CHAPTER 7

COMBUSTION AIR

SECTION 701
GENERAL

701.1 Scope. The provisions of this chapter shall govern the requirements for combustion and dilution air for fuel-burning appliances other than gas-fired appliances. The requirements for combustion and dilution air for gas-fired appliances shall be in accordance with the *International Fuel Gas Code.*

701.2 Combustion and dilution air required. Every room or space containing fuel-burning appliances shall be provided with combustion and dilution air as required by this code. Combustion and dilution air shall be provided in accordance with Section 702, 703, 704, 705, 706 or 707 or shall be provided by an approved engineered system. Direct vent appliances or equipment that do not draw combustion air from inside of the building are not required to be considered in the determination of the combustion and dilution air requirements. Combustion air requirements shall be determined based on the simultaneous operation of all fuel-burning appliances drawing combustion and dilution air from the room or space.

701.3 Circulation of air. The equipment and appliances within every room containing fuel-burning appliances shall be installed so as to allow free circulation of air. Provisions shall be made to allow for the simultaneous operation of mechanical exhaust systems, fireplaces or other equipment and appliances operating in the same room or space from which combustion and dilution air is being drawn. Such provisions shall prevent the operation of such appliances, equipment and systems from affecting the supply of combustion and dilution air.

701.4 Crawl space and attic space. For the purposes of this chapter, an opening to a naturally ventilated crawl space or attic space shall be considered equivalent to an opening to the outdoors.

701.4.1 Crawl space. Where lower-combustion air openings connect with crawl spaces, such spaces shall have unobstructed openings to the outdoors at least twice that required for the combustion air openings. The height of the crawl space shall comply with the requirements of the *International Building Code* and shall be without obstruction to the free flow of air.

701.4.2 Attic space. Where combustion air is obtained from an attic area, the attic ventilating openings shall not be subject to ice or snow blockage, and the attic shall have not less than 30 inches (762 mm) vertical clear height at its maximum point. Attic ventilation openings shall be sufficient to provide the required volume of combustion air and the attic ventilation required by the *International Building Code.* The combustion air openings shall be provided with a sleeve of not less than 0.019-inch (0.5 mm) (No. 26 Gage) galvanized steel or other approved material extending from the appliance enclosure to at least 6 inches (152 mm) above the top of the ceiling joists and insulation.

701.5 Prohibited sources. Openings and ducts shall not connect appliance enclosures with a space in which the operation of a fan will adversely affect the flow of combustion air. Combustion air shall not be obtained from a hazardous location, except where the fuel-fired appliances are located within the hazardous location and are installed in accordance with this code. Combustion air shall not be taken from a refrigeration machinery room.

SECTION 702
INSIDE AIR

702.1 All air from indoors. Combustion and dilution air shall be permitted to be obtained entirely from the indoors in buildings that are not of unusually tight construction. In buildings of unusually tight construction, combustion air shall be obtained from the outdoors in accordance with Section 703, 705, 706 or 707.

Comm 64.0702 (1) Inside air. When the space providing air for combustion, ventilation and dilution of flue gases has a minimum volume of 250 cubic feet per 1,000 Btu per hour combined input rating of all appliances, the use of inside air for combustion shall be allowed.

(2) Note: When applying the provisions of this section, refer to IFGC Section 201 as adopted and modified in s. Comm 65.0210 for the definition of "unusually tight construction."

702.2 Air from the same room or space. The room or space containing fuel-burning appliances shall be an unconfined space as defined in Section 202.

702.3 Air from adjacent spaces. Where the volume of the room in which the fuel-burning appliances are located does not comply with Section 702.2, additional inside combustion and dilution air shall be obtained by opening the room to adjacent spaces so that the combined volume of all communicating spaces meets the volumetric requirement of Section 702.2. Openings connecting the spaces shall comply with Sections 702.3.1 and 702.3.2.

702.3.1 Number and location of openings. Two openings shall be provided, one within 1 foot (305 mm) of the ceiling of the room and one within 1 foot (305 mm) of the floor.

702.3.2 Size of openings. The net free area of each opening, calculated in accordance with Section 708, shall be a minimum of 1 square inch per 1,000 Btu/h (2201 mm^2/kW) of input rating of the fuel-burning appliances drawing combustion and dilution air from the communicating spaces and shall be not less than 100 square inches (64 516 mm^2).

SECTION 703
OUTDOOR AIR

703.1 All air from the outdoors. Where all combustion and dilution air is to be provided by outdoor air, the required combus-

tion and dilution air shall be obtained by opening the room to the outdoors. Openings connecting the room to the outdoor air shall comply with Sections 703.1.1 through 703.1.4.

703.1.1 Number and location of openings. Two openings shall be provided, one within 1 foot (305 mm) of the ceiling of the room and one within 1 foot (305 mm) of the floor.

703.1.2 Size of direct openings. The net free area of each direct opening to the outdoors, calculated in accordance with Section 709, shall be a minimum of 1 square inch per 4,000 Btu/h (550 mm²/kW) of combined input rating of the fuel-burning appliances drawing combustion and dilution air from the room.

703.1.3 Size of horizontal openings. The net free area of each opening, calculated in accordance with Section 709 and connected to the outdoors through a horizontal duct, shall be a minimum of 1 square inch per 2,000 Btu/h (1100 mm²/kW) of combined input rating of the fuel-burning appliances drawing combustion and dilution air from the room. The cross-sectional area of the duct shall be equal to or greater than the required size of the opening.

703.1.4 Size of vertical openings. The net free area of each opening, calculated in accordance with Section 709 and connected to the outdoors through a vertical duct, shall be a minimum of 1 square inch per 4,000 Btu/h (550 mm²/kW) of combined input rating of the fuel-burning appliances drawing combustion and dilution air from the room. The cross-sectional area of the duct shall be equal to or greater than the required size of the opening.

SECTION 704
COMBINED USE OF INSIDE AND OUTDOOR AIR (CONDITION 1)

704.1 Combination of air from inside and outdoors. This section shall apply only to appliances located in confined spaces in buildings not of unusually tight construction. Where the volumes of rooms and spaces are combined for the purpose of providing indoor combustion air, such rooms and spaces shall communicate through permanent openings in compliance with Sections 702.3.1 and 702.3.2. The required combustion and dilution air shall be obtained by opening the room to the outdoors using a combination of inside and outdoor air, prorated in accordance with Section 704.1.6. The ratio of interior spaces shall comply with Section 704.1.5. The number, location and ratios of openings connecting the space with the outdoor air shall comply with Sections 704.1.1 through 704.1.4.

704.1.1 Number and location of openings. At least two openings shall be provided, one within 1 foot (305 mm) of the ceiling of the room and one within 1 foot (305 mm) of the floor.

704.1.2 Ratio of direct openings. Where direct openings to the outdoors are provided in accordance with Section 703.1, the ratio of direct openings shall be the sum of the net free areas of both direct openings to the outdoors, divided by the sum of the required areas for both such openings as determined in accordance with Section 703.1.2.

704.1.3 Ratio of horizontal openings. Where openings connected to the outdoors through horizontal ducts are provided in accordance with Section 703.1, the ratio of horizontal openings shall be the sum of the net free areas of both such openings, divided by the sum of the required areas for both such openings as determined in accordance with Section 703.1.3.

704.1.4 Ratio of vertical openings. Where openings connected to the outdoors through vertical ducts are provided in accordance with Section 703.1, the ratio of vertical openings shall be the sum of the net free areas of both such openings, divided by the sum of the required areas for both such openings as determined in accordance with Section 703.1.4.

704.1.5 Ratio of interior spaces. The ratio of interior spaces shall be the available volume of all communicating spaces, divided by the required volume as determined in accordance with Sections 702.2 and 702.3.

704.1.6 Prorating of inside and outdoor air. In spaces that utilize a combination of inside and outdoor air, the sum of the ratios of all direct openings, horizontal openings, vertical openings and interior spaces shall equal or exceed 1.

SECTION 705
COMBINED USE OF INSIDE AND OUTDOOR AIR (CONDITION 2)

705.1 General. This section shall apply only to appliances located in unconfined spaces in buildings of unusually tight construction. Combustion air supplied by a combined use of indoor and outdoor air shall be supplied through openings and ducts extending to the appliance room or to the vicinity of the appliance.

705.1.1 Openings and supply ducts. Openings shall be provided, located and sized in accordance with Sections 702.3.1 and 702.3.2; additionally, there shall be one opening to the outdoors having a free area of at least 1 square inch per 5,000 Btu/h (440 mm²/kW) of total input of all appliances in the space.

SECTION 706
FORCED COMBUSTION AIR SUPPLY

706.1 General. Where all combustion air and dilution air is provided by a mechanical forced-air system, the combustion air and dilution air shall be supplied at the minimum rate of 1 cfm per 2,400 Btu/h [0.00067 $m^3/(s \cdot kW)$] of combined input rating of all the fuel-burning appliances served. Each of the appliances served shall be electrically interlocked to the mechanical forced-air system so as to prevent operation of the appliances when the mechanical system is not in operation. Where combustion air and dilution air is provided by the building's mechanical ventilation system, the system shall provide the specified combustion/dilution air rate in addition to the required ventilation air.

SECTION 707
DIRECT CONNECTION

707.1 General. Fuel-burning appliances that are listed and labeled for direct combustion air connection to the outdoors shall be installed in accordance with the manufacturer's installation instructions.

SECTION 708
COMBUSTION AIR DUCTS

708.1 General. Combustion air ducts shall:

1. Be of galvanized steel complying with Chapter 6 or of equivalent corrosion-resistant material approved for this application.

