

11.6* Checking the Draft. Draft hood-equipped appliances shall be checked to verify that there is no draft hood spillage after 5 minutes of main burner operation.

11.7 Operating Instructions. Operating instructions shall be furnished and shall be left in a prominent position near the appliance for use by the consumer.

Chapter 12 Venting of Appliances

12.1* Minimum Safe Performance. Venting systems shall be designed and constructed to convey all flue and vent gases to the outdoors.

12.2 General.

12.2.1 Installation. Listed chimneys and vents shall be installed in accordance with Chapter 12 and the manufacturers' installation instructions.

12.3 Specification for Venting.

12.3.1 Connection to Venting Systems. Except as permitted in 12.3.2 through 12.3.6, all appliances shall be connected to venting systems.

12.3.2 Appliances Not Required to Be Vented. The following appliances shall not be required to be vented:

- (1) Listed ranges
- (2) Built-in domestic cooking units listed and marked for optional venting
- (3) Listed hot plates
- (4) Listed Type 1 clothes dryers exhausted in accordance with Section 10.4
- (5) A single listed booster-type (automatic instantaneous) water heater, when designed and used solely for the sanitizing rinse requirements of a dishwashing machine, provided that the appliance is installed with the draft hood in place and unaltered, if a draft hood is required, in a commercial kitchen having a mechanical exhaust system [Where installed in this manner, the draft hood outlet shall not be less than 36 in. (910 mm) vertically and 6 in. (150 mm) horizontally from any surface other than the appliance.]
- (6) Listed refrigerators
- (7) Counter appliances
- (8) Room heaters listed for unvented use
- (9) Direct gas-fired make-up 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 or gas lights

12.3.2.1 Where any or all of the appliances in 12.3.2(5) through 12.3.2(11) are installed so the aggregate input rating exceeds 20 Btu/hr/ft³ (207 W/m³) of room or space in which it is installed, one or more shall be provided with venting systems or other approved means for conveying the vent gases to the outdoors so that the aggregate input rating of the remaining unvented appliances does not exceed 20 Btu/hr/ft³ (207 W/m³).

12.3.2.2 Where the calculation includes the volume of an adjacent room or space, the room or space in which the appliances are installed shall be directly connected to the adjacent room or space by a doorway, archway, or other opening of comparable size that cannot be closed.

12.3.3* 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.

12.3.4 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.

Δ 12.3.5 Direct Vent Appliances.

N 12.3.5.1 Listed direct vent appliances shall be installed in accordance with the manufacturer's installation instructions.

N 12.3.5.2 Through-the-wall vent terminations for listed direct vent appliances shall be in accordance with 12.9.1.

Δ 12.3.6 Appliances with Integral Vents. Appliances incorporating integral venting means shall be installed in accordance with 12.9.1.

Δ 12.3.7 Incinerators. Incinerators shall be vented in accordance with NFPA 82.

12.4 Design and Construction.

12.4.1 Appliance Draft Requirements. A venting system shall satisfy the draft requirements of the appliance in accordance with the manufacturer's instructions.

12.4.2 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 12.5 through 12.16.

12.4.3 Mechanical Draft Systems.

12.4.3.1 Mechanical draft systems shall be listed in accordance with UL 378, *Draft Equipment*, and installed in accordance with both the appliance and the mechanical draft system manufacturer's installation instructions.

12.4.3.2 Appliances requiring venting shall be permitted to be vented by means of mechanical draft systems of either forced or induced draft design.

12.4.3.3 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.

12.4.3.4 Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.

12.4.3.5 Where a mechanical draft system is employed, provision 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.

• 12.4.4* Ventilating Hoods and Exhaust Systems.

12.4.4.1 Where automatically operated appliances, other than food service 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.

12.4.5 Circulating Air Ducts, Above-Ceiling Air-Handling Spaces, and Furnace Plenums.

12.4.5.1 Venting systems shall not extend into or pass through any fabricated air duct or furnace plenum.

12.4.5.2 Where a venting system passes through an above-ceiling air space or other nonducted portion of an air-handling system, it shall conform to one of the following requirements:

- (1) The venting system shall be a listed special gas vent, other 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 vent system shall be installed such that no fittings or joints between sections are installed in the above-ceiling space.
- (3) The venting system shall be installed in a conduit or enclosure with joints between the interior of the enclosure and the ceiling space sealed.

12.5 Type of Venting System to Be Used.

12.5.1 The type of venting system to be used shall be in accordance with Table 12.5.1.

Δ 12.5.2 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, *Venting Systems for Gas-Burning Appliances, Categories II, III, and IV*.

Δ 12.5.3 Plastic Vent Joints. Plastic pipe and fittings used to vent appliances shall be installed in accordance with the appliance manufacturer's installation instructions. Plastic pipe venting materials listed and labeled in accordance with UL 1738, *Venting Systems for Gas-Burning Appliances, Categories II, III, and IV*, shall be installed in accordance with the vent manufacturer's installation instructions. Where primer is required, it shall be of a contrasting color.

