireplace opening. *(See Figure 8-3.2.)*

8-3.4 Where a fireplace is elevated above or overhangs a floor, the hearth extension also shall extend over the area under the fireplace.

8-4 Accessories. Factory-built accessories for fireplaces include such devices as fireplace heater inserts and heat exchangers circulating air or water that could alter the combustion or heating characteristics of the fireplace. Such accessories shall be listed and installed in accordance with the terms of their listing.

Exception: Unlisted accessories that are acceptable to the authority having jurisdiction shall be permitted to be installed as approved and in accordance with the manufacturer's installation instructions.

FIGURE 8-3.2 Fireplace hearth extension details.



8-5 Combustion Air Ducts.

8-5.1 Where required by the authority having jurisdiction, combustion air ducts shall be installed in accordance with this section.

Exception No. 1: Combustion air ducts for factory-built fireplaces shall be a listed component of the fireplace and shall be installed according to the manufacturer's instructions.

Exception No. 2: Listed combustion air duct systems for masonry fireplaces shall be installed according to the terms of their listing and the manufacturer's instructions.

8-5.2 Combustion air ducts shall extend as directly as practicable from the outdoors (inlet) to a termination outside the fire chamber (outlet). Combustion air ducts shall be constructed of masonry, galvanized steel with a thickness not less than 26 gauge [0.019 in. (0.483 mm)], or other approved noncombustible material and shall be equipped with a damper that is capable of being fully closed.

8-5.3 Combustion air ducts that terminate outside the fire chamber but within 6 in. (152 mm) of the fire chamber shall be designed and installed to prevent the direct entry of flame, embers, or ashes from the fire chamber into the duct.

8-5.4 Unlisted combustion air ducts shall be installed with a minimum 1-in. (25.4-mm) clearance to combustibles for all parts of the duct construction within 5 ft (1.5 m) of the duct outlet.

8-5.5 The exterior inlet of the combustion air duct shall be screened.

8-5.6 Combustion air ducts shall not originate in an attic, a basement, a garage, or other interior space.

Chapter 9 Solid Fuel-Burning Appliances

9-1 Appliances. Solid fuel-burning appliances shall be listed and installed in accordance with the terms of their listing.

Exception: Unlisted appliances approved by the authority having jurisdiction shall be installed as specified in this chapter. Such installations also shall be in accordance with the manufacturer's installation instructions if such instructions specify the use of increased protection or greater clearances than specified in this chapter. This exception shall not apply to mobile home installations.

9-2 Location of Appliances.

9-2.1 Every appliance shall be located with respect to building construction and other equipment to allow access to the appliance. Sufficient clearance shall be maintained to allow cleaning of surfaces; the replacement of air filters, blowers, motors, controls, and chimney connectors; the lubrication and servicing of moving parts; and the adjustment and servicing of stokers, if provided.

9-2.2 Solid fuel-burning appliances shall not be installed in alcoves or enclosed spaces less than 512 ft^3. The space or room shall be of ample size to allow adequate circulation of heated air. Appliances shall be so located as not to interfere with the proper circulation of air within the heated space.

Exception: Solid fuel-burning appliances listed for installation in enclosed spaces or alcoves less than 512 ft^3 shall be installed in accordance with the requirements of the listing and the manufacturer's instructions.

9-2.3 Solid fuel-burning appliances shall not be installed in any location where gasoline or any other flammable vapors or gases are likely to be present.

9-2.4 Solid fuel-burning appliances shall not be installed in any residential garage.

9-3 Air for Combustion and Ventilation. Solid fuel-burning appliances shall be installed in a location and manner so as to provide adequate ventilation and combustion air supply to allow satisfactory combustion of fuel, proper chimney draft, and maintenance of safe temperatures. Where buildings are so tight that normal infiltration does not provide the necessary air, outside air shall be introduced.

9-4 Chimney Connections and Usage.

9-4.1 Chimney Connection. All solid fuel-burning appliances shall be connected to chimneys in accordance with Chapter 6. The chimney provided shall be in accordance with Table 2-2.1.

9-4.2 Clearance. The clearance of chimney connectors to combustible material shall be as specified in Table 6-5.1.1.

9-4.3 Inspection and Cleaning Access. Connectors and chimneys for solid fuel-burning appliances shall be designed, located, and installed to allow ready access for internal inspection and cleaning.

9-4.4* Flue Cross-Sectional Area. For residential-type solid fuel-burning appliances, the cross-sectional area of the flue shall not be less than the cross-sectional area of the appliance flue collar. The cross-sectional area of the flue shall not be more than three times the cross-sectional area of the appliance flue collar.

9-4.5 Connection to Masonry Fireplaces. A solid fuel-burning appliance such as a stove or insert shall be permitted to use a masonry fireplace flue where the following conditions are met:

Exception: Listed fireplace accessories shall be permitted to use a masonry fireplace flue.