   Exception: Within dwelling units, unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one required fireblock is removed.

2. Have a minimum cross-sectional dimension of 3 inches (76 mm).
3. Terminate in an unobstructed space allowing free movement of combustion air to the appliances.
4. Have the same cross-sectional areas as the free area of the openings to which they connect.
5. Serve a single appliance enclosure.
6. Not serve both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.
7. Not be screened where terminating in an attic space.
8. Not slope downward toward the source of combustion air, where serving the upper required combustion air opening.

SECTION 709
OPENING OBSTRUCTIONS

709.1 General. The required size of openings for combustion and dilution air shall be based on the net free area of each opening. The net free area of an opening shall be that specified by the manufacturer of the opening covering. In the absence of such information, openings covered with metal louvers shall be deemed to have a net free area of 75 percent of the area of the opening, and openings covered with wood louvers shall be deemed to have a net free area of 25 percent of the area of the opening.

709.2 Dampered openings. Where the combustion air openings are provided with volume, smoke or fire dampers, the dampers shall be electrically interlocked with the firing cycle of the appliances served, so as to prevent operation of any appliance that draws combustion and dilution air from the room when any of the dampers are closed. Manually operated dampers shall not be installed in combustion air openings.

SECTION 710
OPENING LOCATION AND PROTECTION

710.1 [Comm 64.0710] General. Mounting height of the combustion air intakes shall have the lowest side of outside air intake openings located at least 12 inches (305 mm) vertical from the adjoining grade level.

CHAPTER 8

CHIMNEYS AND VENTS

SECTION 801
GENERAL

801.1 Scope. This chapter shall govern the installation, maintenance, repair and approval of factory-built chimneys, chimney liners, vents and connectors. This chapter shall also govern the utilization of masonry chimneys. Gas-fired appliances shall be vented in accordance with the *International Fuel Gas Code.*

Comm 64.0801 (1) Note: For DHFS licensed healthcare facilities as specified in chs. HFS 124, 132, and 134, also refer to NFPA 211 as adopted in these chapters.

801.2 General. Every fuel-burning appliance shall discharge the products of combustion to a vent, factory-built chimney or masonry chimney, except for appliances vented in accordance with Section 804. The chimney or vent shall be designed for the type of appliance being vented.

Comm 64.0801 (2) Space heaters. Permanently installed and portable unvented fuel-fired space heaters are prohibited.

Note: See ch. Comm 65, subch. II, Part 6 for the prohibition of unvented gas-fired space heaters.

801.2.1 Oil-fired appliances. Oil-fired appliances shall be vented in accordance with this code and NFPA 31.

801.3 Masonry chimneys. Masonry chimneys shall be constructed in accordance with the *International Building Code.*

801.4 Positive flow. Venting systems shall be designed and constructed so as to develop a positive flow adequate to convey all combustion products to the outside atmosphere.

801.5 Design. Venting systems shall be designed in accordance with this chapter or shall be approved engineered systems.

801.6 Minimum size of chimney or vent. Except as otherwise provided for in this chapter, the size of the chimney or vent, serving a single appliance, except engineered systems, shall have a minimum area equal to the area of the appliance connection.

801.7 Solid fuel appliance flues. The cross-sectional area of a flue serving a solid fuel-burning appliance shall be not greater than three times the cross-sectional area of the appliance flue collar or flue outlet.

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

801.9 Positive pressure. Where an appliance equipped with a forced or induced draft system creates a positive pressure in the venting system, the venting system shall be designed for positive pressure applications.

801.10 Connection to fireplace. Connection of appliances to chimney flues serving fireplaces shall be in accordance with Sections 801.10.1 through 801.10.3.

801.10.1 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.

801.10.2 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.

801.10.3 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 provided with access or shall be removable for inspection and cleaning of both the connector and the flue. Listed direct connection devices shall be installed in accordance with their listing.

801.11 Multiple solid fuel prohibited. A solid fuel-burning appliance or fireplace shall not connect to a chimney passageway venting another appliance.

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

801.13 Cleanouts. 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.

Exception: Cleanouts shall not be required for chimney flues serving masonry fireplaces, if such flues are provided with access through the fireplace opening.

801.14 Connections to exhauster. All appliance connections to a chimney or vent equipped with a power exhauster shall be made on the inlet side of the exhauster. All 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.

801.15 Fuel-fired appliances. Masonry chimneys utilized to vent fuel-fired appliances shall be located, constructed and sized as specified in the manufacturer's installation instructions for the appliances being vented.

801.16 Flue lining. Masonry chimneys shall be lined. The lining material shall be compatible with the type of appliance connected, in accordance with the appliance listing and manufacturer's installation instructions. Listed materials used as flue linings shall be installed in accordance with their listings and the manufacturer's installation instructions.

801.16.1 Residential and low-heat appliances (general). 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 C 315 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).

801.17 Space around lining. The space surrounding a flue lining system or other vent installed within a masonry chimney shall not be used to vent any other appliance. This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's installation instructions and this code.

801.18 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 801.18.1 through 801.18.4.

801.18.1 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 the venting of oil-fired appliances to masonry chimneys, the resizing shall be in accordance with NFPA 31.

801.18.2 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 which would allow the escape of combustion products, including gases, moisture and creosote. Where an oil-fired appliance is connected to an existing masonry chimney, such chimney flue shall be repaired or relined in accordance with NFPA 31.

801.18.3 Cleanout. Masonry chimneys shall be provided with a cleanout opening complying with Section 801.13.

801.18.4 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 equipped with a chimney lining system tested and listed for installation in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's instructions, shall not be required to have clearance between combustible materials and exterior surfaces of the masonry chimney. Noncombustible fireblocking shall be provided in accordance with the *International Building Code*.

801.19 Multistory prohibited. Common venting systems for appliances located on more than one floor level shall be prohibited, except where all of the appliances served by the common vent are located in rooms or spaces that are accessed only from the outdoors. The appliance enclosures shall not communicate with the occupiable areas of the building.

SECTION 802
VENTS

802.1 General. All vent systems shall be listed and labeled. Type L vents and pellet vents shall be tested in accordance with UL 641.

802.2 Vent application. The application of vents shall be in accordance with Table 802.2.

TABLE 802.2
VENT APPLICATIONS

VENT TYPES	APPLIANCE TYPES
Type L oil vents	Oil-burning appliances listed and labeled for venting with Type L vents; gas appliances listed and labeled for venting with Type B vents.
Pellet vents	Pellet fuel-burning appliances listed and labeled for venting with pellet vents.

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

802.4 Vent termination caps required. Type L vents shall terminate with a listed and labeled cap in accordance with the vent manufacturer's installation instructions.

802.5 Type L vent terminations. Type L vents shall terminate not less than 2 feet (610 mm) above the highest point of the roof penetration and not less than 2 feet (610 mm) higher than any portion of a building within 10 feet (3048 mm).

802.6 Minimum vent heights. Vents shall terminate not less than 5 feet (1524 mm) in vertical height above the highest connected appliance flue collar.

Exceptions:

1. Venting systems of direct vent appliances shall be installed in accordance with the appliance and the vent manufacturer's instructions.
2. Appliances listed for outdoor installations incorporating integral venting means shall be installed in accordance with their listings and the manufacturer's installation instructions.
3. Pellet vents shall be installed in accordance with the appliance and the vent manufacturer's installation instructions.

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

802.8 Insulation shield. Where vents pass through insulated assemblies, an insulation shield constructed of not less than No. 26 Gage sheet metal 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 installation instructions.

SECTION 803
CONNECTORS

803.1 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.

803.2 Location. Connectors shall be located entirely within the room in which the connecting appliance is located, except as provided for in Section 803.10.4. Where passing through an unheated space, a connector shall not be constructed of single-wall pipe.

803.3 Size. The connector shall not be smaller than the size of the flue collar or the size of the outlet of the draft hood supplied by the appliance manufacturer. Where the appliance has more than one flue outlet, and in the absence of the manufacturer's specific instructions, the connector area shall be not less than the combined area of the flue outlets for which it acts as a common connector.

803.4 Branch connections. All branch connections to the vent connector shall be made in accordance with the vent manufacturer's instructions.

803.5 Manual dampers. Manual dampers shall not be installed in connectors except in chimney connectors serving solid fuel-burning appliances.

803.6 Automatic dampers. Automatic dampers shall be listed and labeled in accordance with UL 17 for oil-fired heating appliances. The dampers shall be installed in accordance with the manufacturer's installation instructions. An automatic vent damper device shall not be installed on an existing appliance unless the appliance is listed and labeled and the device is installed in accordance with the terms of its listing. The name of the installer and date of installation shall be marked on a label affixed to the damper device.

803.7 Connectors serving two or more appliances. Where two or more connectors enter a common vent or chimney, the smaller connector shall enter at the highest level consistent with available headroom or clearance to combustible material.

803.8 Vent connector construction. Vent connectors shall be constructed of metal. The minimum nominal thickness of the connector shall be 0.019 inch (0.5 mm) (No. 28 Gage) for galvanized steel, 0.022 inch (0.6 mm) (No. 26 B & S Gage) for copper, and 0.020 inch (0.5 mm) (No. 24 B & S Gage) for aluminum.

803.9 Chimney connector construction. Chimney connectors for low-heat appliances shall be of sheet steel pipe having resistance to corrosion and heat not less than that of galvanized steel specified in Table 803.9(1). Connectors for medium-heat appliances and high-heat appliances shall be of sheet steel not less than the thickness specified in Table 803.9(2).

