

fuel cylinders for the purposes of maintenance, cylinder certification, calibration of dispensers or other activities shall be in accordance with this section. The discharge of CNG from motor vehicle fuel cylinders shall be accomplished through a closed transfer system or an *approved* method of atmospheric venting in accordance with Section 413.9.1 or 413.9.2.

**[F] 413.9.1 Closed transfer system.** A documented procedure that explains the logical sequence for discharging the cylinder shall be provided to the code official for review and approval. The procedure shall include what actions the operator will take in the event of a low-pressure or high-pressure natural gas release during the discharging activity. A drawing illustrating the arrangement of *pipng*, regulators and *equipment* settings shall be provided to the code official for review and approval. The drawing shall illustrate the *pipng* and regulator arrangement and shall be shown in spatial relation to the location of the compressor, storage vessels and emergency shut-down devices.

**[F] 413.9.2 Atmospheric venting.** Atmospheric venting of motor vehicle fuel cylinders shall be in accordance with Sections 413.9.2.1 through 413.9.2.6.

**[F] 413.9.2.1 Plans and specifications.** A drawing illustrating the location of the vessel support, *pipng*, the method of grounding and bonding, and other requirements specified herein shall be provided to the code official for review and approval.

**[F] 413.9.2.2 Cylinder stability.** A method of rigidly supporting the vessel during the venting of CNG shall be provided. The selected method shall provide not less than two points of support and shall prevent horizontal and lateral movement of the vessel. The system shall be designed to prevent movement of the vessel based on the highest gas-release velocity through valve orifices at the vessel's rated pressure and volume. The structure or appurtenance shall be constructed of *noncombustible materials*.

**[F] 413.9.2.3 Separation.** The structure or appurtenance used for stabilizing the cylinder shall be separated from the site *equipment*, features and exposures and shall be located in accordance with Table 413.9.2.3.

**[F] TABLE 413.9.2.3  
SEPARATION DISTANCE FOR ATMOSPHERIC VENTING OF CNG**

EQUIPMENT OR FEATURE	MINIMUM SEPARATION (feet)
Buildings	25
Building openings	25
Lot lines	15
Public ways	15
Vehicles	25
CNG compressor and storage vessels	25
CNG dispensers	25

For SI: 1 foot = 304.8 mm.

**[F] 413.9.2.4 Grounding and bonding.** The structure or appurtenance used for supporting the cylinder shall be grounded in accordance with NFPA 70. The cylinder

valve shall be bonded prior to the commencement of venting operations.

**[F] 413.9.2.5 Vent tube.** A vent tube that will divert the gas flow to the atmosphere shall be installed on the cylinder prior to the commencement of the venting and purging operation. The vent tube shall be constructed of pipe or tubing materials *approved* for use with CNG in accordance with the *International Fire Code*.

The vent tube shall be capable of dispersing the gas not less than 10 feet (3048 mm) above grade level. The vent tube shall not be provided with a rain cap or other feature that would limit or obstruct the gas flow.

At the connection fitting of the vent tube and the CNG cylinder, a *listed* bidirectional detonation flame arrester shall be provided.

**[F] 413.9.2.6 Signage.** Approved NO SMOKING signs shall be posted within 10 feet (3048 mm) of the cylinder support structure or appurtenance. *Approved* CYLINDER SHALL BE BONDED signs shall be posted on the cylinder support structure or appurtenance.

## SECTION 414 (IFGC) SUPPLEMENTAL AND STANDBY GAS SUPPLY

**414.1 Use of air or oxygen under pressure.** Where air or oxygen under pressure is used in connection with the gas supply, effective means such as a backpressure regulator and relief valve shall be provided to prevent air or oxygen from passing back into the gas *pipng*. Where oxygen is used, installation shall be in accordance with NFPA 51.

**414.2 Interconnections for standby fuels.** Where supplementary gas for standby use is connected downstream from a meter or a service regulator where a meter is not provided, a device to prevent backflow shall be installed. A three-way valve installed to admit the standby supply and at the same time shut off the regular supply shall be permitted to be used for this purpose.

## SECTION 415 (IFGS) PIPING SUPPORT INTERVALS

**415.1 Interval of support.** *Pipng* shall be supported at intervals not exceeding the spacing specified in Table 415.1. Spacing of supports for CSST shall be in accordance with the CSST manufacturer's instructions.

**TABLE 415.1  
SUPPORT OF PIPING**

STEEL PIPE, NOMINAL SIZE OF PIPE (inches)	SPACING OF SUPPORTS (feet)	NOMINAL SIZE OF TUBING (SMOOTH-WALL) (inch O.D.)	SPACING OF SUPPORTS (feet)
1/2	6	1/2	4
3/4 or 1	8	5/8 or 3/4	6
1 1/4 or larger (horizontal)	10	7/8 or 1 (horizontal)	8
1 1/4 or larger (vertical)	Every floor level	1 or larger (vertical)	Every floor level

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

## SECTION 416 (IFGS) OVERPRESSURE PROTECTION DEVICES

**416.1 Where required.** Where the serving gas supplier delivers gas at a pressure greater than 2 psi for piping systems serving appliances designed to operate at a gas pressure of 14 inches w.c. or less, overpressure protection devices shall be installed. Piping systems serving equipment designed to operate at inlet pressures greater than 14 inches w.c. shall be equipped with overpressure protection devices as required by the appliance manufacturer's installation instructions.

**416.2 Pressure limitation requirements.** The requirements for pressure limitation shall be in accordance with Sections 416.2.1 through 416.2.5.

**416.2.1 Pressure under 14 inches w.c.** Where piping systems serving appliances designed to operate with a gas supply pressure of 14 inches w.c. or less are required to be equipped with overpressure protection by Section 416.1, each overpressure protection device shall be adjusted to limit the gas pressure to each connected appliance to 2 psi or less upon a failure of the line pressure regulator.