(1) There is a connector that extends from the appliance to the flue liner.
(2) *The cross-sectional area of the flue is no more than three times the cross-sectional area of the flue collar of the appliance.
(3) If the appliance vents directly through the chimney wall above the smoke chamber, there shall be a noncombustible seal below the entry point of the connector.
(4) The installation shall be such that the chimney system can be inspected and cleaned.
(5) Means shall be provided to prevent dilution of combustion products in the chimney flue with air from the habitable space.

9-4.6 Existing Flue Use. Another solid fuel-burning appliance shall not be installed using an existing flue serving a factory-built fireplace unless the appliance is specifically listed for such installation.

9-5 Mounting.

9-5.1 Mounting for Residential-Type Appliances.

9-5.1.1 General Requirements.

9-5.1.1.1 Residential-type solid fuel-burning appliances that are tested and listed by a recognized testing laboratory for installation on floors constructed of combustible materials shall be placed on floors in accordance with the requirements of the listing and the conditions of approval. Such appliances that are not listed by a recognized testing laboratory shall be provided with floor protection in accordance with the provisions of 9-5.1.2 or 9-5.1.3.

Exception: Residential-type solid fuel-burning appliances shall be permitted to be placed without floor protection in any of the following manners:

(a) On concrete bases adequately supported on compacted soil, crushed rock, or gravel

(b) On concrete slabs or masonry arches that do not have combustible materials attached to the underside

(c) On approved assemblies constructed of only noncombustible materials and having a fire resistance rating of not less than 2 hours, with floors constructed of noncombustible material

(d) On properly stabilized ground that can support the load of the appliance

9-5.1.1.2 Any floor assembly, slab, or arch shall extend not less than 18 in. (457 mm) beyond the appliance on all sides.

9-5.1.1.3 In lieu of the requirements for floor protection specified herein, a floor protector listed by a recognized testing laboratory and installed in accordance with the installation instructions shall be permitted to be employed.

9-5.1.1.4 Concrete bases, concrete slabs, masonry arches, and floor-ceiling assemblies and their supports shall be designed and constructed to support the appliances.

9-5.1.2 Room Heaters, Fireplace Stoves, Room Heater/Fireplace Combinations, and Ranges.

9-5.1.2.1 Room heaters, fireplace stoves, room heater/fireplace stove combinations, or ranges that are set on legs or pedestals that provide not less than 6 in. (152 mm) of ventilated open space beneath the fire chamber or base of the appliance

shall be permitted to be placed on floors of combustible construction, provided the floor under the appliance is protected with closely spaced solid masonry units not less than 2 in. (51 mm) in thickness. The top surface of the masonry shall be covered with sheet metal not less than 24 gauge [0.024 in. (0.61 mm)]. The floor protection shall extend not less than 18 in. (457 mm) beyond the appliance on all sides.

9-5.1.2.2 Room heaters, fireplace stoves, room heater/fireplace stove combinations, or ranges that are set on legs or pedestals providing 2 in. to 6 in. (51 mm to 152 mm) of ventilated open space beneath the fire chamber or base of the appliance shall be permitted to be placed on floors of combustible construction, provided the floor under the appliance is protected with one course of hollow masonry units not less than 4 in. (102 mm) in thickness. The masonry units shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air through the core spaces of the masonry. The top surface of the masonry shall be covered with sheet metal not less than 24 gauge [0.024 in. (0.61 mm)]. The floor protection shall extend not less than 18 in. (457 mm) beyond the appliance on all sides.

9-5.1.2.3 Room heaters, fireplace stoves, room heater/fireplace stove combinations, or ranges with legs or pedestals that provide less than 2 in. (51 mm) of ventilated open space beneath the fire chamber or base of the appliance shall not be placed on floors of combustible construction.

9-5.1.3 Furnaces and Boilers.

9-5.1.3.1 Furnaces or boilers with legs or pedestals that provide not less than 6 in. (152 mm) of ventilated open space beneath the fire chamber or base of the appliance shall be permitted to be placed on floors of combustible construction, provided the floor under the appliance is protected with one course of hollow masonry units not less than 4 in. (102 mm) in thickness. The masonry units shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air through the core spaces of the masonry. The top surface of the masonry shall be covered with a steel plate not less than $^3/_{16}$ in. (4.8 mm) in thickness. The floor protection shall extend not less than 18 in. (457 mm) beyond the appliance on all sides.