803.10 Installation. Connectors shall be installed in accordance with Sections 803.10.1 through 803.10.6.

803.10.1 Supports and joints. Connectors shall be supported in an approved manner, and joints shall be fastened with sheet metal screws, rivets or other approved means.

803.10.2 Length. The maximum horizontal length of a single-wall connector shall be 75 percent of the height of the chimney or vent.

TABLE 803.9(1)
MINIMUM CHIMNEY CONNECTOR THICKNESS FOR LOW-HEAT APPLIANCES

DIAMETER OF CONNECTOR (inches)	MINIMUM NOMINAL THICKNESS (galvanized) (inches)
5 and smaller	0.022 (No. 26 Gage)
Larger than 5 and up to 10	0.028 (No. 24 Gage)
Larger than 10 and up to 16	0.034 (No. 22 Gage)
Larger than 16	0.064 (No. 16 Gage)

For SI: 1 inch = 25.4 mm.

TABLE 803.9(2)
MINIMUM CHIMNEY CONNECTOR THICKNESS FOR MEDIUM- AND HIGH-HEAT APPLIANCES

AREA (square inches)	EQUIVALENT ROUND DIAMETER (inches)	MINIMUM NOMINAL THICKNESS (inches)
0-154	0-14	0.060 (No. 16 Gage)
155-201	15-16	0.075 (No. 14 Gage)
202-254	17-18	0.105 (No. 12 Gage)
Greater than 254	Greater than 18	0.135 (No. 10 Gage)

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2.

803.10.3 Connection. The connector shall extend to the inner face of the chimney or vent liner, but not beyond. A connector entering a masonry chimney shall be cemented to masonry in an approved manner. Where thimbles are installed to facilitate removal of the connector from the masonry chimney, the thimble shall be permanently cemented in place with high-temperature cement.

803.10.4 Connector pass-through. Chimney connectors shall not pass through any floor or ceiling, nor through a fire-resistance-rated wall assembly. Chimney connectors for domestic-type appliances shall not pass through walls or partitions constructed of combustible material to reach a masonry chimney unless:

1. The connector is labeled for wall pass-through and is installed in accordance with the manufacturer's instructions; or
2. The connector is put through a device labeled for wall pass-through; or
3. The connector has a diameter not larger than 10 inches (254 mm) and is installed in accordance with one of the methods in Table 803.10.4. Concealed metal parts of the pass-through system in contact with flue gases shall be of stainless steel or equivalent material that resists corrosion, softening or cracking up to 1,800°F (980°C).

803.10.5 Pitch. Connectors shall rise vertically to the chimney or vent with a minimum pitch equal to one-fourth unit vertical in 12 units horizontal (2-percent slope).

TABLE 803.10.4
CHIMNEY CONNECTOR SYSTEMS AND CLEARANCES TO COMBUSTIBLE WALL MATERIALS FOR DOMESTIC HEATING APPLIANCES[a, b, c, d]

System A (12-inch clearance)	A 3.5-inch-thick brick wall shall be framed into the combustible wall. A 0.625-inch-thick fireclay liner (ASTM C 315 or equivalent)[e] shall be firmly cemented in the center of the brick wall maintaining a 12-inch clearance to combustibles. The clay liner shall run from the outer surface of the bricks to the inner surface of the chimney liner.
System B (9-inch clearance)	A labeled solid-insulated factory-built chimney section (1-inch insulation) the same inside diameter as the connector shall be utilized. Sheet metal supports cut to maintain a 9-inch clearance to combustibles shall be fastened to the wall surface and to the chimney section. Fasteners shall not penetrate the chimney flue liner. The chimney length shall be flush with the masonry chimney liner and sealed to the masonry with water-insoluble refractory cement. Chimney manufacturers' parts shall be utilized to fasten securely the chimney connector to the chimney section.
System C (6-inch clearance)	A sheet metal (minimum No. 24 Gage) ventilated thimble having two 1-inch air channels shall be installed with a sheet steel chimney connector (minimum No. 24 Gage). Sheet steel supports (minimum No. 24 Gage) shall be cut to maintain a 6-inch clearance between the thimble and combustibles. One side of the support shall be fastened to the wall on all sides. Glass-fiber insulation shall fill the 6-inch space between the thimble and the supports.
System D (2-inch clearance)	A labeled solid-insulated factory-built chimney section (1-inch insulation) with a diameter 2 inches larger than the chimney connector shall be installed with a sheet steel chimney connector (minimum No. 24 Gage). Sheet metal supports shall be positioned to maintain a 2-inch clearance to combustibles and to hold the chimney connector to ensure that a 1-inch airspace surrounds the chimney connector through the chimney section. The steel support shall be fastened to the wall on all sides and the chimney section shall be fastened to the supports. Fasteners shall not penetrate the liner of the chimney section.

For SI: 1 inch = 25.4 mm, 1.0 Btu × in/ft^2 · h · °F = 0.144 W/m^2 · °K.

a. Insulation material that is part of the wall pass-through system shall be noncombustible and shall have a thermal conductivity of 1.0 Btu × in/ft^2 · h · °F or less.

b. All clearances and thicknesses are minimums.

c. Materials utilized to seal penetrations for the connector shall be noncombustible.

d. Connectors for all systems except System B shall extend through the wall pass-through system to the inner face of the flue liner.

e. ASTM C 315.

803.10.6 Clearances. Connectors shall have a minimum clearance to combustibles in accordance with Table 803.10.6. The clearances specified in Table 803.10.6 apply, except where the listing and labeling of an appliance specifies a different clearance, in which case the labeled clearance shall apply. The clearance to combustibles for connectors shall be reduced only in accordance with Section 308.

TABLE 803.10.6
CONNECTOR CLEARANCES TO COMBUSTIBLES

TYPE OF APPLIANCE	MINIMUM CLEARANCE (inches)
Domestic-type appliances	
Chimney and vent connectors	
Electric and oil incinerators	18
Oil and solid fuel appliances	18
Oil appliances labeled for venting with Type L vents	9
Commercial, industrial-type appliances	
Low-heat appliances	
Chimney connectors	
Oil and solid fuel boilers, furnaces and water heaters	18
Oil unit heaters	18
Other low-heat industrial appliances	18
Medium-heat appliances	
Chimney connectors	
All oil and solid fuel appliances	36
High-heat appliances	
Masonry or metal connectors	(As determined by the
All oil and solid fuel appliances	code official)

For SI: 1 inch = 25.4 mm.

SECTION 804
DIRECT-VENT, INTEGRAL VENT AND MECHANICAL DRAFT SYSTEMS

804.1 Direct-vent terminations. Vent terminals for direct-vent appliances shall be installed in accordance with the manufacturer's installation instructions

804.2 Appliances with integral vents. Appliances incorporating integral venting means shall be installed in accordance with their listings and the manufacturer's installation instructions.

804.2.1 Terminal clearances. Appliances designed for natural draft venting and incorporating integral venting means shall be located so that a minimum clearance of 9 inches (229 mm) is maintained between vent terminals and from any openings through which combustion products enter the building. Appliances using forced draft venting shall be located so that a minimum clearance of 12 inches (305 mm) is maintained between vent terminals and from any openings through which combustion products enter the building.

804.3 Mechanical draft systems. Mechanical draft systems of either forced or induced draft design shall comply with Sections 804.3.1 through 804.3.7.

804.3.1 Forced draft systems. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to be gas tight to prevent leakage of combustion products into a building.

804.3.2 Automatic shutoff. Power exhausters shall be electrically connected to each appliance to prevent operation of the appliance when the power exhauster is not in operation.

804.3.3 Termination. The termination of chimneys or vents equipped with power exhausters shall be located a minimum of 10 feet (3048 mm) from the lot line or from adjacent buildings. The exhaust shall be directed away from the building.

804.3.4 Horizontal terminations. Horizontal terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination of mechanical draft systems shall be not less than 7 feet (2134 mm) above the level of the walkway.
2. Vents shall terminate at least 3 feet (914 mm) above any forced air inlet located within 10 feet (3048 mm).
3. The vent system shall terminate at least 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, window or gravity air inlet into the building.
4. The vent termination point shall not be located closer than 3 feet (914 mm) to an interior corner formed by two walls perpendicular to each other.
5. The vent termination shall not be mounted directly above or within 3 feet (914 mm) horizontally from an oil tank vent or gas meter.
6. The bottom of the vent termination shall be located at least 12 inches (305 mm) above finished grade.

804.3.5 Vertical terminations. Vertical terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination of mechanical draft systems shall be not less than 7 feet (2134 mm) above the level of the walkway.
2. Vents shall terminate at least 3 feet (914 mm) above any forced air inlet located within 10 feet (3048 mm).
3. Where the vent termination is located below an adjacent roof structure, the termination point shall be located at least 3 feet (914 mm) from such structure.
4. The vent shall terminate at least 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from, or 1 foot (305 mm) above any door, window or gravity air inlet for the building.
5. A vent cap shall be installed to prevent rain from entering the vent system.
6. The vent termination shall be located at least 3 feet (914 mm) horizontally from any portion of the roof structure.

804.3.6 Exhauster connections. An appliance vented by natural draft shall not be connected into a vent, chimney or vent connector on the discharge side of a mechanical flue exhauster.

804.3.7 Exhauster sizing. Mechanical flue exhausters and the vent system served shall be sized and installed in accordance with the manufacturer's installation instructions.

SECTION 805
FACTORY-BUILT CHIMNEYS

805.1 Listing. Factory-built chimneys shall be listed and labeled and shall be installed and terminated in accordance with the manufacturer's installation instructions.

