

NFPA[®]

31

Standard for the
Installation of
Oil-Burning Equipment

2020



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NFPA® 31

Standard for the

Installation of Oil-Burning Equipment

2020 Edition

This edition of NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, was prepared by the Technical Committee on Liquid Fuel Burning Equipment. It was issued by the Standards Council on November 4, 2019, with an effective date of November 24, 2019, and supersedes all previous editions.

This edition of NFPA 31 was approved as an American National Standard on November 24, 2019.

Origin and Development of NFPA 31

Oil-burning equipment standards date from 1902, when they were issued by the National Board of Fire Underwriters under the title *Rules and Requirements of the National Board of Fire Underwriters for the Storage and Use of Fuel Oil and for the Construction and Installation of Oil Burning Equipment*. Subsequently, the project was turned over to the NFPA, and a completely revised standard was first presented to the Association in 1913. Since then, the responsibility for NFPA 31 has been that of the Technical Committee on Liquid Fuel Burning Equipment. Revised editions of NFPA 31 were issued in 1948, 1951, 1953, 1955, 1956, 1957, 1959, 1961, 1963, 1964, 1965, 1968, 1972, 1974, 1978, 1983, 1987, 1992, 1997, 2001, 2006, 2010, and 2016.

The 1997 edition of NFPA 31 incorporated complete revisions to Chapter 2 and Chapter 5 with the addition of new Appendixes D and E.

The 2001 edition included a major editorial reorganization to comply with the *Manual of Style for NFPA Technical Committee Documents*, the addition of new Chapters 12 and 13, and a major revision to Appendix E.

The 2006 edition incorporated several amendments all coupled to the revision to Section 7.5 on installation of fuel oil storage tanks in buildings.

The 2011 edition incorporated amendments permitting the use of any liquid fuel deemed appropriate for use for stationary liquid fuel burning appliances, including fuels derived from biodiesel sources. The 2011 edition also included revisions to Chapters 2 and 8.

The 2016 edition incorporated a series of amendments to require oil-burning appliances to be listed or approved for use, to require installers to ensure the appliance functions in accordance with the manufacturer's instructions, and to ensure adequate separation between stored materials and oil-burning appliances, chimneys, chimney connectors, and flues.

In the 2020 edition, Chapter 3 definitions for heating fuel and used oil have been revised, and the list of acceptable fuels in Chapter 4 has been modified based on updated ASTM reference standards. Annex material also has been included to explain the changes regarding acceptable fuels. The specifications for acceptable piping and fitting materials in Section 8.2 also have been revised based on updates to the reference test standards. In addition to these technical requirement changes, references based on extracted text also have been updated.

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

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

Committee Scope: This Committee shall have primary responsibility for documents on the safeguarding against the fire, explosion, and life safety hazards associated with the installation and use of stationary and portable liquid fuel-burning equipment, including: (1) related fuel storage tanks and associated piping, venting systems, pumps, and controls; (2) the combustion air supply and flue gas venting systems for the liquid fuel burning equipment; and (3) combustion and safety controls.

This Committee does not have responsibility for: (1) boiler-furnaces with fuel input ratings of 3660 kW (12,500,000 BTU per hr. or 10,000 lbs. steam per hr.) or more; (2) process ovens; (3) process furnaces; or (4) internal combustion engines.

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NFPA 31

Standard for the

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2020 Edition

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

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex F.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard shall apply to the installation of stationary liquid fuel-burning appliances, including but not limited to industrial-, commercial-, and residential-type steam, hot water, or warm air heating appliances; domestic-type range burners; space heaters; and portable liquid fuel-burning equipment.

1.1.2 This standard shall also apply to all accessories and control systems, whether electric, thermostatic, or mechanical, and all electrical wiring connected to liquid fuel-burning appliances.

1.1.3 This standard shall also apply to the installation of liquid fuel storage and supply systems connected to liquid fuel-burning appliances.

1.1.4 This standard shall also apply to those multifueled appliances in which a liquid fuel is one of the standard or optional fuels.

1.1.5* This standard shall not apply to internal combustion engines, oil lamps, or portable devices not specifically covered in this standard. (See Chapter 11 for portable devices that are covered in this standard.)

1.2 Purpose. The purpose of this standard is to provide minimum requirements for the safe installation of stationary liquid fuel-burning appliances and all related accessories so as to prevent fires and explosions.

1.3 Application. (Reserved)

1.4 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

1.5 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.6 Units.

1.6.1 The units of measure in this standard are presented first in U.S. customary units (inch/pound units). International System (SI) of Units follow the inch/pound units in parentheses.

1.6.2 Either system of units shall be acceptable for satisfying the requirements in the standard.

1.6.3 Users of this standard shall apply one system of units consistently and shall not alternate between units.

1.6.4 The values presented for measurements in this standard are expressed with a degree of precision appropriate for practical application and enforcement. It is not intended that the application or enforcement of these values be more precise than the precision expressed.

1.6.5 Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source documents.

1.7 Code Adoption Requirements. (Reserved)

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2017 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*, 2018 edition.

NFPA 54/ANSI Z223.1, *National Fuel Gas Code*, 2018 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2019 edition.

NFPA 85, *Boiler and Combustion Systems Hazards Code*, 2019 edition.

NFPA 86, *Standard for Ovens and Furnaces*, 2019 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2018 edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2018 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, 2019 edition.

2.3 Other Publications.

2.3.1 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API Standard 650, *Welded Steel Tanks for Oil Storage*, 11th edition, 2007.

2.3.2 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ANSI/ASME B36.10M, *Standard on Welded and Seamless Wrought Steel Pipe*, 2004.

2.3.3 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A53/A53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*, 2012.

ASTM A106/A106M, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*, 2015.

ASTM A254, *Standard Specification for Copper-Brazed Steel Tubing*, 2012.

ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*, 2015.

ASTM A312/A312M, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*, 2017.

ASTM B43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes*, 2015.

ASTM B75/B75M, *Standard Specification for Seamless Copper Tube*, 2011.

ASTM B88, *Standard Specification for Seamless Copper Water Tube*, 2016.

ASTM B135/B135M, *Standard Specification for Seamless Brass Tube*, 2017.

ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*, 2018.

ASTM D396, *Standard Specification for Fuel Oils*, 2016.

ASTM D3699, *Standard Specification for Kerosine*, 2013be1.

ASTM D6448, *Standard Specification for Industrial Burner Fuels from Used Lubricating Oils*, 2016.

ASTM D6751, *Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels*, 2015ce1.

ASTM D6823, *Standard Specification for Commercial Boiler Fuels with Used Lubricating Oils*, 2013.

ASTM D7666, *Standard Specification for Triglyceride Burner Fuel*, 2012.

2.3.4 NORA Publications. National Oilheat Research Alliance, 600 Cameron Street, Suite 206, Alexandria, VA 22314.

NORA Recommended Practice for Anchoring of Heating Oil Tanks, 2014.

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

UL 30, *Standard for Metal Safety Cans*, 1995, revised 2014.

UL 58, *Standard for Steel Underground Tanks for Flammable and Combustible Liquids*, 2006.

UL 80, *Standard for Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids*, 2007, revised 2014.

UL 103, *Standard for Factory-Built Chimneys for Residential Type and Building Heating Appliances*, 2010, revised 2016.

UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*, 2006, 2014.

UL 142A, *Standard for Special Purpose Aboveground Tanks for Specific Flammable or Combustible Liquids*, 2018.

UL 180, *Standard for Combustible Liquid Tank Accessories*, 2019.

UL 295, *Standard for Commercial-Industrial Gas Burners*, 2017.

UL 296, *Standard for Oil Burners*, 2003, revised 2017.

UL 296A, *Standard for Waste Oil-Burning Air-Heating Appliances*, 2013.

UL 443, *Standard for Steel Auxiliary Tanks for Oil Burner Fuel*, 2006, revised 2013.

UL 971, *Standard for Nonmetallic Underground Piping for Flammable Liquids*, 1995, revised 2013.

UL971A, *Outline of Investigation for Metallic Underground Fuel Pipe*, 2006.