9-5.1.3.2 Furnaces or boilers that are set on legs or pedestals that provide 2 in. to 6 in. (51 mm to 152 mm) of ventilated open space beneath the fire chamber or base of the appliance shall be permitted to be placed on floors of combustible construction, provided the floor under the appliance is protected with two courses of hollow masonry units, each not less than 4 in. (102 mm) in thickness. The masonry units shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air through the core spaces of the masonry. The top surface of the masonry shall be covered with a steel plate not less than $^3/_{16}$ in. (4.8 mm) in thickness. The floor protection shall extend not less than 18 in. (457 mm) beyond the appliance on all sides.

9-5.1.3.3 Furnaces or boilers with legs or pedestals that provide less than 2 in. (51 mm) of ventilated open space beneath the fire chamber or base of the appliance shall not be placed on floors of combustible construction.

9-5.2 Mounting for Low-Heat Nonresidential Appliances.

9-5.2.1 Low-heat nonresidential solid fuel-burning appliances that have been tested and listed by a recognized testing laboratory for placement on floors constructed with a combustible material shall be placed on floors in accordance with the requirements of the listing and conditions of approval. Such appliances that are not listed by a recognized testing laboratory shall be provided with floor protection in accordance with the provisions of 9-5.2.3 or 9-5.2.4.

Exception: Low-heat nonresidential solid fuel-burning appliances shall be permitted to be placed without floor protection in any of the following manners:

(a) On floors constructed of noncombustible materials and having a fire resistance rating of not less than 2 hours; this construction shall extend not less than 18 in. (457 mm) beyond the appliance on all sides

(b) On concrete bases adequately supported on compacted soil, crushed rock, or gravel

(c) On properly stabilized ground that can support the load of the appliance

9-5.2.2 Concrete bases, concrete slabs, and floors shall be designed and constructed to support the appliances.

9-5.2.3 Low-heat nonresidential solid fuel-burning appliances that are set on legs or pedestals that provide not less than 18 in. (457 mm) of ventilated open space beneath the fire chamber or base of the appliance shall be permitted to be placed on floors of combustible construction, provided the floor under the appliance is protected with one course of hollow masonry units not less than 4 in. (102 mm) in thickness. The masonry units shall be laid with ends unsealed and joints matched in such a way as to provide free circulation of air through the core spaces of the masonry. The top surface of the masonry shall be covered with a steel plate not less than $^3/_{16}$ in. (4.8 mm) in thickness. The floor protection shall extend not less than 18 in. (457 mm) beyond the appliance on all sides.

9-5.2.4 Low-heat nonresidential solid fuel-burning appliances that are set on legs or pedestals that provide 6 in. to 18 in. (152 mm to 457 mm) of ventilated open space beneath the fire chamber or base of the appliance shall be permitted to be placed on floors of combustible construction, provided the floor under the appliance is protected with two courses of hollow masonry units, each not less than 4 in. (102 mm) in thickness. The masonry units shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air through the core spaces of the masonry. The top surface of the masonry shall be covered with a steel plate not less than $^3/_{16}$ in. (4.8 mm) in thickness. The floor protection shall extend not less than 18 in. (457 mm) beyond the appliance on all sides.

9-5.2.5 Low-heat nonresidential solid fuel-burning appliances with legs or pedestals that provide less than 6 in. (152 mm) of ventilated open space beneath the fire chamber or base of the appliance shall not be placed on floors of combustible construction.

9-5.3 Mounting for Medium-Heat Nonresidential Appliances.

9-5.3.1 Medium-heat nonresidential solid fuel-burning appliances that have been tested and listed by a recognized testing laboratory for placement on floors constructed with a combustible material shall be placed on floors in accordance with the requirements of the listing and conditions of approval. Such appliances that are not listed by a recognized testing laboratory shall be provided with floor protection in accordance with the provisions of 9-5.3.3 or 9-5.3.4.

Exception: Medium-heat nonresidential solid fuel-burning appliances shall be permitted to be placed without floor protection in any of the following manners:

(a) On concrete bases adequately supported on compacted soil, crushed rock, or gravel

(b) On floors constructed of noncombustible materials and having a fire resistance rating of not less than 2 hours; this construction shall extend not less than 3 ft (0.92 m) beyond the appliance on all sides and 8 ft (2.45 m) beyond the front or side where ashes are removed

(c) On properly stabilized ground that can support the load of the appliance

9-5.3.2 Concrete bases, concrete slabs, and floors shall be designed and constructed to support the appliances.

9-5.3.3 Medium-heat nonresidential solid fuel-burning appliances that are set on legs or pedestals that provide not less than 24 in. (610 mm) of ventilated open space beneath the fire chamber or base of the appliance shall be permitted to be placed on floors of combustible construction, provided the floor under the appliance is protected with one course of hollow masonry units not less than 4 in. (102 mm) in thickness. The masonry units shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air through the core spaces of the masonry. The top surface of the masonry shall be covered with a steel plate not less than $^3/_{16}$ in. (4.8 mm) in thickness. The floor protection shall extend not less than 3 ft (0.92 m) beyond the appliance on all sides and 8 ft (2.45 m) beyond the front or side where ashes are removed.