805.2 Solid fuel appliances. Factory-built chimneys for use with solid fuel-burning appliances shall comply with the Type HT requirements of UL 103.

Exception: Chimneys for use with fireplace stoves listed only to UL 737 shall comply with the requirements of UL 103.

805.3 Factory-built fireplaces. Chimneys for use with factory-built fireplaces shall comply with the requirements of UL 127.

805.4 Support. Where factory-built chimneys are supported by structural members, such as joists and rafters, such members shall be designed to support the additional load.

805.5 Medium-heat appliances. Factory-built chimneys for medium-heat appliances producing flue gases having a temperature above 1,000°F (538°C), measured at the entrance to the chimney, shall comply with UL 959.

805.6 Decorative shrouds. 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 Section 304.1.

SECTION 806
METAL CHIMNEYS

806.1 General. Metal chimneys shall be constructed and installed in accordance with NFPA 211.

CHAPTER 9

SPECIFIC APPLIANCES, FIREPLACES AND SOLID FUEL-BURNING EQUIPMENT

SECTION 901 GENERAL

901.1 Scope. This chapter shall govern the approval, design, installation, construction, maintenance, alteration and repair of the appliances and equipment specifically identified herein and factory-built fireplaces. The approval, design, installation, construction, maintenance, alteration and repair of gas-fired appliances shall be regulated by the *International Fuel Gas Code.*

901.2 General. The requirements of this chapter shall apply to the mechanical equipment and appliances regulated by this chapter, in addition to the other requirements of this code.

901.3 Hazardous locations. Fireplaces and solid fuel-burning appliances shall not be installed in hazardous locations.

901.4 Fireplace accessories. Listed fireplace accessories shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions.

Comm 64.0900 Specific criteria for duct humidifiers.

(1) For duct humidifiers located upstream of final filters in a hospital or ambulatory surgery center, all of the following shall apply:
   (a) The duct humidifier shall be located at least 15 feet (4572 mm) upstream of the final filters.
   (b) The ductwork with duct-mounted humidifiers shall have a means of water removal.
   (c) An adjustable high-limit humidistat shall be located downstream of the humidifier to reduce the potential of condensation inside the duct.
   (d) All duct takeoffs shall be sufficiently downstream of the humidifier to ensure complete moisture absorption.

(2) For all other humidifiers located in hospitals or ambulatory surgery centers, all of the following shall apply:
   (a) Steam humidifiers shall be used.
   (b) Reservoir-type water spray or evaporative pan humidifiers shall not be used.

SECTION 902 MASONRY FIREPLACES

902.1 General. Masonry fireplaces shall be constructed in accordance with the *International Building Code.*

SECTION 903 FACTORY-BUILT FIREPLACES

903.1 General. Factory-built fireplaces shall be listed and labeled and shall be installed in accordance with the conditions of the listing. Factory-built fireplaces shall be tested in accordance with UL 127.

903.2 Hearth extensions. Hearth extensions of approved factory-built fireplaces and fireplace stoves shall be installed in accordance with the listing of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area.

903.3 Unvented gas log heaters. An unvented gas log heater shall not be installed in a factory-built fireplace unless the fireplace system has been specifically tested, listed and labeled for such use in accordance with UL 127.

SECTION 904 PELLET FUEL-BURNING APPLIANCES

904.1 General. Pellet fuel-burning appliances shall be listed and labeled and shall be installed in accordance with the terms of the listing.

SECTION 905 FIREPLACE STOVES AND ROOM HEATERS

905.1 General. Fireplace stoves and solid-fuel-type room heaters shall be listed and labeled and shall be installed in accordance with the conditions of the listing. Fireplace stoves shall be tested in accordance with UL 737. Solid-fuel-type room heaters shall be tested in accordance with UL 1482. Fireplace inserts intended for installation in fireplaces shall be listed and labeled in accordance with the requirements of UL 1482 and shall be installed in accordance with the manufacturer's installation instructions.

905.2 Connection to fireplace. The connection of solid fuel appliances to chimney flues serving fireplaces shall comply with Sections 801.7 and 801.10.

SECTION 906 FACTORY-BUILT BARBECUE APPLIANCES

906.1 General. Factory-built barbecue appliances shall be of an approved type and shall be installed in accordance with the manufacturer's installation instructions, this chapter and Chapters 3, 5, 7, 8 and the *International Fuel Gas Code.*

SECTION 907 INCINERATORS AND CREMATORIES

907.1 General. Incinerators and crematories shall be listed and labeled in accordance with UL 791 and shall be installed in accordance with the manufacturer's installation instructions.

SECTION 908
COOLING TOWERS, EVAPORATIVE CONDENSERS AND FLUID COOLERS

908.1 General. A cooling tower used in conjunction with an air-conditioning appliance shall be installed in accordance with the manufacturer's installation instructions.

908.2 Access. Cooling towers, evaporative condensers and fluid coolers shall be provided with ready access.

908.3 Location. Cooling towers, evaporative condensers and fluid coolers shall be located to prevent the discharge vapor plumes from entering occupied spaces. Plume discharges shall be not less than 5 feet (1524 mm) above or 20 feet (6096 mm) away from any ventilation inlet to a building. Location on the property shall be as required for buildings in accordance with the *International Building Code*.

908.4 Support and anchorage. Supports for cooling towers, evaporative condensers and fluid coolers shall be designed in accordance with the *International Building Code*. Seismic restraints shall be as required by the ICC *International Building Code*.

908.5 Water supply. Water supplies and protection shall be as required by the *International Plumbing Code*.

908.6 Drainage. Drains, overflows and blow-down provisions shall be indirectly connected to an approved disposal location. Discharge of chemical waste shall be approved by the appropriate regulatory authority.

908.7 Refrigerants and hazardous fluids. Heat exchange equipment that contains a refrigerant and that is part of a closed refrigeration system shall comply with Chapter 11. Heat exchange equipment containing heat transfer fluids which are flammable, combustible or hazardous shall comply with the *International Fire Code*.

SECTION 909
VENTED WALL FURNACES

909.1 General. Vented wall furnaces shall be installed in accordance with their listing and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 730.

909.2 Location. Vented wall furnaces shall be located so as not to cause a fire hazard to walls, floors, combustible furnishings or doors. Vented wall furnaces installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

909.3 Door swing. Vented wall furnaces shall be located so that a door cannot swing within 12 inches (305 mm) of an air inlet or air outlet of such furnace measured at right angles to the opening. Doorstops or door closers shall not be installed to obtain this clearance.

909.4 Ducts prohibited. Ducts shall not be attached to wall furnaces. Casing extension boots shall not be installed unless listed as part of the appliance.

909.5 Manual shutoff valve. A manual shutoff valve shall be installed ahead of all controls.

909.6 Access. Vented wall furnaces shall be provided with access for cleaning of heating surfaces, removal of burners, replacement of sections, motors, controls, filters and other working parts, and for adjustments and lubrication of parts requiring such attention. Panels, grilles and access doors that must be removed for normal servicing operations shall not be attached to the building construction.

SECTION 910
FLOOR FURNACES

910.1 General. Floor furnaces shall be installed in accordance with their listing and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 729.

910.2 Placement. Floor furnaces shall not be installed in the floor of any aisle or passageway of any auditorium, public hall, place of assembly, or in any egress element from any such room or space.

With the exception of wall register models, a floor furnace shall not be placed closer than 6 inches (152 mm) to the nearest wall, and wall register models shall not be placed closer than 6 inches (152 mm) to a corner.

The furnace shall be placed such that a drapery or similar combustible object will not be nearer than 12 inches (305 mm) to any portion of the register of the furnace. Floor furnaces shall not be installed in concrete floor construction built on grade. The controlling thermostat for a floor furnace shall be located within the same room or space as the floor furnace or shall be located in an adjacent room or space that is permanently open to the room or space containing the floor furnace.

910.3 Bracing. The floor around the furnace shall be braced and headed with a support framework design in accordance with the *International Building Code*.

910.4 Clearance. The lowest portion of the floor furnace shall have not less than a 6-inch (152 mm) clearance from the grade level; except where the lower 6-inch (152 mm) portion of the floor furnace is sealed by the manufacturer to prevent entrance of water, the minimum clearance shall be reduced to not less than 2 inches (51 mm). Where these clearances are not present, the ground below and to the sides shall be excavated to form a pit under the furnace so that the required clearance is provided beneath the lowest portion of the furnace. A 12-inch (305 mm) minimum clearance shall be provided on all sides except the control side, which shall have an 18-inch (457 mm) minimum clearance.

SECTION 911
DUCT FURNACES

911.1 General. Duct furnaces shall be installed in accordance with the manufacturer's installation instructions. Electric furnaces shall be tested in accordance with UL 1995.

SECTION 912
INFRARED RADIANT HEATERS

912.1 Support. Infrared radiant heaters shall be safely and adequately fixed in an approved position independent of fuel and electric supply lines. Hangers and brackets shall be noncombustible material.

912.2 Clearances. Heaters shall be installed with clearances from combustible material in accordance with the manufacturer's installation instructions.

SECTION 913
CLOTHES DRYERS

913.1 General. Clothes dryers shall be installed in accordance with the manufacturer's installation instructions. Electric residential clothes dryers shall be tested in accordance with an approved test standard. Electric commercial clothes dryers shall be tested in accordance with UL 1240. Electric coin-operated clothes dryers shall be tested in accordance with UL 2158.

913.2 Exhaust required. Clothes dryers shall be exhausted in accordance with Section 504.

913.3 Clearances. Clothes dryers shall be installed with clearance to combustibles in accordance with the manufacturer's instructions.