UL 1313, *Standard for Nonmetallic Safety Cans for Petroleum Products*, 2015.

UL 1316, *Standard for Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures*, 1994, revised 2006.

UL 1746, *Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks*, 2007.

UL 2039, *Standard for Safety for Flexible Connector Piping for Fuels*, 2006.

UL 2080, *Standard for Fire Resistant Tanks for Flammable and Combustible Liquids*, 2000.

UL 2085, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids*, 1997, revised 2003.

UL 2245, *Standard for Below-Grade Vaults for Flammable Liquid Storage Tanks*, 2006.

UL 2258, *Standard for Nonmetallic Tanks for Oil Burner Fuels and Other Combustible Liquids*, 2018.

2.3.6 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street NW, Washington DC 20401-0001.

Title 40, Code of Federal Regulations, Part 279.23, "On-Site Burning in Space Heaters."

2.3.7 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 54, *National Fuel Gas Code*, 2018 edition.
NFPA 70®, *National Electrical Code®*, 2017 edition.
NFPA 86, *Standard for Ovens and Furnaces*, 2018 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, 2019 edition.

NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program*, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates

compliance with appropriate standards or performance in a specified manner.

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

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections, without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth. [70:100]

3.3.2 Air Heater. An indirect-fired appliance intended to supply heated air for space heating and other purposes, but not intended for permanent installation.

3.3.3 Antiflooding Device. A safety control that causes the flow of (liquid) fuel to be shut off when a rise in fuel level occurs or when excess fuel is received and that operates before the hazardous discharge of fuel can occur.

3.3.4 Appliance.

3.3.4.1 Industrial High-Heat Appliance. An industrial appliance that is larger than 100 ft³ (2.8 m³) in size, excluding blower compartment, fan compartment, and burner equipment, such as a billet or bloom furnace, a blast furnace, a brass melter, a cupola, a glass furnace, an open-hearth furnace, a ceramic kiln, or a vitreous enameling oven for ferrous materials.

3.3.4.2 Industrial Low-Heat Appliance. An industrial appliance such as a floor-mounted or suspended-type warm-air furnace that is larger than 100 ft³ (2.8 m³) in size, excluding blower compartment, fan compartment, and burner equipment; a steam boiler that operates at pressures that do not exceed a gauge pressure of 50 psi (gauge pressure of 345 kPa) and is larger than 100 ft³ (2.8 m³) in size, excluding burner equipment; a water boiler that operates at water temperatures of not more than the temperature of saturated

steam at pressures that do not exceed a gauge pressure of 50 psi (gauge pressure of 345 kPa) and is larger than 100 ft³ (2.8 m³), excluding burner equipment; a floor mounted or suspended type unit heater larger than 100 ft³ (2.8 m³) in size, excluding blower compartment, fan compartment, and burner equipment; a commercial cooking range; a bake oven; a candy furnace; a stereotype furnace; a drying and curing appliance; or any other process appliance in which materials are heated or melted at temperatures (excluding flue gas temperature) that do not exceed 600°F (316°C).

3.3.4.3 Industrial Medium-Heat Appliance. A steam boiler that operates at pressures that exceed a gauge pressure of 50 psi (gauge pressure of 345 kPa) or an industrial appliance larger than 100 ft³ (2.8 m³) in size, excluding blower compartment, fan compartment, and burner equipment, such as an annealing furnace (glass or metal), a charcoal furnace, a galvanizing furnace, a gas producer, or a commercial or industrial incinerator.

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

3.3.5.1 High Pressure Boiler. A boiler for generating steam at gauge pressures in excess of 15 psi (gauge pressure of 103 kPa), or for heating water to a temperature in excess of 250°F (121°C) or at a gauge pressure in excess of 160 psi (gauge pressure of 1100 kPa).

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

3.3.5.3 Low Pressure Boiler. A boiler for generating steam at gauge pressures not in excess of 15 psi (gauge pressure of 103 kPa) or for furnishing water at a maximum temperature of 250°F (121°C) at a maximum gauge pressure of 160 psi (gauge pressure of 1100 kPa).

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

3.3.7 Burner.

3.3.7.1 Automatically Ignited Burner. A burner equipped so that the main burner fuel can be turned on and ignited automatically.

3.3.7.2 Manually Ignited Burner. A burner equipped so that the main burner fuel is turned on only by hand and ignited under supervision.

3.3.7.3 Mechanical Draft-Type Burner. A burner that includes a power-driven fan, blower, or other mechanism as the primary means for supplying the air for combustion.

3.3.7.4 Natural Draft-Type Burner. A burner that depends primarily on the natural draft created in the chimney or venting system to induce the air required for combustion into the burner.

3.3.8* Central Heating Appliance. A stationary heating appliance comprising the following: boilers, central furnaces, floor furnaces, and wall furnaces.

3.3.9 Centralized Oil Distribution System. A system of piping through which oil is supplied from a remote central storage tank or tanks to one or more buildings, mobile homes, recreational vehicles, or other structures.

3.3.10 Chimney. A structure containing one or more vertical or nearly vertical passageways for conveying flue gases to the outside atmosphere. [211, 2019]

3.3.10.1 Factory-Built Chimney.

3.3.10.1.1 Building Heating Appliance-Type Factory-Built Chimney. A heating appliance chimney suitable for continuous use at 1000°F (538°C), composed of listed, factory-built components, designed for open, nonenclosed use at specified minimum clearances to combustibles, and assembled in accordance with the terms of the listing to form the completed chimney. [211, 2019]

3.3.10.1.2 Factory-Built, Medium-Heat Appliance-Type Chimney. A chimney used with appliances that produce maximum flue gas temperatures of 1800°F (982°C), composed of listed, factory-built components, suitable for open, non-enclosed use at specified minimum clearances to combustibles, and assembled in accordance with the terms of the listing to form the completed chimney. [211, 2019]

▲ **3.3.10.1.3 Factory Built, Residential-Type and Building Heating Appliance-Type Chimney.** A chimney suitable for continuous use at 1000°F (538°C), which complies with the 10-minute 1700°F (927°C) temperature test of UL 103, *Standard for Factory-Built Chimneys for Residential Type and Building Heating Appliances*, and is composed of listed, factory-built components that might be fully enclosed in combustible, residential-type construction, and that is assembled in accordance with the terms of the listing to form the completed chimney. [211, 2019]

▲ **3.3.10.1.4 Unlisted Metal (Smokestack) Chimney.** A manufactured or field-constructed chimney intended only for nonresidential applications having one or more metal walls, or made of metal with a refractory lining, and that is capable of withstanding the flue gas conditions of its use. [211, 2019]

3.3.10.2 Masonry Chimney. A field-constructed chimney of solid masonry units, bricks, stones, listed masonry chimney units, or reinforced Portland cement concrete, lined with suitable chimney flue liners and built in accordance with the provisions of Chapter 7 of NFPA 211. [211, 2019]

3.3.11 Chimney Connector. The pipe that connects a fuel-burning appliance to a chimney. [211, 2019]

3.3.12 Chimney Flue. The passage in a chimney for conveying the flue gases to the outside atmosphere. [211, 2019]

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

3.3.14 Combustible Material. For the purpose of this standard, any material that will burn, regardless of its autoignition temperature.

3.3.15 Confined Space. For the purposes of this standard, a space whose volume is less than 50 ft³ per 1000 Btu/hr (4.8 m³ per kW) of the aggregate input rating of all appliances installed in that space.

3.3.16 Constant-Level Valve. A device for maintaining a constant level of oil fuel within a reservoir for delivery to an oil burner.

3.3.17 Control.

3.3.17.1 Limit Control. An automatic safety control that responds to changes in fluid flow, fluid level, pressure, or temperature, which is normally set beyond the operating range to limit the operation of the controlled equipment by shutting off the energy supply.

3.3.17.2 Primary Safety (Combustion Safeguard) Control. A safety control that responds directly to flame properties, senses the presence or absence of flame, and, in the event of ignition failure or unintentional flame extinguishment, causes safety shutdown.

3.3.17.3 Safety Control. Automatic controls (including relays, switches, and other auxiliary equipment used in conjunction to form a safety control system) that are intended to prevent unsafe operation of the controlled equipment.