**416.2.2 Pressure over 14 inches w.c.** Where piping systems serving appliances designed to operate with a gas supply pressure greater than 14 inches w.c. are required to be equipped with overpressure protection by Section 416.1, each overpressure protection device shall be adjusted to limit the gas pressure to each connected appliance as required by the appliance manufacturer's installation instructions.

**416.2.3 Device capability.** Each overpressure protection device installed to meet the requirements of this section shall be capable of limiting the pressure to its connected appliance(s) as required by this Section 416.2.1, independently of any other pressure control equipment in the piping system.

**416.2.4 Failure detection.** Each gas piping system for which an overpressure protection device is required by Section 416 shall be designed and installed so that a failure of the primary pressure control device(s) is detectable.

**416.2.5 Relief valve.** Where a pressure relief valve is used to meet the requirements of Section 416, it shall have a flow capacity such that the pressure in the protected system is maintained at or below the limits specified in Section 416.2.1 under all of the following conditions:

1. The line pressure regulator for which the relief valve is providing overpressure protection has failed wide open.
2. The gas pressure at the inlet of the line pressure regulator for which the relief valve is providing overpressure protection is not less than the regulator's normal operating inlet pressure.

**416.3 Overpressure protection devices.** Overpressure protection devices shall be one of the following:

1. Pressure relief valve.
2. Monitoring regulator.
3. Series regulator installed upstream from the line regulator and set to continuously limit the pressure on the

inlet of the line regulator to the maximum values specified by Section 416.2.1.

4. Automatic shutoff device installed in series with the line pressure regulator and set to shut off when the pressure on the downstream *piping* system reaches the maximum values specified by Section 416.2.1. This device shall be designed so that it will remain closed until manually reset.

The devices specified in this section shall be installed either as an integral part of the service or line pressure regulator or as separate units. Where separate overpressure protection devices are installed, they shall comply with Sections 416.3.1 through 416.3.6.

**416.3.1 Construction and installation.** Overpressure protection devices shall be constructed of materials so that the operation of the devices will not be impaired by corrosion of external parts by the atmosphere or of internal parts by the gas. Overpressure protection devices shall be designed and installed so that they can be operated to determine whether the valve is free. The devices shall be designed and installed so that they can be tested to determine the pressure at which they will operate and examined for leakage when in the closed position.

**416.3.2 External control piping.** External control *piping* shall be designed and installed so that damage to the control *piping* of one device will not render both the regulator and the overpressure protection device inoperative.

**416.3.3 Setting.** Each overpressure protection device shall be set so that the gas pressure supplied to the connected appliances does not exceed the limits specified in Sections 416.2.1 and 416.2.2.

**416.3.4 Unauthorized operation.** Where unauthorized operation of any shutoff valve could render an overpressure protection device inoperative, one of the following shall be accomplished:

1. The valve shall be locked in the open position. Authorized personnel shall be instructed in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.
2. Duplicate relief valves shall be installed, each having adequate capacity to protect the system, and the isolating valves and three-way valves shall be arranged so that only one relief valve can be rendered inoperative at a time.

**416.3.5 Vents.** The discharge stacks, vents and outlet parts of all overpressure protection devices shall be located so that gas is safely discharged to the outdoors. Discharge stacks and vents shall be designed to prevent the entry of water, insects and other foreign material that could cause blockage. The discharge stack or vent line shall be not less than the same size as the outlet of the pressure-relieving device.

**416.3.6 Size of fittings, pipe and openings.** The fittings, pipe and openings located between the system to be protected and the pressure-relieving device shall be sized to prevent hammering of the valve and to prevent impairment of relief capacity.

## CHAPTER 5

# CHIMNEYS AND VENTS

User note:

**About this chapter:** The majority of gas-fired appliances have their combustion products vented to the outdoors. Venting is by means of chimneys, vents, integral vents, direct-vents and power exhausters. Chapter 5 includes design, sizing and installation requirements for chimneys and vents and requirements for matching the appliance type to the appropriate venting system. Venting system termination location requirements are also addressed.

### SECTION 501 (IFGC) GENERAL

**501.1 Scope.** This chapter shall govern the installation, maintenance, repair and approval of factory-built chimneys, chimney liners, vents and connectors and the utilization of masonry chimneys serving gas-fired appliances. The requirements for the installation, maintenance, repair and approval of factory-built chimneys, chimney liners, vents and connectors serving appliances burning fuels other than fuel gas shall be regulated by the *International Mechanical Code*. The construction, repair, maintenance and approval of masonry chimneys shall be regulated by the *International Building Code*.

**501.2 General.** Every appliance shall discharge the products of combustion to the outdoors, except for appliances exempted by Section 501.8.

**501.3 Masonry chimneys.** Masonry chimneys shall be constructed in accordance with Section 503.5.3 and the *International Building Code*.

**501.4 Minimum size of chimney or vent.** Chimneys and vents shall be sized in accordance with Sections 503 and 504.

**501.5 Abandoned inlet openings.** Abandoned inlet openings in chimneys and vents shall be closed by an *approved* method.

**501.6 Positive pressure.** Where an appliance equipped with a mechanical forced draft system creates a positive pressure in the venting system, the venting system shall be designed for positive pressure applications.

**501.7 Connection to fireplace.** Connection of appliances to chimney flues serving fireplaces shall be in accordance with Sections 501.7.1 through 501.7.3.

**501.7.1 Closure and access.** A noncombustible seal shall be provided below the point of connection to prevent entry of room air into the flue. Means shall be provided for access to the flue for inspection and cleaning.

**501.7.2 Connection to factory-built fireplace flue.** An appliance shall not be connected to a flue serving a factory-built fireplace unless the appliance is specifically *listed* for such installation. The connection shall be made in accordance with the appliance manufacturer's installation instructions.