Δ 12.5.4 Special Gas Vents. Special gas vents shall be listed and labeled in accordance with UL 1738, *Venting Systems for Gas-Burning Appliances, Categories II, III, and IV*, and installed in accordance with the special gas vent manufacturer's installation instructions.

12.6 Masonry, Metal, and Factory-Built Chimneys.

12.6.1 Listing or Construction.

Δ 12.6.1.1 Factory-built chimneys shall be listed in accordance with UL 103, *Chimneys, Factory-Built, Residential Type and Building Heating Appliances*; UL 959, *Medium Heat Appliance Factory-Built Chimneys*; or UL 2561, *1400 Degree Fahrenheit Factory-Built Chimneys*. Factory-built chimneys used to vent appliances that operate at positive vent pressure shall be listed for such application.

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

Δ Table 12.5.1 Type of Venting System to Be Used

Appliances	Type of Venting System	Location of Requirements
Listed Category I appliances	Type B gas vent	12.7
Listed appliances equipped with draft hood	Chimney	12.6
Appliances listed for use with Type B gas vent	Single-wall metal pipe	12.8
	Listed chimney lining system for gas venting	12.6.1.3
	Special gas vent listed for these appliances	12.5.4
Listed vented wall furnaces	Type B-W gas vent	12.7, 10.25
Category II, Category III, and Category IV appliances	As specified or furnished by manufacturers of listed appliances	12.5.2, 12.5.4
Incinerators	In accordance with NFPA 82	
Appliances that can be converted to use solid fuel		
Unlisted combination gas- and oil-burning appliances		
Combination gas- and solid fuel-burning appliances	Chimney	12.6
Appliances listed for use with chimneys only		
Unlisted appliances		
Listed combination gas- and oil-burning appliances	Type L vent	12.7
	Chimney	12.6
Decorative appliance in vented fireplace	Chimney	10.6.3
Gas-fired toilets	Single-wall metal pipe	12.8, 10.23.3
Direct vent appliances		12.3.5
Appliances with integral vents		12.3.6

▲ **12.6.1.3*** Masonry chimneys shall be built and installed in accordance with NFPA 211 and lined with one of the following:

- (1) Approved clay flue lining
- (2) A chimney lining system listed and labeled in accordance with UL 1777, *Chimney Liners*
- (3) Other approved material that resists corrosion, erosion, softening, or cracking from vent gases at temperatures up to 1800°F (982°C)

Exception: Masonry chimney flues lined with a chimney lining system specifically listed for use with listed appliances with draft hoods, Category I appliances, and other appliances listed for use with Type B vents shall be permitted. The liner shall be installed in accordance with the liner manufacturer's installation 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."

12.6.2 Termination.

12.6.2.1* A chimney for residential-type or low-heat appliances shall extend at least 3 ft (0.9 m) above the highest point where it passes through a roof of a building and at least 2 ft (0.6 m) higher than any portion of a building within a horizontal distance of 10 ft (3 m).

12.6.2.2 A chimney for medium-heat appliances shall extend at least 10 ft (3 m) higher than any portion of any building within 25 ft (7.6 m).

12.6.2.3 A chimney shall extend at least 5 ft (1.5 m) above the highest connected appliance draft hood outlet or flue collar.

12.6.2.4 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 manufacturers' installation instructions.

12.6.3 Size of Chimneys.

▲ **12.6.3.1** 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 in accordance with one of the following methods:

- (1) Those listed in Chapter 13.
- (2) The effective areas of the vent connector and chimney flue of a venting system serving a single appliance with a draft hood shall be not less than the area of the appliance flue collar or draft hood outlet or greater than seven times the draft hood outlet area.
- (3) The effective area of the chimney flue of a venting system serving two appliances with draft hoods 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 or greater than seven times the smaller draft hood outlet area.
- (4) Chimney venting systems using mechanical draft shall be sized in accordance with engineering methods.
- (5) Other engineering methods.

12.6.4 Inspection of Chimneys.

12.6.4.1 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 shall be cleaned if previously used for venting solid or liquid fuel-burning appliances or fireplaces.

▲ **12.6.4.2** Chimneys shall be lined in accordance with NFPA 211.

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

12.6.4.4 When 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 shall be suitable for the appliances to be attached.

12.6.5 Chimney Serving Appliances Burning Other Fuels.

12.6.5.1 An appliance shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.

12.6.5.2 Where one chimney serves gas appliances and liquid fuel-burning appliances, the appliances shall be connected through separate openings or connected through a single opening where joined by a suitable fitting 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 gas appliance is automatically controlled, it shall be equipped with a safety shutoff device.

12.6.5.3* A listed combination gas- and solid fuel-burning appliance connected to a single chimney flue shall be 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.

12.6.5.4 A single chimney flue serving a listed combination gas- and oil-burning appliance shall be sized in accordance with the appliance manufacturer's instructions.

12.6.6 Support of Chimneys. All portions of chimneys shall be supported for the design and weight of the materials employed. Listed factory-built chimneys shall be supported and spaced in accordance with the manufacturer's installation instructions.

12.6.7 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 be installed so its upper edge is at least 6 in. (150 mm) below the lower edge of the lowest chimney inlet opening.