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

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

3.3.20 Dew Point. As applied to the combustion products produced by oil-burning appliances, the temperature below which components of the combustion products will condense on exposed surfaces.

3.3.20.1 Acid Dew Point. The temperature below which sulfuric acid in the combustion products will condense on exposed surfaces.

3.3.20.2 Water Dew Point. The temperature below which water in the combustion products will condense on exposed surfaces.

3.3.21 Direct-Fired Appliance. A fuel-burning appliance in which the products of combustion (flue gases) are mixed with the medium (e.g., air) being heated.

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

3.3.23 Direct Vent System. See 3.3.22, Direct Vent Appliance.

3.3.24 Direct Venting System. A venting system that is constructed and installed so that air for combustion and draft control is taken from interior building spaces and all combustion products are discharged to the outside atmosphere.

3.3.25 Draft. A pressure difference that causes gases or air to flow through a chimney, vent, flue, or appliance. [54, 2018]

3.3.25.1* Mechanical Draft. Draft produced by mechanical means.

3.3.25.2 Natural Draft. Draft produced by the difference in the weight of a column of flue gases within a chimney or vent system and a corresponding column of air of equal dimension outside the chimney or venting system.

3.3.26 Draft Fan. A mechanical means used with a chimney venting system to augment the natural draft developed in the connected chimney.

3.3.27 Draft Regulator (Barometric). A device built into a fuel-burning appliance or made a part of a chimney connector or vent connector that functions to maintain draft through an appliance to a desired value by admitting ambient air into the appliance chimney, chimney connector, vent, or vent connector.

3.3.28 Flue Collar. That portion of an appliance designed for attachment of a chimney or vent connector or a draft hood. [211, 2019]

3.3.29 Furnace.

3.3.29.1 Central Warm-Air, Forced-Air-Type Furnace. A central furnace equipped with a blower that provides the primary means for the circulation of air. [211, 2019]

3.3.29.1.1 Central Warm-Air, Forced-Air, Attic-Type Furnace. A forced-air-type furnace designed specifically for installation in an attic or in a space with low headroom that is normally occupied. [211, 2019]

3.3.29.1.2 Central Warm-Air, Forced-Air, Downflow-Type Furnace. A forced-air-type furnace designed with airflow essentially in a vertical path, discharging air at or near the bottom of the furnace. [211, 2019]

3.3.29.1.3 Central Warm-Air, Forced-Air, Horizontal-Type Furnace. A forced-air-type furnace designed with airflow through the furnace essentially in a horizontal path. [211, 2019]

3.3.29.1.4 Central Warm-Air, Forced-Air, Upflow-Type Furnace. A forced-air-type furnace designed with airflow essentially in a vertical path, discharging air at or near the top of the furnace. [211, 2019]

3.3.29.2 Central Warm-Air Furnace. A self-contained indirect-fired or electrically heated appliance designed to supply heated air through ducts to spaces remote from or adjacent to the appliance location. [211, 2019]

3.3.29.3 Central Warm-Air, Gravity-Type Furnace. A central furnace depending primarily on circulation of air by gravity. [211, 2019]

3.3.29.4 Central Warm-Air, Gravity-Type Furnace with Booster Fan. A central furnace equipped with a booster fan that does not materially restrict free circulation of air by gravity flow when such a fan is not in operation. [211, 2019]

3.3.29.5 Central Warm-Air, Gravity-Type Furnace with Integral Fan. A central furnace equipped with a fan as an integral part of its construction and operable on gravity systems only where the fan is used only to overcome the internal resistance to airflow. [211, 2019]

3.3.29.6 Duct Furnace. A central furnace designed for installation in a duct of an air distribution system to supply warm air for heating and that depends on a blower not

furnished as part of the furnace for air circulation. [211, 2019]

3.3.29.7* Floor Furnace. A self-contained indirect-fired or electrically heated furnace designed to be suspended from the floor of the space to be heated. [211, 2019]

3.3.29.8 Stationary Industrial Furnace. A low-, medium-, or high-heat appliance classified in accordance with its character and size and the temperatures developed in the portions thereof where substances or materials are heated for baking, drying, roasting, melting, vaporizing, or other purposes.

3.3.30 Heat Reclaimer, Chimney Connector-Type. A heat exchanger intended to be installed in a chimney connector between a heating appliance and the chimney to transfer heat from the flue gases through metal to air or water. [211, 2019]

3.3.31* Heating and Cooking Appliance. An oil-fired appliance not intended for central heating.

Δ 3.3.32 Heating Fuel. For the purposes of this standard, any fuel covered by one of the following specifications for petroleum distillate fuels, with or without varying amounts of alternative or biofuels: ASTM D396, *Standard Specification for Fuel Oils*; ASTM D3699, *Standard Specification for Kerosine*; ASTM D6751, *Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels*; and ASTM D7666, *Standard Specification for Triglyceride Burner Fuel*.

3.3.33 Ignition Zone. The location on the burner where ignition and combustion of the main burner fuel occurs.

3.3.34 Indirect-Fired Appliance. A fuel-burning appliance in which products of combustion (flue gases) are not mixed in the appliance with the medium (e.g., air) being heated.

3.3.35 Installation. The complete setting-in-place and readying for operation of an oil-burning appliance and its accessories and equipment.

3.3.36 Kerosene-Fired Portable Heater. An unvented, self-contained, self-supporting heater, with integral reservoir, designed to be carried from one location to another.

3.3.37 Kerosene Stove. An unvented, self-contained, self-supporting kerosene-burning range or room heater equipped with an integral fuel tank not exceeding a 2 gal (7.6 L) capacity.

3.3.38* Liquid Fuel. For the purposes of this standard, any combustible liquid burned in an appliance or equipment as identified under the definition of heating fuel (see 3.3.32) or used oil (see 3.3.62).

3.3.39 Main Burner. A device or group of devices essentially forming an integral unit for the final conveyance of fuel or a mixture of fuel and air to the combustion zone and on which combustion takes place to accomplish the function for which the appliance is designed.

3.3.40 Main Burner Flame Establishing Period. The length of time fuel is permitted to be delivered to the main burner before the flame-sensing device is required to detect the main burner flame.

3.3.41 Multiple-Fueled Appliance. An appliance that is designed and intended to burn either solid, liquid, or gaseous fuels, or a combination of these.

3.3.42* Oil Burner. A device for burning oil in heating appliances such as boilers, furnaces, water heaters, and ranges.

3.3.43* Oil-Burning Appliance (Oil-Burning Unit). An appliance equipped with one or more oil burners and all the necessary safety controls, electrical equipment, and related equipment manufactured for assembly as a complete unit.

3.3.44 Oil-Burning Equipment. An oil burner of any type, together with its tank, piping, wiring, controls, and related devices, including all oil burners, oil-fired appliances, and heating and cooking appliances, but excluding those exempted by 1.1.5.

3.3.45* Oil-Burning Stove. A self-contained, freestanding, above-the-floor, indirect-fired appliance equipped with one or more oil burners.

3.3.46 Oil-Gas-Fired Appliance. An appliance that is capable of burning fuel oils and fuel gases as a main fuel source in an alternate manner.

3.3.47 Pilot. A flame that is used to light the main burner. [86, 2018]

3.3.48 Pilot Flame Establishing Period. For the purposes of this standard, the length of time fuel is permitted to be delivered to a proved pilot before the flame-sensing device is required to detect the pilot flame.

3.3.49 Power Venting. The application of a mechanical means of removing combustion products to the outside atmosphere. (See 3.3.25.1, *Mechanical Draft*.)

3.3.50 Pre-Purge Period. The interval of time during burner startup in which air is introduced into the combustion chamber and the associated flue passages in such volume and manner as to completely replace the air or fuel-air mixture contained therein prior to initiating ignition.