9-5.3.4 Medium-heat nonresidential solid fuel-burning appliances that are set on legs or pedestals that provide 18 in. to 24 in. (457 mm to 610 mm) of ventilated open space beneath the fire chamber or base of the appliance shall be permitted to be placed on floors of combustible construction, provided the floor under the appliance is protected with two courses of hollow masonry units, each not less than 4 in. (102 mm) in thickness. The masonry units shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air through the core spaces of the masonry. The top surface of the masonry shall be covered with a steel plate not less than $^3/_{16}$ in. (4.8 mm) in thickness. The floor protection shall extend not less than 3 ft (0.92 m) beyond the appliance on all sides and 8 ft (2.45 m) beyond the front or side where ashes are removed.

9-5.3.5 Medium-heat nonresidential solid fuel-burning appliances with legs or pedestals that provide less than 18 in. (457 mm) of ventilated open space beneath the fire chamber or base of the appliance shall not be placed on floors of combustible construction.

9-5.4 Mounting of High-Heat Nonresidential Appliances.

9-5.4.1 High-heat nonresidential solid fuel-burning appliances shall be placed in one of the following manners:

(1) On concrete bases adequately supported on compacted soil, crushed rock, or gravel
(2) On floors constructed of noncombustible materials and having a fire resistance rating of not less than 2 hours; this construction shall extend not less than 10 ft (3.1 m) beyond the appliance on all sides and not less than 30 ft (9.2 m) beyond the front or side where hot products are removed
(3) On properly stabilized ground that can support the load of the appliance

9-5.4.2 Concrete bases and floors shall be designed and constructed to support the appliances.

9-5.4.3 High-heat nonresidential solid fuel-burning appliances shall not be placed on floors of combustible construction.

9-6 Clearances from Solid Fuel-Burning Appliances.

9-6.1 Solid fuel-burning appliances shall be installed so that their use cannot create a hazard to persons or property. The clearance shall be not less than specified in Table 9-6.1.

Exception No. 1: Appliances listed for installation with clearances less than specified in Table 9-6.1 shall be permitted to be installed in accordance with the terms of their listing and the manufacturer's instructions.

Exception No. 2: Heating furnaces and boilers and water heaters specifically listed for installation in spaces such as alcoves shall be permitted to be so installed in accordance with the terms of their listing, provided the specified clearance is maintained regardless of whether the enclosure is of combustible or noncombustible material.

These clearances shall apply to appliances installed in rooms that are large in comparison with the size of the appliances. For reduced clearances, see Table 9-6.2.1.

Table 9-6.1 Standard Clearances for Solid Fuel-Burning Appliances

Kind of Appliance	Above Top of Casing or Appliance; Above Top and Sides of Furnace Plenum or Bonnet		From Front		From Back[c]		From Sides[c]	
	in.	mm	in.	mm	in.	mm	in.	mm
Residential Appliances	6	152	48	1219	6[b]	152[b]	6[b]	152[b]
Steam boilers — 15 psi (103 kPa)								
Water boilers — 250°F (121°C) max.								
Water boilers — 200°F (93°C) max.								
All water walled or jacketed								
Furnaces								
Gravity and forced air[d]	18	457	48	1219	18	457	18	457
Room Heaters, Fireplace Stoves, Fireplace Inserts, Combinations	36	914	36	914	36	914	36	914
Ranges					**Firing Side**		**Opposite Side**	
Lined fire chamber	30[a]	762[a]	36	914	24	610	18	457
Unlined fire chamber	30[a]	762[a]	36	914	36	914	18	457

[a]To combustible material or metal cabinets. If the underside of such combustible material or metal cabinet is protected with sheet metal of not less than 24 gauge [0.024 in. (0.61 mm)], spaced out 1 in. (25.4 mm), the distance shall be permitted to be reduced to not less than 24 in. (610 mm).
[b]Adequate clearance for cleaning and maintenance shall be provided.
[c]Provisions for fuel storage shall be located at least 36 in. (914 mm) from any side of the appliance.
[d]For clearances from air ducts, see NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.*

9-6.2 Clearance Reduction.

9-6.2.1 Clearances from listed and unlisted solid fuel-burning appliances to combustible material shall be permitted to be reduced if the combustible material is protected as described in Table 9-6.2.1 and in Figures 9-6.2.1(a) through (d).

After reduction, clearance shall be not less than 12 in. (305 mm) to combustible walls and not less than 18 in. (457 mm) to combustible ceilings.