SECTION 914
SAUNA HEATERS

914.1 Location and protection. Sauna heaters shall be located so as to minimize the possibility of accidental contact by a person in the room.

914.1.1 Guards. Sauna heaters shall be protected from accidental contact by an approved guard or barrier of material having a low coefficient of thermal conductivity. The guard shall not substantially affect the transfer of heat from the heater to the room.

914.2 Installation. Sauna heaters shall be listed and labeled and shall be installed in accordance with their listing and the manufacturer's installation instructions.

914.3 Access. Panels, grilles and access doors that are required to be removed for normal servicing operations shall not be attached to the building.

914.4 Heat and time controls. Sauna heaters shall be equipped with a thermostat that will limit room temperature to 194°F (90°C). If the thermostat is not an integral part of the sauna heater, the heat-sensing element shall be located within 6 inches (152 mm) of the ceiling. If the heat-sensing element is a capillary tube and bulb, the assembly shall be attached to the wall or other support, and shall be protected against physical damage.

914.4.1 Timers. A timer, if provided to control main burner operation, shall have a maximum operating time of 1 hour. The control for the timer shall be located outside the sauna room.

914.5 Sauna room. A ventilation opening into the sauna room shall be provided. The opening shall be not less than 4 inches by 8 inches (102 mm by 203 mm) located near the top of the door into the sauna room.

914.5.1 Warning notice. The following permanent notice, constructed of approved material, shall be mechanically attached to the sauna room on the outside:

WARNING: DO NOT EXCEED 30 MINUTES IN SAUNA. EXCESSIVE EXPOSURE CAN BE HARMFUL TO HEALTH. ANY PERSON WITH POOR HEALTH SHOULD CONSULT A PHYSICIAN BEFORE USING SAUNA.

The words shall contrast with the background and the wording shall be in letters not less than 0.25-inch (6.4 mm) high.

Exception: This section shall not apply to one- and two-family dwellings.

SECTION 915
ENGINE AND GAS TURBINE-POWERED EQUIPMENT AND APPLIANCES

915.1 General. The installation of liquid-fueled stationary internal combustion engines and gas turbines, including fuel storage and piping, shall meet the requirements of NFPA 37.

915.2 Powered equipment and appliances. Permanently installed equipment and appliances powered by internal combustion engines and turbines shall be installed in accordance with the manufacturer's installation instructions and NFPA 37.

SECTION 916
POOL AND SPA HEATERS

916.1 General. Pool and spa heaters shall be installed in accordance with the manufacturer's instructions. Oil-fired pool heaters shall be tested in accordance with UL 726.

SECTION 917
COOKING APPLIANCES

917.1 Cooking appliances. Cooking appliances that are designed for permanent installation, including ranges, ovens, stoves, broilers, grills, fryers, griddles and barbecues, shall be listed, labeled and installed in accordance with the manufacturer's installation instructions. Oil-burning stoves shall be tested in accordance with UL 896. Solid fuel-fired ovens shall be tested in accordance with UL 2162.

917.2 Prohibited location. Cooking appliances designed, tested, listed and labeled for use in commercial occupancies shall not be installed within dwelling units or within any area where domestic cooking operations occur.

917.3 Domestic appliances. Cooking appliances installed within dwelling units and within areas where domestic cooking operations occur shall be listed and labeled as household-type appliances for domestic use.

SECTION 918
FORCED-AIR WARM-AIR FURNACES

918.1 Forced-air furnaces. Forced-air furnaces shall be installed in accordance with the listings and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 727. Electric furnaces shall be tested in accordance with UL 1096 or UL 1995. Solid fuel furnaces shall be tested in accordance with UL 391.

918.2 Minimum duct sizes. The minimum unobstructed total area of the outside and return air ducts or openings to a forced-air warm-air furnace shall be not less than 2 square inches per 1,000 Btu/h (4402 mm²/kW) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions. The minimum unobstructed total area of supply ducts from a forced-air warm-air furnace shall not be less than 2 square inches for each 1,000 Btu/h (4402 mm²/kW) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions.

Exception: The total area of the supply air ducts and outside and return air ducts shall not be required to be larger than the minimum size required by the furnace manufacturer's installation instructions.

918.3 Heat pumps. The minimum unobstructed total area of the outside and return air ducts or openings to a heat pump shall be not less than 6 square inches per 1,000 Btu/h (13 208 mm²/kW) output rating or as indicated by the conditions of listing of the heat pump. Electric heat pumps shall be tested in accordance with UL 559 or UL 1995.

918.4 Dampers. Volume dampers shall not be placed in the air inlet to a furnace in a manner that will reduce the required air to the furnace.

918.5 Circulating air ducts for forced-air warm-air furnaces. Circulating air for fuel-burning, forced-air-type, warm-air furnaces shall be conducted into the blower housing from outside the furnace enclosure by continuous air-tight ducts.

918.6 [Comm 64.0918] Prohibited sources. Outside or return air for a forced-air heating system shall not be taken from the following locations:

1. Closer than 10 feet (3048 mm) from any appliance vent outlet, a vent opening from a plumbing drainage system or the discharge outlet of an exhaust fan, unless the outlet is 2 feet (610 mm) above the outside air inlet.
2. Where located less than 10 feet (3048 mm) above the surface of any abutting public way or driveway, or at grade level by a sidewalk, street, alley or driveway.
3. A hazardous or insanitary location or a refrigeration machinery room as defined in this code.
4. A room or space, the volume of which is less than 25 percent of the entire volume served by such system. Where connected by a permanent opening having an area sized in accordance with Sections 918.2 and 918.3, adjoining rooms or spaces shall be considered as a single room or space for the purpose of determining the volume of such rooms or spaces.

   Exception: The minimum volume requirement shall not apply where the amount of return air taken from a room or space is less than or equal to the amount of supply air delivered to such room or space.
5. A closet, bathroom, toilet room, kitchen, garage, mechanical room, boiler room or furnace room.
6. A room or space containing a fuel-burning appliance where such room or space serves as the sole source of return air.

   Exceptions:

   1. This shall not apply where the fuel-burning appliance is a direct-vent appliance.
   2. This shall not apply where the room or space complies with the following requirements:
      2.1. The return air shall be taken from a room or space having a volume exceeding 1 cubic foot for each 10 Btu/h (9.6 L/W) of combined input rating of all fuel-burning appliances therein.
      2.2. The volume of supply air discharged back into the same space shall be approximately equal to the volume of return air taken from the space.
      2.3. Return-air inlets shall not be located within 10 feet (3048 mm) of any appliance firebox or draft hood in the same room or space.
   3. This shall not apply to rooms or spaces containing solid fuel-burning appliances, provided that return-air inlets are located not less than 10 feet (3048 mm) from the firebox of such appliances.

Comm 64.0918 Forced-air warm-air furnaces. (1) The outside air intake openings shall be located at least 12 inches (305 mm) vertical from the adjoining grade level.

918.7 Outside opening protection. Outdoor air intake openings shall be protected in accordance with Section 401.6.

918.8 Return-air limitation. Return air from one dwelling unit shall not be discharged into another dwelling unit.

SECTION 919
CONVERSION BURNERS

919.1 Conversion burners. The installation of conversion burners shall conform to ANSI Z21.8.

SECTION 920
UNIT HEATERS

920.1 General. Unit heaters shall be installed in accordance with the listing and the manufacturer's installation instructions. Oil-fired unit heaters shall be tested in accordance with UL 731.

920.2 Support. Suspended-type unit heaters shall be supported by elements that are designed and constructed to accommodate the weight and dynamic loads. Hangers and brackets shall be of noncombustible material. Suspended-type oil-fired unit heaters shall be installed in accordance with NFPA 31.

920.3 Ductwork. A unit heater shall not be attached to a warm-air duct system unless listed for such installation.

SECTION 921
VENTED ROOM HEATERS

921.1 General. Vented room heaters shall be listed and labeled and shall be installed in accordance with the conditions of the listing and the manufacturer's instructions.

SECTION 922
KEROSENE AND OIL-FIRED STOVES

922.1 General. Kerosene and oil-fired stoves shall be listed and labeled and shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions. Kerosene and oil-fired stoves shall comply with NFPA 31. Oil-fired stoves shall be tested in accordance with UL 896.

SECTION 923
SMALL CERAMIC KILNS

923.1 General. The provisions of this section shall apply to kilns that are used for ceramics, have a maximum interior volume of 20 cubic feet (0.566 m^3) and are used for hobby and non-commercial purposes.

923.1.1 Installation. Kilns shall be installed in accordance with the manufacturer's installation instructions and the provisions of this code.

SECTION 924
STATIONARY FUEL CELL POWER PLANTS

924.1 General. Stationary fuel cell power plants having a power output not exceeding 1,000 kW, shall be tested in accordance with ANSI Z21.83 and shall be installed in accordance with the manufacturer's installation instructions.

CHAPTER 10

BOILERS, WATER HEATERS AND PRESSURE VESSELS

Comm 64.1001 Boilers, water heaters and pressure vessels.

(1) The provisions of ch. Comm 41 shall govern the installation, alteration and repair of boilers and pressure vessels. The provisions of chapters Comm 81 to 86 shall govern the installation, alteration and repair of water heaters.

(2) Water heaters utilized both to supply potable hot water and provide hot water for space-heating applications shall be listed and labeled by the manufacturer and shall be installed in accordance with the manufacturer's installation instructions and applicable provisions in chs. Comm 81 to 86.