12.6.8 Space Surrounding Lining or Vent.

12.6.8.1 The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry chimney shall not be used to vent another appliance.

Exception: The insertion of another liner or vent within the chimney as provided in this code and the liner or vent manufacturer's instructions.

12.6.8.2 The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry, metal, or factory-built chimney flue shall not be used to supply combustion air.

Exception: Direct vent appliances designed for installation in a solid fuel-burning fireplace where installed in accordance with the manufacturer's installation instructions.

▲ 12.6.9 Insulation Shield. Where a factory-built chimney passes through insulated assemblies, an insulation shield constructed of steel having a minimum thickness of 0.0187 in. (0.4712 mm) (nominal 26 gage) shall be installed to provide clearance between the chimney and the insulation material. The clearance shall not be 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 in. (51 mm) above the insulation materials and shall be secured in place to prevent displacement.

12.7 Gas Vents.

▲ 12.7.1 Materials. Type B and Type BW gas vents shall be listed in accordance with UL 441, *Gas Vents*. Vents for listed combination gas- and oil-burning appliances shall be listed in accordance with UL 641, *Type L Low-Temperature Venting Systems*.

12.7.2 Installation. The installation of gas vents shall meet the following requirements:

- (1) Gas vents shall be installed in accordance with the manufacturer's installation instructions.
- (2) 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.
- (3) Gas vents installed within masonry chimneys shall be installed in accordance with the manufacturer's installation 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."
- (4) Screws, rivets, and other fasteners shall not penetrate the inner wall of double-wall gas vents, except at the transition from the appliance draft hood outlet, flue collar, or single-wall metal connector to a double-wall vent.

12.7.3 Gas Vent Termination. The termination of gas vents shall comply with the following requirements:

- (1) A gas vent shall terminate in accordance with one of the following:
 - (a) Gas vents that are 12 in. (300 mm) or less in size and located not less than 8 ft (2.4 m) from a vertical wall or similar obstruction shall terminate above the roof in accordance with Figure 12.7.3 and Table 12.7.3.
 - (b) Gas vents that are over 12 in. (300 mm) in size or are located less than 8 ft (2.4 m) from a vertical wall or similar obstruction shall terminate not less than 2 ft (0.6 m) above the highest point where they pass through the roof and not less than 2 ft (0.6 m) above any portion of a building within 10 ft (3.0 m) horizontally.
 - (c) Industrial appliances as provided in 12.3.4.
 - (d) Direct vent systems as provided in 12.3.5.
 - (e) Appliances with integral vents as provided in 12.3.6.
 - (f) Mechanical draft systems as provided in 12.4.3.
 - (g) Ventilating hoods and exhaust systems as provided in 12.4.4.
- (2) A Type B or a Type L gas vent shall terminate at least 5 ft (1.5 m) in vertical height above the highest connected appliance draft hood or flue collar.

- (3) A Type B-W gas vent shall terminate at least 12 ft (3.7 m) in vertical height above the bottom of the wall furnace.
- (4) A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets, except as provided in 12.3.5 and 12.4.3.
- (5) 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 the manufacturer's installation instructions.
- (6) All gas vents shall extend through the roof flashing, roof jack, or roof thimble and terminate with a listed cap or listed roof assembly.
- (7) A gas vent shall terminate at least 3 ft (0.9 m) above a forced air inlet located within 10 ft (3.0 m).

12.7.4 Size of Gas Vents. Venting systems shall be sized and constructed in accordance with 12.7.4.1 through 12.7.4.3 and the appliance manufacturer's instructions.

Table 12.7.3 Roof Slope Heights

Roof Slope	H (minimum)	
	ft	m
Flat to 6/12	1.0	0.30
Over 6/12 to 7/12	1.25	0.38
Over 7/12 to 8/12	1.5	0.46
Over 8/12 to 9/12	2.0	0.61
Over 9/12 to 10/12	2.5	0.76
Over 10/12 to 11/12	3.25	0.99
Over 11/12 to 12/12	4.0	1.22
Over 12/12 to 14/12	5.0	1.52
Over 14/12 to 16/12	6.0	1.83
Over 16/12 to 18/12	7.0	2.13
Over 18/12 to 20/12	7.5	2.27
Over 20/12 to 21/12	8.0	2.44

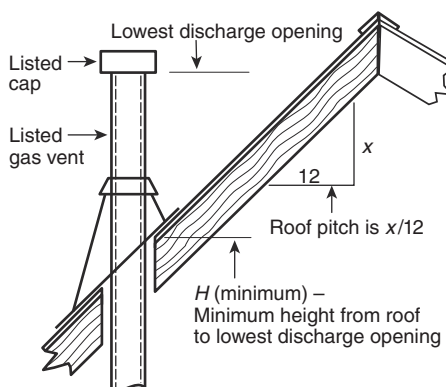


FIGURE 12.7.3 Termination Locations for Gas Vents with Listed Caps 12 in. (300 mm) or Less in Size at Least 8 ft (2.4 m) from a Vertical Wall.