Exception: Appliances listed for installation with a clearance of less than 12 in. (305 mm) to a combustible wall or less than 18 in. (457 mm) to a combustible ceiling shall be installed in accordance with the terms of their listing and the manufacturer's instructions.

Table 9-6.2.1 Reduction of Appliance Clearance with Specified Forms of Protection[1-10]

	Clearance Reduction Applied to and Covering All Combustible Surfaces within the Distance Specified as Required Clearance with No Protection (*See 9-6.1.*)	Maximum Allowable Reduction in Clearance (%)		Where the required clearance with no protection is 36 in. (914 mm), the clearances below are the minimum allowable clearances. For other required clearances with no protection, calculate minimum allowable clearance from maximum allowable reduction.[9,10]			
				As Wall Protector		As Ceiling Protector	
		As Wall Protector (%)	As Ceiling Protector (%)	in.	mm	in.	mm
(a)	$3^1/_2$ in. (90 mm) thick masonry wall without ventilated air space	33	—	24	610	—	—
(b)	$^1/_2$ in. (13 mm) thick noncombustible insulation board over 1-in. (25.4-mm) glass fiber or mineral wool batts without ventilated air space	50	33	18	457	24	610
(c)	0.024-in. (0.61-mm), 24-gauge sheet metal over 1-in. (25.4-mm) glass fiber or mineral wool batts reinforced with wire, or equivalent, on rear face with ventilated air space	66	50	12	305	18	457
(d)	$3^1/_2$ in. (90 mm) thick masonry wall with ventilated air space	66	—	12	305	—	—
(e)	0.024-in. (0.61-mm), 24-gauge sheet metal with ventilated air space	66	50	12	305	18	457
(f)	$^1/_2$ in. (13 mm) thick noncombustible insulation board with ventilated air space	66	50	12	305	18	457
(g)	0.024-in. (0.61-mm), 24-gauge sheet metal with ventilated air space over 0.024-in. (0.61-mm), 24-gauge sheet metal with ventilated air space	66	50	12	305	18	457
(h)	1-in. (25.4-mm) glass fiber or mineral wool batts sandwiched between two sheets 0.024-in. (0.61-mm), 24-gauge sheet metal with ventilated air space	66	50	12	305	18	457

Notes:
1. Spacers and ties shall be of noncombustible material. No spacers or ties shall be used directly behind appliance or conductor.
2. With all clearance reduction systems using a ventilated air space, adequate air circulation shall be provided as described in 9-6.2.4. There shall be at least 1 in. (25.4 mm) between the clearance reduction system and combustible walls and ceilings for clearance reduction systems using a ventilated air space.
3. Mineral wool batts (blanket or board) shall have a minimum density of 8 lb/ft^3 (128.7 kg/m^3) and have a minimum melting point of 1500°F (816°C).
4. Insulation material used as part of clearance reduction system shall have a thermal conductivity of 1.0 (Btu-in.)/(ft^2-hr-°F) or less. Insulation board shall be formed of noncombustible material.
5. If a single-wall connector passes through a masonry wall used as a wall shield, there shall be at least $^1/_2$ in. (13 mm) of open, ventilated air space between the connector and the masonry.
6. There shall be at least 1 in. (25.4 mm) between the appliance and the protector. In no case shall the clearance between the appliance and the wall surface be reduced below that allowed in this table.
7. Clearances in front of the loading door or ash removal door, or both, of the appliance shall not be reduced from those in Section 9-5.
8. All clearances and thicknesses are minimums; larger clearances and thicknesses shall be permitted.
9. To calculate the minimum allowable clearance, the following formula can be used: $C_{pr} = C_{un} \times [1 - (R/100)]$. C_{pr} is the minimum allowable clearance, C_{un} is the required clearance with no protection, and R is the maximum allowable reduction in clearance.
10. Refer to Figures 9-6.2.1(e) and 9-6.2.1(f) for other reduced clearances using materials found in (a) through (h) of this table.

FIGURE 9-6.2.1(a) Clearance reduction system — fastener location.