**501.7.3 Connection to masonry fireplace flue.** A connector shall extend from the appliance to the flue serving a masonry fireplace such that the flue gases are exhausted

directly into the flue. The connector shall be accessible or removable for inspection and cleaning of both the connector and the flue. *Listed* direct connection devices shall be installed in accordance with their listing.

**501.8 Appliances not required to be vented.** The following appliances shall not be required to be vented:

1. Ranges.
2. Built-in domestic cooking units *listed* and marked for optional venting.
3. Hot plates and laundry stoves.
4. Type 1 clothes dryers (Type 1 clothes dryers shall be exhausted in accordance with the requirements of Section 614).
5. A single booster-type automatic instantaneous water heater, where designed and used solely for the sanitizing rinse requirements of a dishwashing machine, provided that the heater is installed in a commercial kitchen having a mechanical exhaust system. Where installed in this manner, the draft hood, if required, shall be in place and unaltered and the draft hood *outlet* shall be not less than 36 inches (914 mm) vertically and 6 inches (152 mm) horizontally from any surface other than the heater.
6. Refrigerators.
7. Counter appliances.
8. Room heaters *listed* for unvented use.
9. Direct-fired makeup air heaters.
10. Other appliances *listed* for unvented use and not provided with flue collars.
11. Specialized appliances of limited input such as laboratory burners and gas lights.

Where the appliances listed in Items 5 through 11 are installed so that the aggregate input rating exceeds 20 British thermal units (Btu) per hour per cubic foot (207 watts per m<sup>3</sup>) of volume of the room or space in which such appliances are installed, one or more shall be provided with venting systems or other approved means for conveying the vent gases to the outdoor atmosphere so that the aggregate input rating of the remaining unvented appliances does not exceed 20 Btu per hour per cubic foot (207 watts per m<sup>3</sup>). Where the room or space in which the appliance is installed is directly connected to another room or space by a doorway, archway or other

opening of comparable size that cannot be closed, the volume of such adjacent room or space shall be permitted to be included in the calculations.

**501.9 Chimney entrance.** Connectors shall connect to a masonry chimney flue at a point not less than 12 inches (305 mm) above the lowest portion of the interior of the chimney flue.

**501.10 Connections to exhauster.** *Appliance* connections to a chimney or vent equipped with a power exhauster shall be made on the inlet side of the exhauster. Joints on the positive pressure side of the exhauster shall be sealed to prevent flue-gas leakage as specified by the manufacturer's installation instructions for the exhauster.

**501.11 Masonry chimneys.** Masonry chimneys utilized to vent appliances shall be located, constructed and sized as specified in the manufacturer's installation instructions for the appliances being vented and Section 503.

**501.12 Residential and low-heat appliances flue lining systems.** Flue lining systems for use with residential-type and low-heat appliances shall be limited to the following:

1. Clay flue lining complying with the requirements of ASTM C315 or equivalent. Clay flue lining shall be installed in accordance with the *International Building Code*.
2. *Listed* chimney lining systems complying with UL 1777.
3. Other *approved* materials that will resist, without cracking, softening or corrosion, flue gases and condensate at temperatures up to 1,800°F (982°C).

**501.13 Category I appliance flue lining systems.** Flue lining systems for use with Category I appliances shall be limited to the following:

1. Flue lining systems complying with Section 501.12.
2. Chimney lining systems *listed* and *labeled* for use with gas appliances with draft hoods and other Category I gas appliances *listed* and *labeled* for use with Type B vents.

**501.14 Category II, III and IV appliance venting systems.** The design, sizing and installation of vents for Category II, III and IV appliances shall be in accordance with the *appliance* manufacturer's instructions.

**501.15 Existing chimneys and vents.** Where an *appliance* is permanently disconnected from an existing chimney or vent, or where an *appliance* is connected to an existing chimney or vent during the process of a new installation, the chimney or vent shall comply with Sections 501.15.1 through 501.15.4.

**501.15.1 Size.** The chimney or vent shall be resized as necessary to control flue gas condensation in the interior of the chimney or vent and to provide the *appliance* or appliances served with the required draft. For Category I appliances, the resizing shall be in accordance with Section 502.

**501.15.2 Flue passageways.** The flue gas passageway shall be free of obstructions and combustible deposits and shall be cleaned if previously used for venting a solid or liquid fuel-burning *appliance* or *fireplace*. The flue liner,

chimney inner wall or vent inner wall shall be continuous and shall be free of cracks, gaps, perforations or other damage or deterioration that would allow the escape of combustion products, including gases, moisture and creosote.

**501.15.3 Cleanout.** Masonry chimney flues shall be provided with a cleanout opening having a minimum height of 6 inches (152 mm). The upper edge of the opening shall be located not less than 6 inches (152 mm) below the lowest chimney inlet opening. The cleanout shall be provided with a tight-fitting, noncombustible cover.

**501.15.4 Clearances.** Chimneys and vents shall have airspace *clearance* to combustibles in accordance with the *International Building Code* and the chimney or vent manufacturer's installation instructions.

**Exception:** Masonry chimneys without the required airspace clearances shall be permitted to be used if lined or relined with a chimney lining system *listed* for use in chimneys with reduced clearances in accordance with UL 1777. The chimney *clearance* shall be not less than permitted by the terms of the chimney liner listing and the manufacturer's instructions.

**501.15.4.1 Fireblocking.** Noncombustible fireblocking shall be provided in accordance with the *International Building Code*.

## SECTION 502 (IFGC) VENTS

**502.1 General.** Vents, except as provided in Section 503.7, shall be *listed* and *labeled*. Type B and BW vents shall be tested in accordance with UL 441. Type L vents shall be tested in accordance with UL 641. Vents for Category II and III appliances shall be tested in accordance with UL 1738. Plastic vents for Category IV appliances shall not be required to be *listed* and *labeled* where such vents are as specified by the *appliance* manufacturer and are installed in accordance with the *appliance* manufacturer's instructions.