3.3.51 Qualified Person. A person who, by possession of a recognized degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, has demonstrated the ability to deal with problems related to the subject matter, the work, or the project. [1451, 2018]

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

3.3.53 Room Heater. A heating appliance intended for installation in the space being heated and not intended for duct connection. [211, 2019]

3.3.53.1* Circulating Room Heater. A room heater with an outer jacket surrounding the heat exchanger, arranged with openings at top and bottom so that air circulates between the heat exchanger and the outer jacket. [211, 2019]

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

3.3.53.3 Radiant Room Heater. A room heater designed to transfer heat primarily by direct radiation. [211, 2019]

3.3.53.4 Solid Fuel Room Heater. A chimney-connected, solid fuel-burning room heater that is designed to be operated with the fire chamber closed. [211, 2019]

3.3.54 Safety Shutdown. The action of shutting off all fuel and ignition energy to an appliance by means of a safety control or controls, such that restart of the appliance cannot be accomplished without some form of manual reset that requires local, manual intervention.

3.3.55 Sealed Combustion Venting System. See 3.3.22, Direct Vent Appliance.

3.3.56 Sidewall or Through-Wall Venting. A mechanical means applied to a nearly horizontal venting system to remove combustion products without benefit of a chimney or significant natural draft.

3.3.57 Tank.

3.3.57.1* Oil Burner Auxiliary Tank. A tank having a capacity of not more than 60 gal (227 L) that is listed for installation in the supply piping between a burner and its main fuel supply tank. (See 3.3.57.3, *Oil Burner Integral Tank*.)

3.3.57.2 Oil Burner Gravity Tank. A supply tank from which the oil is delivered directly to the burner by gravity.

3.3.57.3 Oil Burner Integral Tank. A tank that is furnished by the manufacturer as an integral part of an oil-burning appliance. (See 3.3.57.1, *Oil Burner Auxiliary Tank*.)

3.3.57.4 Oil Burner Storage Tank. A separate tank that is not connected directly to the oil-burning appliance.

3.3.57.5 Oil Burner Supply Tank. A separate tank connected either directly or by means of a pump to the oil-burning appliance.

3.3.58 Total Input Rating. The sum of the maximum Btu rating, as marked on the appliance by the manufacturer, of all appliances, not the nozzle sizes or actual firing rates.

3.3.59 Trial for Ignition Period. The interval of time during which main burner fuel is permitted to be delivered into the ignition zone before the flame-sensing device is required to detect flame. (See 3.3.40, *Main Burner Flame Establishing Period*, and 3.3.48, *Pilot Flame Establishing Period*.)

3.3.60* Unconfined Space. Any space whose volume is equal to or greater than 50 ft³ per 1000 Btu/hr (4.8 m³ per kW) of the aggregate input rating of all fuel-burning appliances installed therein.

3.3.61* Unit Heater. A self-contained heating appliance that might or might not include an integral fan for circulating air, that can be of the floor-mounted or suspended type and that is intended for the heating of the space in which it is installed.

▲ **3.3.62 Used Oil.** For the purposes of this standard, any fuel covered by one of the following specifications for petroleum distillate fuels, with or without varying amounts of reprocessed lubricating or functional oils that can vary considerably in its chemical and physical properties: ASTM D6448, *Standard Specification for Industrial Burner Fuels from Used Lubricating Oils*, and ASTM D6823, *Standard Specification for Commercial Boiler Fuels with Used Lubricating Oils*.

3.3.63 Valve.

3.3.63.1 Manual Oil Shutoff Valve. A manually operated valve in an oil line for the purpose of turning on or completely shutting off the oil supply to the burner.

3.3.63.2 Metering (Regulating) Valve. An oil control valve for regulating burner input.

3.3.63.3 Oil Control Valve. An automatically or manually operated device consisting essentially of an oil valve for controlling the fuel supply to a burner.

3.3.63.4 Safety Valve. An automatic oil control valve of the “on” and “off” type (without any bypass to the burner) that is actuated by a safety control or by an emergency device.

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

3.3.65* Venting System (Flue Gases). A continuous, open passageway from the flue collar or draft hood of a fuel-burning appliance to the outside atmosphere for the purpose of removing flue gases. [211, 2019]

3.3.66* Wall Furnace. A self-contained vented appliance, complete with grilles or equivalent, designed for incorporation in or permanent attachment to the structure of a building, manufactured home, or recreational vehicle and furnishing heated air directly into the space to be heated through openings in the casing.

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

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

3.3.67 Water Heater. A fuel-burning appliance for heating water to a temperature not more than 200°F (93°C). [211, 2019]

Chapter 4 Basic Installation and Operation Requirements

4.1 Scope. This chapter shall apply to the basic installation and operation requirements for oil-burning appliances and equipment.

4.2 Use of Approved Equipment.

4.2.1 Oil-burning appliances and equipment shall be listed or approved for their intended use.

4.3 Installation of Oil-Burning Appliances and Equipment.

4.3.1 Before installing or remodeling any oil-burning appliance or equipment for commercial or industrial application, plans or sketches that show the relative location of burners, tanks, pumps, piping, and elevations of buildings and their lowest floors or pits relating to the proposed installation or alteration shall be submitted to the authority having jurisdiction.

4.3.2 The installation shall be made in accordance with manufacturers' instructions, as well as in accordance with all federal, state, and local rules and regulations.

4.3.2.1 Such instructions shall include directions and information for attaining proper and safe installation, maintenance, and use of the appliance or equipment.

4.3.2.2 The instructions shall be left with the owner.

4.3.2.3 If for any reason it becomes necessary to change, modify, or alter a manufacturer's instructions in any way, written approval shall be obtained from the manufacturer before doing so.

4.3.3 The installation shall be made by qualified, competent technicians experienced in making such installations.

4.3.4 The installation shall be accessible for cleaning heating surfaces; for removing burners; for replacing motors, controls, air filters, chimney connectors, draft regulators, and other working parts; and for adjusting, cleaning, and lubricating parts requiring such attention.

4.3.5 Oil-burning appliances shall not be installed or located in areas where combustible dusts or flammable liquids, gases, or vapors are normally present.

4.3.5.1 Return air for warm air units shall not be taken from such areas.

4.3.6 Oil-burning appliances and equipment shall be installed so that a minimum 3 ft (0.9 m) separation is maintained from any electrical panelboard and a minimum 5 ft (1.5 m) separation is maintained from any unenclosed fuel oil tank.

4.3.7 After installation, the appliance or equipment shall be tested for proper operation and combustion performance to make certain that the burner is operating in a safe and acceptable manner and that all accessory equipment, controls, and safety devices function as intended.

4.3.8 Contractors installing industrial oil-burning systems shall furnish diagrams showing the main oil lines and control valves, one of which shall be posted at the equipment and another at some point that will be readily accessible in case of emergency.

4.3.9 After completing the installation, the installer shall instruct the owner or operator on the proper operation of the equipment.

4.3.9.1 The installer also shall furnish the owner or operator with name(s) and telephone numbers of person(s) to contact for technical information or assistance and for routine or emergency services.

4.4 Electrical Services.

4.4.1 Electrical wiring and utilization equipment used in connection with oil-burning appliances or equipment shall be installed in accordance with *NFPA 70*.

4.4.2 Safety control circuits shall be 2-wire, one side grounded, with a nominal voltage not exceeding 150 volts.

4.4.3 Safety controls or protective devices shall be connected so that they interrupt the ungrounded conductor and shut all fuel flow to the appliance, including fuel flow to any pilot flame or burner.

4.4.4 The control circuit shall be connected to a power supply branch circuit fused at not more than the value appropriate for the rating of any control or device included in the circuit.

4.5 Acceptable Liquid Fuels.

▲ **4.5.1*** The type and grade of liquid fuel used in a liquid fuel-burning appliance shall be that type and grade for which the appliance is listed and approved or is stipulated by the manufacturer. Liquid fuels shall meet one of the following specifications

and shall not contain gasoline or any other flammable liquid:

- (1) ASTM D396, *Standard Specification for Fuel Oils*
- (2) ASTM D3699, *Standard Specification for Kerosine*
- (3) ASTM D6448, *Industrial Burner Fuels from Used Lube Oils*
- (4) ASTM D6751, *Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels*
- (5) ASTM D6823, *Standard Specification for Commercial Boiler Fuels with Used Lubricating Oils*
- (6) ASTM D7666, *Standard Specification for Triglyceride Burner Fuel*

4.5.2 Appliances that burn crankcase oil or used oil shall not be used in a residential occupancy. Such appliances shall only be used if all of the following conditions are met:

- (1) The installation is in a commercial or industrial occupancy.
- (2) The oil-burning appliance is designed to burn crankcase oil or used oil and is listed for such use.
- (3) The appliance is installed in accordance with the manufacturer's instructions and with the terms of its listing.
- (4) The installation meets the applicable requirements of Section 4.6 and Chapter 12.