Δ 12.7.4.1* 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 a Type B gas vent, installed in a single story of a building, shall be in accordance with one of the following:

- (1) The provisions of Chapter 13.
- (2) Vents serving fan-assisted combustion system appliances, or combinations of fan-assisted combustion system and draft hood-equipped appliances, shall be sized in accordance with Chapter 13 or other engineering methods.
- (3) 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 or greater than seven times the draft hood outlet area.
- (4) 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 or greater than seven times the smaller draft hood outlet area.
- (5) **Engineering methods.**

12.7.4.2 Vent Offsets. Type B and Type L vents sized in accordance with 12.7.4.1(3) or 12.7.4.1(4) shall extend in a generally vertical direction with offsets not exceeding 45 degrees, except that a vent system having not more than one 60 degree offset shall be permitted. Any angle greater than 45 degrees from the vertical is considered horizontal. The total horizontal distance of a vent plus the horizontal vent connector serving draft hood-equipped appliances shall not be greater than 75 percent of the vertical height of the vent.

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

Δ 12.7.4.4 Sizing. Chimney venting systems using mechanical draft shall be sized in accordance with engineering methods.

12.7.5 Gas Vents Serving Appliances on More than One Floor.

Δ 12.7.5.1 Where a common vent is installed in a multistory installation to vent Category I appliances located on more than one floor level, the venting system shall be designed and installed in accordance with engineering methods. **Crawl** spaces, basements, and attics shall be considered as floor levels.

12.7.5.2* All 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 occupiable space.

12.7.5.3 The size of the connectors and common segments of multistory venting systems for appliances listed for use with a Type B double-wall gas vent shall be in accordance with Table 13.2(a), provided all of the following apply:

- (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's gas input rate and available connector rise and shall not be smaller than the draft hood outlet or flue collar size.
- (3) The size of the common vertical vent segment, and of the interconnection tee at the base of that segment, is based on the total appliance's gas input rate entering that segment and its available total height.

12.7.6 Support of Gas Vents. Gas vents shall be supported and spaced in accordance with the manufacturer's installation instructions.

12.7.7 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 label shall read: "This gas vent is for appliances that burn gas. Do not connect to solid or liquid fuel-burning appliances or incinerators." The authority having jurisdiction shall determine whether its area constitutes such a locality.

12.8 Single-Wall Metal Pipe.

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

12.8.2* 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).

12.8.3 Termination. The termination of single-wall metal pipe shall meet the following requirements:

- (1) Single-wall metal pipe shall terminate at least 5 ft (1.5 m) in vertical height above the highest connected appliance draft hood outlet or flue collar.
- (2) Single-wall metal pipe shall extend at least 2 ft (0.6 m) above the highest point where it passes through a roof of a building and at least 2 ft (0.6 m) higher than any portion of a building within a horizontal distance of 10 ft (3 m).
- (3) An approved cap or roof assembly shall be attached to the terminus of a single-wall metal pipe.

12.8.4 Installation with Appliances Permitted by 12.5.1.

12.8.4.1* Prohibited Use. Single-wall metal pipe shall not be used as a vent in dwellings and residential occupancies.

12.8.4.2 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. A pipe passing through a roof shall extend without interruption through the roof flashing, roof jacket, or roof thimble.

12.8.4.3 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.

12.8.4.4 Minimum clearances from single-wall metal pipe to combustible material shall be in accordance with Table 12.8.4.4. Reduced clearances from single-wall metal pipe to combustible material shall be as specified for vent connectors in Table 10.2.4.

Table 12.8.4.4 Clearances for Connectors

Appliance	Minimum Distance from Combustible Material			
	Listed Type B Gas Vent Material	Listed Type L Vent Material	Single-Wall Metal Pipe	Factory-Built Chimney Sections
Listed appliance with draft hoods and appliance listed for use with Type B gas vents	As listed	As listed	6 in.	As listed
Residential boilers and furnaces with listed gas conversion burner and with draft hood	6 in.	6 in.	9 in.	As listed
Residential appliances listed for use with Type L vents	Not permitted	As listed	9 in.	As listed
Listed gas-fired toilets	Not permitted	As listed	As listed	As listed
Unlisted residential appliances with draft hood	Not permitted	6 in.	9 in.	As listed
Residential and low-heat appliances other than those above	Not permitted	9 in.	18 in.	As listed
Medium-heat appliance	Not permitted	Not permitted	36 in.	As listed

For SI units, 1 in. = 25.4 mm.

Note: These clearances shall apply unless the installation instructions of a listed appliance or connector specify different clearances, in which case the listed clearances shall apply.

12.8.4.5 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 at least 18 in. (460 mm) above and 6 in. (150 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 12.8.4.6.

12.8.4.6 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 a minimum of 4 in. (100 mm) larger in diameter than the metal pipe. Where there is a run of not less than 6 ft (1.8 m) of metal pipe in the opening between the draft hood outlet and the thimble, the thimble shall be a minimum of 2 in. (50 mm) larger in diameter than the metal pipe.
- (2) For unlisted appliances having draft hoods, the thimble shall be a minimum of 6 in. (150 mm) larger in diameter than the metal pipe.
- (3) For residential and low-heat appliances, the thimble shall be a minimum of 12 in. (300 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.