**502.2 Connectors required.** Connectors shall be used to connect appliances to the vertical chimney or vent, except where the chimney or vent is attached directly to the *appliance*. Vent connector size, material, construction and installation shall be in accordance with Section 503.

**502.3 Vent application.** The application of vents shall be in accordance with Table 503.4.

**502.4 Insulation shield.** Where vents pass through insulated assemblies, an insulation shield constructed of steel having a minimum thickness of 0.0187 inch (0.4712 mm) (No. 26 gage) shall be installed to provide *clearance* between the vent and the insulation material. The *clearance* shall be not less than the *clearance* to combustibles specified by the vent manufacturer's installation instructions. Where vents pass through attic space, the shield shall terminate not less than 2 inches (51 mm) above the insulation materials and shall be secured in place to prevent displacement. Insulation shields provided as part of a *listed* vent system shall be installed in accordance with the manufacturer's instructions.



**502.5 Installation.** Vent systems shall be sized, installed and terminated in accordance with the vent and *appliance* manufacturer's installation instructions and Section 503.

**502.6 Support of vents.** All portions of vents shall be adequately supported for the design and weight of the materials employed.

**502.7 Protection against physical damage.** In concealed locations, where a vent is installed through holes or notches in studs, joists, rafters or similar members less than 1½ inches (38 mm) from the nearest edge of the member, the vent shall be protected by shield plates. Protective steel shield plates having a minimum thickness of 0.0575 inch (1.463 mm) (No. 16 gage) shall cover the area of the vent where the member is notched or bored and shall extend not less than 4 inches (102 mm) above sole plates, below top plates and to each side of a stud, joist or rafter.

**502.7.1 Door swing.** Appliance and equipment vent terminals shall be located such that doors cannot swing within 12 inches (305 mm) horizontally of the vent terminal. Door stops or closers shall not be installed to obtain this clearance.

## SECTION 503 (IFGS) VENTING OF APPLIANCES

**503.1 General.** The venting of appliances shall be in accordance with Sections 503.2 through 503.16.

**503.2 Venting systems required.** Except as permitted in Sections 501.8 and 503.2.1 through 503.2.4, all appliances shall be connected to venting systems.

**503.2.1 Ventilating hoods.** The use of ventilating hoods and exhaust systems to vent appliances shall be limited to industrial appliances and appliances installed in commercial applications.

**503.2.2 Well-ventilated spaces.** The flue gases from industrial-type appliances shall not be required to be vented to the outdoors where such gases are discharged into a large and well-ventilated industrial space.

**503.2.3 Direct-vent appliances.** *Listed direct-vent appliances* shall be installed in accordance with the manufacturer's instructions and Section 503.8, Item 3.

**503.2.4 Appliances with integral vents.** Appliances incorporating integral venting means shall be installed in accordance with the manufacturer's instructions and Section 503.8, Items 1 and 2.

**503.2.5 Incinerators.** Commercial-industrial-type incinerators shall be vented in accordance with NFPA 82.

**503.3 Design and construction.** Venting systems shall be designed and constructed so as to convey all flue and vent gases to the outdoors.

**503.3.1 Appliance draft requirements.** A venting system shall satisfy the draft requirements of the *appliance* in accordance with the manufacturer's instructions.

**503.3.2 Design and construction.** Appliances required to be vented shall be connected to a venting system designed

and installed in accordance with the provisions of Sections 503.4 through 503.16.

**503.3.3 Mechanical draft systems.** Mechanical draft systems shall comply with the following:

1. Mechanical draft systems shall be *listed* in accordance with UL 378 and shall be installed in accordance with the manufacturer's instructions for both the *appliance* and the mechanical draft system.
2. Appliances requiring venting shall be permitted to be vented by means of mechanical draft systems of either forced or induced draft design.
3. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to prevent leakage of flue or vent gases into a building.
4. Vent connectors serving appliances vented by natural draft shall not be connected to any portion of mechanical draft systems operating under positive pressure.
5. Where a mechanical draft system is employed, provisions shall be made to prevent the flow of gas to the main burners when the draft system is not performing so as to satisfy the operating requirements of the *appliance* for safe performance.
6. The exit terminals of mechanical draft systems shall be not less than 7 feet (2134 mm) above finished ground level where located adjacent to public walkways and shall be located as specified in Section 503.8, Items 1 and 2.

**503.3.4 Ventilating hoods and exhaust systems.** Where automatically operated appliances, other than commercial cooking appliances, are vented through a ventilating hood or exhaust system equipped with a damper or with a power means of exhaust, provisions shall be made to allow the flow of gas to the main burners only when the damper is open to a position to properly vent the *appliance* and when the power means of exhaust is in operation.

**503.3.5 Air ducts and furnace plenums.** Venting systems shall not extend into or pass through any fabricated air duct or *furnace plenum*.

**503.3.6 Above-ceiling air-handling spaces.** Where a venting system passes through an above-ceiling air-handling space or other nonducted portion of an air-handling system, the venting system shall conform to one of the following requirements:

1. The venting system shall be a *listed* special gas vent; other venting system serving a Category III or Category IV *appliance*; or other positive pressure vent, with joints sealed in accordance with the *appliance* or vent manufacturer's instructions.
2. The venting system shall be installed such that fittings and joints between sections are not installed in the above-ceiling space.
3. The venting system shall be installed in a conduit or enclosure with sealed joints separating the interior of the conduit or enclosure from the ceiling space.

**503.4 Type of venting system to be used.** The type of venting system to be used shall be in accordance with Table 503.4.