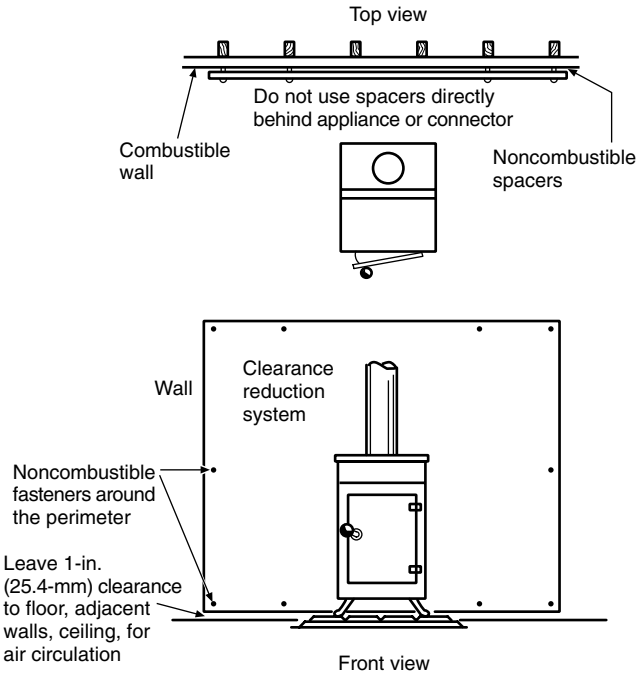


FIGURE 9-6.2.1(b) Distance to combustible wall/floor.

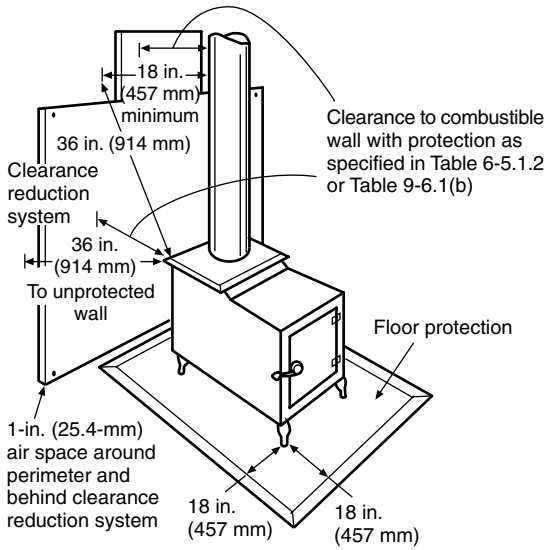
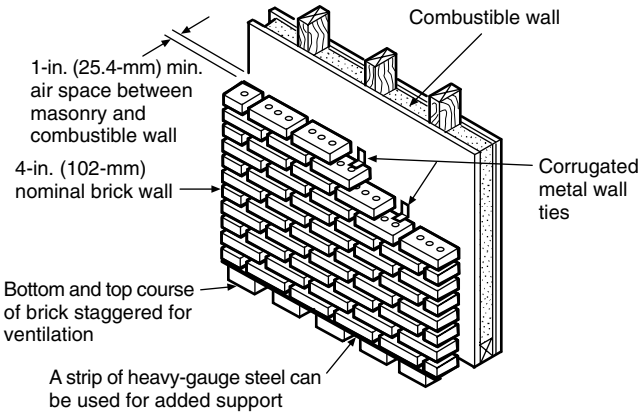


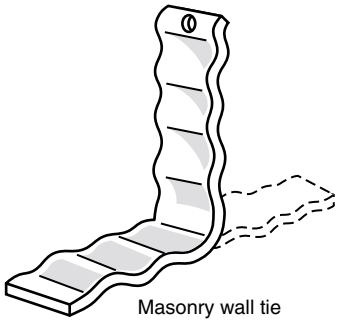
FIGURE 9-6.2.1(c) Masonry clearance reduction system.

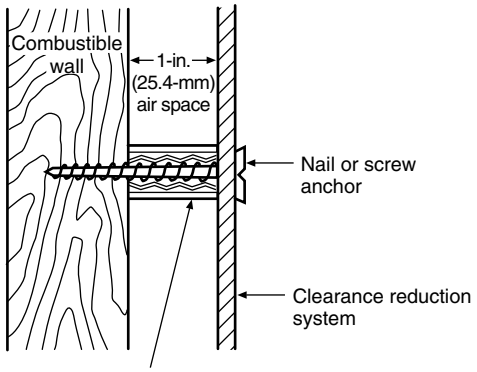


Note: Do not place masonry wall ties directly behind appliance or connector.

Masonry clearance reduction system

FIGURE 9-6.2.1(d) Fastener detail.



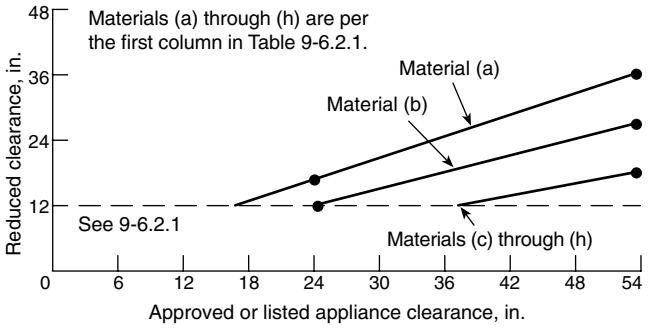


1-in. (25.4-mm) noncombustible spacer such as stacked washers, small-diameter pipe, tubing, or electrical conduit

Masonry walls can be attached to combustible walls using wall ties.