12.8.5 Size of Single-Wall Metal Pipe. Single-wall metal piping shall comply with the following requirements:

- (1)* A venting system of a single-wall metal pipe shall be sized in accordance with one of the following methods and the appliance manufacturer's instructions:
 - (a) For a draft hood-equipped appliance, in accordance with Chapter 13.
 - (b) For a venting system for a single appliance with a draft hood, the areas of the connector and the pipe

each shall not be less than the area of the appliance flue collar or draft hood outlet, whichever is smaller. The vent area shall not be greater than seven times the draft hood outlet area.

- (c) **Engineering methods.**
- (2) Where a single-wall metal pipe is used and has a shape other than round, it shall have an equivalent effective area equal to the effective area of the round pipe for which it is substituted and the minimum internal dimension of the pipe shall be 2 in. (50 mm).
- (3) The vent cap or a roof assembly shall have a venting capacity not less than that of the pipe to which it is attached.

12.8.6 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.

12.8.7 Marking. Single-wall metal pipe shall comply with the marking provisions of 12.7.7.

12.9 Through-the-Wall Vent Termination.

Δ 12.9.1 The clearance for through-the-wall direct vent and non-direct vent terminals shall be in accordance with Table 12.9.1 and Figure 12.9.1.

Exception: The clearances in Table 12.9.1 shall not apply to the combustion air intake of a direct vent appliance.

12.9.2 Where vents, including those for direct-vent appliances or combustion air intake pipes, penetrate outside walls of buildings, the annular spaces around such penetrations shall be permanently sealed using approved materials to prevent entry of combustion products into the building.

12.9.3 Vent systems for Category IV appliances that terminate through an outside wall of a building and discharge flue gases perpendicular to the adjacent wall shall be located not less than 10 ft (3 m) horizontally from an operable opening in an adjacent building.

Exception: This shall not apply to vent terminals that are 2 ft (0.6 m) or more above or 25 ft (7.6 m) or more below operable openings.

N Table 12.9.1 Through the Wall Vent Terminal Clearances

Figure Clearance	Clearance Location	Minimum Clearances for Direct Vent Terminals	Minimum Clearances for Non-Direct Vent Terminals
A	Clearance above finished grade level, veranda, porch, deck, or balcony	12 in.	12 in.
B	Clearance to window or door that is openable	6 in. Appliances ≤ 10,000 Btu/hr 9 in. Appliances > 10,000 Btu/hr ≤ 50,000 Btu/hr 12 in. Appliances > 50,000 Btu/hr ≤ 150,000 Btu/hr Appliances > 150,000 Btu/hr, in accordance with the appliance manufacturer's instructions and not less than the clearances specified for non-direct vent terminals in row B	4 ft below or to side of opening or 1 ft above opening
C	Clearance to non-openable window	None unless otherwise specified by the appliance manufacturer	
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (610 mm) from the center line of the terminal	None unless otherwise specified by the appliance manufacturer	
E	Clearance to unventilated soffit	None unless otherwise specified by the appliance manufacturer	
F	Clearance to outside corner of building	None unless otherwise specified by the appliance manufacturer	
G	Clearance to inside corner of building	None unless otherwise specified by the appliance manufacturer	
H	Clearance to non-mechanical air supply inlet to building and the combustion air inlet to any other appliance	Same clearance as specified for row B	
I	Clearance to a mechanical air supply inlet	10 ft horizontally from inlet or 3 ft above inlet	
J	Clearance above paved sidewalk or paved driveway located on public property or other areas where condensate or vapor can cause a nuisance or hazard	7 ft and not located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard	
K	Clearance to underside of veranda, porch, deck, or balcony	12 in. where the area beneath the veranda, porch, deck, or balcony is open on not less than two sides. The vent terminal is prohibited in this location where only one side is open.	

For SI units, 1 in. = 25.4 mm, 1 ft = 0.3 m, 1 Btu/hr = 0.293 W.

12.10 Condensation Drain.

Δ 12.10.1 Provision shall be made to collect and dispose of condensate from venting systems serving Category II and Category IV appliances and noncategorized condensing appliances.

12.10.2 Drains for condensate shall be installed in accordance with the appliance and vent manufacturers' installation instructions.