**503.4.1 Plastic piping.** Where plastic piping is used to vent an appliance, the appliance shall be listed for use with such venting materials and the appliance manufacturer's installation instructions shall identify the specific plastic piping material. The plastic pipe venting materials shall be labeled in accordance with the product standards specified by the appliance manufacturer or shall be listed and labeled in accordance with UL 1738.

**503.4.1.1 Plastic vent joints.** Plastic pipe and fittings used to vent appliances shall be installed in accordance with the *appliance* manufacturer's instructions. Plastic pipe venting materials *listed* and labeled in accordance with UL 1738 shall be installed in accordance with the vent manufacturer's instructions. Where a primer is required, it shall be of a contrasting color.

**503.4.2 Special gas vent.** Special gas vent shall be *listed* and labeled in accordance with UL 1738 and installed in accordance with the special gas vent manufacturer's instructions.

**503.5 Masonry, metal and factory-built chimneys.** Masonry, metal and factory-built chimneys shall comply with Sections 503.5.1 through 503.5.11.

**503.5.1 Factory-built chimneys.** Factory-built chimneys shall be *listed* in accordance with UL 103 and installed in accordance with the manufacturer's instructions. Factory-built chimneys used to vent appliances that operate at a positive vent pressure shall be *listed* for such application.

**503.5.2 Metal chimneys.** Metal chimneys shall be built and installed in accordance with NFPA 211.

**503.5.3 Masonry chimneys.** Masonry chimneys shall be built and installed in accordance with NFPA 211 and shall

be lined with an *approved* clay flue lining, a chimney lining system *listed* and labeled in accordance with UL 1777 or other *approved* material that will resist corrosion, erosion, softening or cracking from vent gases at temperatures up to 1,800°F (982°C).

**Exception:** Masonry chimney flues serving *listed* gas appliances with draft hoods, Category I appliances and other gas appliances *listed* for use with Type B vents shall be permitted to be lined with a chimney lining system specifically *listed* for use only with such appliances. The liner shall be installed in accordance with the liner manufacturer's instructions. A permanent identifying label shall be attached at the point where the connection is to be made to the liner. The label shall read: "This chimney liner is for appliances that burn gas only. Do not connect to solid or liquid fuel-burning appliances or incinerators."

For installation of gas vents in existing masonry chimneys, see Section 503.6.4.

**503.5.4 Chimney termination.** Chimneys for residential-type or low-heat appliances shall extend not less than 3 feet (914 mm) above the highest point where they pass through a roof of a building and not less than 2 feet (610 mm) higher than any portion of a building within a horizontal distance of 10 feet (3048 mm). Chimneys for medium-heat appliances shall extend not less than 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm). Chimneys shall extend not less than 5 feet (1524 mm) above the highest connected *appliance* draft hood outlet or flue collar. Decorative shrouds shall not be installed at the termination of factory-built chimneys except where such shrouds are *listed* and *labeled* for use with the specific factory-built chimney system and are installed in accordance with the manufacturer's instructions.

**TABLE 503.4  
TYPE OF VENTING SYSTEM TO BE USED**

APPLIANCES	TYPE OF VENTING SYSTEM
Listed Category I appliances Listed appliances equipped with draft hood Appliances listed for use with Type B gas vent	Type B gas vent (Section 503.6) Chimney (Section 503.5) Single-wall metal pipe (Section 503.7) Listed chimney lining system for gas venting (Section 503.5.3) Special gas vent listed for these appliances (Section 503.4.2)
Listed vented wall furnaces	Type B-W gas vent (Sections 503.6, 608)
Category II, Category III and Category IV appliances	As specified or furnished by manufacturers of listed appliances (Sections 503.4.1, 503.4.2)
Incinerators	In accordance with NFPA 82
Appliances that can be converted for use with solid fuel	Chimney (Section 503.5)
Unlisted combination gas and oil-burning appliances	Chimney (Section 503.5)
Listed combination gas and oil-burning appliances	Type L vent (Section 503.6) or chimney (Section 503.5)
Combination gas and solid fuel-burning appliances	Chimney (Section 503.5)
Appliances listed for use with chimneys only	Chimney (Section 503.5)
Unlisted appliances	Chimney (Section 503.5)
Decorative appliances in vented fireplaces	Chimney
Gas-fired toilets	Single-wall metal pipe (Section 626)
Direct-vent appliances	See Section 503.2.3
Appliances with integral vent	See Section 503.2.4

**503.5.5 Size of chimneys.** The effective area of a chimney venting system serving *listed* appliances with draft hoods, Category I appliances and other appliances *listed* for use with Type B vents shall be determined in accordance with one of the following methods:

1. The provisions of Section 504.
2. For sizing an individual chimney venting system for a single *appliance* with a draft hood, the effective areas of the vent connector and chimney flue shall be not less than the area of the *appliance* flue collar or draft hood outlet, nor greater than seven times the draft hood outlet area.
3. For sizing a chimney venting system connected to two appliances with draft hoods, the effective area of the chimney flue shall be not less than the area of the larger draft hood outlet plus 50 percent of the area of the smaller draft hood outlet, nor greater than seven times the smallest draft hood outlet area.
4. Chimney venting systems using mechanical draft shall be sized in accordance with *approved* engineering methods.
5. Other *approved* engineering methods.

**503.5.6 Inspection of chimneys.** Before replacing an existing *appliance* or connecting a vent connector to a chimney, the chimney passageway shall be examined to ascertain that it is clear and free of obstructions and it shall be cleaned if previously used for venting solid or liquid fuel-burning appliances or fireplaces.

**503.5.6.1 Chimney lining.** Chimneys shall be lined in accordance with NFPA 211.

**Exception:** Where an existing chimney complies with Sections 503.5.6 through 503.5.6.3 and its sizing is in accordance with Section 503.5.5, its continued use shall be allowed where the *appliance* vented by such chimney is replaced by an *appliance* of similar type, input rating and efficiency.