▲ **4.5.3*** Where heavy oils are used, the following shall be required:

- (1) The oil-burning appliance shall be designed to burn such fuels.
- (2) Means shall be provided to maintain the oil at its proper atomizing temperature.
- (3) Automatically operated burners that require preheating of oil shall be arranged so that no oil can be delivered for combustion until the oil is at the proper atomizing temperature.
- (4)* Use of an oil-fired appliance that is listed in accordance with UL 296A, *Standard for Waste Oil-Burning Air-Heating Appliances*, shall be deemed as meeting the intent of 4.5.3(1) through 4.5.3(3).

4.5.4 A properly sized and rated oil filter or strainer shall be installed in the oil supply line to an oil burner.

4.6 Use of Crankcase Oil and Used Oil.

4.6.1* During any storing, handling, or burning of crankcase oil and used oils, care shall be taken to not mix gasoline with the crankcase oil or used oil.

4.6.2 When a mixture could have a flash point below 100°F (38°C) or when a mixture could be heated above its flash point, attention shall be given to electrical installations in areas where flammable vapors or gases can be present in the atmosphere.

4.6.3 Where a supply tank is used, provisions shall be made to prevent stratification of fuel in the tank.

4.6.4* Areas where oil leakage can occur, such as at pumps, heaters, strainers, and burners, or where maintenance is performed shall be provided with adequate ventilation. Confined fuel-handling areas and burner sites shall also be provided with adequate ventilation. Mechanical ventilation shall be provided where necessary.

4.6.5 Means shall be provided to safely dispose of spills.

4.7 Temporary Heating. Where salamanders, space heaters, or other heating appliances are used for temporary heating, all requirements of this standard, including those for maximum operating temperatures, clearances to combustible materials, venting of combustion gases, fuel storage, safety, shutoffs, combustion and ventilation air, and electrical wiring, where applicable, shall be met and all such equipment shall be used in accordance with its listing.

Chapter 5 Air for Combustion and Ventilation

5.1 Scope. This chapter shall apply to those requirements necessary to ensure that adequate air for safe combustion is provided for oil-burning appliances and equipment.

5.2 Basic Requirements.

5.2.1 Oil-burning appliances and equipment shall be installed in locations where available ventilation permits satisfactory combustion of oil, proper venting of combustion gases, and maintenance of safe ambient temperatures under normal conditions of use.

5.2.1.1* After installing a new or replacement oil-burning appliance and before placing the equipment into service, the equipment installer shall perform testing of the worst-case depressurization of the room where the appliance is located and shall determine, by measuring the flue draft and over-fire draft, that the appliance can operate in accordance with the draft requirements of the appliance manufacturer.

5.2.2 Appliances shall be located so that they do not interfere with the supply of air within the space.

5.2.3* Where buildings are so tight that normal infiltration does not provide sufficient air for combustion, outside air shall be introduced.

5.2.3.1 Ducts used to convey air from outdoors shall have the same cross-sectional area as the free area of the openings to which they connect.

5.2.3.2 The smaller dimension of rectangular air ducts shall not be less than 3 in. (75 mm).

5.2.4 For residential and similar installations, the requirements of 5.2.1 shall be permitted to be met by application of either one of the methods covered in Section 5.3 or Section 5.4. For commercial and industrial installations, the requirements of Section 5.5 shall apply.

5.3 Appliances Located in Unconfined Spaces.

5.3.1* In unconfined spaces in buildings of conventional frame, brick, or stone construction, air for combustion and ventilation shall be permitted to be supplied by normal infiltration.

5.3.2 If normal infiltration is not sufficient because of tight construction, air for combustion and ventilation shall be obtained directly from outdoors or from spaces that freely communicate with outdoors by means of a permanent opening or openings having a total free area of not less than 1 in.² per 5000 Btu/hr (28 in.² per gal/hr) (4.4 cm²/kW), based on the total input rating of all appliances in the space.

5.4 Appliances Located in Confined Spaces. For appliances installed in confined spaces, air for combustion and ventilation

shall be provided using one of the methods set forth in this section.

5.4.1 All Air Taken from Inside the Building.

5.4.1.1 The confined space shall be provided with two permanent openings as shown in Figure 5.4.1.1, one near the top of the space and one near the bottom.

5.4.1.2 Each opening shall have a free area of not less than 1 in.² per 1000 Btu/hr (140 in.² per gal/hr) (22 cm²/kW), based on the total input rating of all appliances in the space.

5.4.1.3 Each opening shall freely communicate with interior areas of the building that, in turn, have adequate infiltration from the outside.

5.4.2 All Air Taken from Outdoors.

5.4.2.1 The confined space shall be provided with two permanent openings, one in or near the top of the space and one in or near the bottom.

5.4.2.2 The openings shall communicate directly or by means of ducts with the outdoors or to spaces, such as an attic or crawl space, that themselves freely communicate with the outdoors, as shown in Figure 5.4.2.2(a), Figure 5.4.2.2(b), and Figure 5.4.2.2(c).

5.4.2.3 Where communicating with the outdoors directly or by means of vertical ducts, each opening shall have a free area of not less than 1 in.² per 4000 Btu/hr (35 in.² per gal/hr) (5.5 cm²/kW), based on the total input rating of all appliances in the space.

5.4.2.4 Where communicating with the outdoors by means of horizontal ducts, each opening shall have a free area of not less than 1 in.² per 2000 Btu/hr (70 in.² per gal/hr) (11 cm²/kW), based on the total input rating of all appliances in the space.

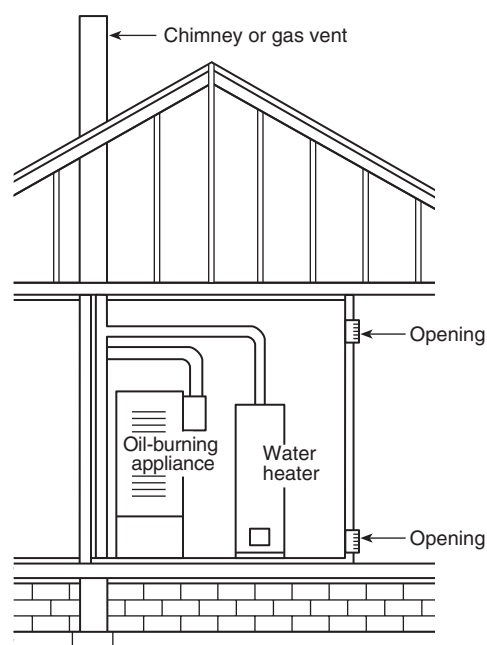


FIGURE 5.4.1.1 Appliances Located in Confined Spaces — All Air Taken from Inside the Building.

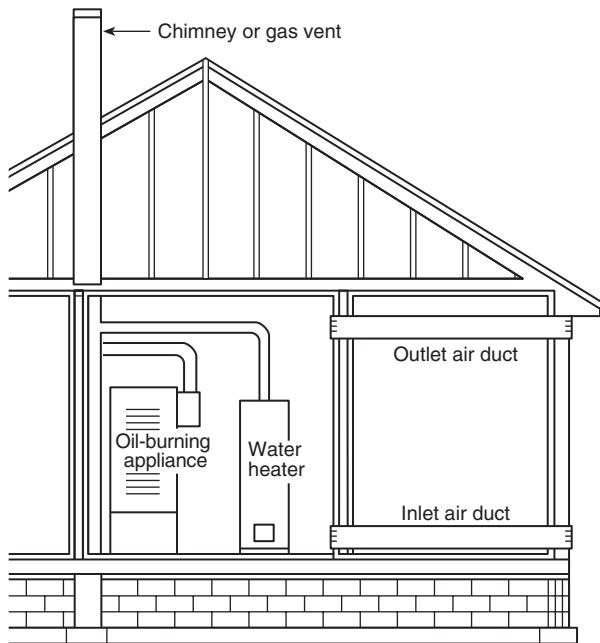


FIGURE 5.4.2.2(a) Appliances Located in Confined Spaces — All Air from Outdoors.