(3) Water heaters utilized for both potable water heating and space-heating applications shall be sized to prevent the space-heating load from diminishing the required water-heating capacity.

(4) Where a combination potable water-heating and space-heating system requires water for space heating at temperatures higher than 140°F (60°C), a tempering valve shall be provided to temper the water supplied to the potable hot water distribution system to a temperature of 140°F (60°C) or less.

CHAPTER 11

REFRIGERATION

Comm 64.1101 Refrigeration. Mechanical refrigerating systems installed in public buildings and places of employment shall comply with ch. Comm 45.

CHAPTER 12

HYDRONIC PIPING

Comm 64.1201 Hydronic piping. The provisions of ch. Comm 41 shall apply to boilers, piping components associated with boilers, pressure vessels and power piping in places of employment and in public buildings.

CHAPTER 13

FUEL OIL PIPING AND STORAGE

Comm 64.1300 Note: See ch. Comm 10 for fuel oil piping requirements.

CHAPTER 14

SOLAR SYSTEMS

SECTION 1401
GENERAL

1401.1 Scope. This chapter shall govern the construction, installation, alteration and repair of systems, equipment and appliances intended to utilize solar energy for space heating or cooling, domestic hot water heating, swimming pool heating or process heating.

1401.2 Potable water supply. Potable water systems shall be protected against contamination in accordance with the *International Plumbing Code.*

1401.3 Heat exchangers. Heat exchangers used in domestic water-heating systems shall be approved for the intended use. The system shall have adequate protection to ensure that the potability of the water supply and distribution system is properly safeguarded.

1401.4 Solar energy equipment and appliances. Solar energy equipment and appliances shall conform to the requirements of this chapter and shall be installed in accordance with the manufacturer's installation instructions.

1401.5 Ducts. Ducts utilized in solar heating and cooling systems shall be constructed and installed in accordance with Chapter 6 of this code.

SECTION 1402
INSTALLATION

1402.1 Access. Access shall be provided to solar energy equipment and appliances for maintenance.

1402.2 Controlling condensation. Where attics or structural spaces are part of a passive solar system, ventilation of such spaces, as required by Section 406, is not required where other approved means of controlling condensation are provided.

1402.3 Roof-mounted collectors. Roof-mounted solar collectors that also serve as a roof covering shall conform to the requirements for roof coverings in accordance with the *International Building Code.*

Exception: The use of plastic solar collector covers shall be limited to those approved plastics meeting the requirements for plastic roof panels in the *International Building Code.*

1402.3.1 Collectors mounted above the roof. When mounted on or above the roof covering, the collector array and supporting construction shall be constructed of noncombustible materials or fire-retardant-treated wood conforming to the *International Building Code* to the extent required for the type of roof construction of the building to which the collectors are accessory.

Exception: The use of plastic solar collector covers shall be limited to those approved plastics meeting the requirements for plastic roof panels in the *International Building Code.*

1402.4 Equipment. The solar energy system shall be equipped in accordance with the requirements of Sections 1402.4.1 through 1402.4.4.

1402.4.1 Pressure and temperature. Solar energy system components containing pressurized fluids shall be protected against pressures and temperatures exceeding design limitations with a pressure and temperature relief valve. Each section of the system in which excessive pressures are capable of developing shall have a relief device located so that a section cannot be valved off or otherwise isolated from a relief device. Relief valves shall comply with the requirements of Section 1006.4 and discharge in accordance with Section 1006.6.

1402.4.2 Vacuum. The solar energy system components that are subjected to a vacuum while in operation or during shutdown shall be designed to withstand such vacuum or shall be protected with vacuum relief valves.

1402.4.3 Protection from freezing. System components shall be protected from damage by freezing of heat transfer liquids at the lowest ambient temperatures that will be encountered during the operation of the system.

1402.4.4 Expansion tanks. Liquid single-phase solar energy systems shall be equipped with expansion tanks sized in accordance with Section 1009.

1402.5 Roof penetrations. Roof penetrations shall be flashed to prevent entry of water.

1402.6 Filtering. Air transported to occupied spaces through rock or dust-producing materials by means other than natural convection shall be filtered at the outlet from the heat storage system.

SECTION 1403
HEAT TRANSFER FLUIDS

1403.1 Flash point. The flash point of heat transfer liquids utilized in solar system equipment and appliances shall not be less than the highest temperature determined from the following:

1. Fifty °F (28°C) above the design maximum operating (flow) temperature of the fluid in the solar system.
2. Two hundred °F (111°C) below the design maximum nonoperating (no-flow) temperature of the fluid attained in the collector, provided that the collector manifold assembly is located outside of the building and is exposed to the weather, and provided that relief valves located adjacent to the collector or collector manifold do not discharge directly into the building.
3. The design maximum no-flow temperature in other collector manifold and relief valve configurations.

1403.2 Flammable gases and liquids. A flammable liquid or gas shall not be utilized as a heat transfer fluid. The flash point of liquids used in occupancies classified in Use Group H or F shall not be lower unless approved.

SECTION 1404
MATERIALS

1404.1 Collectors. Factory-built collectors shall be listed and labeled, and bear a label showing the manufacturer's name and address, model number, collector dry weight, collector maximum allowable operating and nonoperating temperatures and pressures, minimum allowable temperatures and the types of heat transfer fluids that are compatible with the collector. The label shall clarify that these specifications apply only to the collector.

1404.2 Thermal storage units. Pressurized thermal storage units shall be listed and labeled, and bear a label showing the manufacturer's name and address, model number, serial number, storage unit maximum and minimum allowable operating temperatures, storage unit maximum and minimum allowable operating pressures and the types of heat transfer fluids compatible with the storage unit. The label shall clarify that these specifications apply only to the thermal storage unit.

CHAPTER 15
REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.8.

AIA

The American Institute of Architects
9 Jay Gould Court, Box 753
Waldorf, MD 20601

Standard reference number	Title	Referenced in code section number
	AIA Guidelines for Design and Construction of Hospital and Health Care Facilities, 1996-97 [Comm 64.1500 (2)]	Table 64.0403, Comm 64.0605 (1)

ANSI

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

Standard reference number	Title	Referenced in code section number
Z21.8—94	Installation of Domestic Gas Conversion Burners	919.1
Z21.83—98	Fuel Cell Power Plants	924.1

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle, NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
ASHRAE—97	Handbook of Fundamentals	312.1
34—97	Number Designation and Safety Classification of Refrigerants—with Addenda through 1997	202

ASME

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
B16.18—84	Cast Copper Alloy Solder Joint Pressure Fittings	513.13.1
B16.22—95	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings —with B16.22a-98 Addendum	513.13.1
ASME—98	Boiler & Pressure Vessel Code (Sections I, II, IV, V & VI)	1004.1, 1011.1
ASME CSD-1	Controls And Safety Devices for Automatically Fired Boilers	1004.1

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428

Standard reference number	Title	Referenced in code section number
B 42—98	Specification for Seamless Copper Pipe, Standard Sizes	513.13.1
B 43—98	Specification for Seamless Red Brass Pipe, Standard Sizes	513.13.1
B 68—95	Specification for Seamless Copper Tube, Bright Annealed	513.13.1
B 88—96	Specification for Seamless Copper Water Tube	513.13.1
B 251—97	Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	513.13.1
B 280—98	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	513.13.1
C 315—98b	Specification for Clay Flue Linings	801.16.1, Table 803.10.4
C 411—97	Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation	604.3
D 56—98a	Test Method for Flash Point by Tag Closed Tester	202
D 93—99	Test Method for Flash Point of Pensky-Martens Closed Tester	202
D 2412—96	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading	603.7.4
D 3278—96e^{01}	Test Methods for Flash Point of Liquids by Setaflash-Closed-Cup Apparatus	202
E 84—98e^{01}	Test Method for Surface Burning Characteristics of Building Materials	202, 510.8, 602.2.1, 604.3
E119—98	Test Method for Fire Tests of Building Construction and Materials	607.5.2
E 136—98e^{01}	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	202
E 814—97	Test Method for Fire Tests of Through-Penetration Fire Stops	506.3.11

DOL

Department of Labor
Occupational Safety and Health Administration
c/o Superintendent of Docments
U.S. Government Printing Office
Washington, DC 20402-9325

Standard Reference Number	Title	Referenced in code section number
29 CFR; 1910.1000—74	Air Contaminants	502.5

ICC

International Code Council, Inc.
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041-3401

Standard reference number	Title	Referenced in code section number
EC—2000	ICC Electrical Code™—Administrative Provisions	201.3, 301.7, 306.3.1, 306.4.1, 513.11, 513.12.1, 602.2.1.1
IBC—2000	International Building Code®	201.3, 202, 301.12, 301.13, 301.15, 301.16, 302.1, 302.2, 304.6, 304.9, 308.8, 308.10, 401.4, 401.6, 402.1, 406.1, 502.9, 502.9.1, 504.2, 506.3.4, 506.3.11, 506.3.13.2, 506.4.1, 509.1, 510.6, 510.7, 511.1.5, 513.1, 513.2, 513.3, 513.4.3, 513.5, 513.5.2, 513.5.2.1, 513.6.2, 513.10.5, 513.12, 513.12.2, 513.20, 601.2, 602.3, 603.1, 603.9, 604.4, 606.2.1, 607.1.1, 607.5.1, 607.5.2, 607.5.3, 607.6, 607.5.4, 607.5.4.1, 701.4.1, 701.4.2, 801.3, 801.16.1, 801.18.4, 902.1, 908.3, 908.4, 910.3, 911.3, 1004.6, 1402.3, 1402.3.1
IECC—2000	International Energy Conservation Code®	301.2, 303.3, 312.1, 603.8, 604.1
IFC—2000	International Fire Code®	201.3, 310.1, 311.1, 502.6.2, 502.7.1, 502.8.5, 502.8.5.2, 502.8.5.3, 502.8.8.2, 502.8.8.3, 502.8.8.5, 502.8.8.6, 502.9, 502.9.3, 502.15.2, 509.1, 510.2.1, 510.2.2, 510.4, 513.12.1, 513.12.2, 513.15, 513.16, 513.17, 513.18, 513.19, 513.20.2, 513.20.3, 908.7
IFGC—2000	International Fuel Gas Code®	201.3, 301.3, 701.1, 801.1, 901.1, 906.1
IPC—2000	International Plumbing Code®	201.3, 301.8, 512.2, 908.5, 1002.1, 1002.2, 1002.3, 1005.2, 1006.6, 1008.2, 1009.3, 1401.2