**503.5.6.2 Cleanouts.** Cleanouts shall be examined and where they do not remain tightly closed when not in use, they shall be repaired or replaced.

**503.5.6.3 Unsafe chimneys.** Where inspection reveals that an existing chimney is not safe for the intended application, it shall be repaired, rebuilt, lined, relined or replaced with a vent or chimney to conform to NFPA 211 and it shall be suitable for the appliances to be vented.

**503.5.7 Chimneys serving appliances burning other fuels.** Chimneys serving *appliances* burning other fuels shall comply with Sections 503.5.7.1 through 503.5.7.4.

**503.5.7.1 Solid fuel-burning appliances.** An *appliance* shall not be connected to a chimney flue serving a separate *appliance* designed to burn solid fuel.

**503.5.7.2 Liquid fuel-burning appliances.** Where one chimney flue serves gas appliances and liquid fuel-burning appliances, the appliances shall be connected through separate openings or shall be connected through a single opening where joined by a suitable fit-

ting located as close as practical to the chimney. Where two or more openings are provided into one chimney flue, they shall be at different levels. Where the appliances are automatically controlled, they shall be equipped with safety shutoff devices.

**503.5.7.3 Combination gas- and solid fuel-burning appliances.** A combination gas- and solid fuel-burning *appliance* shall be permitted to be connected to a single chimney flue where equipped with a manual reset device to shut off gas to the main burner in the event of sustained backdraft or flue gas spillage. The chimney flue shall be sized to properly vent the *appliance*.

**503.5.7.4 Combination gas- and oil fuel-burning appliances.** Where a single chimney flue serves a *listed* combination gas- and oil fuel-burning *appliance*, such flue shall be sized in accordance with appliance manufacturer's instructions.

**503.5.8 Support of chimneys.** All portions of chimneys shall be supported for the design and weight of the materials employed. Factory-built chimneys shall be supported and spaced in accordance with the manufacturer's installation instructions.

**503.5.9 Cleanouts.** Where a chimney that formerly carried flue products from liquid or solid fuel-burning appliances is used with an *appliance* using fuel gas, an accessible cleanout shall be provided. The cleanout shall have a tight-fitting cover and shall be installed so its upper edge is not less than 6 inches (152 mm) below the lower edge of the lowest chimney inlet opening.

**503.5.10 Space surrounding lining or vent.** The remaining space surrounding a chimney liner, gas vent, special gas vent or plastic *piping* installed within a masonry chimney flue shall not be used to vent another *appliance*. The insertion of another liner or vent within the chimney as provided in this code and the liner or vent manufacturer's instructions shall not be prohibited.

The remaining space surrounding a chimney liner, gas vent, special gas vent or plastic *piping* installed within a masonry, metal or factory-built chimney shall not be used to supply *combustion air*. Such space shall not be prohibited from supplying *combustion air* to *direct-vent appliances* designed for installation in a solid fuel-burning *fireplace* and installed in accordance with the manufacturer's instructions.

**503.5.11 Insulation shield.** Where a factory-built chimney passes through insulated assemblies, an insulation shield constructed of steel having a thickness of not less than 0.0187 inch (0.475 mm) shall be installed to provide clearance between the chimney and the insulation material. The clearance shall be not less than the clearance to combustibles specified by the chimney manufacturer's installation instructions. Where chimneys pass through attic space, the shield shall terminate not less than 2 inches (51 mm) above the installation materials and shall be secured in place to prevent displacement. Insulation shields provided as part of a listed chimney system shall be installed in accordance with the manufacturer's installation instructions.



**503.6 Gas vents.** Gas vents shall comply with Sections 503.6.1 through 503.6.14 (see Section 202, General Definitions).

**503.6.1 Materials.** Type B and BW gas vents shall be listed in accordance with UL 441. Vents for listed combination gas- and oil-burning appliances shall be listed in accordance with UL 641.

**503.6.2 Installation, general.** Gas vents shall be installed in accordance with the manufacturer's instructions.

**503.6.3 Type B-W vent capacity.** A Type B-W gas vent shall have a *listed* capacity not less than that of the *listed* vented wall furnace to which it is connected.

**503.6.4 Gas vents installed within masonry chimneys.** Gas vents installed within masonry chimneys shall be installed in accordance with the manufacturer's instructions. Gas vents installed within masonry chimneys shall be identified with a permanent label installed at the point where the vent enters the chimney. The label shall contain the following language: "This gas vent is for appliances that burn gas. Do not connect to solid or liquid fuel-burning appliances or incinerators."

**503.6.5 Gas vent terminations.** A gas vent shall terminate in accordance with one of the following:

1. Gas vents that are 12 inches (305 mm) or less in size and located not less than 8 feet (2438 mm) from a vertical wall or similar obstruction shall terminate above the roof in accordance with Figure 503.6.5.
2. Gas vents that are over 12 inches (305 mm) in size or are located less than 8 feet (2438 mm) from a vertical wall or similar obstruction shall terminate not less than 2 feet (610 mm) above the highest point where they pass through the roof and not less than 2 feet (610 mm) above any portion of a building within 10 feet (3048 mm) horizontally.
3. As provided for industrial appliances in Section 503.2.2.
4. As provided for direct-vent systems in Section 503.2.3.
5. As provided for appliances with integral vents in Section 503.2.4.
6. As provided for mechanical draft systems in Section 503.3.3.
7. As provided for ventilating hoods and exhaust systems in Section 503.3.4.

**503.6.5.1 Decorative shrouds.** Decorative shrouds shall not be installed at the termination of gas vents except where such shrouds are *listed* for use with the specific gas venting system and are installed in accordance with manufacturer's instructions.