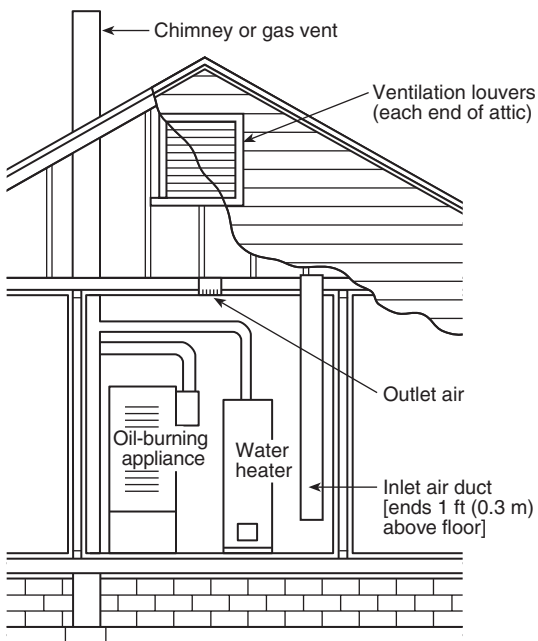


FIGURE 5.4.2.2(b) Appliances Located in Confined Spaces — All Air from Outdoors Through Ventilated Attic.

5.4.3 Ventilation Air Taken from Inside the Building — Combustion Air Taken from Outdoors.

5.4.3.1 The confined space shall be provided with two openings for ventilation, located and sized as specified in 5.4.1 and as shown in Figure 5.4.3.1.

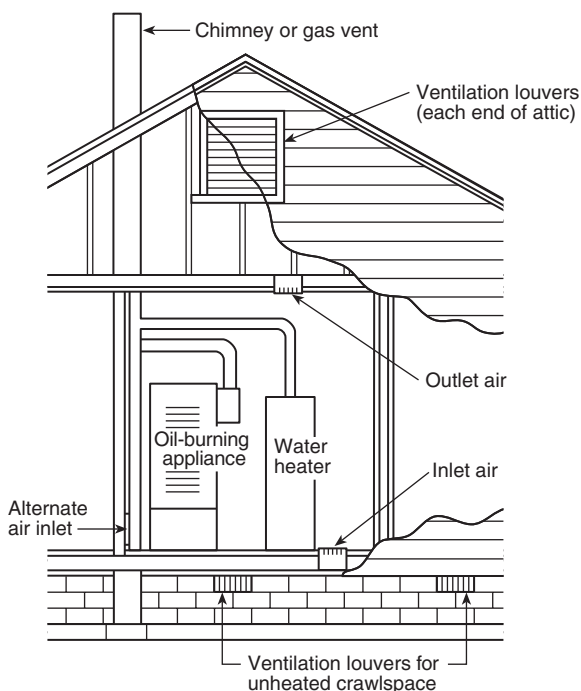


FIGURE 5.4.2.2(c) Appliances Located in Confined Spaces — All Air from Outdoors, with Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic.

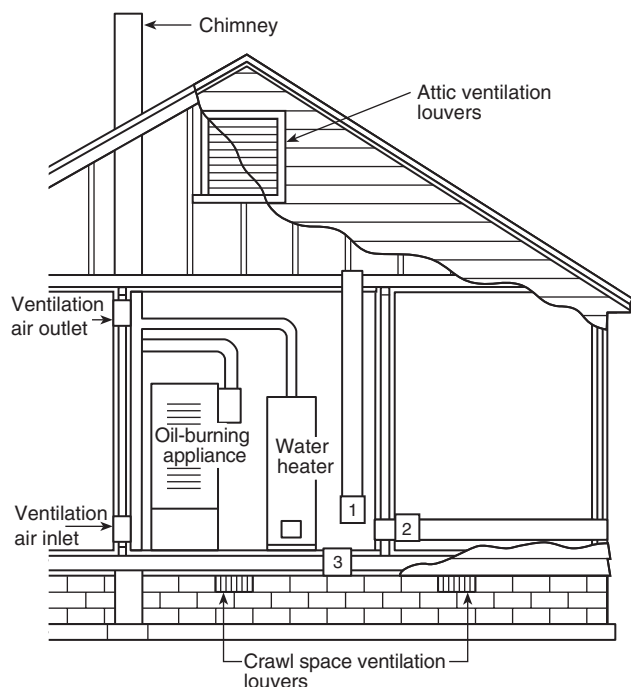
5.4.3.2 In addition to the openings specified in 5.4.3.1, there shall be one opening communicating directly with the outdoors or to spaces, such as an attic or crawl space, that freely communicates with the outdoors and has a free area of not less than 1 in.² per 5000 Btu/hr (28 in.² per gal/hr) (4.4 cm²/kW), based on the total input of all appliances in the space.

5.4.3.3 The additional opening specified in 5.4.3.2 shall not be required where an engineered system is used to provide outside combustion air and meets all of the following requirements:

- (1) The system shall be listed and appropriately sized for the application.
- (2) The system shall include safeguards that prevent burner operation in the event of blockage of the air passage to the oil burner(s).
- (3) In addition, as long as the requirements of 5.2.1.1 are met, the volume of air required for ventilation of the confined space shall be permitted to be reduced to 25 ft³ per 1000 Btu/hr (2.4 m³/kW), based on the total input of all appliances in the space.

5.5 Combustion Air for Commercial and Industrial Installations. For commercial and industrial oil-burning equipment, permanent means for supplying an ample amount of outside air shall be provided in accordance with this section.

5.5.1 For furnace or boiler rooms adjacent to outside walls and where combustion air is provided by natural ventilation from the outside, there shall be a permanent air supply inlet having a total free area of not less than 1 in.² per 4000 Btu/hr (35 in.² per gal/hr) (5.5 cm²/kW), based on the total input rating of the burner or burners, but in no case less than 35 in.² (0.425 m²).



Note: Ducts used for make-up air can be connected to the cold air return of the heating system only if they connect directly to outdoor air.

Nos. 1, 2, and 3 mark alternate locations for air from outdoors.

Provide attic ventilation louvers at each end of attic with alternate air inlet No. 1.

Provide crawl space ventilation louvers for unheated crawl space with alternate air inlet No. 3.

FIGURE 5.4.3.1 Appliances Located in Confined Spaces, with Ventilation Air from Inside Building and Combustion Air from Outside, Ventilated Attic, or Ventilated Crawl Space.

5.5.2 For furnace or boiler rooms that are not adjacent to outside walls, the combustion air shall be supplied in a manner acceptable to the authority having jurisdiction.

5.6 Louvers and Grilles.

5.6.1 In calculating the free area required by Sections 5.2, 5.3, 5.4, and 5.5, the blocking effect of louvers, grilles, or screens protecting openings shall be taken into consideration.

5.6.2 Screens used in louvers or grilles shall not be smaller than $\frac{1}{4}$ in. (6.3 mm) mesh and shall be accessible for cleaning.

5.6.3 If the free area through a particular design of louver or grille is known, it shall be used in calculating the size of the opening needed to provide the free area required. If the free area of the design is not known, it shall be assumed that wood louvers will have 25 percent free area and metal louvers and grilles will have 75 percent free area.

5.7* Specially Engineered Installations. The size of combustion air openings required by Sections 5.3, 5.4, and 5.5 shall not govern when special engineering methods approved by the authority having jurisdiction ensure an adequate supply of air for combustion and ventilation.

Chapter 6 Venting of Combustion (Flue) Gases

6.1 Scope. This chapter shall apply to those requirements necessary to ensure the safe venting of combustion and flue gases from oil-burning appliances and equipment.