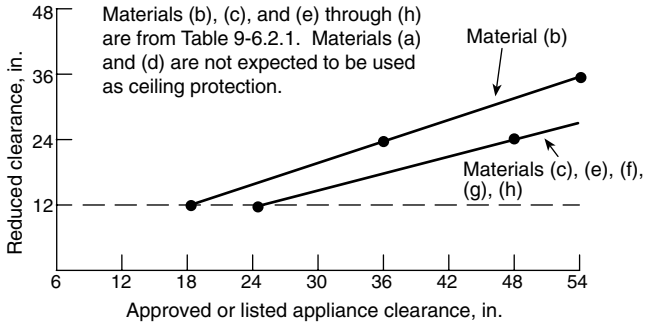
Do not use spacers directly behind appliance or connector.

FIGURE 9-6.2.1(e) Wall protection using materials in Table 9-6.2.1.



For SI units: 1 in. = 25.4 mm

FIGURE 9-6.2.1(f) Ceiling protection using materials in Table 9-6.2.1.



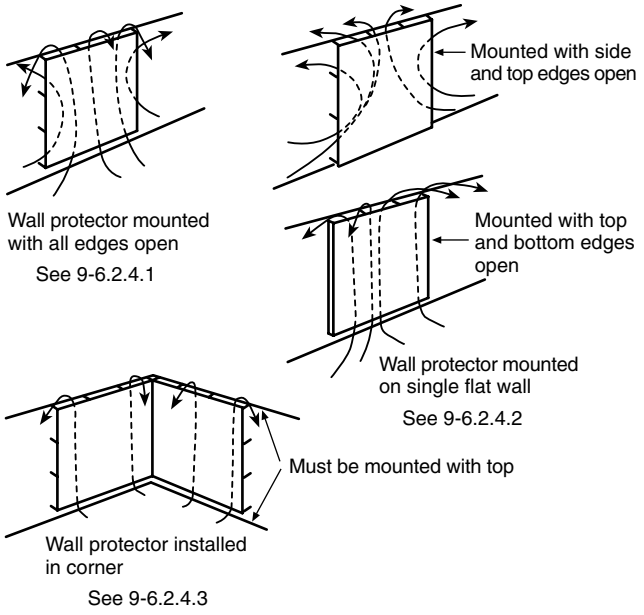
For SI units: 1 in. = 25.4 mm

9-6.2.2 Clearances from solid fuel-burning appliances to combustible material shall be permitted to be reduced, provided the combustible material is protected by an engineered protection system acceptable to the authority having jurisdiction. Engineered systems installed for the protection of combustible material shall reduce the temperature of such materials to 90°F (50°C) rise above ambient. System design shall be based on applicable heat transfer principles, taking into account the geometry of the system, the heat loss characteristics of the structure behind the combustible material, and the possible abnormal operating conditions of the heat-producing sources.

9-6.2.3 Clearances from solid fuel-burning appliances to combustible material shall be permitted to be reduced by the use of materials or products listed for protection purposes. Materials and products listed for the purpose of reducing clearance to combustibles shall be installed in accordance with the conditions of the listing and the manufacturer's instructions.

9-6.2.4 For clearance reduction systems using an air space between the combustible wall and the wall protector, adequate air circulation shall be provided by one of the following methods as shown in Figure 9-6.2.4.

FIGURE 9-6.2.4 Air circulation methods.



9-6.2.4.1 Adequate air circulation shall be permitted to be provided by leaving all edges of the wall protector open with at least a 1-in. (25.4-mm) air gap.

9-6.2.4.2 If the wall protector is mounted on a single flat wall away from corners, adequate air circulation shall be permitted to be provided by leaving only the bottom and top edges or only the side and top edges open with at least a 1-in. (25.4-mm) air gap.

9-6.2.4.3 Wall protectors that cover two walls in a corner shall be open at the bottom and top edges with at least a 1-in. (25.4-mm) air gap.

9-6.2.5 All clearances shall be measured from the outer surface of the combustible material to the nearest point on the surface of the solid fuel-burning appliance, disregarding any intervening protection applied to the combustible material.

9-6.2.6 All clearances provided between solid fuel-burning appliances and combustible materials shall be large enough to maintain sufficient clearances between chimney connectors and combustible material as required in Section 6-5.

9-7 Accessories. Factory-built accessories for solid fuel-burning appliances such as heat exchangers, stove mats, floor pads, and protection shields shall be listed and shall be installed in accordance with the terms of their listing.

Exception: Unlisted accessories that are acceptable to the authority having jurisdiction shall be permitted to be installed in accordance with the approval of the authority having jurisdiction and the appliance and accessory manufacturers' installation instructions.