12.11 Vent Connectors for Category I Appliances.

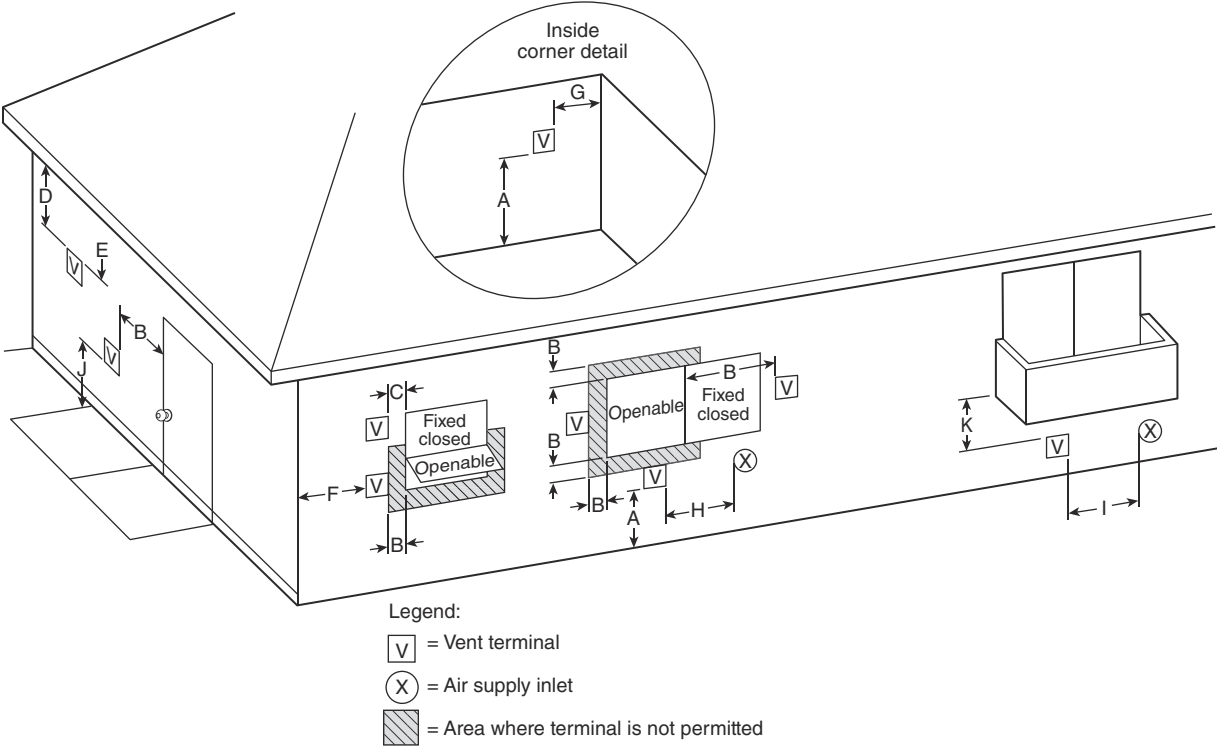
12.11.1 Where Required. A vent connector shall be used to connect an appliance to a gas vent, chimney, or single-wall metal pipe, except where the gas vent, chimney, or single-wall metal pipe is directly connected to the appliance.

12.11.2 Materials.

12.11.2.1 A vent connector shall be made of noncombustible, corrosion-resistant material capable of withstanding the vent gas temperature produced by the appliance and of sufficient thickness to withstand physical damage.

12.11.2.2 Where the vent connector used for an appliance having a draft hood or a Category I appliance is located in or passes through an unconditioned area, attic, or crawl space, that portion of the vent connector shall be listed Type B, Type L, or listed vent material having equivalent insulation qualities.

Exception: Single-wall metal pipe located within the exterior walls of the building and located in an unconditioned area other than an attic or a crawl space having a local 99 percent winter design temperature of 5°F (−15°C) or higher.



N FIGURE 12.9.1 Through the Wall Vent Terminal Clearances.

12.11.2.3 Vent connectors for residential-type appliances shall comply with the following:

- (1) Vent connectors for listed appliances having draft hoods, appliances having draft hoods and equipped with listed conversion burners, and Category I appliances that are not installed in attics, crawl spaces, or other unconditioned areas shall be one of the following:
 - (a) Type B or Type L vent material
 - (b) Galvanized sheet steel not less than 0.018 in. (0.46 mm) thick
 - (c) Aluminum (1100 or 3003 alloy or equivalent) sheet not less than 0.027 in. (0.69 mm) thick
 - (d) Stainless steel sheet not less than 0.012 in. (0.31 mm) thick
 - (e) Smooth interior wall metal pipe having resistance to heat and corrosion equal to or greater than that of 12.11.2.3(1)(b), 12.11.2.3(1)(c), or 12.11.2.3(1)(d)
 - (f) A listed vent connector
- (2) Vent connectors shall not be covered with insulation.

Exception: Listed insulated vent connectors shall be installed in accordance with the manufacturer's installation instructions.

12.11.2.4 A vent connector for a nonresidential low-heat appliance shall be a factory-built chimney section or steel pipe having resistance to heat and corrosion equivalent to that for the appropriate galvanized pipe as specified in Table 12.11.2.4. Factory-built chimney sections shall be joined together in accordance with the chimney manufacturer's instructions.

12.11.2.5 Vent connectors for medium-heat appliances shall be constructed of factory-built, medium-heat chimney sections

Table 12.11.2.4 Minimum Thickness for Galvanized Steel Vent Connectors for Low-Heat Appliances

Diameter of Connector (in.)	Minimum Thickness (in.)
Less than 6	0.019
6 to less than 10	0.023
10 to 12 inclusive	0.029
14 to 16 inclusive	0.034
Over 16	0.056

For SI units, 1 in. = 25.4 mm, 1 in.² = 645 mm².

or steel of a thickness not less than that specified in Table 12.11.2.5 and shall comply with the following:

- (1) A steel vent connector for an appliance with a vent gas temperature in excess of 1000°F (538°C) measured at the entrance to the connector shall be lined with medium-duty fire brick or the equivalent.
- (2) The lining shall be at least 2½ in. (64 mm) thick for a vent connector having a diameter or greatest cross-sectional dimension of 18 in. (460 mm) or less.
- (3) The lining shall be at least 4½ in. (110 mm) thick laid on the 4½ in. (110 mm) bed for a vent connector having a diameter or greatest cross-sectional dimension greater than 18 in. (460 mm).
- (4) Where factory-built chimney sections are installed, they shall be joined together in accordance with the chimney manufacturer's instructions.