6.2 Basic Requirements.

6.2.1 Except as provided for in Section 6.7, oil-burning appliances and equipment other than direct-fired heaters, listed kerosene stoves, and listed portable kerosene heaters shall be connected to venting systems and chimneys to remove combustion (flue) gases from the combustion chamber of the appliance or equipment and to direct them to a point outside the building, as required by this chapter.

6.2.2 The installation of oil-burning appliances and equipment shall require careful consideration of positive and negative pressures in the venting system and chimney and the formation of corrosive condensate throughout the system.

6.2.3 The venting system and chimney shall be designed, constructed, and maintained to ensure that a positive flow is developed and that this flow is sufficient to remove products of combustion to the outside atmosphere.

6.3 Draft.

6.3.1* A chimney shall be capable of producing the minimum draft recommended by the manufacturer of the appliance.

6.3.2 A draft fan, installed so that the fuel supply to the main burner is immediately shut off if the draft fan fails, shall be permitted to be used to increase low draft.

6.3.3 Two or more oil-burning appliances shall be permitted to be connected to a single chimney, provided that sufficient draft is available for safe combustion in each appliance and that all products of combustion are safely removed to the outdoors.

6.3.4* Where chimney downdraft conditions cause faulty operation that creates a hazard, corrective steps shall be taken.

6.4 Draft Regulators.

6.4.1 A draft regulator shall be provided for each oil-burning appliance that is connected to a chimney or power venting system unless the appliance design, conditions of installation, or combinations thereof preclude excessive chimney draft, or the appliance is listed for use without one.

6.4.2 A manually operated damper shall not be placed in the chimney connector from an oil-burning appliance.

6.4.3 Automatically operated dampers shall be of an approved type, shall be designed to maintain a safe damper opening at all times, and shall be arranged to prevent starting of the burner unless the damper is fully opened.

6.4.4 Fixed baffles shall be permitted to be installed in the appliance flue collar where they are specified by the appliance manufacturer.

6.4.4.1 Baffles shall be securely fastened into position. When in a closed position, baffles shall not block off more than 80 percent of the chimney connector area.

6.5 Chimney Connectors.

6.5.1 An oil-burning appliance shall be placed so that the chimney connector is as short as practicable.

6.5.1.1 For natural-draft appliances, the horizontal length of a chimney connector shall not exceed 10 ft (3 m) unless a draft fan is used.

6.5.1.2 For appliances requiring a negative chimney draft, the chimney connector shall be not longer than 75 percent of the portion of the chimney above the chimney connector inlet.

6.5.2 A chimney connector shall not pass through a floor or ceiling.

6.5.3 A chimney connector of a low-, medium-, or high-heat industrial appliance shall not pass through a combustible wall or partition.

6.5.4 Chimney connectors of appliances other than industrial appliances shall not pass through combustible walls or partitions unless the installation complies with 6.5.4.1, 6.5.4.2, or 6.5.4.3.

6.5.4.1 Chimney connectors shall be permitted to pass through a combustible wall or partition if guarded at the point of passage by one of the following:

- (1) Metal ventilated thimbles not less than 12 in. (300 mm) larger in diameter than the diameter of the connector
- (2) Metal or burned fire-clay thimbles built in brickwork or other approved fireproofing materials and extending not less than 8 in. (200 mm) beyond all sides of the thimble

6.5.4.2 Chimney connectors shall be permitted to pass through a combustible wall or partition if all combustible material in the wall or partition is cut away from the chimney connector a sufficient distance to provide the clearance required from the connector and noncombustible insulating material is used to close up the opening.

6.5.4.3 Chimney connectors shall be permitted to pass through a combustible wall or partition if a listed, commercially available or factory-built vent assembly, such as a Type L vent, that is approved for use with oil-fired appliances is used.

6.5.5 In masonry chimneys, the chimney connector shall extend through the chimney wall to the inner face or liner, but not beyond, and shall be firmly cemented in place.

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

6.5.6 The chimney connector shall be sized in accordance with one of the following methods:

- (1) The connector shall be sized using approved engineering methods, and the connected appliance shall be marked to indicate the maximum firing rate that can be used with the venting system.
- (2) The connector shall be sized in accordance with the manufacturer's instructions.

6.5.7 The connector, for its entire length, shall not be smaller in effective cross-sectional area than the flue collar of the appliance, as delivered or as modified in accordance with the manufacturer's instructions. Any change in size made to

accommodate a chimney lining system shall be done at the connection to that system.

6.5.8 The chimney connector shall be of steel, refractory masonry, or corrosion-resistant material and shall be maintained in good condition.

6.5.9 Where insulation of the chimney connector is required to maintain the temperature of the combustion products, an insulated Type L chimney connector or a factory-built chimney connector listed for that purpose shall be used.

6.5.10 The chimney connector shall maintain a pitch or rise of at least ¼ in./ft (20 mm/m) of horizontal length of pipe from the appliance to the chimney.

6.5.11 The chimney connector shall be installed to minimize the number of elbows and to avoid sharp turns or other construction features that might create excessive resistance to the flow of flue gases.

6.5.12 Unless specifically listed for such use, for example, heat reclaimers, automatic dampers, or safety controls, any device that will obstruct the free flow of gases shall not be installed in a chimney connector or chimney.

6.5.13 The chimney connector shall be securely supported.

6.5.14 Each joint of the chimney connector shall be fastened together with at least three screws.

6.5.15 Clearance from combustible construction or materials shall be as specified in Table 10.6.1, except as permitted by 6.5.4 and Table 10.6.2.

6.5.16 The entire length of the chimney connector shall be accessible for inspection, cleaning, and replacement.

6.5.17 Placement of the chimney connector shall maintain minimum fire protection clearances.

6.5.18 A connector shall not be connected to a chimney flue serving a fireplace unless the fireplace opening is sealed or the chimney flue that vents the fireplace is permanently sealed below the connection.

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

6.5.20 Connectors for appliances installed in attics or crawl spaces shall be either a Type L chimney connector or a factory-built chimney connector listed for the purpose, or the appliance shall be attached directly to the chimney.

6.5.21 If two or more openings are provided into a chimney flue, they shall be at different levels and the smaller connector shall enter at the higher level consistent with available head room or clearance to combustible material. [211:9.8.4]

6.5.22 Regardless of the fuel(s) used, two or more connectors shall not be joined unless the common connector, the manifold, and the chimney are sized to serve the appliances connected thereto.

6.5.22.1 Adequate draft shall be available to remove all products of combustion to the outdoors without leakage, spillage, or backflow from the connectors, manifold, chimney, or appliances.

6.5.23 Two or more oil-burning appliances shall be permitted to be connected to a common venting system, provided the following conditions are met:

- (1) Each appliance is equipped with a primary safety control.
- (2) The venting system is designed to meet the requirements of the applicable code.

6.5.24 Oil-burning appliances that are connected to a common venting system shall be located within the same story of the building unless the vent system is specifically designed for the purpose and has been approved by the authority having jurisdiction.

6.5.25 Solid fuel-burning appliances shall not be connected to a chimney flue serving another appliance burning other fuels, unless specifically listed for such connection.

6.5.26 Gas utilization appliances and appliances burning liquid fuel shall be permitted to be connected to the same chimney flue through separate openings.

6.5.27 Gas utilization appliances and appliances burning liquid fuel shall be permitted to be connected to the same chimney flue through a single opening, provided the appliances are joined by a suitable fitting located as close as practicable to the chimney and provided the following conditions are met:

- (1) Sufficient draft is available for the safe combustion of each appliance and for the removal of all products of combustion. [211:9.8.3(1)]
- (2) The appliances so connected are equipped with primary safety controls and all appliances are located in the same room. [211:9.8.3(2)]

6.5.28 Single-wall connector pipe shall be installed by one of the following methods:

- (1) In accordance with the appliance manufacturer's instructions
- (2) With the crimped end toward the chimney

6.5.29 The minimum thickness for steel pipe connectors shall meet the requirements of Table 6.5.29.

6.6 Chimneys.

6.6.1 Masonry and metal chimneys shall be erected in accordance with applicable building code requirements.

6.6.2 Masonry chimneys shall meet the requirements of Chapter 7 of NFPA 211.

6.6.3 Metal chimneys shall meet the requirements of Chapter 8 of NFPA 211.

Table 6.5.29 Minimum Thickness for Steel Pipe Connectors

Pipe Diameter (in.)	Thickness
	Sheet Metal Gauge
Up to 9	26
>9 up to 10	24
>10 up to 16	22
>16	16

For SI units, 1 in. = 25 mm.