Chapter 10 Maintenance

10-1 Initial Installation. Initial installation of chimneys, fireplaces, and vents shall allow inspection of the surroundings to determine that the required clearances have been maintained and that correct provisions for support, stabilization, future inspection, and maintenance are in place.

10-2 Annual Inspection. Chimneys, fireplaces, and vents shall be inspected at least once a year in accordance with the requirements of Section 11-3. Connectors, spark arrestors, cleanouts, and tee fittings connected to chimneys and to oil and pellet venting systems shall be inspected at least once a year in accordance with the requirements of Section 11-3. Cleaning, maintenance, and repairs shall be done if necessary.

Exception: Type B and Type BW gas venting systems.

10-3 Inspection — Connectors. Connectors, spark arresters, cleanouts, and tee fittings for chimneys and for oil and pellet venting systems shall be inspected at least once a year for soundness and freedom from deposits.

Exception: Connectors for Type B gas venting systems.

10-4 Appliance or Connector Replacement. When an existing appliance or connector is replaced or a new appliance is connected to a chimney, the chimney flue shall be inspected in accordance with Chapter 11. The chimney shall be cleaned, lined or relined, or repaired as necessary.

10-5 Cleanout Doors. After any inspection or maintenance operation, cleanout doors and caps or plugs for cleanout tee fittings shall be closed tightly or secured in place.

10-6 Cleaning Methods. Cleaning of chimneys, if necessary, shall be done by methods that do not impair structural or thermal performance.

10-7 Evidence of Damage. Chimneys, vents, and fireplaces shall be inspected, cleaned, and repaired if there is any evidence of damage to the chimney, fireplace, or vent or to the surroundings. Inspections required by this section shall comply with the requirements for a Level II Inspection in accordance with Section 11-4.

10-8 Operating Malfunction. When inspection or an operating malfunction shows that an existing chimney, fireplace, or vent is damaged, unsuitable, or improperly sized, it shall be repaired, rebuilt, or resized to the construction and functional requirements of this standard.

10-9* Damaged or Deteriorated Liners. If the flue liner in a chimney has softened, cracked, or otherwise deteriorated so that it no longer has the continued ability to contain the products of combustion (i.e., heat, moisture, creosote, and flue gases), it shall be either removed and replaced, repaired, or relined with a listed liner system or other approved material that will resist corrosion, softening, or cracking from flue gases at temperatures appropriate to the class of chimney service. (*See Table 2-2.1.*)

Chapter 11 Inspection of Existing Chimneys

11-1* General. Inspections shall be conducted by a qualified agency.

Exception: Observations that are incidental to a chimney maintenance or repair task not shown in Table 11-3 shall not be required to comply with the minimum levels of inspection set forth in this chapter. However, defects that are observed during the course of such work shall be reported to the property owner, occupant, or responsible party.*

11-2 Inspection Definitions.

11-2.1 See Accessible.

11-2.2 See Accessible, Readily.

11-2.3 See Non-Accessible, Concealed.

11-3 Type of Inspection. The scope of the inspection, the areas of the chimney examined, and the degree of invasiveness of the inspection shall be appropriate for the conditions giving rise to the inspection. The type of inspection shall be determined in accordance with Table 11-3.

11-3.1 The type of inspection performed shall be based on the circumstances that give rise to the inspection. For situations shown in the Circumstances row of Table 11-3, the minimum level of inspection shall be that indicated by column in which the situation is found. For situations not shown in the Circumstances row, the type of inspection shall be based on the descriptions in the Indications row.

11-3.2 Nothing shall prevent the examination of all or part of the chimney at a higher level than the minimum indicated by Table 11-3, Selection of Inspection Types. Partial examination of the chimney at a higher level shall not require that the entire inspection be conducted at the higher level.

11-4* Level I Inspections. A Level I inspection shall be utilized when verification of the suitability of the chimney or flue for continued service, under the same conditions and with the same or similar appliance or appliances, is needed.

11-4.1 Circumstances. A Level I inspection shall be conducted under the following circumstances.

11-4.1.1 During annual inspections in accordance with Section 10-2.

11-4.1.2 During routine cleaning of a flue or flues within the chimney.

11-4.1.3 At the time of replacement of one or more connected appliances with an equal number of appliances of similar type, input rating, and efficiency, in accordance with Section 10-4.

11-4.1.4 At other times as indicated in Section 11-4.

11-4.2 Scope and Access. Level I inspections shall include examination of readily accessible portions of the chimney and accessible portions of the connected appliance and chimney connection.

11-4.2.1 The chimney exterior and surroundings shall be inspected at locations that can be accessed without removal of panels, doors, or coverings. Where panels, doors, or coverings are opened as part of performance of another task, such as chimney cleaning, such locations shall be examined as part of a Level I inspection.