Table 12.11.2.5 Minimum Thickness for Steel Vent Connectors for Medium-Heat Appliances

Vent Connector Size		Minimum Thickness (in.)
Diameter (in.)	Area (in. ²)	
Up to 14	Up to 154	0.053
Over 14 to 16	154 to 201	0.067
Over 16 to 18	201 to 254	0.093
Over 18	Larger than 254	0.123

For SI units, 1 in. = 25.4 mm, 1 in.² = 645 mm².

12.11.3* Size of Vent Connector.

▲ **12.11.3.1** A vent connector for an appliance with a single draft hood or for a Category I fan-assisted combustion system appliance shall be sized and installed in accordance with Chapter 13 or engineering methods.

▲ **12.11.3.2** Where a single appliance having more than one draft hood outlet or flue collar is installed, the manifold shall be constructed according to the instructions of the appliance manufacturer. Where there are no instructions, the manifold shall be designed and constructed in accordance with engineering methods. As an alternative method, the effective area of the manifold shall equal the combined area of the flue collars or draft hood outlets, and the vent connectors shall have a minimum 1 ft (0.3 m) rise.

▲ **12.11.3.3** Where two or more appliances are connected to a common vent or chimney, each vent connector shall be sized in accordance with Chapter 13 or engineering methods.

12.11.3.4 As an alternative method applicable only where all of the appliances are draft hood-equipped, each vent connector shall have an effective area not less than the area of the draft hood outlet of the appliance to which it is connected.

▲ **12.11.3.5** Where two or more appliances are vented through a common vent connector or vent manifold, the common vent connector or vent manifold shall be located at the highest level consistent with available headroom and clearance to combustible material and sized in accordance with Chapter 13 or engineering methods.

12.11.3.6 As an alternative method applicable only where there are two draft hood-equipped appliances, the effective area of the common vent connector or vent manifold and all junction fittings shall be not less than the area of the larger vent connector plus 50 percent of the area of the smaller flue collar outlet.

12.11.3.7 Where the size of a vent connector is increased to overcome installation limitations and obtain connector capacity equal to the appliance input, the size increase shall be made at the appliance draft hood outlet.

12.11.4 Two or More Appliances Connected to a Single Vent.

12.11.4.1 Where two or more openings are provided into one chimney flue or vent, either of the following shall apply:

- (1) The openings shall be at different levels.

- (2) The connectors shall be attached to the vertical portion of the chimney or vent at an angle of 45 degrees or less relative to the vertical.

12.11.4.2 Where two or more vent connectors enter a common vent, chimney flue, or single-wall metal pipe, the smaller connector shall enter at the highest level consistent with the available headroom or clearance to combustible material.

12.11.4.3 Vent connectors serving Category I appliances shall not be connected to any portion of a mechanical draft system operating under positive static pressure, such as those serving Category III or Category IV appliances.

12.11.5 Clearance. Minimum clearances from vent connectors to combustible material shall be in accordance with Table 12.8.4.4.

Exception: The clearance between a vent connector and combustible material shall be permitted to be reduced where the combustible material is protected as specified for vent connectors in Table 10.2.4.

12.11.6 Joints. Joints between sections of connector piping and connections to flue collars or draft hood outlets shall be fastened in accordance with one of the following methods:

- (1) Sheet metal screws
- (2) Vent connectors of listed vent material assembled and connected to flue collars or draft hood outlets in accordance with the manufacturers' instructions
- (3) Other approved means

■ **12.11.7 Connector Junctions.** Where vent connectors are joined together, the connection shall be made with a manufactured tee or wye fitting.

12.11.8 Slope. A vent connector shall be installed without any dips or sags and shall slope upward toward the vent or chimney at least ¼ in./ft (20 mm/m).

Exception: Vent connectors attached to a mechanical draft system installed in accordance with appliance and the draft system manufacturers' instructions.

12.11.9* Length of Vent Connector.

12.11.9.1 The maximum horizontal length of a single-wall connector shall be 75 percent of the height of the chimney or vent, except for engineered systems.

12.11.9.2 The maximum horizontal length of a Type B double-wall connector shall be 100 percent of the height of the chimney or vent, except for engineered systems. The maximum length of an individual connector for a chimney or vent system serving multiple appliances, from the appliance outlet to the junction with the common vent or another connector, shall be 100 percent of the height of the chimney or vent.

12.11.10 Support. A vent connector shall be supported for the design and weight of the material employed to maintain clearances and prevent physical damage and separation of joints.

▲ 12.11.11 Chimney Connection.