6.6.4 Factory-built chimneys shall be listed, installed, and used in accordance with their listings and with manufacturers' instructions.

6.6.5 Factory-built chimneys shall meet the requirements of Chapter 6 of NFPA 211.

6.6.6* The flue gas exit of a chimney shall be at least 3 ft (0.9 m) above the highest point where it passes through the roof of a building and shall be at least 2 ft (0.6 m) higher than any portion of a building within 10 ft (3 m) of the chimney.

Δ 6.6.7* Prior to the installation of a new or replacement oil burner or oil-burning appliance, the installer shall perform a visual inspection of the chimney or flue gas venting system and shall verify the proper size of the chimney or flue gas venting system. (See Annex E for additional information.)

6.6.7.1 The inspection shall be limited to the cleanout and to the area where the flue gas connector enters the chimney or flue gas venting system and to the extent possible with artificial lighting and conventional tools such as a mirror.

6.6.7.2 If deterioration exists or if the chimney or flue gas venting system is found to inhibit the performance of the oil burner or oil-burning appliance, as specified by the manufacturer, the owner shall be notified in writing, stating that the chimney or flue gas venting system to which the appliance is connected shall be examined by a qualified person in accordance with the requirements of Chapter 14 of NFPA 211.

6.6.8* Masonry chimneys shall be lined with an approved clay tile liner or a listed chimney lining system installed in accordance with manufacturers' instructions.

6.6.9* When chimneys are relined, the liner shall be listed or shall be of an approved material that will resist corrosion, softening, or cracking from the flue gases, at a temperature appropriate to the class of service.

6.6.10 All portions of a mechanical draft system under positive pressure during operation shall be designed and installed so as to prevent leakage of flue gas into the building.

6.7 Special Venting Systems.

6.7.1 Type L Venting Systems.

6.7.1.1 Listed Type L venting systems shall be permitted to be used with appliances that are listed as suitable for installation with Type L venting systems.

6.7.1.2 Type L venting systems shall be installed and used in accordance with their listings and the manufacturers' instructions.

6.7.1.3 A Type L venting system shall be capable of producing the minimum draft recommended by the manufacturer of the appliance.

6.7.1.4 The flue gas exit of a Type L venting system shall be at least 2 ft (0.6 m) above the highest point where it passes through the roof of a building and at least 2 ft (0.6 m) higher than any portion of a building within 10 ft (3 m) of such Type L venting system.

6.7.2 Direct Vent Appliances.

6.7.2.1 Direct vent appliances (sealed combustion system appliances) shall be listed and shall be installed in accordance with their listing and with manufacturers' instructions.

6.7.2.2 The combustion air inlet and the flue gas outlet of a direct vent appliance shall terminate in the same plane and in the same ambient pressure zone when they terminate at the outside wall of the structure.

6.7.3* Termination of Special Venting Systems.

6.7.3.1 Special venting systems shall be listed and shall be installed in accordance with their listing and with manufacturers' instructions.

6.7.3.2 The flue gas outlet of an appliance other than a direct vent appliance shall terminate at least 4 ft (1.2 m) below, 4 ft (1.2 m) horizontally from, or 1 ft (0.3 m) above any door, window, or gravity air inlet of the structure and also shall terminate at least 1 ft (0.3 m) above grade.

6.7.3.3 The combustion air inlet and flue gas outlet of a direct vent appliance or the flue gas outlet of an appliance other than a direct vent appliance shall terminate at least 1 ft (0.3 m) from the soffit of the roof of the structure and at least 3 ft (0.9 m) from an inside corner of an L-shaped structure.

6.7.3.4 The exit terminal of a mechanical draft system shall not be less than 7 ft (2.1 m) above grade when located adjacent to public walkways.

6.7.3.5 Any air inlet and any flue gas outlet of any appliance shall terminate at least 5 ft (1.5 m) from the vent outlet of a liquid fuel supply tank.

6.8 Replacement and Upgrading of Chimneys. (Reserved)

Chapter 7 Tanks for Liquid Fuels

7.1 Scope. This chapter shall apply to tanks used to store or to supply liquid fuel for use in liquid fuel-burning appliances.

7.2 Basic Design and Construction of Tanks.

7.2.1 Tanks shall be designed and constructed to any shape or type consistent with sound engineering practice for the materials of construction used and shall be listed in accordance with one of the design standards specified in 7.2.7 or their approved equivalents.

7.2.2 Tanks shall be installed and used in accordance with this standard and shall be approved for the specific liquid fuel-burning application.

7.2.3 Tanks meeting the requirements of Chapters 21, 22, and 23 of NFPA 30 shall be deemed as meeting the requirements of this section.

7.2.4 Tanks shall be permitted to have combustible or noncombustible internal linings that are compatible with the intended liquid fuel(s).

7.2.5 Tank Openings for Fill and Venting.

7.2.5.1 All tanks shall be provided with top openings large enough to prevent abnormal pressures in the tank during normal operations (fill and withdrawal) and emergency venting (fire exposure for aboveground tanks), but not smaller than the nominal pipe sizes specified in Table 7.2.5.1.

7.2.5.2 Normal and emergency vent opening(s) shall be permitted to be either separate or combined, provided openings are sized in accordance with Table 7.2.5.1.

Table 7.2.5.1 Minimum Diameter of Tank Vent Opening

Capacity of Tank (U.S. gal)	Diameter of Vent, Nominal Opening Size (in.)
660 or less	1¼
661 to 3,000	1½
3,001 to 10,000	2
10,001 to 20,000	2½
20,001 to 35,000	3

For SI units, 1 gal = 3.785 L, 1 in. = 25 mm.

7.2.5.3 Interstitial spaces of secondary containment tanks shall be provided with venting sized in accordance with Table 7.2.5.1.

7.2.5.4 Each compartment of a compartmented tank shall be provided with venting sized in accordance with Table 7.2.5.1.

7.2.6 Operating Pressures.

7.2.6.1 Tanks shall be permitted to be operated under normal operating conditions at pressures that do not exceed a gauge pressure of 1 psi (gauge pressure of 7 kPa), measured at the top of the tank, but shall be limited to a gauge pressure of 2.5 psi (gauge pressure of 17 kPa) under emergency venting conditions, also measured at the top of the tank.

7.2.6.2 Where the vertical length of the fill and vent pipes is such that the static head imposed on the bottom of the tank exceeds a gauge pressure of 10 psi (70 kPa) if the pipes are filled with liquid, the tank and its related piping shall be tested hydrostatically to a pressure equal to the static head thus imposed.

7.2.7 Design Standards.

Δ 7.2.7.1 Atmospheric tanks shall be constructed in accordance with one of the following or its approved equivalent:

- (1) API Standard 650, *Welded Steel Tanks for Oil Storage*
- (2) UL 58, *Standard for Steel Underground Tanks for Flammable and Combustible Liquids*
- (3) UL 80, *Standard for Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids*
- (4) UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*
- (5) UL 142A, *Standard for Special Purpose Aboveground Tanks for Specific Flammable and Combustible Liquids*
- (6) UL 443, *Standard for Steel Auxiliary Tanks for Oil Burner Fuel*
- (7) UL 1316, *Standard for Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures*
- (8) UL 1746, *Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks*
- (9) UL 2080, *Standard for Fire Resistant Tanks for Flammable and Combustible Liquids*
- (10) UL 2085, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids*
- (11) UL 2245, *Standard for Below-Grade Vaults for Flammable Liquid Storage Tanks*
- (12) **UL 2258, *Standard for Nonmetallic Tanks for Oil Burner Fuels and Other Combustible Liquids***