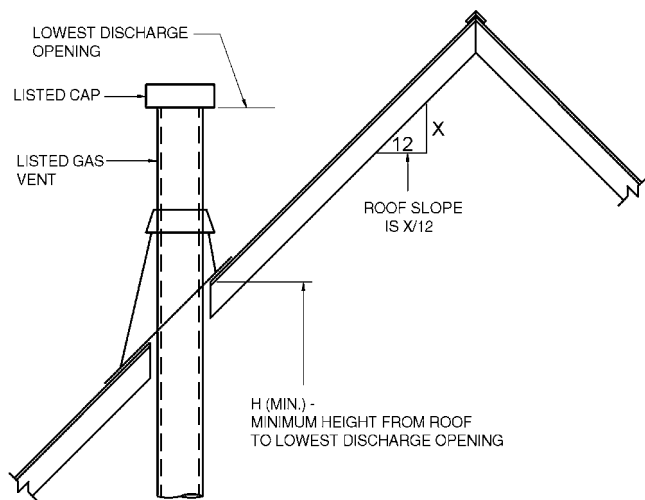
**503.6.6 Minimum height.** A Type B or L gas vent shall terminate not less than 5 feet (1524 mm) in vertical height above the highest connected *appliance* draft hood or flue collar. A Type B-W gas vent shall terminate not less than 12 feet (3658 mm) in vertical height above the bottom of the wall furnace.

**503.6.7 Roof terminations.** Gas vents shall extend through the roof flashing, roof jack or roof thimble and terminate with a *listed* cap or *listed* roof assembly.

**503.6.8 Forced air inlets.** Gas vents shall terminate not less than 3 feet (914 mm) above any forced air inlet located within 10 feet (3048 mm).

**503.6.9 Exterior wall penetrations.** A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets, except as provided in Sections 503.2.3 and 503.3.3.

**503.6.10 Size of gas vents.** Venting systems shall be sized and constructed in accordance with Sections 503.6.10.1 through 503.6.10.4 and the *appliance* manufacturer's installation instructions.



ROOF SLOPE	H (min) ft
Flat to 6/12	1.0
Over 6/12 to 7/12	1.25
Over 7/12 to 8/12	1.5
Over 8/12 to 9/12	2.0
Over 9/12 to 10/12	2.5
Over 10/12 to 11/12	3.25
Over 11/12 to 12/12	4.0
Over 12/12 to 14/12	5.0
Over 14/12 to 16/12	6.0
Over 16/12 to 18/12	7.0
Over 18/12 to 20/12	7.5
Over 20/12 to 21/12	8.0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE 503.6.5**  
TERMINATION LOCATIONS FOR GAS VENTS WITH  
LISTED CAPS 12 INCHES OR LESS IN SIZE  
NOT LESS THAN 8 FEET FROM A VERTICAL WALL

**503.6.10.1 Category I appliances.** The sizing of natural draft venting systems serving one or more *listed* appliances equipped with a draft hood or appliances *listed* for use with Type B gas vent, installed in a single story of a building, shall be in accordance with one of the following methods:

1. The provisions of Section 504.
2. For sizing an individual gas vent for a single, draft-hood-equipped *appliance*, the effective area of the vent connector and the gas vent shall be not less than the area of the *appliance* draft hood outlet, nor greater than seven times the draft hood outlet area.
3. For sizing a gas vent connected to two appliances with draft hoods, the effective area of the vent shall be not less than the area of the larger draft hood outlet plus 50 percent of the area of the smaller draft hood outlet, nor greater than seven times the smaller draft hood outlet area.
4. *Approved* engineering practices.

**503.6.10.2 Vent offsets.** Type B and L vents sized in accordance with Item 2 or 3 of Section 503.6.10.1 shall extend in a generally vertical direction with offsets not exceeding 45 degrees (0.79 rad), except that a vent system having not more than one 60-degree (1.04 rad) *offset* shall be permitted. Any angle greater than 45 degrees (0.79 rad) from the vertical is considered horizontal. The total horizontal distance of a vent plus the horizontal vent connector serving draft-hood-equipped appliances shall be not greater than 75 percent of the vertical height of the vent.

**503.6.10.3 Category II, III and IV appliances.** The sizing of gas vents for Category II, III and IV appliances shall be in accordance with the *appliance* manufacturer's instructions. The sizing of plastic pipe that is specified by the appliance manufacturer as a venting material for Category II, III and IV appliances shall be in accordance with the manufacturer's instructions.

**503.6.10.4 Mechanical draft.** Chimney venting systems using mechanical draft shall be sized in accordance with *approved* engineering methods.

**503.6.11 Gas vents serving appliances on more than one floor.** A common vent shall be permitted in multistory installations to vent Category I appliances located on more than one floor level, provided that the venting system is designed and installed in accordance with *approved* engineering methods. For the purpose of this section, crawl spaces, basements and attics shall be considered to be floor levels.

**503.6.11.1 Appliance separation.** Appliances connected to the common vent shall be located in rooms separated from occupiable space. Each of these rooms shall have provisions for an adequate supply of combustion, ventilation and dilution air that is not supplied from an occupiable space.

**503.6.11.2 Sizing.** The size of the connectors and common segments of multistory venting systems for appliances *listed* for use with Type B double-wall gas vents shall be in accordance with Table 504.3(1), provided that:

1. The available total height (*H*) for each segment of a multistory venting system is the vertical distance between the level of the highest draft hood outlet or flue collar on that floor and the centerline of the next highest interconnection tee.
2. The size of the connector for a segment is determined from the *appliance* input rating and available connector rise and shall be not smaller than the draft hood outlet or flue collar size.
3. The size of the common vertical segment, and of the interconnection tee at the base of that segment, shall be based on the total *appliance* input rating entering that segment and its available total height.

**503.6.12 Support of gas vents.** Gas vents shall be supported and spaced in accordance with the manufacturer's installation instructions.