■ **12.11.11.1** Where entering a flue in a masonry or metal chimney, the vent connector shall be installed above the extreme bottom to avoid stoppage.

12.11.11.2 Where a thimble or slip joint is used to facilitate removal of the connector, the connector shall be firmly attached to or inserted into the thimble or slip joint to prevent the connector from falling out.

12.11.11.3 Means shall be employed to prevent the connector from entering so far as to restrict the space between its end and the opposite wall of the chimney flue.

12.11.12 Inspection. The entire length of a vent connector shall be readily accessible for inspection, cleaning, and replacement.

12.11.13 Fireplaces. A vent connector shall not be connected to a chimney flue serving a fireplace unless the fireplace flue opening is permanently sealed.

12.11.14 Passage Through Ceilings, Floors, or Walls.

12.11.14.1 Single-wall metal pipe connectors shall not pass through any wall, floor, or ceiling except as permitted by 12.8.4.2 and 12.8.4.6.

12.11.14.2 Vent connectors for medium-heat appliances shall not pass through walls or partitions constructed of combustible material.

12.12 Vent Connectors for Category II, Category III, and Category IV Appliances. The vent connectors for Category II, Category III, and Category IV appliances shall be in accordance with Section 12.5.

12.13 Draft Hoods and Draft Controls.

12.13.1 Appliances Requiring Draft Hoods. Vented appliances shall be installed with draft hoods.

Exception: Dual oven-type combination ranges; direct vent appliances; fan-assisted combustion system appliances; appliances requiring chimney draft for operation; single-firebox boilers equipped with conversion burners with inputs greater than 400,000 Btu/hr (117 kW); appliances equipped with blast, power, or pressure burners that are not listed for use with draft hoods; and appliances designed for forced venting.

12.13.2 Installation. A draft hood supplied with or forming a part of a listed vented appliance shall be installed without alteration, exactly as furnished and specified by the appliance manufacturer.

12.13.2.1 If a draft hood is not supplied by the appliance manufacturer where one is required, a draft hood shall be installed, be of a listed or approved type, and, in the absence of other instructions, be of the same size as the appliance flue collar. Where a draft hood is required with a conversion burner, it shall be of a listed or approved type.

12.13.3 Draft Control Devices. Where a draft control device is part of the appliance or is supplied by the appliance manufacturer, it shall be installed in accordance with the manufacturer's instructions. In the absence of manufacturer's instructions, the device shall be attached to the flue collar of the appliance or as near to the appliance as practical.

12.13.4* Additional Devices. Appliances requiring controlled chimney draft shall be permitted to be equipped with listed double-acting barometric draft regulators installed and adjusted in accordance with the manufacturer's instructions.

12.13.5 Location. Draft hoods and barometric draft regulators shall be installed in the same room or enclosure as the appliance in such a manner as to prevent any difference in pressure between the hood or regulator and the combustion air supply.

12.13.6 Positioning. Draft hoods and draft regulators shall be installed in the position for which they were designed with reference to the horizontal and vertical planes and shall be located so that the relief opening is not obstructed by any part of the appliance or adjacent construction. The appliance and its draft hood shall be located so that the relief opening is accessible for checking vent operation.

12.13.7 Clearance. A draft hood shall be located so that its relief opening is not less than 6 in. (150 mm) from any surface except that of the appliance it serves and the venting system to which the draft hood is connected. Where a greater or lesser clearance is indicated on the appliance label, the clearance shall not be less than that specified on the label. Such clearances shall not be reduced.

12.14 Manually Operated Dampers.

12.14.1 A manually operated damper shall not be placed in any appliance vent connector. Fixed baffles and balancing baffles shall not be classified as manually operated dampers.

12.14.2* Balancing baffles shall be mechanically locked in the desired position before placing the appliance in service.

12.14.3 Balancing baffles shall be listed in accordance with UL 378, *Draft Equipment*.

12.15 Automatically Operated Vent Dampers. An automatically operated vent damper shall be listed.

12.16 Obstructions. Devices that retard the flow of vent gases shall not be installed in a vent connector, chimney, or vent. The following shall not be considered as obstructions:

- (1) Draft regulators and safety controls specifically listed for installation in venting systems and installed in accordance with the manufacturer's installation instructions
- (2) Approved draft regulators and safety controls designed and installed in accordance with engineering methods
- (3) Listed heat reclaimers and automatically operated vent dampers installed in accordance with the manufacturers' installation instructions
- (4) Vent dampers serving listed appliances installed in accordance with 13.1.1 or 13.2.1 or engineering methods
- (5) Approved economizers, heat reclaimers, and recuperators installed in venting systems of appliances not required to be equipped with draft hoods, provided the appliance manufacturer's instructions cover the installation of such a device in the venting system and performance in accordance with Section 12.1 and 12.4.1 is obtained

Chapter 13 Sizing of Category I Venting Systems

13.1 Additional Requirements to Single Appliance Vent. This section shall apply where Table 13.1(a) through Table 13.1(f) are used to size single appliance venting systems. Subsections 13.1.1 through 13.1.18 apply to Table 13.1(a) through Table 13.1(f).