MSS

Manufacturers Standardization Society of the Valve & Fittings Industry, Inc.
127 Park Street, N.E.
Vienna, VA 22180

Standard reference number	Title	Referenced in code section number
SP-69—96	Pipe Hangers and Supports	305.4

NAIMA

North American Insulation Manufacturers Association
Suite 310
44 Canal Center Plaza
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
AH116—97	Fibrous Glass Duct Construction Standards	603.4

NFPA

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

Standard reference number	Title	Referenced in code section number
13—99	Installation of Sprinkler Systems [Comm 64.1500(1)]	513.12.3
31—01	Installation of Oil-Burning Equipment [Comm 64.1500(1)]	801.2.1, 801.18.1, 801.18.2, 920.2, 922.1
37—98	Stationary Combustion Engines and Gas Turbines	915.1, 915.2
58—98	Liquefied Petroleum Gas Code	502.8.10
69—97	Explosion Prevention Systems	510.8.3
72—99	National Fire Alarm Code [Comm 64.1500(1)]	606.3, 607.2
82—99	Incinerators, Waste and Linen Handling Systems and Equipment	601.1
88B—97	Repair Garages	304.4
91—99	Exhaust Systems for Air Conveying of Materials	502.8.5.1, 502.16
211—96	Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	806.1
704—96	Identification of the Hazards of Materials for Emergency Response	502.7.4, 510.1
8501—97	Single Burner Boiler Operation	1004.1
8502—99	Prevention of Furnace Explosions/Implosions in Multiple Burner Boiler-Furnaces	1004.1
8504—96	Atmospheric Fluidized-Bed Boiler Operation	1004.1

SMACNA

Sheet Metal & Air Conditioning Contractors National Assoc., Inc.
4021 Lafayette Center Road
Chantilly, VA 22021

Standard reference number	Title	Referenced in code section number
SMACNA—95	HVAC Duct Construction Standards—Metal and Flexible; Addendum number 1, November 1997	603.3
SMACNA—92	Fibrous Glass Duct Construction Standards	603.4

UL

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
17—94	Vent or Chimney Connector Dampers for Oil-Fired Appliances—with Revisions thru September 1998	803.6
103—95	Chimneys, Factory-Built, Residential Type and Building Heating Appliance—with Revisions thru March 1999	805.2
127—96	Factory-Built Fireplaces—with Revisions thru January 1998	805.3, 903.1, 903.3
174—96	Household Electric Storage Tank Water Heaters	1002.1
181—96	Factory-made Air Ducts and Air Connectors —with Revisions thru December 1998	512.2, 603.4, 603.5.1, 603.5.2, 604.13
300—96	Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas	509.3
391—95	Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces—with Revisions thru June 1997	918.1
555—95	Fire Dampers	607.3
555C—96	Ceiling Dampers	607.6.2, 607.3
555S—96	Leakage Rated Dampers for Use in Smoke Control Systems	607.3.1.1, 607.3
641—95	Low-Temperature Venting Systems, Type L	802.1
710—95	Exhaust Hoods for Commercial Cooking Equipment	507.1, 507.7.1
726—95	Oil-Fired Boiler Assemblies—with Revisions thru January 1999	916.1
727—94	Oil-Fired Central Furnaces—with Revisions thru January 1999	918.1
729—94	Oil-Fired Floor Furnaces—with Revisions thru August 1995	910.1
730—94	Oil-Fired Wall Furnaces—with Revisions thru January 1999	909.1
731—95	Oil-Fired Unit Heaters—with Revisions thru January 1999	920.1
732—95	Oil-Fired Storage Tank Water Heaters	1002.1
737—96	Fireplace Stoves—with Revisions thru June 1998	805.2, 905.1
791—93	Residential Incinerators—with Revisions thru May 1998	907.1
834—95	Heating, Water Supply and Power Boilers—Electric—With Revisions Thru August 1997	1004.1
896—93	Oil-Burning Stoves—with Revisions thru April 1997	916.1, 917.1, 922.1
910—98	Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Use in Space Transporting Environmental Air	602.2.1.1
959—95	Medium Heat Appliance Factory Built Chimneys—with Revisions thru April 1998	805.5
1240—94	Electric Commercial Clothes Drying Equipment—with Revisions thru October 1998	913.1
1453—95	Electronic Booster and Commercial Storage Tank Water Heaters	1002.1
1482—96	Room Heaters, Solid-Fuel Type—with Revisions thru September 1998	905.1
1777—96	Chimney Liners—with Revisions thru August 1998	801.16.1, 801.18.4
1820—96	Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics	602.2.1.3
1887—96	Fire Tests of Plastic Sprinkler Pipe for Flame and Smoke Characteristics—with Revisions thru April 1998	602.2.1.2
1995—95	Heating and Cooling Equipment—with Revisions thru July 1998	911.1, 918.1, 918.3
2043—96	Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces	602.2.1.4
2158—97	Electric Clothes Dryer—with Revisions June 1997	913.1
2162—94	Outline of Investigation for Commercial Wood-Fired Baking Ovens—Refractory Type	917.1

(Note: UL 303-97, UL 465-82, UL 559-85 & UL 1096-86 are replaced by UL 1995-95 and UL 1556-90 is replaced by 2158-97.)

APPENDIX A
COMBUSTION AIR OPENINGS AND CHIMNEY CONNECTOR PASS-THROUGHS

Figures A-1 through A-4 are illustrations of appliances located in confined spaces.

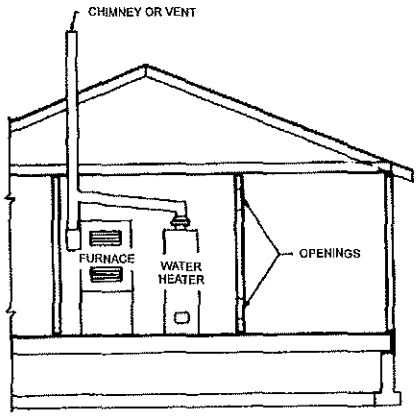

FIGURE A-1
ALL AIR FROM INSIDE THE BUILDING

NOTE: Each opening shall have a free area of not less than 1 square inch per 1,000 Btu per hour of the total input rating of all appliances in the enclosure and not less than 100 square inches.

For SI: 1 square inch = 645 mm^2, 1 British thermal unit per hour = 0.2931 W.

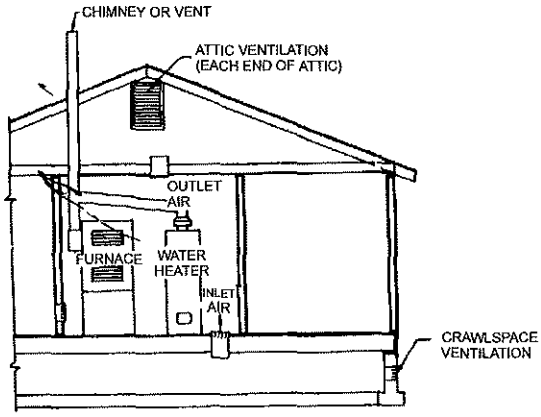

FIGURE A-2
ALL AIR FROM OUTDOORS—INLET AIR FROM VENTILATED CRAWL SPACE AND OUTLET AIR TO VENTILATED ATTIC

NOTE: The inlet and outlet air openings shall each have a free area of not less than 1 square inch per 4,000 Btu per hour of the total input rating of all appliances in the enclosure.

For SI: 1 square inch = 645 mm^2, 1 British thermal unit per hour = 0.2931 W.

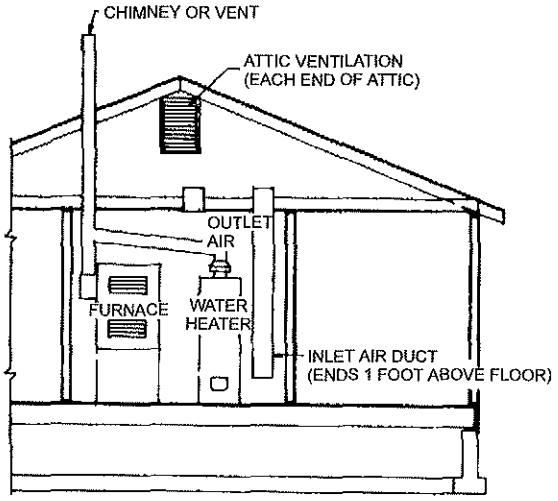

FIGURE A-3
ALL AIR FROM OUTDOORS THROUGH VENTILATED ATTIC

NOTE: The inlet and outlet air openings shall each have a free area of not less than 1 square inch per 4,000 Btu per hour of the total input rating of all appliances in the enclosure.