**503.6.13 Marking.** In those localities where solid and liquid fuels are used extensively, gas vents shall be permanently identified by a label attached to the wall or ceiling at a point where the vent connector enters the gas vent. The determination of where such localities exist shall be made by the code official. 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."

**503.6.14 Fastener penetrations.** Screws, rivets and other fasteners shall not penetrate the inner wall of double-wall gas vents, except at the transition from an *appliance* draft hood outlet, a flue collar or a single-wall metal connector to a double-wall vent.

**503.7 Single-wall metal pipe.** Single-wall metal pipe vents shall comply with Sections 503.7.1 through 503.7.13.

**503.7.1 Construction.** Single-wall metal pipe shall be constructed of galvanized sheet steel not less than 0.0304 inch (0.7 mm) thick, or other *approved*, noncombustible, corrosion-resistant material.

**503.7.2 Cold climate.** Uninsulated single-wall metal pipe shall not be used outdoors for venting appliances in regions where the 99-percent winter design temperature is below 32°F (0°C).

**503.7.3 Termination.** Single-wall metal pipe shall terminate not less than 5 feet (1524 mm) in vertical height above the highest connected *appliance* draft hood outlet or flue collar. Single-wall metal pipe shall extend not less than 2 feet (610 mm) above the highest point where it passes through a roof of a building and not less than 2 feet (610 mm) higher than any portion of a building within a horizontal distance of 10 feet (3048 mm). An *approved* cap or roof assembly shall be attached to the terminus of a single-wall metal pipe.

**503.7.4 Limitations of use.** 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 outdoor atmosphere.

**503.7.5 Roof penetrations.** A pipe passing through a roof shall extend without interruption through the roof flashing, roof jack or roof thimble. Where a single-wall metal pipe passes through a roof constructed of *combustible material*, a noncombustible, nonventilating thimble shall be used at the point of passage. The thimble shall extend not less than 18 inches (457 mm) above and 6 inches (152 mm) below the roof with the annular space open at the bottom and closed only at the top. The thimble shall be sized in accordance with Section 503.7.7.

**503.7.6 Installation.** 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 floor. The installation of a single-wall metal pipe through an exterior combustible wall shall comply with Section 503.7.7.

**503.7.7 Single-wall penetrations of combustible walls.** A single-wall metal pipe shall not pass through a combustible exterior wall unless guarded at the point of passage by a ventilated metal thimble not smaller than the following:

1. For *listed* appliances with draft hoods and appliances *listed* for use with Type B gas vents, the thimble shall be not less than 4 inches (102 mm) larger in diameter than the metal pipe. Where there is a run of not less than 6 feet (1829 mm) of metal pipe in the open between the draft hood outlet and the thimble, the thimble shall be permitted to be not less than 2 inches (51 mm) larger in diameter than the metal pipe.
2. For unlisted appliances having draft hoods, the thimble shall be not less than 6 inches (152 mm) larger in diameter than the metal pipe.
3. For residential and low-heat appliances, the thimble shall be not less than 12 inches (305 mm) larger in diameter than the metal pipe.

**Exception:** In lieu of thimble protection, all *combustible material* in the wall shall be removed a sufficient distance from the metal pipe to provide the specified *clearance* from such metal pipe to *combustible material*. Any material used to close up such opening shall be noncombustible.

**503.7.8 Clearances.** Minimum clearances from single-wall metal pipe to *combustible material* shall be in accordance with Table 503.10.5. The *clearance* from single-wall metal pipe to *combustible material* shall be permitted to be reduced where the *combustible material* is protected as specified for vent connectors in Table 308.2.

**503.7.9 Size of single-wall metal pipe.** A venting system constructed of single-wall metal pipe shall be sized in accordance with one of the following methods and the appliance manufacturer's instructions:

1. For a draft-hood-equipped *appliance*, in accordance with Section 504.

2. For a venting system for a single *appliance* with a draft hood, the areas of the connector and the pipe each shall be not less than the area of the *appliance* flue collar or draft hood outlet, whichever is smaller. The vent area shall be not greater than seven times the draft hood outlet area.

3. Other *approved* engineering methods.

**503.7.10 Pipe geometry.** Any shaped single-wall metal pipe shall be permitted to be used, provided that its equivalent effective area is equal to the effective area of the round pipe for which it is substituted, and provided that the minimum internal dimension of the pipe is not less than 2 inches (51 mm).

**503.7.11 Termination capacity.** The vent cap or a roof assembly shall have a venting capacity of not less than that of the pipe to which it is attached.

**503.7.12 Support of single-wall metal pipe.** All portions of single-wall metal pipe shall be supported for the design and weight of the material employed.

**503.7.13 Marking.** Single-wall metal pipe shall comply with the marking provisions of Section 503.6.13.

**503.8 Venting system termination location.** The location of venting system terminations shall comply with the following (see Appendix C):

1. A mechanical draft venting system shall terminate not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).

**Exceptions:**

1. This provision shall not apply to the *combustion air* intake of a direct-vent *appliance*.
2. This provision shall not apply to the separation of the integral outdoor air inlet and flue gas discharge of *listed* outdoor appliances.
2. A mechanical draft venting system, excluding *direct-vent appliances*, shall terminate not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from, or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.
3. The clearances for through-the-wall, direct-vent terminals shall be in accordance with Table 503.8. The bottom of the vent terminal and the air intake shall be located not less than 12 inches (305 mm) above finished ground level.
4. Through-the-wall vents for Category II and IV appliances and noncategorized condensing 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*. Where local experience indicates that condensate is a problem with Category I and III appliances, this provision shall also apply. Drains for condensate shall be installed in accordance with the appliance and vent manufacturers' instructions.
5. Vent systems for Category IV appliances that terminate through an outside wall of a building and discharge flue