For SI: 1 foot = 304.8 mm, 1 square inch = 645 mm^2, 1 British thermal unit per hour = 0.2931 W.

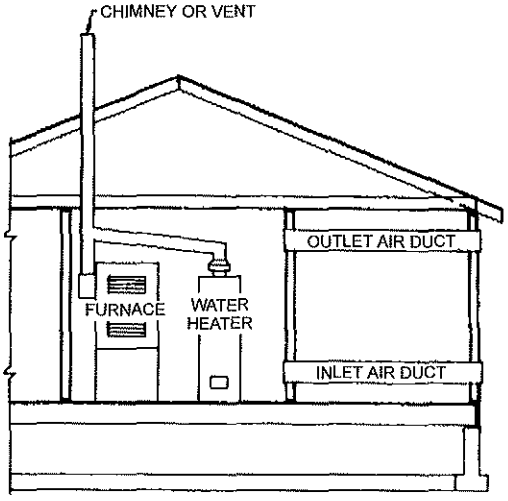

FIGURE A-4
ALL AIR FROM OUTDOORS THROUGH HORIZONTAL DUCTS OR DIRECT OPENINGS

NOTE: Each air duct opening shall have a free area of not less than 1 square inch per 2,000 Btu per hour of the total input rating of all appliances in the enclosure. If the appliance room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of not less than 1 square inch per 4,000 Btu per hour or the total input rating of all appliances in the enclosure.

For SI: 1 foot = 304.8 mm, 1 square inch = 645 mm^2, 1 British thermal unit per hour = 0.2931 W.

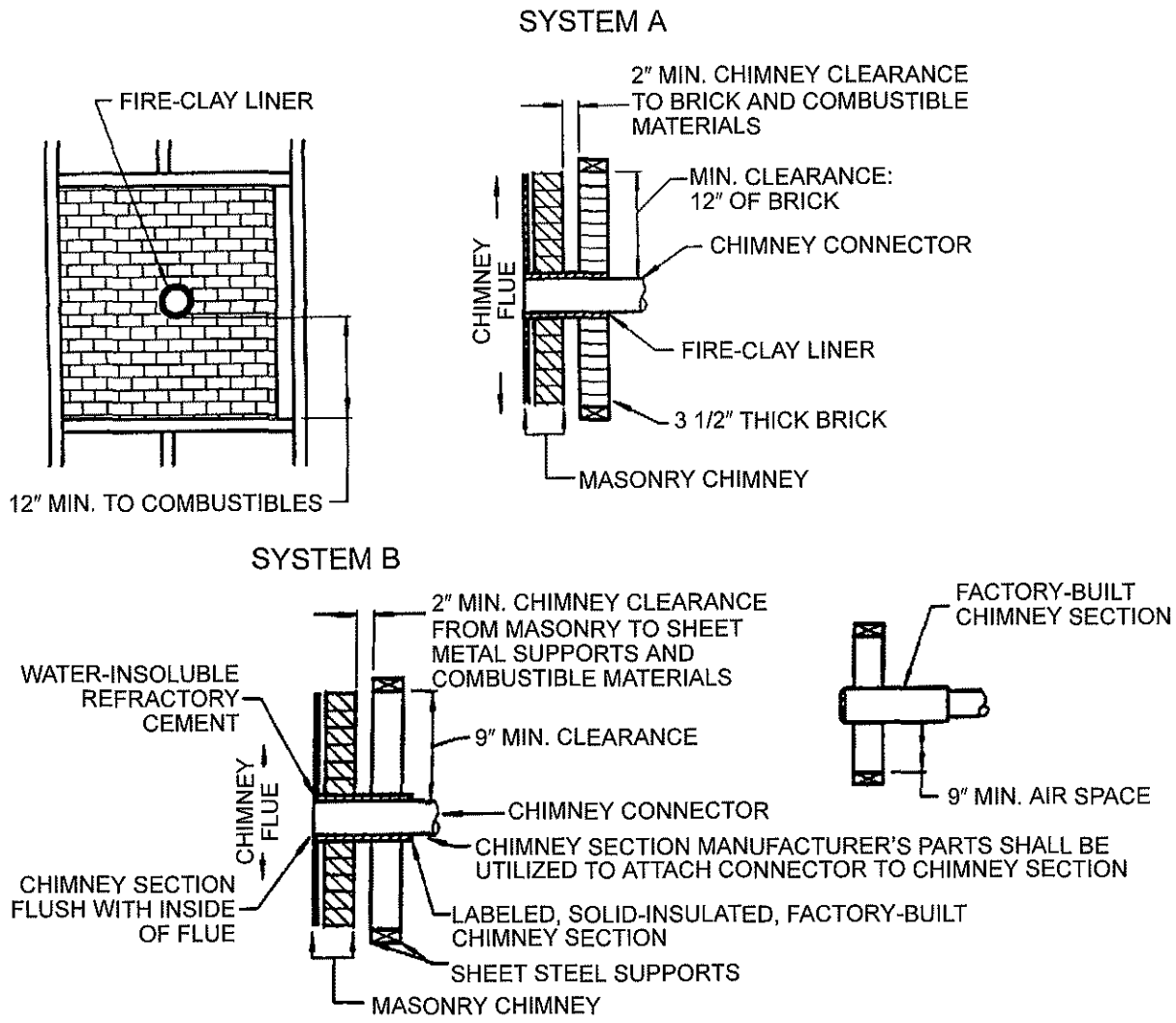

FIGURE A-5
CHIMNEY CONNECTOR SYSTEMS

For SI: 1 inch = 25.4 mm.

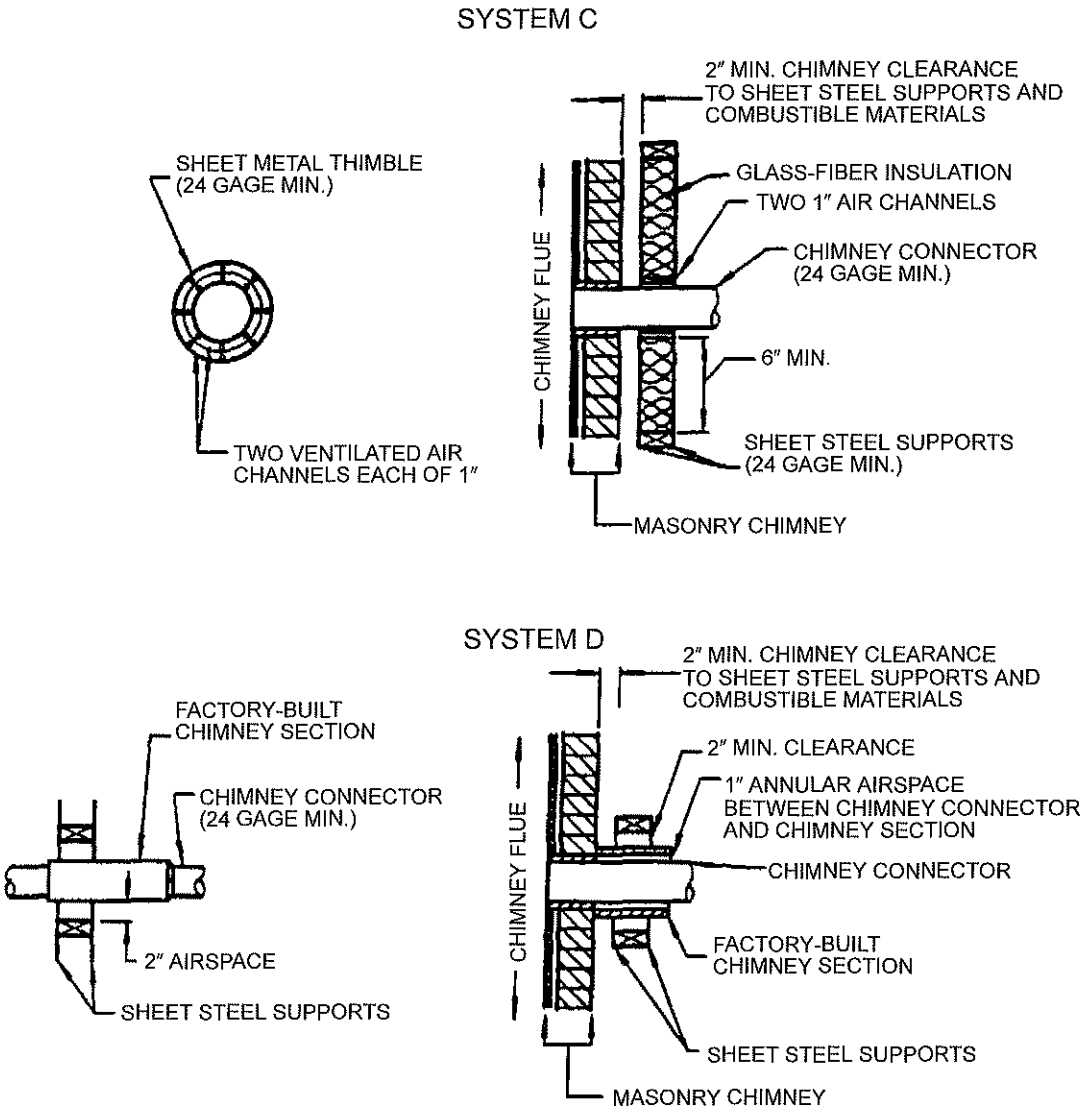

FIGURE A-5—continued
CHIMNEY CONNECTOR SYSTEMS

For SI: 1 inch = 25.4 mm.

APPENDIX B
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